United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Missouri Agricultural
Experiment Station

Soil Survey of Perry County, Missouri

How To Use This Soil Survey

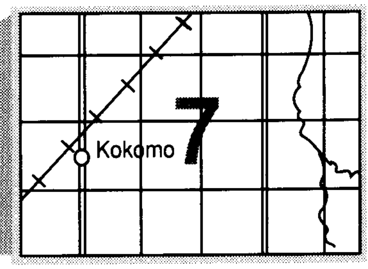
General Soil Map

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.

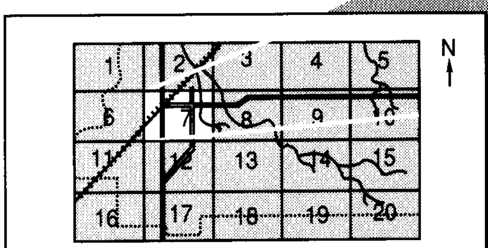
Detailed Soil Maps

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



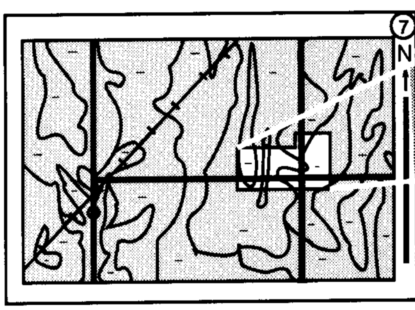
MAP SHEET

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

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



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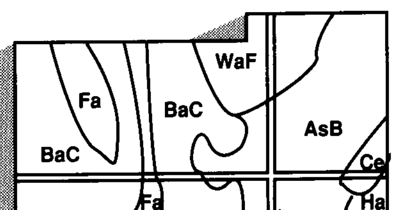

AREA OF INTEREST

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

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

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

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982.

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 Perry County Court provided monetary support and a soil scientist. The survey is part of the technical assistance furnished to the Perry County Soil and Water Conservation District.

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

Cover: The River Hills in an area of the Menfro soil association in the foreground. The fertile soils in the Leta-Darwin-Parkville association are on the bottom land in the background.

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Soil Series

Issued September 1986

Index to Map Units

Summary of Tables

Foreword

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

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

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

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

Paul F. Larson
State Conservationist
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Soil Survey of
Perry County, Missouri

By D. F. (Buddy) Festervand, Soil Conservation Service

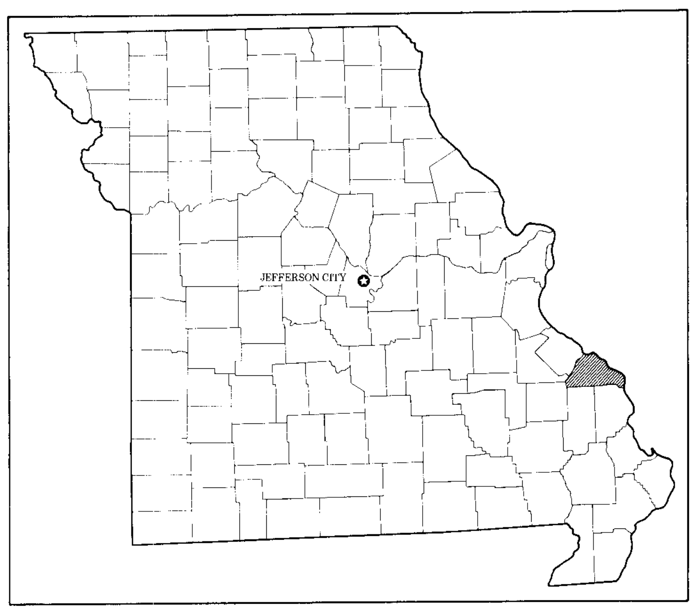
Fieldwork by Buddy Festervand, Soil Conservation Service, Gerald Manis, Missouri Department of Natural Resources, and Rich Mayer, Perry County Soil and Water Conservation District

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

PERRY COUNTY is in the east-central part of Missouri (fig. 1). It is on the eastern fringe of the Ozark region. It has an area of 309,754 acres, or about 484 square miles. Of this total, 303,034 acres is land and the rest is water areas larger than 40 acres. The county is somewhat triangular in shape. Its north boundary is Randolph County, Illinois, and is about 6 miles long. The east boundary, the Mississippi River, is about 37 miles long. The south boundary is Cape Girardeau and Bollinger Counties, Missouri, and is about 35 miles long. The west boundary is Madison, St. Francois, and Ste. Genevieve Counties and is about 23 miles long. The population of the county in 1980 was 16,784.

This survey updates the soil survey of Perry County published in 1913 (*12*). It provides additional interpretative information and larger maps, which show the soils in greater detail.

The Jackson County, Illinois, soil survey publication includes a small part of Perry County, Missouri, that is on the Illinois side of the Mississippi River. This part of Perry County is served by the Soil and Water Conservation District of Jackson County, Illinois. It is shown on the published maps of this survey as part of Perry County, Missouri, but is not included within the soil survey boundary of Perry County.



The two major land resource areas in the county are the Central Mississippi Valley Wooded Slopes and the Ozark Border. Some of the major soils on the Central Mississippi Valley Wooded Slopes are Darwin, Haymond, Leta, Menfro, and Wilbur soils. Darwin and Leta soils are along the flood plains of the Mississippi River. Haymond and Wilbur soils are on the flood plains along the tributaries of the Mississippi River. Menfro soils are on ridges and side slopes in the uplands. Some of the major soils on the Ozark Border are Ashton, Elsah, Goss, and Hildebrecht soils. Ashton soils are on stream terraces. Elsah soils are on small flood plains. Goss soils are moderately steep to very steep and are on side slopes. Hildebrecht soils have a fragipan and are on ridges and foot slopes.

Farming is the main enterprise in the survey area. Soybeans, corn, wheat, and grain sorghum are the major cultivated crops. Many areas on uplands in the eastern half of the county are cultivated. Erosion is a severe hazard in these areas. Most of the steep and very steep soils are used as pasture or woodland. The soils on the Bois Brule bottoms are used for row crops. Wetness is a problem.

General Nature of the Survey Area

This section gives general information concerning the survey area. It describes climate and early history.

Climate

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

The consistent pattern of climate in Perry 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 all grain crops.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Marble Hill in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 35 degrees F, and the average daily minimum temperature is 24 degrees. The lowest temperature on record, which occurred at Marble Hill on February 2, 1951, is -27 degrees. In summer the average temperature is 76 degrees, and the average daily maximum temperature is 89 degrees. The highest recorded temperature, which occurred on June 30, 1952, is 108 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 44.37 inches. Of this, about 50 percent usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 6.30 inches at Marble Hill on March 28, 1977. Thunderstorms occur on about 45 days each year. Tornadoes and severe thunderstorms occur occasionally but are local in extent and of short duration. They can cause damage in scattered spots. Hailstorms occur at times during the warmer part of the year but in an irregular pattern and only in small areas.

The average seasonal snowfall is about 12 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average, 2 days of the year have at least 1 inch of snow on the ground.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in spring.

Early History

In 1540, Hernando De Soto probably came through what is now Perry County. The Indians in the area then were from three basic tribes: the Casquins of New Madrid, the Capahas of Cape Girardeau, and the Osages, who lived in areas along the Missouri River but whose hunting grounds extended east to the Mississippi River and south to the Arkansas River. The Casquins were from the Algonquin family, and the Capaha and Osage were from the Siouan family. The Indians of the Siouan family originally came from the valley of the Ohio River.

Prior to the arrival of the Siouan family of Indians, about 400 B.C. to 700 A.D., a race of people who built large mounds is believed to have settled throughout southeast Missouri. These people are referred to as the mound builders. They built cities similar to those in ancient Mexico. They established trade routes to very distant areas in North America, as is evidenced by relics found in the large mounds that they built. These people probably relied heavily on farming, whereas the Siouan family at the time of De Soto relied on both hunting and farming. The disappearance of the mound builders is a mystery.

Perry County was originally heavily forested. The central part of the county had an area of prairie. The predominant timber species were oak, hickory, walnut, pecan, cottonwood, poplar, maple, locust, and gum. Big bluestem, indiangrass, and switchgrass were the main prairie grasses.

The first recorded settler in Perry County was a Frenchman, John Baptiste Barsaloux, a traveling merchant who lived in Brois Brule in 1787. His land bordered the Jones Cutoff, about a mile north of Menfro. Although the Spanish governed this region from 1770 to 1803, the settlers were French who had come during the French rule, which was from 1673 to 1770. From 1770 to 1795, Spanish policy kept Americans out of Upper Louisiana, which included Missouri. In 1795, Spain lifted the restriction and allowed immigration. Settlers payed only a small fee for the survey and registration of the land granted them. Most grants were for 640 acres, but a few were much larger.

In 1796, the first permanent American settlers sought land that had access to water. They asked for their grants in the Bois Brule bottoms and along Cinque Hommes, Saline, St. Laurents, and Apple Creeks. Several groups of these settlers came from Kentucky. They settled in an area called the Barrens, probably named for the area in Kentucky from which they came. In 1800, Spain secretly transferred all the territory of Louisiana back to France. In 1803, Perry County came under the jurisdiction of the United States when the Louisiana Purchase was bought from France.

The early settlers cleared land in the same way that settlers had across the United States. They preferred wooded land, which they considered to be fertile. Prairie land was more difficult to work than forest land because cutting through the sod with a plow was difficult. The farmers first grew crops that would make them self-sufficient. Corn was the main crop, but cotton and flax were also grown to provide thread for cloth.

In 1821, the first county court was organized. Bernard Layton donated 51 acres and a spring, which later became the site of the present county seat, at Perryville. The first courthouse was built in 1825. A log jail was the only other building. By 1831, Perryville was incorporated, and by 1843, a hotel was built. The hotel served as the headquarters for German immigrants who came to the county during this period.

In 1839, a large group of Lutheran immigrants settled in Missouri for religious reasons. They purchased about 4,475 acres in eastern Perry County. These settlers founded the town of Altenburg, named for the city of Altenburg in Saxony, Germany, from which they came. Altenburg soon became the hub of the Saxon settlement and was incorporated in 1870.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

Soil Descriptions

1. Menfro Association

Gently sloping to very steep, deep, well drained, silty soils; on uplands

This association consists of soils on uplands adjoining the flood plains along the Mississippi River and extending west to the central part of the county. It is characterized by long, narrow ridges that are highly dissected by narrow, V-shaped drainageways. About 40 percent of the association is the Perry County Sinkhole Plain (fig. 2). Slopes range from 3 to 50 percent.

This association makes up about 45 percent of the survey area. It is about 94 percent Menfro and similar soils and 6 percent minor soils.

Menfro soils are on ridgetops and side slopes. Typically, they have a surface layer of brown, friable silt loam. The subsoil is brown and dark yellowish brown silty clay loam and silt loam. It is mottled in the middle part.

Minor in this association are Bucklick, Caneyville, and Haymond soils. Bucklick soils have more clay than the Menfro soils. They are on the mid and lower side slopes and foot slopes at the lower elevations. Caneyville soils are moderately deep to bedrock. They are in positions on the landscape similar to those of Bucklick soils. Haymond soils are silty throughout. They are on narrow flood plains.

About 70 percent of the acreage in this association has been cleared. The gently sloping soils on ridgetops and the strongly sloping soils in the smoother areas are used mostly for cultivated crops and pasture. Soybeans, corn, wheat, and grain sorghum are the main crops. Barley and rye are grown in a few areas. Alfalfa, red clover, and fescue are the main pasture plants and hay crops. The uncleared areas, where the soils are mostly moderately steep to very steep, generally support mixed hardwoods.

The soils on ridgetops and in some of the smoother, strongly sloping areas are suited to cultivated crops. The moderately steep areas and most of the steep areas are suited to pasture. Erosion is the main management concern. In areas that are cultivated, a conservation tillage system that leaves crop residue on the surface, terraces, grassed waterways, and winter cover crops are needed to control erosion. Overgrazing is the major concern in managing pasture because it causes rapid erosion and gullying.

The soils in this association are suited to trees. Most stands are mixed hardwoods. Yellow-poplar is more abundant in the River Hills area than in other areas. The equipment limitation and the erosion hazard are management concerns in the steep and very steep areas.

This association is suited to most kinds of sanitary facilities and building site development. Slope is the main limitation. Also, pollution of ground water by waste disposal facilities is possible in the karst areas.

2. Leta-Darwin-Parkville Association

Nearly level, deep, somewhat poorly drained and poorly drained, clayey soils; on flood plains and low terraces

This association consists of soils on broad flood plains and terraces along the Mississippi River. Slopes range from 0 to 2 percent.

This association makes up about 12 percent of the survey area. It is about 22 percent Leta soils, 15 percent Darwin soils, 13 percent Parkville soils, and 50 percent minor soils.

The somewhat poorly drained Leta soils generally are on low terraces. Typically, they have a surface layer of very dark gray silty clay. The subsurface layer is very dark grayish brown, mottled silty clay. The subsoil is dark gray and dark grayish brown, mottled silty clay. The

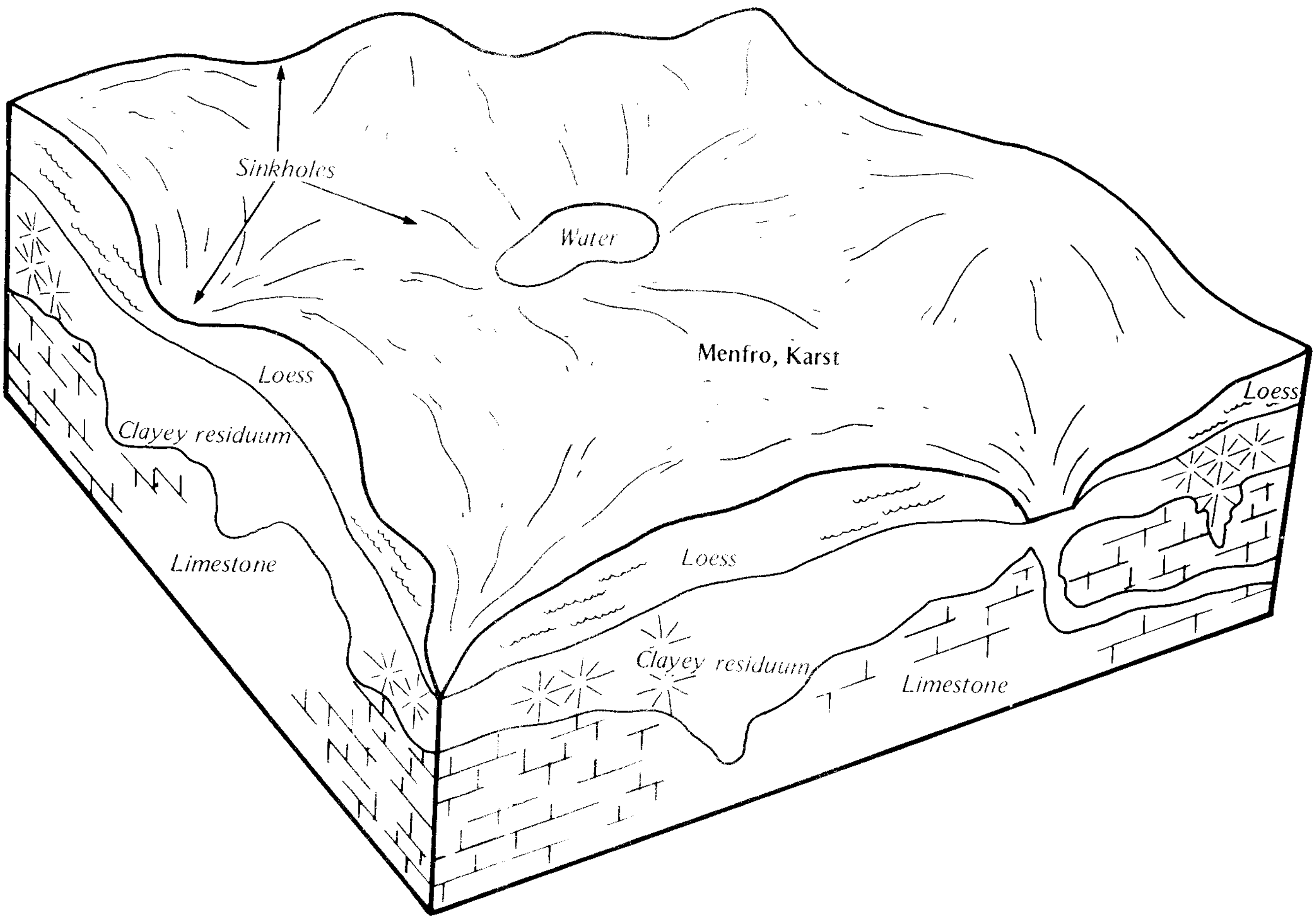


Figure 2.—Typical pattern of the karst topography and the parent material in the Menfro association.

substratum occurs as stratified layers of gray and dark grayish brown, mottled silt loam and very fine sandy loam.

The poorly drained Darwin soils are on flood plains. Typically, they have a surface layer of very dark grayish brown silty clay. The subsurface layer also is very dark grayish brown silty clay. The subsoil is dark gray and gray, mottled silty clay and clay.

The somewhat poorly drained Parkville soils generally are on low terraces. They are higher on the landscape than the Leta soils. Typically, they have a surface layer of very dark gray silty clay. The subsurface layer is very dark grayish brown silty clay. The substratum is brown and dark grayish brown silt loam, very fine sandy loam, and very fine sand. It is mottled in the upper part.

Minor in this association are Dupo, Haynie, and Waldron soils and Orthents. Dupo soils are adjacent to the uplands. They have a silty surface layer. The well drained Haynie soils are in the higher areas. Orthents are on manmade soils on levees and in borrow pits. Waldron soils are in basins and swales. They have less clay in the lower part than the Darwin soils.

Nearly all of this association has been cleared. Soybeans, corn, wheat, and grain sorghum are the most common crops. Pasture plants, alfalfa, and red clover are grown to a lesser extent. Most of the levee system supports fescue grass, but small areas support alfalfa and red clover.

Cash crops are the main farm enterprise. Wetness is the chief concern in managing the major soils. Drainage ditches extend to all parts of the association. Very little of the land has been graded.

This association generally is suitable for sanitary facilities and building site development. Wetness, the shrink-swell potential, and rare flooding are the main management concerns.

3. Haymond-Wilbur-Auxvasse Association

Nearly level and very gently sloping, deep, well drained *to somewhat poorly drained, silty soils; on flood plains and terraces*

This association consists of soils on flood plains and terraces along the tributaries of the Mississippi River. The flood plains range from 1/8 to 1/2 mile wide. The terraces range from about 3 or 4 feet to 30 feet above the adjacent flood plains. Slopes range from 0 to 3 percent.

This association makes up about 4 percent of the survey area. It is about 50 percent Haymond soils, 20 percent Wilbur soils, 13 percent Auxvasse soils, and 17 percent minor soils.

The well drained, nearly level Haymond soils are on narrow to wide flood plains. Typically, they have a surface layer of dark brown silt loam. The substratum is dark brown and brown, mottled silt loam.

The moderately well drained, nearly level Wilbur soils are on narrow to wide flood plains. Typically, they have a surface layer of brown silt loam. The substratum is brown and dark yellowish brown, mottled silt loam.

The somewhat poorly drained, nearly level and very gently sloping Auxvasse soils are on terraces. Typically, they have a surface layer of dark grayish brown silt loam. The subsurface layer is grayish brown and light brownish gray silt loam. The subsoil is brown, mottled silty clay. The substratum is grayish brown and olive gray, mottled silty clay loam.

Minor in this association are Ashton, Freeburg, and Kickapoo soils. The well drained Ashton soils have more clay in the subsoil than the Haymond soils. They are on terraces. The well drained Kickapoo soils have more sand than the Haymond soils. They are on flood plains. The somewhat poorly drained Freeburg soils have less clay in the subsoil than the Auxvasse soils. They are on terraces.

About 90 percent of the acreage in this association has been cleared. Most areas are cultivated, but a few areas are pastured. Soybeans, corn, wheat, and grain sorghum are the most common crops. A small acreage is used for alfalfa, red clover, and fescue pasture.

Cash crops are the main farm enterprise. Wetness and flooding are the main concerns in managing the major soils. Most flooding occurs during winter and early spring.

This association generally is unsuitable for sanitary facilities and building site development. Flooding, wetness, very slow permeability, and the shrink-swell potential are the main management concerns.

4. Goss-Hildebrecht Association

Gently sloping to very steep, deep, well drained and moderately well drained, cherty and silty soils; on uplands

This association consists of soils on highly dissected uplands. It is characterized by long, winding, narrow ridges, V-shaped drainageways, and narrow flood plains. The soils on summit divides are gently sloping to strongly sloping. The elevation of these divides decreases from west to east. Slopes range from 3 to 35 percent.

This association makes up about 11 percent of the survey area. It is about 56 percent Goss and similar soils, 38 percent Hildebrecht soils, and 6 percent minor soils (fig. 3).

The well drained, moderately steep to very steep Goss soils generally are on the lower side slopes. Typically, they have a surface layer of dark grayish brown cherty silt loam. The subsurface layer is light yellowish brown cherty silt loam. The subsoil is strong brown very cherty silt loam in the upper part; yellowish red and red, mottled very cherty silty clay loam and very cherty silty clay in the next part; and red and yellowish brown, mottled very cherty clay in the lower part.

The moderately well drained, gently sloping to strongly sloping Hildebrecht soils generally are on ridgetops, side slopes, and foot slopes. Typically, they have a surface layer of brown silt loam. The subsurface layer is yellowish brown silt loam. The subsoil is strong brown, mottled silty clay loam in the upper part; a fragipan of brown, mottled extremely cherty silt loam and strong brown cherty clay loam in the next part; and yellowish red cherty silty clay in the lower part.

Minor in this association are the somewhat excessively drained Elsah and Midco soils on narrow flood plains and the somewhat excessively drained, shallow Gasconade soils on steep slopes adjacent to narrow creek bottoms. Also of minor extent is Rock outcrop on a few of the steep slopes.

About 35 percent of the acreage in this association has been cleared. Most of the cleared areas are used for pasture. A small acreage is used for wheat, corn, soybeans, or grain sorghum. The uncleared acreage supports mixed hardwoods.

The gently sloping to strongly sloping soils are suited to grasses and legumes for pasture and hay. Wheat and grain sorghum can be grown in rotation with grasses or legumes in the gently sloping and moderately sloping areas. Erosion is the major management concern.

The strongly sloping to very steep soils are suited to trees. The timber stands are mostly of low quality because of improper management, fire, and high grade harvesting. The equipment limitation and the erosion hazard are the major management concerns. They are caused by the chertiness and the slope.

Many areas in this association are suited to sanitary facilities and building site development if proper design and installation procedures are used. Chertiness, slope, seepage, and wetness are the main management concerns.

5. Elsah-Ashton-Auxvasse Association

Nearly level and very gently sloping, deep, somewhat excessively drained, well drained, and somewhat poorly

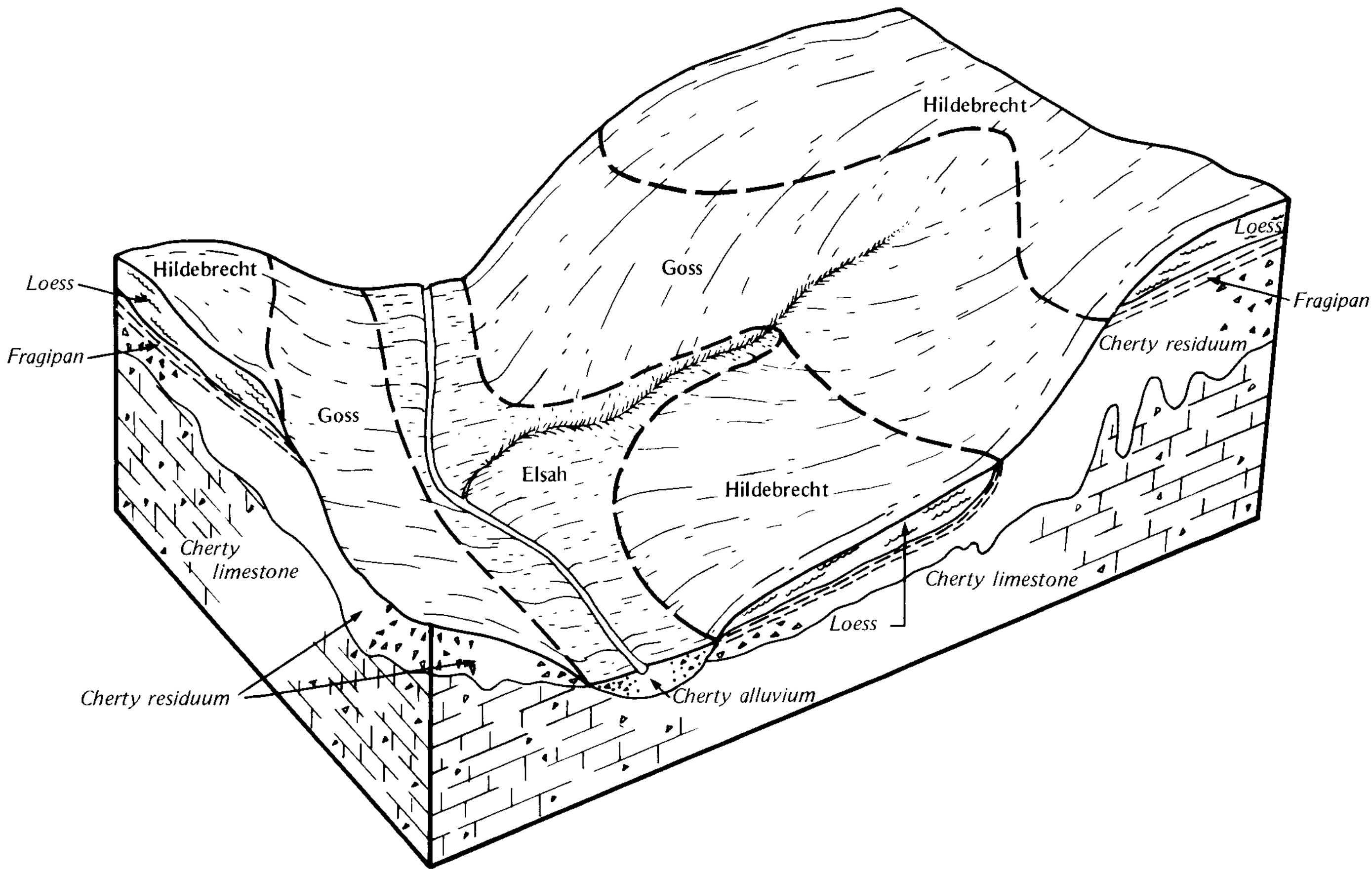


Figure 3.—Typical pattern of soils and parent material in the Goss-Hildebrecht association.

drained, loamy and silty soils; on flood plains and terraces

This association consists of soils on narrow flood plains and low terraces along small tributaries. The terraces are higher than the flood plains, many of them 5 to 10 feet higher. Slopes range from 0 to 3 percent.

This association makes up about 2 percent of the survey area. It is about 72 percent Elsah soils, 9 percent Ashton soils, 5 percent Auxvasse soils, and 14 percent minor soils.

The somewhat excessively drained Elsah soils are on narrow to wide flood plains. Typically, they have a surface layer of dark yellowish brown loam. The substratum occurs as stratified layers of brown cherty loam, extremely cherty loam, and extremely cherty sand.

The well drained Ashton soils are on terraces. Typically, they have a surface layer of dark brown silt loam. The subsoil is brown silt loam and silty clay loam.

The somewhat poorly drained Auxvasse soils are on terraces. Typically, they have a surface layer of dark grayish brown silt loam. The subsurface layer is grayish brown and light brownish gray silt loam. The subsoil is brown, mottled silty clay. The substratum is grayish brown and olive gray, mottled silty clay loam.

Minor in this association are Freeburg, Midco, and Weller soils. Freeburg soils are somewhat poorly drained, have less clay than the Auxvasse soils, and typically are on the lower terraces. Midco soils have a cherty surface layer and are on flood plains. Weller soils are moderately sloping and are on toe slopes and side slopes in the uplands.

About 90 or more percent of the acreage in this association has been cleared. Soybeans, corn, wheat, and grain sorghum are the main crops. Fescue, clover, and alfalfa are also grown. Most of the trees are on narrow flood plains, along stream channels, and on gravel bars. The main farm enterprise is cash crops. Flooding and droughtiness are the main management concerns.

Beef cattle are raised in some areas of this association. Fescue, clover, and alfalfa are grown for pasture and hay. Overgrazing and grazing when the soils are wet are the major concerns in managing pasture.

This association generally is unsuitable for sanitary facilities and building site development because of flooding. The gravel bars and stream channels are a common source of gravel.

6. Goss-Weingarten-Gasconade Association

Gently sloping to very steep, deep and shallow, well drained and somewhat excessively drained, cherty, silty, and stony soils; on uplands

This association consists of soils on highly dissected ridges that have V-shaped drainageways and narrow flood plains. Stony areas are common on the lower slopes. Slopes range from 3 to 35 percent.

This association makes up about 14 percent of the survey area. It is about 50 percent Goss soils, 39 percent Weingarten soils, 7 percent Gasconade soils, and 4 percent minor soils (fig. 4).

The deep, well drained, moderately steep to very steep, cherty Goss soils are on side slopes. Typically, they have a surface layer of dark grayish brown cherty silt loam. The subsurface layer is light yellowish brown cherty silt loam. The subsoil is strong brown very cherty silt loam in the upper part; yellowish red very cherty silty clay loam and red, mottled very cherty silty clay in the next part; and red and yellowish brown, mottled very cherty clay in the lower part.

The deep, well drained, gently sloping to strongly sloping Weingarten soils are on ridges, foot slopes, and side slopes. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is yellowish brown, mottled silty clay loam and silt loam. The lower part is strong brown, mottled very cherty silty clay loam and red, mottled very cherty silty clay.

The shallow, somewhat excessively drained, strongly sloping to very steep, stony Gasconade soils are on the lower side slopes, intermingled with ledges of Rock

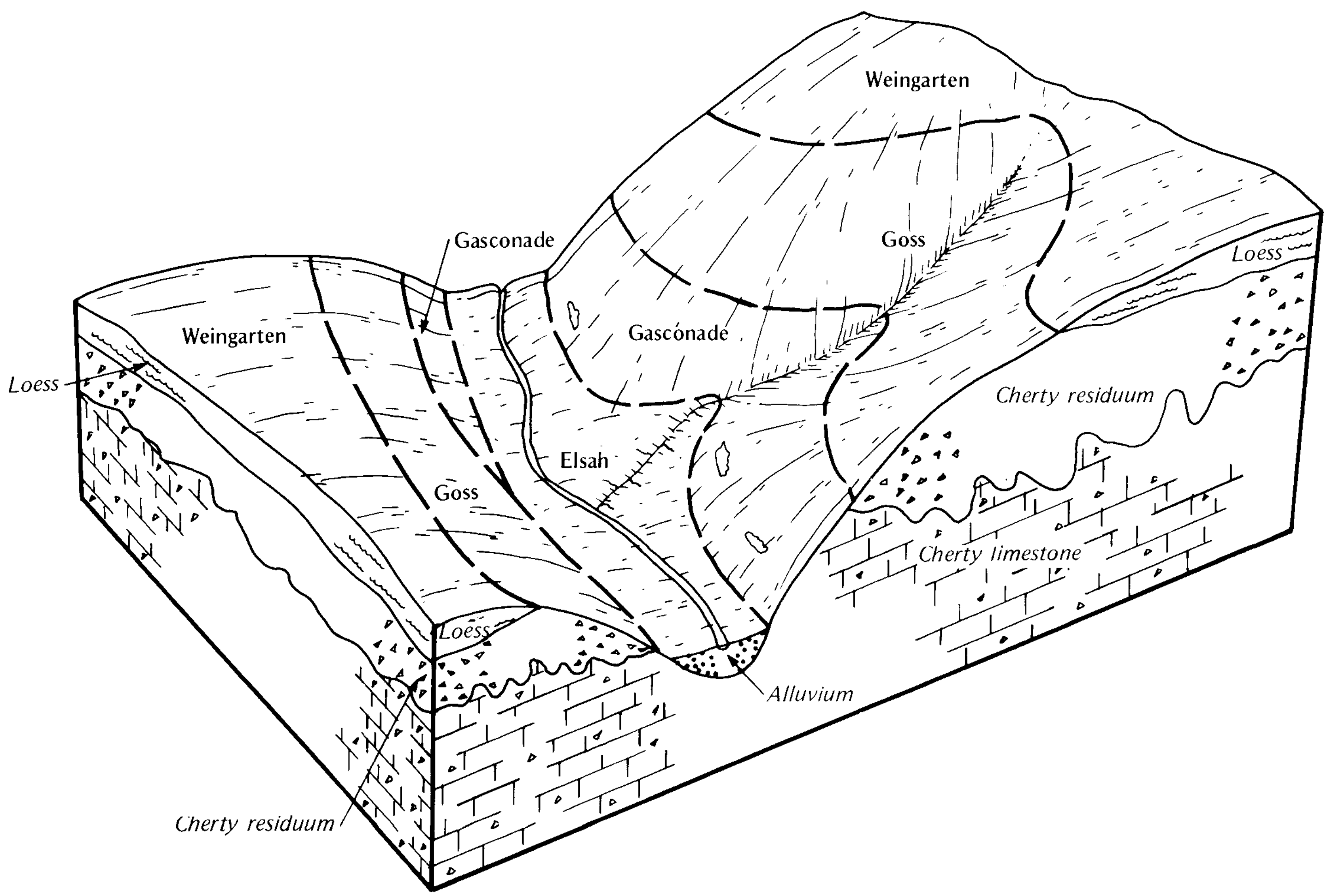


Figure 4.—Typical pattern of soils and parent material in the Goss-Weingarten-Gasconade association.

outcrop. These soils are dominantly on south- and west-facing slopes. Typically, they have a surface layer of black stony silty clay loam. The subsurface layer is black very channery silty clay loam. The subsoil is very dark brown very channery silty clay loam. Hard dolomite bedrock is at a depth of about 14 inches.

Minor in this association are the deep, somewhat excessively drained Elsah soils on flood plains along narrow creeks and the deep moderately well drained Weller soils on side slopes and foot slopes.

About 60 percent of this association is cleared areas, mainly of Weingarten, Weller, and Elsah soils. Most of these areas are used for pasture and hay, and some are used for row crops, mainly corn, soybeans, and wheat. The uncleared areas are made up dominantly of Goss soils. They support mixed hardwoods. The Gasconade soils in the steeper, rough areas generally support eastern redcedar and native grasses.

The gently sloping and moderately sloping soils are used mainly for pasture and hay. Cultivated crops are grown to a lesser extent. The slope and the hazard of erosion are the main management concerns. Droughtiness also is a concern in managing pasture.

The moderately steep to very steep soils are suitable for trees. The timber stands are mostly of low quality because of improper management, fire, and high grade harvesting. The equipment limitation, the erosion hazard, seedling mortality, and the windthrow hazard are the major management concerns.

The Goss and Weingarten soils are suitable for sanitary facilities and building site development. Slope, moderately slow permeability, and the shrink-swell potential are the main management concerns.

7. Minnith-Lily Association

Gently sloping to steep, deep and moderately deep, moderately well drained and well drained, silty and loamy soils; on uplands

This association consists of soils on long, narrow ridges and irregularly shaped, short side slopes. Sandstone crops out in a few areas. Slopes range from 3 to 30 percent.

This association makes up about 9 percent of the survey area. It is about 68 percent Minnith soils, 26 percent Lily and similar soils, and 6 percent minor soils (fig. 5).

The deep, moderately well drained, gently sloping to steep Minnith soils generally are on ridgetops and shoulder slopes. Typically, they have a surface layer of brown silt loam. The subsoil is brown, mottled silty clay loam and silt loam. The substratum is brown, mottled loam.

The moderately deep, well drained, strongly sloping to steep Lily soils are on irregularly shaped side slopes. Typically, they have a surface layer of very dark grayish brown loam. The subsurface layer is dark grayish brown loam. The subsoil is yellowish brown, strong brown, and brown, mottled loam and clay loam. Hard sandstone bedrock is at a depth of about 28 inches.

Minor in this association are Haymond and Kickapoo soils on narrow flood plains. Haymond soils are more silty than the major soils, and Kickapoo soils are more sandy.

About 60 percent of the acreage in this association has been cleared. Most of the soils on ridgetops are used for cultivated crops or pasture. Soybeans, corn, wheat, and grain sorghum are the main crops.

The strongly sloping soils are used mainly for pasture and to a lesser extent for cultivated crops or woodland. They are suited to hay and pasture. The slope and the hazard of erosion are the main management concerns. Overgrazing is a major concern in managing pasture because it causes rapid erosion and gullying. The strongly sloping soils in a few of the smoother areas are suitable for a limited amount of cultivation if the cultivated crops are grown in rotation with close grown crops. Erosion is a severe hazard if the soils are cropped. It can be controlled by a conservation tillage system that leaves crop residue on the surface, winter cover crops, grassed waterways, and proper management of crop residue.

The steeper areas of this association mainly support trees. The timber stands are mostly of low quality because of improper management, fire, and high grade harvesting. The equipment limitation, the erosion hazard, and the windthrow hazard are the major management concerns.

This association is suitable for sanitary facilities and building site development. The slope, moderately slow permeability, the shrink-swell potential, and the depth to bedrock are the main management concerns.

8. Clarksville-Menfro Association

Steep and very steep, deep, somewhat excessively drained and well drained, cherty and silty soils; on uplands

This association consists of soils on highly dissected, narrow ridges characterized by V-shaped drainageways and narrow flood plains. The side slopes are relatively long. On many of these side slopes, chert is exposed. The ridgetops are very narrow, mainly less than 100 feet wide. The drainage pattern is complex, and drainageways cut deeply into the landscape. Valleys are deep and narrow. Slopes range from 20 to 60 percent.

This association makes up about 3 percent of the survey area. It is about 56 percent Clarksville and similar soils, 42 percent Menfro soils, and 2 percent minor soils.

The cherty, somewhat excessively drained Clarksville soils are on the mid and lower side slopes. Typically, they have a surface layer of very dark grayish brown very cherty silt loam. The subsurface layer is yellowish brown very cherty silt loam. The subsoil is, in sequence downward, strong brown extremely cherty silty clay loam,

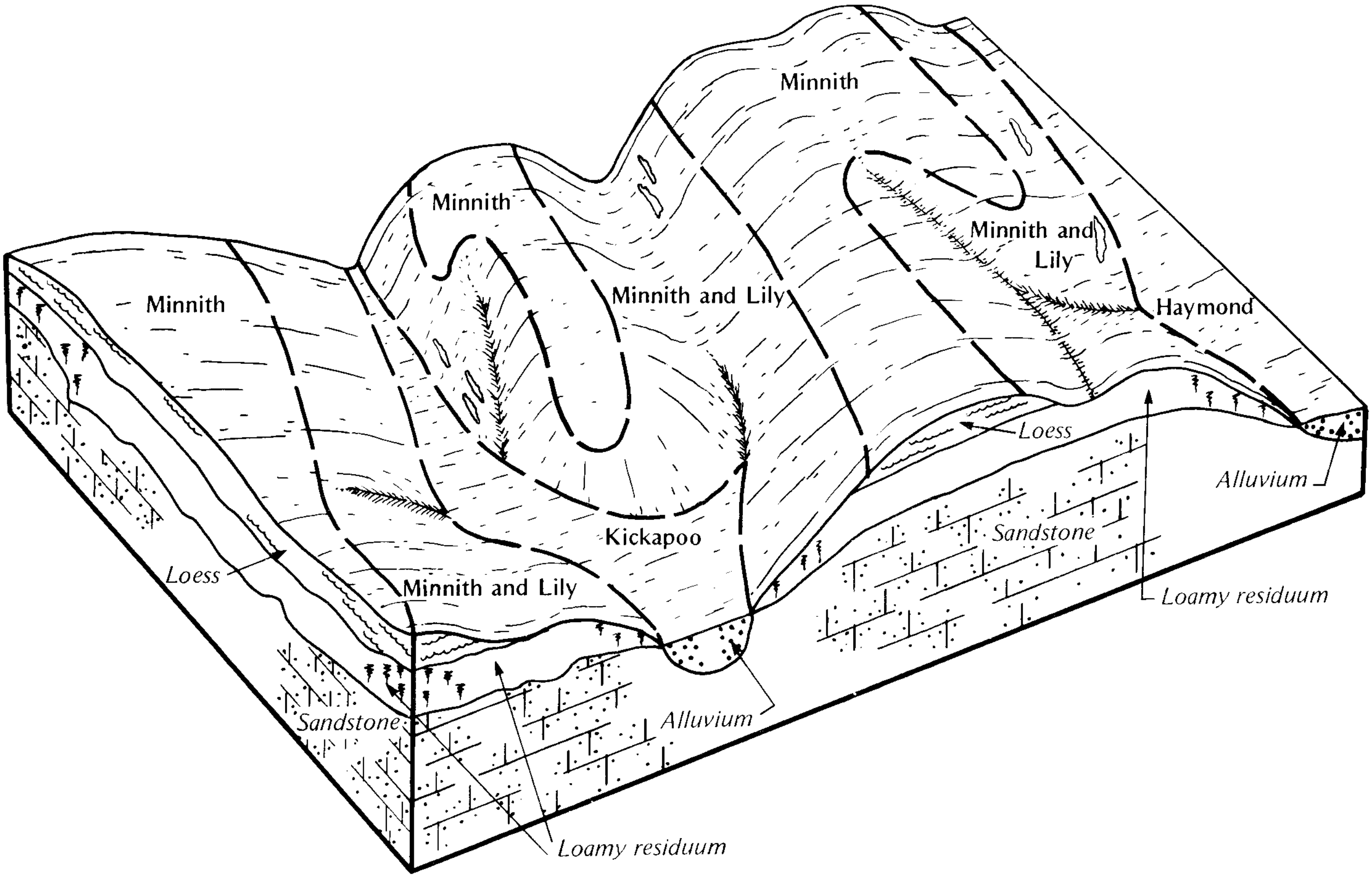


Figure 5.—Typical pattern of soils and parent material in the Minnith-Lily association.

reddish yellow and light brown extremely cherty silt loam, yellowish red extremely cherty silty clay loam, and red, mottled very cherty silty clay.

The well drained Menfro soils are on narrow ridgetops, on shoulder slopes, and on some foot slopes. Typically, they have a surface layer of dark brown silt loam. The subsoil is dark yellowish brown silt loam and brown silty clay loam and silt loam. The substratum is brown silt loam.

Minor in this association are Elsah and Haymond soils on narrow flood plains. Elsah soils have a loamy surface layer. Haymond soils are silty throughout.

About 90 percent or more of the acreage in this association is forested. Cleared areas are on some ridgetops or foot slopes that are used for pasture or on narrow creek bottoms that are used for pasture or crops.

The soils in this association are suitable for trees. The equipment limitation, the erosion hazard, and seedling mortality are the main management concerns.

This association generally is unsuitable for sanitary facilities and building site development because of the slope of both the major soils and the high content of chert in the Clarksville soils.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Menfro silt loam, 3 to 9 percent slopes, is one of several phases in 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. Clarksville-Menfro complex, 20 to 60 percent slopes, is an example.

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

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

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

Soil Descriptions

1C—Menfro silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on convex ridgetops and side slopes. Individual areas generally are long and irregularly shaped and range from 10 to more than 500 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil is brown silty clay loam about 40 inches thick. The substratum to a depth of 60 inches or more is brown silt loam. In some eroded areas the surface layer is silty clay loam.

Permeability is moderate, and surface runoff is medium. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. Reaction ranges from strongly acid to neutral in the subsoil and varies widely in the surface layer as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for row crops or pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves all or part of the crop residue on the surface (fig. 6), winter cover crops, contour farming, and conservation cropping systems that include grasses and legumes help to prevent excessive soil loss. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Some type of grade stabilization structure generally is needed. Proper management of crop residue helps to control erosion, maintains tilth, improves or maintains the organic matter content, and increases the rate of water intake.

A cover of hay or pasture plants is very effective in controlling erosion. This soil is well suited to tall fescue, orchardgrass, smooth bromegrass, big bluestem, little bluestem, switchgrass, alfalfa, and red clover. No serious hazards or limitations affect pasture or hayland. Erosion is a problem when the plants are becoming established. Seedbed preparation should be timed to ensure a good ground cover.

Some areas support native hardwoods. This soil is suited to trees. Shortleaf pine, black walnut, yellow-poplar, and white oak grow well. Measures that protect new stands from fire and grazing are needed. These measures also will improve the habitat for woodland wildlife.

This soil is suitable for onsite waste disposal and building site development if proper design and installation procedures are used. Grading sites for sewage lagoons and small commercial buildings helps to modify the slope. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. Septic tank absorption fields can function adequately. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints also are helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength.

Figure 6.—Corn residue on Menfro silt loam, 3 to 9 percent slopes.

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

1D2—Menfro silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on narrow ridgetops and side slopes. The side slopes commonly are dissected by many small drainageways that run into larger drainageways. Individual areas are long and irregularly shaped and range from 10 to several hundred acres in size.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is brown silty clay loam, and the lower part is dark yellowish brown silt loam. The substratum to a depth of 60 inches or more is brown silt loam. In some eroded areas the surface layer is silty clay loam.

Included with this soil in mapping are soils that have chert fragments in the lower part of the subsoil. These soils are on the lower side slopes. Also included are a few areas of limestone outcrop on the lower side slopes and along the sides of drainageways. Included areas make up about 5 percent of this unit.

Permeability is moderate in the Menfro soil, and surface runoff is rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. Reaction ranges from strongly acid to neutral in the subsoil, from medium acid to neutral in the substratum, and varies widely in the surface layer as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

This soil is suitable for row crops grown on a limited basis in rotation with small grain and close growing pasture or hay crops. Erosion is a severe hazard if row crops are grown year after year. A system of conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, contour farming, and conservation cropping systems that include grasses and legumes help to control erosion. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Some type of grade stabilization structure generally is needed. Proper management of crop residue helps to control erosion, maintains tilth, improves or maintains the organic matter content, and increases the rate of water intake.

A cover of hay or pasture plants is very effective in controlling erosion. This soil is well suited to tall fescue, switchgrass, and red clover. It is moderately well suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

Many areas support native hardwoods. This soil is suited to trees. Measures that improve the existing stands and protect them from fire and grazing are needed. These measures also improve the habitat for woodland wildlife, especially deer and turkeys.

This soil is suitable for onsite waste disposal and building site development if proper design and installation procedures are used. Grading sites for septic tank absorption fields, sewage lagoons, and buildings helps to modify the slope. Some land shaping may be necessary on sites for buildings. Absorption fields can be designed so that they conform to the natural slope of the land. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in footings and foundations and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints also are helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling may be needed because of the slope.

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

1E2—Menfro silt loam, 14 to 30 percent slopes, eroded. This deep, moderately steep and steep, well drained soil is on convex, uneven side slopes. Individual areas are irregular in shape and range from 20 to more than 1,000 acres in size.

Typically, the surface layer is dark brown silt loam about 3 inches thick. The subsoil is about 29 inches thick. The upper part is dark yellowish brown silty clay loam, the next part is brown silty clay loam, and the lower part is brown silt loam. The substratum to a depth of 60 inches or more is brown silt loam. In some eroded areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of the Caneyville, Gasconade, and Goss soils, which generally are on south- and west-facing slopes. Caneyville and Gasconade soils are less than 40 inches deep over bedrock. Goss soils are cherty throughout. Also included are limestone outcrops or limestone boulders. Included areas make up about 10 to 15 percent of this unit.

Permeability is moderate in the Menfro soil, and surface runoff is rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. Reaction ranges from strongly acid to neutral in the subsoil, is medium acid to neutral in the substratum, and varies widely in the surface layer as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

This soil generally is unsuitable for cultivated crops because of the slope and a severe erosion hazard. It should be tilled only when reseeding of pasture or hayland is needed. A cover of pasture plants or hay is very effective in controlling erosion. The soil is well suited to tall fescue, switchgrass, and red clover. It is moderately well suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

Many areas support native hardwoods. This soil is suited to trees. Because of the slope, the erosion hazard and the equipment limitation are management concerns that affect planting and harvesting. Special erosion-control measures are needed. Careful design and proper construction of logging roads and skid trails, for example, can minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Hand planting or direct seeding may be needed. Planting container-grown nursery stock increases the seedling survival rate on south- and west-facing slopes.

This soil is suitable for onsite waste disposal and building site development if proper design and installation procedures are used. Grading sites for septic tank absorption fields, sewage lagoons, and buildings helps to modify the slope. Some land shaping may be necessary on sites for buildings. Absorption fields should be designed so that they conform to the natural slope of the land. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling generally is needed because of the slope.

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

1F—Menfro silt loam, 30 to 50 percent slopes. This deep, very steep, well drained soil is on upland side slopes adjacent to the flood plains along the Mississippi River. The drainage pattern is deeply cut into the landscape, and large gullies are common. Individual areas are irregular in shape and range from 70 to more than 1,000 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is silty clay loam about 42 inches thick. The upper part is dark yellowish brown, and the lower part is brown. The substratum to a depth of 60 inches or more is yellowish brown silt loam.

Included with this soil in mapping are small areas of Clarksville and Goss soils. These soils are cherty throughout. They occur as narrow bands that are below the Menfro soil on some side slopes and that extend into drainageways. Also included are gullies, limestone outcrops, and bluffs and areas where the slope is as much as 70 percent. Included areas make up about 10 percent of this unit.

Permeability is moderate in the Menfro soil, and surface runoff is very rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. Reaction ranges from strongly acid to neutral in the surface layer and subsoil and from medium acid to neutral in the substratum.

Most areas support native hardwoods. This soil generally is unsuitable for cultivated crops because of the slope and a severe erosion hazard. It is suited to trees. Because of the slope, the erosion hazard and the equipment limitation are management concerns that affect planting and harvesting. Special erosion-control measures are needed. Careful design and proper construction of logging roads and skid trails, for example, minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Hand planting or direct seeding may be needed. Planting container-grown nursery stock increases the seedling survival rate on south- and west-facing slopes.

This soil is generally unsuitable for sanitary facilities and building site development because of the slope.

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

2F—Clarksville-Menfro complex, 20 to 60 percent slopes. These deep, steep and very steep soils are on upland side slopes and narrow ridges. The slopes are long, and the drainageways are deeply cut into the landscape. The somewhat excessively drained Clarksville soil is on the concave parts of the side slopes and extends into the drainageways. The well drained Menfro soil is on narrow ridgetops and extends partway down the convex parts of the side slopes. In some areas it is on toe slopes. Individual areas are about 50 to 60 percent Clarksville soil and 25 to 35 percent Menfro soil. The two soils occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the Clarksville soil has a surface layer of very dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is yellowish brown very cherty silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence downward, it is strong brown extremely cherty silty clay loam, reddish yellow and light brown extremely cherty silt loam, yellowish red extremely cherty silty clay loam, and red, mottled very cherty silty clay.

Typically, the Menfro soil has a surface layer of very dark grayish brown silt loam about 4 inches thick. The subsoil is about 48 inches thick. The upper part is dark yellowish brown silt loam, and the lower part is brown silty clay loam. The substratum to a depth of 60 inches or more is dark yellowish brown silt loam.

Included with these soils in mapping are small areas of Elsah soils on narrow flood plains and areas of limestone rock outcrop on side slopes and bluffs. Also included are areas where the slope is as much as 70 percent or more. Included areas make up about 10 percent of this unit.

Permeability is moderately rapid in the upper part of the Clarksville soil and moderate in the lower part. It is moderate in the Menfro soil. Surface runoff is very rapid on both soils. The available water capacity is low in the Clarksville soil and high in the Menfro soil. Natural fertility is low in the Clarksville soil and medium in the Menfro soil. The organic matter content is low in the Clarksville soil and moderately low in the Menfro soil. The Clarksville soil is very strongly acid to medium acid in the surface layer and subsurface layer and is very strongly acid or strongly acid in the subsoil. The Menfro soil is strongly acid to neutral in the upper part and medium acid to neutral in the substratum.

Nearly all areas are forested. A few areas have been cleared and are used for pasture. These soils generally are unsuitable for cultivated crops because of the slope of both soils, a severe erosion hazard on both soils, and the high content of chert fragments in the surface layer of the Clarksville soil. The smoother areas can be used as pasture if erosion is controlled by a system of conservation tillage that leaves plant residue on the surface when grasses and legumes are seeded.

Because of the slope, the erosion hazard and the equipment limitation are management concerns that affect planting and harvesting. Special erosion-control measures are needed. Careful design and proper construction of logging roads and skid trails, for example, can minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Hand planting or direct seeding may be needed. Planting container-grown nursery stock increases the seedling survival rate on south- and west-facing slopes.

These soils generally are unsuitable for sanitary facilities and building site development because of the slope of both soils and the high content of chert in the Clarksville soil.

The land capability classification is VIIe. The woodland ordination symbol of the Clarksville soil is 4r, and that of the Menfro soil is 3r.

3D2—Menfro silt loam, karst, 2 to 14 percent slopes, eroded. This deep, gently sloping to strongly sloping, well drained soil is on convex ridgetops and side slopes (fig. 7). Individual areas range from 10 to more than 10,000 acres in size.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsoil extends to a depth of 64 inches or more. The upper part is dark yellowish brown and brown, friable silty clay loam; the next part is brown, mottled, firm silty clay loam; and the lower part is dark yellowish brown silt loam. In some severely eroded areas, the surface layer is silty clay loam.

Included with this soil in mapping are areas of limestone floats consisting of rocks and boulders and areas of limestone rock outcrop. These areas commonly are on the lower side slopes, in the sinkhole cavities, or on the bottom of the sinkholes. Also included are areas of the finer textured Bucklick and Caneyville soils on the lower side slopes and small areas of stratified silt loam on the bottom of many sinkholes. Included areas make up about 5 percent of this unit.

Permeability is moderate in the Menfro soil, and surface runoff is medium or rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. Reaction ranges from strongly acid to neutral in the subsoil and varies widely in the surface layer as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops or pasture. The strongly sloping areas are suited to row crops grown on a limited basis in rotation with small grain or close grown pasture or hay crops. If cultivated crops are grown, erosion is a severe hazard. A system of

Figure 7.—A sinkhole in an area of Menfro silt loam, karst, 2 to 14 percent slopes, eroded.

conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, contour farming, and conservation cropping systems that include grasses and legumes help to prevent excessive soil loss. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Some type of grade stabilization structure generally is needed. Proper management of crop residue helps to control erosion, maintains tilth, improves or maintains the organic matter content, and increases the rate of water intake.

A cover of hay or pasture plants is very effective in controlling erosion. This soil is well suited to tall fescue, switchgrass, and red clover. It is moderately well suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

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

This soil is suitable for onsite waste disposal and building site development if proper design and installation procedures are used. Grading sites for septic tank absorption fields, sewage lagoons, and buildings helps to modify the slope. Some land shaping may be necessary on sites for buildings. Absorption fields can be designed so that they conform to the natural slope of the land. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. If onsite sanitary facilities are installed, the sewage can pollute the ground water by seeping into the nearby sinkholes. The sinkholes should be considered in determining the limitations of a given area for urban development. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in footings and foundations and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling may be needed because of the slope.

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

3E2—Menfro silt loam, karst, 9 to 35 percent slopes, eroded. This deep, strongly sloping to very steep, well drained soil is on convex ridgetops and side slopes. Individual areas range from 20 to more than 2,000 acres in size.

Typically, the surface layer is dark brown silt loam about 4 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown silty clay loam, and the lower part is dark yellowish brown silt loam.

Included with this soil in mapping are small areas of Bucklick, Caneyville, and Gasconade soils, typically on the lower south- and west-facing slopes and on the lower side slopes within sinkholes. Bucklick soils have bedrock at a depth of 40 to 60 inches, Caneyville soils have bedrock at a depth of 20 to 40 inches, and Gasconade soils have bedrock within a depth of 20 inches. Also included are limestone outcrops on the lower side slopes in the sinkholes and on the bottom of some sinkholes. Included areas make up about 10 percent of this unit.

Permeability is moderate in the Menfro soil, and surface runoff is rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. Reaction ranges from strongly acid to neutral in the subsoil and varies widely in the surface layer as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Because of the slope and a severe erosion hazard, this soil generally is unsuitable for cultivated crops. It should be tilled only when reseeding of pasture or hayland is needed. A cover of hay or pasture plants is very effective in controlling erosion. The soil is well suited to tall fescue, switchgrass, and red clover. It is moderately well suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

Many areas support native hardwoods. This soil is suited to trees. Because of the slope, the erosion hazard and the equipment limitation are management concerns that affect planting and harvesting. Special erosion-control measures are needed. Careful design and proper construction of logging roads and skid trails, for example, minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Hand planting or direct seeding may be needed. Planting container-grown nursery stock increases the seedling survival rate on south- and west-facing slopes.

The less sloping areas of this soil are suitable for onsite waste disposal and building site development if proper design and installation procedures are used. Grading sites for septic tank absorption fields, sewage lagoons, buildings, and roads and streets helps to modify the slope. Some land shaping will be necessary on sites for buildings. The dwellings can be designed so that they conform to the natural slope of the land. Absorption field lines can be installed across the slope. If onsite sanitary facilities are installed, the sewage can pollute the ground water by seeping into the nearby sinkholes. The sinkholes should be considered in determining the limitations of a given area for urban development. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling generally is needed because of the slope.

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

4D2—Menfro-Bucklick silt loams, 9 to 14 percent slopes, eroded. These deep, strongly sloping, well drained soils are on convex upland ridgetops and side slopes. The Menfro soil is on convex ridgetops and shoulder slopes and extends approximately midway down the side slopes. The Bucklick soil is near midslope and extends into shallow drainageways. The drainageways dissect most areas, exposing limestone outcrop. Individual areas range from 20 to about 300 acres in size. They are about 50 to 60 percent Menfro soil and 30 to 40 percent Bucklick soil. The two soils occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the Menfro soil has a surface layer of brown silt loam about 4 inches thick. The subsoil is brown silty clay loam about 38 inches thick. The substratum to a depth of 60 inches or more is brown, mottled silt loam.

Typically, the Bucklick soil has a surface layer of brown silt loam about 4 inches thick. The subsoil is about 44 inches thick. The upper part is strong brown silty clay loam; the next part is yellowish red, mottled silty clay loam; and the lower part is reddish brown, mottled silty clay. Hard limestone bedrock is at a depth of about 48 inches. In some severely eroded areas, the surface layer is silty clay loam.

Included with these soils in mapping are areas of Caneyville soils on lower side slopes and areas of limestone rock outcrop. Caneyville soils are 20 to 40 inches deep over bedrock. The rock outcrop commonly is on south- and west-facing slopes. Included areas make up about 10 percent of this unit.

Permeability is moderate in the Menfro and Bucklick soils. Surface runoff is rapid. The available water capacity is high in the Menfro soil and moderate in the Bucklick soil. The shrink-swell potential is moderate in both soils. Natural fertility is medium. The organic matter content is moderately low in the Menfro soil and moderate in the Bucklick soil. The rooting depth is restricted by the bedrock at a depth of 40 to 60 inches in the Bucklick soil. The Menfro soil is strongly acid to neutral in the upper part and medium acid to neutral in the substratum. The Bucklick soil is very strongly acid to neutral in the surface layer, very strongly acid to medium acid in the upper part of the subsoil, and slightly acid or neutral in the lower part. The surface layer of both soils is friable and can be tilled fairly easily. In areas where it is mixed with subsoil material, however, it tends to crust after heavy rains.

These soils are suited to row crops grown on a limited basis in rotation with small grain and pasture and hay crops. Erosion is a severe hazard if row crops are grown year after year. A system of conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, contour farming, and conservation cropping systems that include grasses and legumes help to control erosion. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Some type of grade stabilization structure generally is needed. Proper management of crop residue and green manure crops help to control erosion, maintain tilth, improve or maintain the organic matter content, and increase the rate of water infiltration.

A cover of hay or pasture plants is very effective in controlling erosion. These soils are well suited to tall fescue, switchgrass, and red clover. They are moderately well suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

Many areas support native hardwoods. These soils are suited to trees. No major management concerns affect planting or harvesting on the Menfro soil. On the Bucklick soil plant competition is a limitation. It can be controlled by careful and thorough site preparation, which may include spraying or cutting. The less desirable woody species should be periodically removed.

These soils are suited to onsite waste disposal and building site development if proper design and installation procedures are used. Grading sites for septic tank absorption fields, sewage lagoons, and buildings helps to modify the slope. Some land shaping may be necessary on sites for buildings. If septic tank absorption fields are installed in the Bucklick soil, the depth to bedrock and the moderate permeability are limitations. They can be overcome by increasing the depth of the soil material over bedrock and by increasing the length of the lateral field. Absorption fields should be constructed farther upslope, on the Menfro soil where possible. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. The design of dwellings should allow for the depth to bedrock in the Bucklick soil. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel.

These soils are suitable as sites for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent damage caused by low strength. Some cutting and filling may be needed because of the slope.

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

4E—Menfro-Bucklick silt loams, 14 to 20 percent slopes. These deep, moderately steep, well drained soils are on convex, uneven side slopes and very narrow ridgetops. The Menfro soil is on convex, narrow ridgetops and the upper and middle side slopes. The Bucklick soil is on the lower side slopes and extends into drainageways. The drainageways dissect most areas, exposing limestone bedrock. Individual areas range from 20 to about 500 acres in size. They are about 50 to 60 percent Menfro soil and about 30 to 40 percent Bucklick soil. The two soils occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the Menfro soil has a surface layer of brown silt loam about 6 inches thick. The subsoil is dark yellowish brown and brown silty clay loam about 36 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown silt loam.

Typically, the Bucklick soil has a surface layer of dark brown silt loam about 2 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish red, mottled silty clay loam; the next part is reddish brown silty clay loam; and the lower part is reddish brown, mottled silty clay. Below this is a layer of weathered limestone about 2 inches thick. Hard limestone bedrock is at a depth of about 47 inches.

Included with these soils in mapping are areas of Caneyville soils on the lower side slopes, areas of limestone rock outcrop, and glades. Caneyville soils are 20 to 40 inches deep over bedrock. The glades and the rock outcrop commonly are on south- and west-facing slopes. Also included are severely eroded areas. Included areas make up about 10 percent of this unit.

Permeability is moderate in the Menfro and Bucklick soils. Surface runoff is rapid. The available water capacity is high in the Menfro soil and moderate in the Bucklick soil. The shrink-swell potential is moderate in both soils. Natural fertility is medium. The organic matter content is moderately low in the Menfro soil and moderate in the Bucklick soil. The rooting depth is restricted by the bedrock at a depth of 40 to 60 inches in the Bucklick soil. The Menfro soil is strongly acid to neutral throughout. The Bucklick soil is very strongly acid to neutral in the surface layer, very strongly acid to medium acid in the upper part of the subsoil, and slightly acid or neutral in the lower part.

These soils generally are unsuitable for cultivated crops because of the slope and a severe erosion hazard. They should be tilled only when reseeding of pasture or hayland is necessary. A cover of pasture plants or hay is very effective in controlling erosion. The soils are well suited to tall fescue, switchgrass, and red clover. They are moderately well suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

Many areas support native hardwoods. These soils are suited to trees. The erosion hazard and the equipment limitation are the main management concerns. Special erosion-control measures are needed. Careful design and proper construction of logging roads and skid trails, for example, can minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Hand planting or direct seeding may be needed. Plant competition on the Bucklick soil can be controlled by careful and thorough site preparation, which may include spraying or cutting. The less desirable woody species should be periodically removed.

These soils are suited to onsite waste disposal and building site development if proper design and installation procedures are used. Grading sites for buildings, septic tank absorption fields, and sewage lagoons help to modify the slope. If septic tank absorption fields are installed on the Bucklick soil, the depth to bedrock and the moderate permeability are limitations. They can be overcome by increasing the depth of the soil material over bedrock and increasing the length of the lateral field. Absorption fields should be constructed further upslope, on the Menfro soil where possible. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. Dwellings should be designed to allow for the depth to bedrock on the Bucklick soil. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel.

These soils are suitable as sites for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling may be needed because of the slope.

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

5C—Minnith silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on convex ridgetops and side slopes. Individual areas generally are long and irregularly shaped and range from 10 to more than 1,000 acres in size.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil is about 44 inches thick. It is brown and mottled. It is silty clay loam in the upper part and silt loam in the lower part. The substratum to a depth of 60 inches or more is brown, mottled loam. In some eroded areas the surface layer is silty clay loam. In places the depth to layers higher in content of sand is more than 40 inches.

Permeability is moderately slow, and surface runoff is medium or rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. A seasonal high water table is at a depth of 3 to 5 feet during winter and spring. Reaction ranges from very strongly acid to neutral in the subsoil and varies widely in the surface layer as a result of local liming practices. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops or pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, contour farming, and conservation cropping systems that include grasses and legumes help to prevent excessive soil loss. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Some type of grade stabilization structure generally is needed. Proper management of crop residue helps to control erosion, maintains tilth, improves or maintains the organic matter content, and increases the rate of water intake.

A cover of hay or pasture plants is very effective in controlling erosion. This soil is well suited to tall fescue, orchardgrass, smooth bromegrass, big bluestem, little bluestem, switchgrass, alfalfa, and red clover. No serious hazards or limitations affect pasture or hayland. Erosion is a problem when the plants are becoming established. Seedbed preparation should be timed to ensure a good ground cover.

Some areas support native hardwoods. This soil is suited to trees. Shortleaf pine, yellow-poplar, and white oak grow well. Measures that protect new stands from fire and grazing are needed. These measures also improve the habitat for woodland wildlife.

This soil is suitable for sanitary facilities and building site development if proper design and installation procedures are used. Because of the restricted permeability and the wetness, septic tank absorption fields should be constructed on a mound of better suited material. Also, the length of lateral field should be increased or the laterals should be installed in the deeper, more permeable material. Grading sites for sewage lagoons and small commercial buildings helps to modify the slope. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Installing drain tile around foundations and footings helps to prevent the damage caused by excessive wetness. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways.

This soil is suitable for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength.

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

7E2—Menfro-Caneyville silt loams, karst, 5 to 20 percent slopes, eroded. These moderately sloping to moderately steep, well drained soils are on uplands characterized by numerous sinkholes. The sinkholes are about 2 to 30 or more feet deep. They range from 20 to 500 or more feet in diameter. The largest ones are 15 to 20 acres in size. The deep Menfro soil is on ridges between the sinkholes and extends partway down the side slopes, towards the sinkholes. The moderately deep Caneyville soil is on the mid and lower side slopes of the sinkholes. Individual areas range from 10 to more than 800 acres in size. They generally are about 40 to 50 percent Menfro soil and 30 to 40 percent Caneyville soil. Areas that have shallow depressions, however, are about 80 percent Menfro soil. The two soils occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the Menfro soil has a surface layer of brown silt loam about 3 inches thick. The subsoil is brown silty clay loam about 47 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown silt loam.

Typically, the Caneyville soil has a surface layer of mixed brown and dark grayish brown silt loam about 3 inches thick. The subsoil is about 29 inches thick. The upper part is yellowish red, mottled silty clay, and the lower part is yellowish brown, dark yellowish brown, and light olive brown clay. Hard limestone bedrock is at a depth of about 32 inches.

Included with these soils in mapping are small areas of Bucklick and Gasconade soils. Bucklick soils are 40 to 60 inches deep over bedrock. Gasconade soils are somewhat excessively drained and are less than 20 inches deep over bedrock. Also included are areas where limestone crops out on the lower side slopes or the bottom of sinkholes. Included areas generally make up about 15 percent of this unit, but in places they make up as much as 25 percent.

Permeability is moderate in the Menfro soil and moderately slow in the Caneyville soil. Surface runoff is medium or rapid on both soils. The available water capacity is high in the Menfro soil and low in the Caneyville soil. The organic matter content is moderately low in both soils, and natural fertility is medium. The Menfro soil is strongly acid to neutral in the surface layer and subsoil and medium acid to neutral in the substratum. The Caneyville soil is very strongly acid to neutral in the surface soil and in the upper part of the subsoil and is slightly acid to mildly alkaline in the lower part. Root development is restricted by the bedrock at a depth of 20 to 40 inches in the Caneyville soil.

Most areas are used for pasture, hay, or woodland. A few of the moderately sloping areas of the Menfro soil are used for cultivated crops. They are suited to corn, soybeans, and small grain grown on a limited basis. These areas generally have fewer sinkholes than the steeper areas. Erosion is a severe hazard in the cultivated areas. It can be controlled by a system of conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, and grassed waterways. Proper management of crop residue and green manure crops help to control erosion, maintain tilth, improve or maintain the organic matter content, and increase the rate of water intake.

These soils are moderately well suited to tall fescue, big bluestem, little bluestem, indiangrass, and lespedeza. They are moderately suited to orchardgrass, smooth bromegrass, and switchgrass. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner help to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed. Shallow rooted species that can withstand droughty conditions should be selected for planting. Erosion is a problem when the plants are seeded. Timely tillage and rapid establishment of the ground cover help to prevent excessive erosion.

These soils are suited to trees. The erosion hazard and the equipment limitation are management concerns in areas where the slope is more than 15 percent. Seedling mortality is a limitation on the Caneyville soil. Planting container-grown nursery stock increases the seedling survival rate. Special erosion-control measures are needed. Careful design and proper construction of logging roads and skid trails, for example, minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed areas should be seeded after the trees are harvested. Operating equipment on these slopes is hazardous. As a result roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads or skid trails. Hand planting or direct seeding may be needed.

In most areas these soils are unsuitable for sanitary facilities and building site development. The moderately sloping areas of the Menfro soil that are between the sinkholes, however, are suitable if proper design and installation procedures are used. Septic tank absorption fields can be installed across the slope. The sewage, however, can pollute the ground water by seeping into the nearby sinkholes. The sinkholes should be considered in determining the limitations of a given area for urban development. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel.

These soils are suitable as sites for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling may be necessary because of the slope.

The land capability classification is VIe. The woodland ordination symbol of the Menfro soil is 3r, and that of the Caneyville soil is 4r.

8D2—Minnith-Lily complex, 9 to 14 percent slopes, eroded. These strongly sloping soils are on convex side slopes. The deep, moderately well drained Minnith soil is on shoulder slopes and extends approximately midway down the side slopes. The moderately deep, well drained Lily soil extends from near midslope to the bottom of the side slopes and into shallow drainageways. The drainageways dissect some areas, exposing sandstone outcrops. Individual areas range from 10 to several hundred acres in size. They are about 50 to 55 percent Minnith soil and 30 to 35 percent Lily soil. The two soils occur as areas so intermingled that they cannot be mapped separately at the scale selected for mapping.

Typically, the Minnith soil has a surface layer of dark yellowish brown silt loam about 4 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish brown silty clay loam; the next part is brown, mottled silt loam; and the lower part is dark yellowish brown, mottled loam.

Typically, the Lily soil has a surface layer of brown loam about 4 inches thick. The subsoil is about 23 inches thick. The upper part is strong brown clay loam, and the lower part is strong brown sandy clay loam. Hard sandstone bedrock is at a depth of about 27 inches.

Included with these soils in mapping are areas of Kickapoo soils on narrow flood plains; areas of sandstone rock outcrop on some side slopes, on toe slopes, and in drainageways; and areas of soils that are less than 20 inches deep over hard sandstone bedrock. The shallow soils are on the lower side slopes, on toe slopes, and in areas intermingled with the rock outcrop. Kickapoo soils contain less clay than the Minnith and Lily soils. Also included are some severely eroded areas where the surface layer is yellowish brown silty clay loam or strong brown clay loam. Included areas make up about 15 percent of this unit.

Permeability is moderately slow in the Minnith soil and moderately rapid in the Lily soil. Surface runoff is medium on both soils. The available water capacity is high in the Minnith soil and low in the Liiy soil. The Minnith soil is strongly acid to neutral in the surface layer and very strongly acid to neutral in the subsoil. The Lily soil is extremely acid to strongly acid throughout. Natural fertility is medium in the Minnith soil and low in the Lily soil. The organic matter content is moderately low in the Minnith soil and low in the Lily soil. The rooting depth is restricted by the bedrock at a depth of 20 to 40 inches in the Lily soil. A seasonal high water table is at a depth of 3 to 5 feet during winter and spring in the Minnith soil. The surface layer of both soils is very friable and can be tilled fairly easily in all areas except for small eroded ones.

These soils are suited to cultivated crops grown on a limited basis in rotation with close grown pasture and hay crops. Erosion is a severe hazard if cultivated crops are grown. Also, the low available water capacity of the Lily soil is a limitation. A system of conservation tillage that leaves all or part of the crop residue on the surface, contour farming, winter cover crops, conservation cropping systems that include grasses and legumes, grassed waterways, and terraces help to prevent excessive erosion. Proper management of crop residue and green manure crops help to control erosion, maintain tilth, improve or maintain the organic matter content, and increase the rate of water infiltration.

A cover of hay or pasture plants is very effective in controlling erosion. These soils are moderately well suited to tall fescue, big bluestem, little bluestem, indiangrass, and lespedeza. They are moderately suited to orchardgrass, smooth bromegrass, and switchgrass. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner help to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Shallow rooted species that can withstand droughty conditions should be selected for planting. Erosion is a serious problem when the plants are seeded. Timely tillage and rapid establishment of the ground cover help to prevent excessive erosion. Applications of lime and fertilizer help to maintain fertility. Mowing helps to control brush and weeds.

Many areas support native hardwoods. These soils are suited to trees. Shortleaf pine and white oak grow well. No major hazards or limitations affect planting or harvesting.

The Minnith soil is suitable for some sanitary facilities and building site development if proper design and installation procedures are used. The Lily soil generally is unsuitable because of the moderate depth to bedrock. Grading areas of the Minnith soil used for onsite waste disposal and dwellings can modify the slope. The dwellings can be designed so that they conform to the natural slope of the land. This soil is better suited to sewage lagoons than to septic tank absorption fields. Sealing the bottom of the lagoons with slowly permeable material helps to prevent seepage. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways.

These soils are suitable as sites for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling may be needed because of the slope. Also, filling is needed in some areas because of the moderate depth to bedrock in the Lily soil.

The land capability classification is IVe. The woodland ordination symbol of the Minnith soil is 3a, and that of the Lily soil is 4a.

9C—Hildebrecht silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on narrow ridgetops and, less commonly, on foot slopes. Individual areas are long and narrow and range from about 10 to several hundred acres in size.

Typically, the surface layer is brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam to about 8 inches thick. The upper part of the subsoil is brown and strong brown, mottled silty clay loam about 16 inches thick. The next part is a dense, brittle fragipan about 17 inches thick. It is dark yellowish brown, mottled very cherty silt loam. The lower part to a depth of about 60 inches or more is yellowish red, mottled cherty silty clay. In some areas, mainly on foot slopes, the chert content in the lower part of the subsoil is 0 to 5 percent.

Included with this soil in mapping are small areas of Weingarten soils on ridges and foot slopes. These soils do not have a fragipan. They make up about 5 percent of this unit.

Permeability is moderate above the fragipan in the Hildebrecht soil and slow in the pan. Surface runoff is medium. The available water capacity is low in the root zone above the fragipan. Natural fertility is low, and the organic matter content is moderately low. Reaction is very strongly acid to medium acid in the upper part of the soil unless the surface layer has been limed. The dense fragipan ranges from extremely acid to strongly acid. The rooting depth is limited by the fragipan at a depth of about 27 inches. A perched seasonal high water table is at a depth of 2.0 to 2.5 feet during winter and spring.

This soil is suited to most cultivated crops, but a shortage of soil moisture in summer commonly is a limitation if row crops are grown. In cultivated areas measures that help to control erosion are needed. Examples are a system of conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, contour farming, and conservation cropping systems that include grasses and legumes. Proper management of crop residue helps to control erosion, maintains tilth, improves or maintains the organic matter content, and increases the rate of water intake.

A cover of hay or pasture plants is effective in controlling erosion. This soil is moderately well suited to tall fescue, orchardgrass, big bluestem, little bluestem, indiangrass, and lespedeza. It is moderately suited to smooth bromegrass, switchgrass, alfalfa, and red clover. The rooting depth is only moderate, and droughtiness is a problem during much of the growing season. Erosion control is a major concern when the plants are seeded. Timely tillage and rapid establishment of the ground cover help to prevent excessive erosion.

Many areas support native hardwoods. This soil is suited to trees. Windthrow is a management concern. Stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is less severe. No other hazards or limitations affect planting or harvesting.

This soil is suitable for onsite waste disposal and building site development if proper design and installation procedures are used. Grading sites for sewage lagoons and small commercial buildings helps to modify the slope. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. Installing tile drains around footings and foundations will help lower the water table and prevent damage caused by excessive wetness. The damage caused to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Adequate reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable material or mixing the soil with additives helps to prevent the damage caused by low strength.

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

9D—Hildebrecht silt loam, 9 to 14 percent slopes. This deep, strongly sloping, moderately well drained soil is on narrow ridgetops, side slopes, and foot slopes. Individual areas are irregular in shape and range from about 10 to several hundred acres in size.

Typically, the surface layer is brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is strong brown, friable silty clay loam that is mottled below a depth of 19 inches. The next part is a dense, brittle fragipan about 25 inches thick. It is brown, mottled extremely cherty silt loam over strong brown cherty clay loam. The part of the subsoil below the fragipan is yellowish red cherty silty clay. In some areas the content of chert in the subsoil layer directly above the fragipan is about 10 to 30 percent.

Included with this soil in mapping are small areas of Elsah and Goss soils. The somewhat excessively drained Elsah soils are on narrow flood plains. The well drained Goss soils are cherty throughout and are on short, steep slopes on the lower parts of the landscape. Also included are some areas of the well drained Weingarten soils, which do not have a fragipan. Included soils make up about 15 percent of this unit.

Permeability is moderate above the fragipan in the Hildebrecht soil and slow in the pan. Surface runoff is rapid. The available water is low in the root zone above the fragipan. Natural fertility is low, and the organic matter content is moderately low. The upper part of the soil is very strongly acid to medium acid unless the surface layer has been limed. The dense fragipan ranges from extremely acid to strongly acid. The rooting depth is limited by the fragipan at a depth of about 27 inches. A perched seasonal high water table is at a depth of 2.0 to 2.5 feet during winter and spring.

This soil generally is suitable for cultivated crops grown on a limited basis in rotation with close growing pasture and hay crops. A shortage of soil moisture in summer commonly is a severe limitation if row crops are grown. Also, erosion is a hazard. It can be controlled by a system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, contour farming, and a conservation cropping system that includes grasses and legumes.

A cover of hay or pasture plants is effective in controlling erosion. This soil is moderately well suited to tall fescue, big bluestem, little bluestem, indiangrass, lespedeza, and birdsfoot trefoil. It is moderately suited to orchardgrass, smooth bromegrass, and switchgrass. Shallow rooted species that can withstand droughtiness should be selected for planting. Erosion is a serious problem when the plants are seeded. Timely tillage and rapid establishment of the ground cover help to prevent excessive erosion.

Many areas support native hardwoods. This soil is suited to trees. Windthrow is a management concern. Stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is less severe. No other hazards or limitations affect planting or harvesting.

This soil is suited to some sanitary facilities and building site development if structures are properly designed and installed. It is better suited to sewage lagoons than to other methods of onsite waste disposal. The site generally can be leveled to a suitable grade. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. Some land shaping or grading generally is necessary on sites for dwellings. Otherwise, the dwellings can be designed so that they conform to the natural slope of the land. Installing tile drains around footings and foundations helps to prevent the damage caused by excessive wetness. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling may be necessary because of the slope.

The land capability classification is IVe. The woodland ordination symbol is 4d.

10F—Menfro-Caneyville-Rubble land complex, 20 to 60 percent slopes. This map unit consists of well drained Menfro and Caneyville soils intermingled with areas of Rubble land on steep and very steep side slopes and narrow ridges in the geologically faulted "River Hills" area adjacent to the flood plains along the Mississippi River. The deep Menfro soil is on side slopes and narrow ridges. The moderately deep Caneyville soil is on side slopes that face south and west. The Rubble land occurs as narrow bands on side slopes and is directly associated with the fault system. Individual areas range from 80 to several hundred acres in size. They are about 50 percent Menfro soil, 20 percent Caneyville soil, and 10 percent Rubble land. The soils and the Rubble land occur as areas so intermingled that they cannot be mapped separately at the scale selected for mapping.

Typically, the Menfro soil has a surface layer of brown silt loam about 4 inches thick. The subsurface layer is dark yellowish brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown silt loam, the next part is brown silty clay loam, and the lower part is dark yellowish brown silt loam.

Typically, the Caneyville soil has a surface layer of brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil is about 25 inches thick. The upper part is strong brown silty clay loam, the next part is yellowish red silty clay, and the lower part is red, mottled silty clay. Hard limestone bedrock is at a depth of about 34 inches.

The Rubble land occurs as areas of limestone, sandstone, and chert stones and boulders, generally on south- to west-facing exposures below the prominent ridges associated with the fault system. It also is on a few northeast-facing exposures on the bluffs along the Mississippi River.

Included with this unit in mapping are areas of Clarksville and Goss soils. These soils occur as areas intermingled with areas of the Caneyville soil. They are cherty throughout. Also included are soils that have colors and textures similar to those of the Menfro soil but that are moderately deep over bedrock. Included soils make up about 20 percent of this unit.

Permeability is moderate in the Menfro soil and moderately slow in the Caneyville soil. Surface runoff is rapid on both soils. The available water capacity is high in the Menfro soil and low in the Caneyville soil. The organic matter content is moderately low in both soils, and natural fertility is medium. The rooting depth is restricted by the bedrock at a depth of 20 to 40 inches in the Caneyville soil. The Menfro soil is strongly acid to neutral in the upper part and medium acid to neutral in the substratum. The Caneyville soil is very strongly acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part.

Nearly all areas are forested. The Menfro and Caneyville soils generally are unsuitable for cultivated crops because of the slope and a severe erosion hazard. These soils are suited to trees. Because of the slope, the hazard of erosion and the equipment limitation are management concerns that affect planting and harvesting. Special erosion-control measures are needed. Careful design and proper construction of logging roads and skid trails, for example, minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Hand planting or direct seeding may be needed. Seedling mortality is a management concern on the Caneyville soil. Planting container-grown nursery stock increases the seedling survival rate.

The Menfro and Caneyville soils generally are unsuitable for sanitary facilities and building site development because of the slope of both soils and the depth to bedrock in the Caneyville soil.

The land capability classification is VIIe. The woodland ordination symbol of the Menfro soil is 3r, and that of the Caneyville soil is 4r. The Rubble land is not assigned a woodland ordination symbol.

11E—Goss cherty silt loam, 14 to 35 percent slopes. This deep, moderately steep to very steep, well drained soil is on highly dissected uplands. Individual areas are irregular in shape and range from about 10 to more than 1,000 acres in size.

Typically, the surface layer is a dark grayish brown cherty silt loam about 2 inches thick. The subsurface layer is light yellowish brown cherty silt loam about 10 inches thick. The subsoil extends to a depth of 75 inches or more. In sequence downward, it is strong brown very cherty silt loam; yellowish red very cherty silty clay loam; red, mottled very cherty silty clay; and red and yellowish brown, mottled very cherty clay. In some areas limestone bedrock is within a depth of 60 inches. In other areas the content of chert fragments in the subsoil is less than 35 percent. In places the surface layer is silt loam.

Included with this soil in mapping are areas of Elsah, Gasconade, and Hildebrecht soils. Elsah soils contain less clay than the Goss soil. They are on narrow flood plains. The shallow Gasconade soils are on the lower slopes in some areas and on short, steep slopes adjacent to creeks. Hildebrecht soils have a fragipan. They are on short foot slopes and narrow ridges. Also included are stony areas as much as 3 acres in size. Included areas make up about 15 percent of this unit.

Permeability is moderate in the Goss soil, and surface runoff is rapid. The available water capacity and natural fertility are low. The organic matter content is moderately low. Reaction ranges from very strongly acid to medium acid throughout the soil unless the surface layer has been limed.

Most areas support native hardwoods. This soil is suited to trees. The erosion hazard, the equipment limitation, and seedling mortality affect planting and harvesting. Special erosion-control measures are needed. Careful design and construction of logging roads and skid trails, for example, minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Planting container-grown nursery stock increases the seedling survival rate.

This soil generally is unsuited to cultivated crops and hay because of the slope, the low available water capacity, and the cherty surface layer. Cleared areas where the slope is less than 20 percent are moderately suited to tall fescue, big bluestem, little bluestem, switchgrass, crownvetch, and lespedeza. Droughtiness, erosion, and the chert fragments in the surface layer are the main concerns in managing pastured areas. Tillage should be avoided.

This soil is suited to sanitary facilities and building site development only if proper design and installation procedures are used. Grading sites for septic tank absorption fields and buildings helps to modify the slope. Land shaping may be needed. Buildings can be designed so that they conform to the natural slope of the land. Laterals in septic tank absorption fields should be installed across the slope. Increasing the length of the lateral field helps to overcome the moderate permeability. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling generally is needed because of the slope.

The land capability classification is VIIs. The woodland ordination symbol is 4r.

12E—Lily-Minnith complex, 14 to 30 percent slopes. These moderately steep and steep, well drained soils are on upland side slopes that generally are dissected by draws or hollows. The moderately deep Lily soil is on the mid and lower parts of the side slopes. The deep Minnith soil is on the upper parts of the side slopes. Individual areas range from about 10 to 400 acres in size. They are about 50 percent Lily soil and 35 percent Minnith soil. The two soils occur as areas so intricately mixed or so small that they cannot be mapped separately at the scale selected for mapping.

Typically, the Lily soil has a surface layer of very dark grayish brown loam about 3 inches thick. The subsurface layer is dark grayish brown, mottled loam about 3 inches thick. The subsoil is about 22 inches thick. It is mottled. The upper part is yellowish brown loam, the next part is strong brown clay loam, and the lower part is brown clay loam. Acid sandstone bedrock is at a depth of about 28 inches.

Typically, the Minnith soil has a surface layer of dark brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown silty clay loam; the next part is strong brown, mottled clay loam; and the lower part is strong brown loam.

Included with these soils in mapping are areas of soils that are less than 20 inches deep over sandstone and areas of sandstone outcrop and boulders. Also included are areas of the deep, cherty Goss soils on the lower side slopes. Included areas make up about 15 percent of this unit.

Permeability is moderately rapid in the Lily soil and moderately slow in the Minnith soil. Surface runoff is rapid on both soils. The available water capacity is low in the Lily soil and high in the Minnith soil. The rooting depth is restricted by the bedrock at a depth of 20 to 40 inches in the Lily soil. A seasonal high water table is at a depth of 3 to 5 feet during winter and spring in the Minnith soil. The Lily soil is extremely acid to strongly acid throughout. The Minnith soil is strongly acid to neutral in the surface soil and very strongly acid to neutral in the subsoil. The organic matter content is low in the Lily soil and moderately low in the Minnith soil. Natural fertility is low in the Lily soil and medium in the Minnith soil.

A few areas are used for pasture and hay. Because of the slope and a severe erosion hazard, these soils generally are unsuitable for cultivated crops. They are moderately well suited to tall fescue, big bluestem, little bluestem, indiangrass, birdsfoot trefoil, and lespedeza. They are moderately suited to orchardgrass, smooth bromegrass, and switchgrass. Shallow rooted species that can withstand droughty conditions should be selected for planting. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Most areas support native hardwoods. These soils are suited to trees. Because of the slope, the hazard of erosion and the equipment limitation are management concerns that affect planting and harvesting. Special erosion-control measures are needed. Careful design and proper construction of logging roads and skid trails, for example, minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Hand planting or direct seeding may be needed.

The Lily soil generally is unsuitable for onsite waste disposal and building site development because of the depth to bedrock and the slope. The Minnith soil is suitable for some sanitary facilities and building site development if proper design and installation procedures are used. Sites for sewage lagoons and buildings generally can be graded, shaped, or leveled to a suitable gradient. The Minnith soil is better suited to sewage lagoons than to septic tank absorption fields. Seepage from the lagoons can be prevented by sealing the bottom and berms with slowly permeable material. The damage to buildings caused by shrinking and swelling generally can be prevented by using reinforcement steel in foundations, footings, and walls and by backfilling with sand or gravel. Installing tile drains around the footings and foundations helps to prevent the damage caused by excessive wetness. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways.

The Minnith soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Some cutting and filling generally is needed because of the slope.

The land capability classification is VIe. The woodland ordination symbol of the Lily soil is 4r, and that of the Minnith soil is 3r.

15E—Gasconade-Rock outcrop complex, 9 to 35 percent slopes. This map unit occurs as areas of a shallow, strongly sloping to steep, somewhat excessively drained Gasconade soil closely intermingled with areas of Rock outcrop. It is on side slopes and on some narrow ridges. The Gasconade soil is on shelflike layers of dolomite limestone. Stones cover about 1 to 2 percent of the surface of this soil. Individual areas are irregularly shaped and range from 10 to about 500 acres in size. They are about 60 percent Gasconade soil and 20 percent Rock outcrop.

Typically, the Gasconade soil has a surface layer of black stony silty clay loam about 4 inches thick. The subsurface layer is black very channery silty clay loam about 5 inches thick. The subsoil is very dark brown very channery silty clay loam about 5 inches thick. Hard dolomite bedrock is at a depth of about 14 inches. In some areas the soil contains less clay.

Included with this unit in mapping are small areas of the moderately deep Caneyville soils and the deep Goss soils. Also included, on north- and east-facing slopes, are areas where the soil is more than 20 inches deep over bedrock. Included soils make up about 20 percent of this unit.

Permeability is moderately slow in the Gasconade soil, and surface runoff is rapid. The available water capacity is very low. Natural fertility is medium, and the organic matter content is moderate. The rooting depth is restricted by the bedrock at a depth of about 4 to 20 inches. The roots of some shrubs and trees, however, can extend into crevices or fractures in the dolomite. The soil is slightly acid to mildly alkaline throughout.

Most areas are used for timber or for wooded pasture that supports native grasses. Only a few areas are grazed. Because of the slope, the depth to bedrock, and the stones on the surface, the Gasconade soil generally is unsuitable for cultivated crops. It is suited to trees, but the production is low and intensive timber management generally is not feasible. In most areas eastern redcedar is the dominant species. It is used for high-quality fenceposts. On some north- and east-facing slopes, however, growth rates are significantly higher and black oak, white oak, and hickories are the dominant species. Some north-facing slopes support oaks, mainly black oak.

The Gasconade soil is poorly suited to pasture. The best suited pasture plants are big bluestem, little bluestem, indiangrass, crownvetch, and lespedeza. Tilling the soil is nearly impossible because it is shallow and has a surface layer that commonly is flaggy. Broadcasting is the best seeding method.

The Gasconade soil generally is unsuitable for sanitary facilities and building site development because of the slope, the depth to bedrock, and the large stones.

The land capability classification is VIIs. The woodland ordination symbol of the Gasconade soil is 5r. The Rock outcrop is not assigned a woodland ordination symbol.

18C—Weller silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on ridgetops, foot slopes, and long side slopes. Individual areas are irregular in shape and range from 15 to about 250 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish brown and brown, mottled silty clay loam; the next part is grayish brown, mottled silty clay and silty clay loam; and the lower part is yellowish brown, mottled silt loam.

Included with this soil in mapping are small areas of Auxvasse and Weingarten soils. The poorly drained Auxvasse soils are on terraces and narrow foot slopes. The well drained Weingarten soils are in a few scattered upland areas. Included soils make up about 10 percent of this unit.

Permeability is slow in the Weller soil, and surface runoff is medium. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. A seasonal high water table is at a depth of 2 to 4 feet during winter and spring. The shrink-swell potential is high in the subsoil. Reaction ranges from very strongly acid to neutral in the surface layer and is very strongly acid to medium acid in the subsoil.

Most areas are used for cultivated crops or pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled by a system of conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, conservation cropping systems that include grasses and legumes, and grassed waterways. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Some type of grade stabilization structure generally is needed. Proper management of crop residue helps to control erosion, maintains the organic matter content, and increases the rate of water intake.

A cover of hay or pasture plants is very effective in controlling erosion. This soil is moderately well suited to tall fescue, reed canarygrass, big bluestem, switchgrass, crownvetch, and lespedeza. It is moderately suited to orchardgrass, smooth bromegrass, little bluestem, alfalfa, and red clover. Erosion during seedbed preparation is the main management problem. It can be controlled by timely tillage and rapid establishment of the ground cover.

This soil is suited to trees. Seedling mortality and windthrow are management concerns. Planting container-grown nursery stock increases the seedling survival rate. Stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is less severe.

This soil is suited to some sanitary facilities and building site development if proper design and installation procedures are used. Septic tank absorption fields function poorly in winter and early in spring because of the slow permeability and the wetness. A sewage lagoon is a better system of onsite waste disposal. Grading sites for lagoons helps to modify the slope. The shrink-swell potential and the wetness are limitations on sites for buildings. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel and by backfilling concrete footings, foundations, and basement walls with sand or gravel. Installing tile drains around footings and foundations reduces the wetness. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable material or mixing the soil with additives helps to prevent the damage caused by low strength.

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

19C—Weingarten silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on convex ridgetops, side slopes, and foot slopes. Individual areas are long and irregularly shaped and range from about 10 to several hundred acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. It is mottled. The upper part is yellowish brown silty clay loam; the next part is yellowish brown, slightly brittle silt loam; and the lower part is strong brown very cherty silty clay loam and red very cherty silty clay.

Included with this soil in mapping are small areas of Hildebrecht and Weller soils. The moderately well drained Hildebrecht soils are on the fringes of the mapped areas. The moderately well drained Weller soils are in the smoother, less sloping areas and on foot slopes. Included soils make up about 5 percent of this unit.

Permeability is moderately slow in the Weingarten soil, and surface runoff is medium. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is slightly acid or neutral unless it has been limed. The upper part of the subsoil is very strongly acid to medium acid, the next part is strongly acid to slightly acid, and the lower part is strongly acid to mildly alkaline. The rooting depth is moderately restricted at a depth of about 40 to 60 inches.

Most areas are used for cultivated crops or pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled by a system of conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, conservation cropping systems that include grasses and legumes, and grassed waterways. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Some type of grade stabilization structure generally is needed. Proper management of crop residue helps to control erosion, maintains tilth, improves or maintains the organic matter content, and increases the rate of water intake.

A cover of hay or pasture plants is very effective in controlling erosion (fig. 8). This soil is well suited to tall fescue, orchardgrass, smooth bromegrass, big bluestem, little bluestem, switchgrass, alfalfa, and red clover. No serious hazards or limitations affect pasture or hayland. Erosion is a problem when the plants are becoming established. Seedbed preparation should be timed to ensure a good ground cover. Applications of lime and fertilizer help to maintain fertility. Mowing helps to control brush and weeds.

Some areas support native hardwoods. This soil is suited to trees. Yellow-poplar, shortleaf pine, and northern red oak grow well. No major hazards or limitations affect planting or harvesting.

This soil is suitable for most sanitary facilities and building site development if proper design and

Figure 8.—Bales of grass-legume hay on Weingarten silt loam, 3 to 9 percent slopes.

installation procedures are used. Septic tanks function poorly because of the slow permeability. Grading sites for sewage lagoons and small commercial buildings helps to modify the slope. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable material or mixing the soil with additives helps to prevent the damage caused by low strength.

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

19D—Weingarten silt loam, 9 to 14 percent slopes. This deep, strongly sloping, well drained soil is on ridges, side slopes, and foot slopes. Individual areas are long and irregularly shaped and range from 10 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is yellowish brown silt loam about 4 inches thick. The subsoil extends to a depth of about 70 inches. It is mottled. In sequence downward, it is strong brown silt loam and silty clay loam; brown silty clay loam; brown, slightly brittle silt loam; and yellowish red extremely cherty silty clay loam and cherty silty clay. In some severely eroded areas, the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Goss and Hildebrecht soils. The cherty Goss soils are on the lower, steeper side slopes. Hildebrecht soils have a fragipan. They are mainly on south- to west-facing slopes. Included soils make up about 10 percent of this unit.

Permeability is moderately slow in the Weingarten soil, and surface runoff is rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is slightly acid or neutral unless it has been limed. The upper part of the subsoil is very strongly acid to medium acid, the next part is strongly acid to slightly acid, and the lower part is strongly acid to mildly alkaline. The rooting depth is moderately restricted at a depth of about 40 to 60 inches.

Most areas are used for pasture, hay, or timber. Some are used for row crops. This soil is suited to row crops grown on a limited basis in rotation with close grown pasture and hay crops. If row crops are grown, erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, conservation cropping systems that include grasses and legumes, and grassed waterways. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Some type of grade stabilization structure generally is needed. Proper management of crop residue helps to control erosion, maintains tilth, improves or maintains the organic matter content, and increases the rate of water intake.

A cover of hay or pasture plants is very effective in controlling erosion. This soil is well suited to tall fescue, switchgrass, and red clover. It is moderately well suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid plant growth and thus a good ground cover. Overgrazing should be avoided. Applications of lime and fertilizer help to maintain fertility. Mowing helps to control brush and weeds.

Many areas support native hardwoods. This soil is suited to trees. Shortleaf pine, yellow-poplar, and northern red oak grow well. No major hazards or limitations affect planting or harvesting.

This soil is suitable for most sanitary facilities and building site development if proper design and installation procedures are used. Septic tank absorption fields function poorly because of the slow permeability. Grading sites for sewage lagoons and buildings helps to modify the slope. Seepage from sewage lagoons can be prevented by sealing the berms and bottom with slowly permeable material. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete foundations, footings, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts helps to prevent the damage caused by frost action and by shrinking and swelling. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps prevent the damage caused by low strength. Some cutting and filling may be necessary because of the slope.

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

20—Wilbur silt loam. This deep, nearly level, moderately well drained soil is on flood plains. It is frequently flooded. Individual areas are long and irregularly shaped and range from 10 to more than 600 acres in size.

Typically, the surface layer is brown silt loam about 7 inches thick. The substratum to a depth of 60 inches or more is brown and dark yellowish brown, mottled silt loam. In some areas the soil has no mottles within a depth of 36 inches.

Included with this soil in mapping are a few areas of the somewhat poorly drained Freeburg soils on low terraces. Also included are slightly concave areas of a somewhat poorly drained soil that is grayer throughout than the Wilbur soil. Included soils make up about 10 percent of this unit.

Permeability is moderate in the Wilbur soil, and surface runoff is slow. The available water capacity is very high. Natural fertility is high, and the organic matter content is moderately low. A seasonal high water table is at a depth of 1.5 to 3.0 feet during winter and spring. Reaction ranges from strongly acid to neutral throughout the soil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for row crops. A few are used for pasture and hay. This soil is suited to corn, soybeans, and small grain. Flooding causes minor crop damage in some years, but most periods of flooding do not occur during the summer growing season and are brief. Wet spots in fields can be eliminated by land grading. Returning crop residue to the soil helps to maintain fertility and tilth.

This soil is well suited to tall fescue, orchardgrass, switchgrass, alfalfa, and red clover. It is moderately well suited to smooth bromegrass, big bluestem, and little bluestem. Flooding is the main management problem. It should be considered when a grazing system is selected. The species that can withstand wetness grow best.

A few areas are timbered. This soil is suited to trees. Plant competition can be controlled by thorough site preparation, which may include spraying or cutting. No major hazards or limitations affect planting or harvesting.

This soil generally is unsuitable for sanitary facilities and building site development because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 1a.

21—Haymond silt loam. This deep, nearly level, well drained soil is on flood plains. It is frequently flooded. Individual areas are long and irregularly shaped and range from about 10 to more than 200 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The substratum to a depth of 65 inches or more is dark brown and brown, mottled silt loam.

Included with this soil in mapping are small areas of Elsah, Freeburg, and Kickapoo soils. Elsah soils are cherty throughout. They generally occur as narrow bands along stream channels or are on alluvial fans and along narrow drainageways bordering steep uplands. Freeburg soils are somewhat poorly drained and are on low terraces. Kickapoo soils contain more sand than the Haymond soil. They are in the lower areas adjacent to drainageways and creeks. Also included are small areas of soils that are grayer throughout than the Haymond soil. Included soils make up about 10 percent of this unit.

Permeability is moderate in the Haymond soil, and surface runoff is very slow. The available water capacity is very high. Natural fertility is high, and the organic matter content is moderately low. Reaction ranges from medium acid to neutral throughout the soil. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. A few are used for pasture and hay. This soil is well suited to corn, soybeans, and wheat. Flooding causes minor crop damage in some years, but it generally occurs in winter or early in spring, before crops are planted.

This soil is well suited to fall fescue, orchardgrass, switchgrass, alfalfa, and red clover. It is moderately well suited to smooth bromegrass, big bluestem, and little bluestem. Flooding is the main management problem. It should be considered when a grazing system is selected. The species that can withstand wetness grow best.

A few small areas support hardwoods. This soil is suited to trees, including high-value species, such as black walnut and pecan. Plant competition can be controlled by careful and thorough site preparation, which may include spraying or cutting.

This soil generally is unsuitable for sanitary facilities and building site development because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 1a.

24A—Elsah loam, 0 to 3 percent slopes. This nearly level and very gently sloping, somewhat excessively drained soil is on narrow flood plains. It is frequently flooded. Individual areas are linear and range from about 20 to more than 400 acres in size.

Typically, the surface layer is dark yellowish brown loam about 12 inches thick. The substratum to a depth of 60 inches or more is brown, stratified cherty loam, extremely cherty loam, and extremely cherty sand. In some areas the surface layer is cherty. In other areas it is dark brown.

Included with this soil in mapping are areas of the well drained, noncherty Haymond soils, the moderately well drained Hildebrecht soils on foot slopes, and the somewhat excessively drained Midco soils adjacent to the stream channels or in old stream channels. Midco soils have a cherty surface layer and contain more sand than the Elsah soil. Included soils make up about 15 percent of this unit.

Permeability is moderately rapid in the Elsah soil, and surface runoff is slow. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderately low. Reaction is neutral to medium acid throughout the soil.

Most areas are used for pasture and hay. Some are wooded. This soil is well suited to tall fescue and switchgrass and is moderately suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, red clover, and lespedeza. Drought and flooding are the main hazards. Flood-tolerant species should be selected for planting.

This soil is suited to cultivated crops, but it generally is droughty during the summer because of the high content of chert. Brief flooding is a hazard, particularly during the spring.

This soil is suited to trees (fig. 9). Seedling mortality is a management concern. Planting larger nursery stock than is typical increases the seedling survival rate.

This soil generally is unsuitable for sanitary facilities and building site development because of the flooding.

The land capability classification is IIs. The woodland ordination symbol is 4f.

25A—Midco-Riverwash complex, 0 to 3 percent slopes. This map unit occurs as areas of a deep, nearly level and very gently sloping, somewhat excessively drained Midco soil closely intermingled with Riverwash. The unit is frequently flooded. The Midco soil occurs as long, narrow bands on narrow creek bottoms. The Riverwash occurs as long, narrow areas along creek channels and as severely channeled areas away from the present stream channels. Individual areas range from about 10 to more than 300 acres in size. They are about 60 to 70 percent Midco soil and 20 to 30 percent Riverwash.

Typically, the Midco soil has a surface layer of brown very cherty sandy loam about 5 inches thick. The substratum extends to a depth of 60 inches or more. The upper part is stratified dark yellowish brown and yellowish brown cherty loamy sand; the next part is dark brown cherty sandy loam; and the lower part is dark yellowish brown extremely cherty sandy loam and yellowish brown extremely cherty sand. In some areas the content of chert in the surface layer is less than 15 percent. In other areas the dark surface layer is more than 10 inches thick.

The Riverwash consists of gravel bars and creek channels and areas of stratified sand, silt, and gravel.

Included with this unit in mapping are small areas of the excessively drained Elsah soils in the slightly higher landscape positions and the moderately well drained Hildebrecht soils on narrow foot slopes. Elsah soils contain less sand than the Midco soil and have no chert in the surface layer. Hildebrecht soils have a fragipan. Included soils make up about 5 percent of this unit.

Permeability is moderately rapid in the Midco soil, and surface runoff is slow. The available water capacity is very low. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is medium acid to neutral, and the substratum is strongly acid to slightly acid. The high content of chert restricts root development.

Figure 9.—Young stand of trees on Elsah loam, 0 to 3 percent slopes.

Most areas are used for pasture and hay. Some are wooded. Because of droughtiness in summer and flooding in spring, the Midco soil generally is unsuitable for cultivated crops. It is well suited to tall fescue and switchgrass and moderately suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, red clover, and lespedeza. Drought and flooding are the main hazards. Flood-tolerant species should be selected for planting.

The Midco soil is suited to trees. Seedling mortality is a management concern. Planting container-grown nursery stock increases the seedling survival rate.

The Midco soil generally is unsuitable for sanitary facilities and building site development because of the flooding.

The land capability classification is IVs. The woodland ordination symbol of the Midco soil is 4f. The Riverwash is not assigned a woodland ordination symbol.

26A—Auxvasse silt loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, somewhat poorly drained soil is on terraces. It is subject to rare flooding on second bottoms. Individual areas commonly are oval or oblong and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is grayish brown and light brownish gray silt loam about 9 inches thick. The subsoil is brown, mottled silty clay about 19 inches thick. The substratum to a depth of 60 inches or more is grayish brown and olive gray, mottled silty clay loam.

Included with this soil in mapping are areas of Freeburg and Weller soils. Freeburg soils have less clay in the subsoil than the Auxvasse soil. They are in the slightly lower areas. The moderately well drained Weller soils are in the slightly higher areas or on narrow foot slopes. Also included are moderately well drained and well drained, moderately sloping to steep soils on short escarpments. These soils commonly are severely eroded and contain less clay than the Auxvasse soil. Included soils make up about 10 percent of this unit.

Permeability is very slow in the Auxvasse soil, and surface runoff is slow. The available water capacity is high. Natural fertility and the organic matter content are low. The surface layer is friable and can be easily tilled during all periods except for wet ones. It tends to puddle after hard rains, especially where some subsoil material is mixed with the plow layer. Reaction is strongly acid to extremely acid in the subsoil and varies widely in surface layer because of local liming practices. The shrink-swell potential is high in the subsoil. A perched seasonal high water table is at a depth of 1 to 2 feet for extended periods during winter and spring. The clayey subsoil somewhat restricts root development.

Most areas are used for cultivated crops. Some are used for pasture or hay. This soil is suited to soybeans, grain sorghum, small grain, and corn, but yields are reduced because of surface wetness and very slow air and water movement through the soil. A drainage system helps to remove excess water, and chiseling helps to aerate the subsoil. Proper management of crop residue, green manure crops, and applications of barnyard manure, lime, and fertilizer improve or maintain the organic matter content, fertility, and tilth.

This soil is moderately well suited to tall fescue, reed canarygrass, big bluestem, switchgrass, crownvetch, and lespedeza. It is moderately suited to orchardgrass, smooth bromegrass, little bluestem, alfalfa, and red clover. The species that can withstand wetness grow best. A surface drainage system and a controlled grazing system that allows the plants to grow late in fall help to prevent winterkill. Applications of lime and fertilizer help to maintain fertility. Mowing helps to control brush and weeds.

Some small areas are wooded. This soil is suited to trees. The equipment limitation, seedling mortality, and windthrow are management concerns. Equipment should be used only when the soil is dry or frozen. Planting container-grown nursery stock increases the seedling survival rate. Stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is less severe.

This soil is suitable for some sanitary facilities and building site development if proper design and installation procedures are used. Sewage lagoons function adequately. Septic tank absorption fields, however, do not function adequately because of the very slow permeability. Dwellings without basements can be constructed on raised, well compacted fill material above known flood levels. Installing tile drains around footings and foundations lowers the water table. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful. Onsite investigation and knowledge of the flooding history in a specific area are needed before construction.

This soil is suitable as a site for local roads and streets. Providing adequate side ditches and culverts and building on a raised, well compacted subgrade help to prevent the damage caused by flooding, frost action, shrinking and swelling, and wetness. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength.

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

27A—Ashton silt loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on terraces that are slightly convex or undulating. It is subject to rare flooding. Individual areas tend to be elongated and narrow and parallel the stream channels. They range from about 10 to 80 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil to a depth of 60 inches or more is brown silty clay loam and silt loam. In some places it contains more sand. In other places the surface layer is lighter in color. In some areas the dark surface layer is more than 10 inches thick, and in a few of these areas it is silty clay loam.

Included with this soil in mapping are small areas of Elsah and Freeburg soils. The somewhat excessively drained Elsah soils are cherty below the surface layer. They are adjacent to stream channels and on alluvial fans. The somewhat poorly drained Freeburg soils are in concave areas on terraces. Included areas make up about 10 percent of this unit.

Permeability is moderate in the Ashton soil, and surface runoff is slow or medium. The available water capacity is high. Reaction generally ranges from neutral to medium acid, but it varies greatly in the surface layer because of local liming practices. Natural fertility is high, and the organic matter content is moderate. The surface layer can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for row crops. This soil is suited to corn, soybeans, and small grain. Minimizing tillage, returning crop residue to the soil, and regularly adding other organic material improve fertility, help to prevent crusting and excessive erosion, and increase the rate of water infiltration. Diversion terraces can be used to protect some areas from the runoff from adjacent upland areas.

This soil is well suited to tall fescue, orchardgrass, smooth bromegrass, big bluestem, little bluestem, switchgrass, alfalfa, and red clover. No serious hazards or limitations affect pasture or hayland. Applications of lime and fertilizer help to maintain fertility. Mowing helps to control brush and weeds.

A few areas are wooded. This soil is suited to trees. Plant competition is the only management concern. It generally can be controlled by careful and thorough site preparation, which may include spraying and cutting.

This soil generally is unsuitable for sanitary facilities and building site development because of the flooding.

The land capability classification is I. The woodland ordination symbol is 2a.

28A—Freeburg silt loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, somewhat poorly drained soil is on low terraces. It is subject to rare flooding. Individual areas are commonly oval or oblong and range from 10 to about 120 acres in size.

Typically, the surface layer is a dark brown silt loam about 8 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 9 inches thick. The subsoil to a depth of 62 inches or more is mottled silt loam. The upper part is brown, and the lower part is grayish brown.

Included with this soil in mapping are small areas of Ashton and Auxvasse soils. Ashton soils are well drained. Their surface layer is darker than that of the Freeburg soil. Auxvasse soils have more clay in the subsoil than the Freeburg soil. They are commonly on the higher terraces. Included soils make up about 10 percent of this unit.

Permeability is moderately slow in the Freeburg soil, and surface runoff is slow. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. Reaction is very strongly acid to medium acid in the subsoil and varies in surface layer because of local liming practices. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet during winter and spring.

Most areas are used for row crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. Land grading and constructing shallow drainage ditches help to remove excess water. Chiseling helps to break up the compacted, silty subsurface layer and thus improves root growth, water infiltration, and surface drainage. Diversion terraces can be used to protect some areas from the runoff from adjacent upland areas. Proper management of crop residue, green manure crops, and applications of barnyard manure, lime, and fertilizer improve or maintain the organic matter content, fertility, and tilth.

Some areas are used for hay and pasture. This soil is well suited to reed canarygrass and is moderately well suited to tall fescue, switchgrass, red clover, and lespedeza. It is moderately suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. The seasonal high water table is the main limitation. The species that can withstand the wetness should be selected for planting. A seedbed can be easily prepared. A drainage system is helpful if deep rooted species are grown.

A few areas are wooded. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil generally is unsuitable for sanitary facilities and building site development because of the flooding.

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

29—Kickapoo fine sandy loam. This deep, nearly level, well drained soil is on flood plains along creeks and drainageways. It is frequently flooded. Individual areas are long and irregularly shaped and range from about 20 to 200 acres in size.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The substratum extends to a depth of 60 inches or more. The upper part is dark yellowish brown, mottled loam, and the lower part is stratified brownish yellow loamy sand and brown loam.

Included with this soil in mapping are small areas of Elsah and Haymond soils. Elsah soils are cherty throughout. They are adjacent to stream channels and on alluvial fans. Haymond soils are silty throughout. They are in the slightly higher areas. Also included are rocky stream channels and gravel bars and a few areas of soils that are sandy throughout. Included areas make up about 10 to 15 percent of this unit.

Permeability is moderate in the Kickapoo soil, and surface runoff is slow. The available water capacity is moderate. Natural fertility is high, and the organic matter content is moderate. Reaction ranges from strongly acid to mildly alkaline. The surface layer is very friable and can be easily tilled.

Most areas are used for row crops. Areas bordering creek channels and drainageways commonly are timbered. This soil is suitable for cultivated crops. Production of corn, soybeans, and other summer annuals, however, commonly is marginal or low because a shortage of soil moisture is common in summer. Flooding is most common in late winter or in spring. This period coincides with the growing season of small grain.

A few areas are used for pasture and hay. This soil is well suited to tall fescue and switchgrass and moderately well suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, red clover, and lespedeza. Drought and flooding are the main hazards. Flood-tolerant species should be selected for planting.

A few areas support mixed hardwoods. This soil is suited to trees. The trees should not be planted or harvested during periods when flooding is likely.

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

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

32E—Gasconade-Caneyville complex, 14 to 35 percent slopes. These soils are on side slopes that generally are dissected by drainageways and that in a few small areas have sinkholes, which provide underground drainage. The shallow, somewhat excessively drained Gasconade soil generally is on the mid or lower parts of the side slopes, especially the south- and west-facing aspects. The moderately deep, well drained Caneyville soil is on the upper parts of the side slopes. Individual areas range from about 500 to 1,000 acres in size. They are about 50 to 60 percent Gasconade soil and 20 to 30 percent Caneyville soil. The two soils occur as areas so intricately mixed or so small that they cannot be mapped separately at the scale selected for mapping.

Typically, the Gasconade soil has a surface layer of very dark grayish brown silty clay loam about 4 inches thick. The subsoil is dark brown very channery silty clay loam about 7 inches thick. Hard limestone bedrock is at a depth of about 11 inches.

Typically, the Caneyville soil has a surface layer of dark brown silt loam about 3 inches thick. The subsoil is about 23 inches thick. The upper part is strong brown silty clay loam, the next part is yellowish red silty clay, and the lower part is reddish brown, mottled silty clay. Hard limestone bedrock is at a depth of about 26 inches.

Included with these soils in mapping are small areas of Bucklick and Menfro soils. These included soils are on the upper side slopes and on narrow ridgetops. Also included are areas of Rock outcrop, which are intermingled with areas of the Gasconade soil. Included areas make up about 15 percent of this unit.

Permeability is moderately slow in the Gasconade and Caneyville soils. Surface runoff is rapid. The available water capacity is very low in the Gasconade soil and is low in the Caneyville soil. Reaction is slightly acid to mildly alkaline in the Gasconade soil. The Caneyville soil ranges from very strongly acid to neutral in the surface layer and the upper part of the subsoil and from medium acid to mildly alkaline in the lower part. The organic matter content is moderate in the Gasconade soil and moderately low in the Caneyville soil. Natural fertility is medium in both soils.

A few areas are used for pasture and hay. Because of the slope of both soils, a severe erosion hazard on both soils, and the depth to bedrock in the Gasconade soil, these soils generally are unsuitable for cultivated crops. They are poorly suited to pasture. The best suited pasture plants are big bluestem, little bluestem, indiangrass, lespedeza, and crownvetch. Erosion is a serious hazard when the plants are seeded. Timely tillage and rapid establishment of a ground cover help to prevent excessive erosion. Tilling the Gasconade soil is nearly impossible because it is shallow and has a surface layer that commonly is flaggy or gravelly.

Most areas support native hardwoods. These soils are suited to trees. Low production, however, can be expected on the Gasconade soil. The erosion hazard, the equipment limitation, and seedling mortality are management concerns on both soils, and windthrow is a hazard on the Gasconade soil. Special erosion-control measures are needed. Careful design and proper construction of roads and skid trails, for example, can minimize the steepness and length of slopes and thus help to prevent excessive water concentration. Some disturbed 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 logging roads or skid trails. Hand planting or direct seeding may be needed. Planting container-grown nursery stock increases the seedling survival rate. Stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is less severe.

These soils generally are unsuitable for sanitary facilities and building site development because of the slope, the depth to bedrock, and the large stones.

The land capability classification is VIIe. The woodland ordination symbol of the Gasconade soil is 5r, and that of the Caneyville soil is 4r.

50—Darwin silty clay. This nearly level, poorly drained soil is in abandoned channels of the Mississippi River, in natural drainageways, and on low terraces. It is subject to ponding. Although protected by levees, it is subject to rare flooding because of levee breaks or runoff from adjacent areas. Individual areas are long and narrow or are broad. They range from 10 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown silty clay about 8 inches thick. The subsurface layer also is very dark grayish brown silty clay. It is about 7 inches thick. The subsoil to a depth of 60 inches or more is dark gray and gray, mottled silty clay and clay.

Included with this soil in mapping are very small areas of Dupo, Leta, and Waldron soils. Dupo soils have a silty surface layer. They are adjacent to uplands. Leta soils are clayey in the upper part and loamy in the lower part. They are somewhat poorly drained and are in the higher areas. Waldron soils are stratified throughout and are somewhat poorly drained. Included soils make up less than 5 percent of this unit.

Permeability is very slow in the Darwin soil, and surface runoff is slow. Reaction ranges from slightly acid to mildly alkaline in the subsoil and varies widely in the surface layer because of local liming practices. The substratum is mildly alkaline or moderately alkaline. Natural fertility and the organic matter content are high. The available water capacity is moderate. The shrink-swell potential is high. A seasonal high water table is above the surface or is within a depth of 2 feet during winter and spring. The surface layer is firm and can be easily tilled only within a narrow range in moisture content. It is sticky and difficult to till when wet and hard and cloddy when dry. The soil should be tilled far enough in advance to allow freezing and thawing or alternate wetting and drying to break up the clods (fig. 10). It receives seepage during periods when the water level in the Mississippi River is high. It also receives runoff from the higher adjacent areas.

Most areas are used for cultivated crops. A few small areas are used for pasture and hay. If adequately drained, this soil is suited to soybeans, grain sorghum, cotton, and wheat. Excess water generally can be removed by a system of shallow field ditches. Land grading improves drainage, fills potholes, and provides a suitable grade for supplemental irrigation. Leaving a protective cover of crop residue on the surface and incorporating the rest of the residue into surface soil improve fertility and tilth.

This soil is moderately well suited to reed canarygrass and moderately suited to birdsfoot trefoil and alsike clover. The wetness and the flooding are the main management problems. In the depressional areas, maintaining stands of desirable species is difficult. A surface drainage system is helpful if the deeper rooted species are grown.

A few small areas are wooded. This soil is suited to some trees. The equipment limitation, seedling mortality, and plant competition are management concerns. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Competing vegetation generally can be controlled by careful and thorough site preparation, which may include spraying or cutting.

This soil is suitable as a site for sewage lagoons and buildings if proper design and installation procedures are used. Sewage lagoons function adequately. Septic tank absorption fields, however, do not function properly because of the very slow permeability and the ponding. Buildings should be constructed on raised, well compacted fill material above known flood levels. The soil is better suited to dwellings without basements than to dwellings with basements. The ponding and the shrink-swell potential are limitations. Installing tile drains around footings and foundations helps to lower the water table. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets that are constructed on a raised, well compacted subgrade above known flood levels. Strengthening the subgrade with crushed rock or other suitable base material helps to prevent the damage caused by low strength. If they are installed deep enough to lower the water table, side ditches and culverts help to prevent the damage caused by wetness, frost action, and shrinking and swelling.

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

52—Parkville silty clay. This nearly level, somewhat poorly drained soil is on terraces and natural levees on the broad flood plains along the Mississippi River. Many areas occur as narrow, undulating ridges. Although protected by levees, the soil is subject to rare flooding because of levee breaks or the runoff from adjacent areas. Individual areas range from 10 to about 500 acres in size.

Typically, the surface layer is very dark gray silty clay about 8 inches thick. The subsurface layer is very dark grayish brown silty clay about 9 inches thick. The substratum extends to a depth of 60 inches or more. In sequence downward, it is brown, mottled silt loam; brown, mottled very fine sandy loam; dark grayish brown very fine sand; and dark grayish brown very fine sandy loam. In some areas the clayey material is less than 12 inches thick.

Included with this soil in mapping are small areas of Haynie and Waldron soils. Haynie soils are well drained

Figure 10.—Large clods broken up by freezing and thawing in an area of Darwin silty clay.

and are on narrow ridges and broad plains. Waldron soils are clayey throughout. They are in the lower basins and swales. Included soils make up about 15 percent of this unit.

Permeability is slow in the upper part of the Parkville soil and moderate in the lower part. Surface runoff is slow. Reaction is neutral to moderately alkaline in the surface layer and is mildly alkaline or moderately alkaline below the surface layer. The available water capacity is moderate. Natural fertility is high, and the organic matter content is moderate. A seasonal high water table is 1 to 2 feet below the surface in winter and spring.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Shallow surface drains, land grading, and timely tillage are needed.

Some areas are used for hay and pasture. This soil is well suited to reed canarygrass and moderately well suited to tall fescue, switchgrass, red clover, and lespedeza. It is moderately suited to orchardgrass, big bluestem, little bluestem, and alfalfa. The seasonal high water table is the main limitation. The species that can withstand the wetness should be selected for planting. A seedbed can be easily prepared. A drainage system is helpful if deep rooted species are grown.

This soil is suited to trees. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Competing vegetation can be controlled by careful and thorough site preparation, which may include spraying or cutting.

This soil is suited to some sanitary facilities and building site development if proper design and installation procedures are used. Septic tank absorption fields function poorly in winter and early in spring because of the wetness. Some low areas are flooded by seep water and rainfall. A sewage lagoon is a better alternative for onsite waste disposal. Sealing the bottom of the lagoon with slowly permeable material helps to prevent seepage. In areas that are subject to flooding, the berms should be constructed high enough to keep out floodwater. The soil is better suited to dwellings without basements than to dwellings with basements. Buildings should be constructed on raised, well compacted fill material above known flood levels. The wetness is a limitation. Installing tile drains around footings and foundations helps to lower the water table.

This soil is suitable as a site for local roads and streets if the side ditches are installed deep enough to lower the water table. Mixing the soil with additives or coarser textured material and removing excess water help to prevent the damage caused by low strength and frost action. In low lying areas the roads should be constructed on a raised, well compacted fill material above known flood levels.

The land capability classification is IIw. The woodland ordination symbol is 2c.

53—Leta silty clay. This nearly level, somewhat poorly drained soil is on the flood plains along the Mississippi River. Although protected by levees, it is subject to rare flooding because of levee breaks or runoff from adjacent areas. Many areas are broad, undulating plains or terraces that range from 100 to 500 acres in size, but a few are narrow, undulating, low ridges ranging from 20 to 40 acres in size.

Typically, the surface layer is very dark gray silty clay about 8 inches thick. The subsurface layer is very dark grayish brown, mottled silty clay about 7 inches thick. The subsoil is dark gray and dark grayish brown, mottled silty clay about 12 inches thick. The substratum extends to a depth of 60 inches or more. The upper part is gray, mottled silt loam, and the lower part is dark grayish brown, mottled very fine sandy loam.

Included with this soil in mapping are small areas of Darwin and Haynie soils. Darwin soils are clayey throughout. They are in the lower basins and swales. Haynie soils are loamy throughout. They typically are on small, narrow ridges and broad plains. Included soils make up about 15 percent of this unit.

Permeability is slow in the upper part of the Leta soil and moderate in the lower part. Surface runoff is slow. Reaction is neutral or mildly alkaline throughout the soil. The available water capacity and natural fertility are high. The organic matter content is moderate. A seasonal high water table is 1 to 3 feet below the surface in winter and spring.

Most areas are used for cultivated crops. A few are used for pasture and hay. This soil is suited to corn, soybeans, and small grain. Surface drains, timely tillage, and land grading are needed.

Some areas are used for hay and pasture. This soil is well suited to reed canarygrass and moderately well suited to tall fescue, switchgrass, red clover, and lespedeza. It is moderately suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. The seasonal high water table is the main limitation. The species that can withstand the wetness should be selected for planting. A seedbed can be easily prepared. A drainage system is helpful if deep rooted species are grown.

This soil is suited to trees. Equipment should be used only when the soil is dry or frozen. Ridging the soil and then planting on the ridges increase the seedling survival rate. Competing vegetation can be controlled by careful and thorough site preparation, which may include spraying or cutting.

This soil is suited to some sanitary facilities and building site development if proper design and installation procedures are used. Septic tank absorption fields function poorly in winter and early in spring because of the wetness and the restricted permeability. Also, low lying areas are occasionally flooded. A sewage lagoon is a better alternative for onsite waste disposal. Sealing the bottom of the lagoon with slowly permeable material helps to prevent seepage. If the site is subject to flooding, the berms should be constructed high enough to keep out floodwater. The soil is better suited to dwellings without basements than to dwellings with basements. Buildings should be constructed on raised, well compacted fill material above known flood levels. The wetness and the shrink-swell potential are limitations. Installing tile drains around footings and foundations helps to lower the water table. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints are also helpful.

This soil is suitable as a site for local roads and streets that are constructed on raised, well compacted fill material above known flood levels. Strengthening the subgrade with crushed rock or other suitable material or mixing the soil with additives helps to prevent the damage caused by low strength. Removing excess water with adequate side ditches and culverts helps to prevent the damage caused by frost action.

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

54—Waldron silty clay. This deep, nearly level, somewhat poorly drained soil is in areas of recent deposition on the flood plains along the Mississippi River. Although generally protected by a levee system, it is subject to rare flooding because of levee breaks or local runoff. Individual areas are irregular in shape and range from 15 to more than 200 acres in size.

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

Included with this soil in mapping are areas of Darwin, Haynie, and Parkville soils. The poorly drained Darwin soils are in landscape positions similar to those of the Waldron soil or are in swales. Haynie soils are well drained. Parkville soils are clayey in the upper part and loamy in the lower part. They are on ridges. Also included, between the levees and the Mississippi River and along Brazeau and Apple Creeks, are areas where the Waldron soil is frequently flooded. Included areas make up about 10 to 15 percent of this unit.

Permeability is slow in the Waldron soil. Surface runoff also is slow. The available water capacity is moderate. A perched seasonal high water table commonly is at a depth of 1 to 3 feet from late in winter through early in spring. Natural fertility is high, and the organic matter content is moderate. Reaction is neutral or mildly alkaline in the surface layer and is mildly alkaline or moderately alkaline in the substratum.

Nearly all areas are used for row crops. A few small areas are pastured. This soil is suited to corn, soybeans, wheat, and grain sorghum. Excess surface water generally can be removed by a system of shallow field ditches. Land grading improves drainage and fills potholes.

This soil is well suited to reed canarygrass and moderately well suited to tall fescue, switchgrass, and lespedeza. It is moderately suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. The seasonal wetness is the main problem. A drainage system is helpful if deep rooted species are grown.

This soil is suited to trees. Equipment should be used only when the soil is dry or frozen. Ridging the soil and planting on the ridges increase the seedling survival rate.

This soil is suitable for some sanitary facilities and building site development if proper design and installation procedures are used. Septic tank absorption fields function poorly because of the wetness and the restricted permeability. Sewage lagoons function well. If the site is flood prone, the berms should be constructed high enough to keep out floodwater. The soil is better suited to dwellings without basements than to dwellings with basements. Buildings should be constructed on raised, well compacted fill material above known flood levels. Installing tile drains around footings and foundations helps to lower the water table. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints also are helpful.

This soil is suitable as a site for local roads and streets that are constructed on raised, well compacted fill material above known flood levels. Strengthening the subgrade with crushed rock or other suitable base material helps to prevent the damage caused by low strength. If they are installed deep enough to lower the water table, side ditches and culverts help to prevent the damage caused by wetness, frost action, and shrinking and swelling.

The land capability classification is IIw. The woodland ordination symbol is 2c.

55—Haynie silt loam. This deep, nearly level, well drained soil is on ridges and natural levees on the flood plains along the Mississippi River. Although generally protected by levees, it is subject to rare flooding because of levee breaks or runoff from adjacent areas. Individual areas are irregular in shape and range from 20 to more than 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The substratum extends to a depth of 67 inches or more. The upper part is dark grayish brown silt loam, the next part is brown very fine sandy loam, and the lower part is dark grayish brown, mottled silt loam that has thin strata of very fine sandy loam and silty clay loam. In some areas the soil has thin layers of sandy material.

Included with this soil in mapping are areas of the somewhat poorly drained Parkville and Waldron soils and, on some of the higher ridges, areas of soils that are sandy throughout. Parkville soils are on the lower parts of the ridges. Waldron soils are in swales and on the lower plains. Also included, between the levees and the Mississippi River, are areas where the Haynie soil is frequently flooded. Included areas make up about 10 percent of this unit.

Permeability is moderate in the Haynie soil, and surface runoff is slow. The available water capacity is very high. Natural fertility is high, and the organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. Reaction is mildly alkaline or moderately alkaline throughout the soil.

Most areas are used for cultivated crops. A few are used for alfalfa. This soil is suited to corn, soybeans, wheat, and grain sorghum. Some areas outside of the levees are subject to frequent flooding in winter and early in spring. This flooding, however, does not usually affect the growing season of soybeans and corn.

This soil is well suited to tall fescue, orchardgrass, switchgrass, alfalfa, and red clover. It is moderately well suited to smooth bromegrass, big bluestem, and little bluestem. No serious hazards or limitations affect pastured areas.

This soil is suited to trees. Plant competition can be controlled by thorough site preparation, which may include spraying or cutting. No major hazards or limitations affect planting or harvesting.

This soil is suitable as a site for buildings and sewage lagoons. Seepage from sewage lagoons can be prevented by sealing the bottom and berms with slowly permeable material. Buildings should be constructed on raised, well compacted fill material above known flood levels.

This soil is suitable as a site for local roads and streets. Mixing the soil with additives or coarser textured material and removing excess water help to prevent frost action. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength.

The land capability classification is I. The woodland ordination symbol is 1a.

58—Dupo silt loam. This deep, nearly level, somewhat poorly drained soil is in areas of recent alluvium on the flood plains along the Mississippi River. Although generally protected by levees, it is subject to rare flooding in low lying areas because of seep water, rainfall, or runoff from adjacent areas. Individual areas are irregular in shape and range from about 20 to more than 500 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The substratum extends to a depth of 67 inches or more. The upper part is brown, mottled silt loam; the next part is stratified brown and grayish brown, mottled silt loam; and the lower part is dark gray silty clay and silty clay loam.

Included with this soil in mapping are areas of Darwin and Haymond soils. Darwin soils are poorly drained and commonly are in small concave areas. Haymond soils are well drained. They are adjacent to uplands and extend into narrow tributaries. Also included, between the levees and the uplands, are areas where the Dupo soil is frequently flooded. Included areas make up about 10 percent of this unit.

Permeability is moderate in the upper part of the Dupo soil and slow in the lower part. Surface runoff is slow. The available water capacity and natural fertility are high. The organic matter content is moderately low. A seasonal high water table commonly is at a depth of 1 to 3 feet from late in winter through early in spring. Reaction ranges from medium acid to neutral in the surface layer and from medium acid to moderately alkaline in the substratum.

Nearly all areas are used for row crops. A few small areas are pastured. This soil is suited to corn, soybeans, wheat, and grain sorghum. Excess surface water generally can be removed by a system of shallow field ditches. Land grading improves drainage and fills potholes.

This soil is well suited to reed canarygrass and moderately well suited to tall fescue, switchgrass, and lespedeza. It is moderately suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. The seasonal wetness is the main problem. A drainage system is helpful if deep rooted species are grown.

This soil is suitable for some sanitary facilities and building site development if proper design and installation procedures are used. Septic tank absorption fields function poorly because of the wetness and the restricted permeability. Sewage lagoons function well. If the site is flood prone, the berms should be constructed high enough to keep out floodwater. Sealing the bottom and berms with slowly permeable material helps to prevent seepage. The soil is better suited to dwellings without basements than to dwellings with basements. Buildings should be constructed on raised, well compacted fill material above known flood levels. Installing tile drains around footings and foundations helps to lower the water table. The damage to buildings caused by shrinking and swelling generally can be prevented by using adequate reinforcement steel in concrete footings, foundations, and basement walls and by backfilling with sand or gravel. Reinforcement steel and a base of sand or gravel help to prevent damage to sidewalks and driveways. Expansion joints also are helpful.

This soil is suitable as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable base material or mixing the soil with additives helps to prevent the damage caused by low strength. Removing excess water with side ditches and culverts helps to prevent frost action. In flood-prone areas the roads and streets should be constructed on raised, well compacted fill material above known flood levels.

The land capability classification is IIw. The soil is not assigned a woodland ordination symbol.

62A—Haynie-Waldron complex, 0 to 3 percent slopes. These nearly level and undulating soils are on low ridges and in narrow channels on the flood plains along the Mississippi River. Although protected by a levee system, they are subject to rare flooding because of levee breaks or local runoff from the higher adjacent areas. The well drained Haynie soil is on narrow ridges and natural levees. The somewhat poorly drained Waldron soil is in narrow swales or old stream channels. Individual areas range from 50 to more than 1,000 acres in size. They are 45 to 60 percent Haynie soil and 20 to 30 percent Waldron soil. The two soils occur as areas so intricately mixed or so small that they could not be mapped separately at the scale selected for mapping.

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

Typically, the Waldron soil has a surface layer of very dark gray silty clay about 12 inches thick. The substratum extends to a depth of 60 inches or more. The upper part is dark grayish brown and very dark grayish brown, stratified silty clay loam. The lower part is dark gray and dark grayish brown, stratified silty clay. In some areas the soil contains less clay.

Included with these soils in mapping are small areas of the somewhat poorly drained Leta and Parkville soils. These included soils are underlain by loamy material. They are in narrow areas between the Haynie and Waldron soils. Also included are a few narrow swales that are ponded in spring and areas of soils that are sandy throughout. The sandy soils commonly are on the higher parts or crests of ridges. Included soils make up about 15 percent of this unit.

Permeability is moderate in the Haynie soil and slow in the Waldron soil. Surface runoff is slow on both soils. The available water capacity is very high in the Haynie soil and moderate in the Waldron soil. The organic matter content is moderate in both soils, and natural fertility is high. A seasonal high water table commonly is at a depth of 1 to 3 feet in the Waldron soil from late in winter through early in spring. Reaction is mildly alkaline or moderately alkaline throughout both soils. The surface layer of the Haynie soil is friable and can be easily tilled throughout a wide range in moisture content. The Waldron soil, however, is difficult to till. It is sticky when wet and hard and cloddy when dry.

Nearly all areas are used for row crops. A few are used for hay and pasture. These soils are suited to corn, soybeans, and small grain. The wetness of the Waldron soil is a limitation. Excess water generally can be removed by a system of field ditches. Leaving a protective cover of crop residue on the surface and incorporating the rest of the residue into the surface layer improve fertility and tilth.

These soils are well suited to reed canarygrass and moderately well suited to tall fescue, switchgrass, red clover, and lespedeza. They are moderately suited to orchardgrass, smooth bromegrass, big bluestem, little bluestem, and alfalfa. The rare flooding is the main problem. The water table in the Waldron soil also is a problem. The species that can withstand the wetness grow best on these soils. A drainage system is helpful if deep rooted species are grown.

These soils are suited to trees. Equipment should be used only when the Waldron soil is dry or frozen. Also, ridging this soil and planting on the ridges increase the seedling survival rate. Plant competition is a limitation on both soils. It can be controlled by thorough site preparation, which may include spraying or cutting.

If proper design and installation procedures are used, these soils are suitable for some sanitary facilities and building site development. Septic tank absorption fields function poorly on the Waldron soil in winter and early in spring because of the wetness and the slow permeability. Sewage lagoons function well on the Waldron soil but should be protected if the site is subject to flooding. The Haynie soil is a better site for buildings than the Waldron soil. The buildings should be constructed on raised, well compacted fill material above known flood levels. The wetness and the shrink-swell of the Waldron soil are limitations. Adequately reinforcing foundations and footings with steel and installing drainage tile help to prevent the damage caused by wetness and by shrinking and swelling.

These soils are suitable as sites for local roads and streets that are constructed on raised, well compacted fill material above known flood levels. Strengthening the subgrade with crushed rock or other suitable base material helps to prevent the damage caused by low strength. If they are installed deep enough to lower the water table, side ditches and culverts help to prevent the damage caused by wetness, frost action, and shrinking and swelling.

The land capability classification is IIw. The woodland ordination symbol of the Haynie soil is 1a, and that of the Waldron soil is 2c.

65—Orthents-Water complex. This map unit mainly is on a large levee and, in places, a levee berm that parallels the Mississippi River and in the adjacent borrow pits from which the material for the levee was taken. It also includes the levee system along Bois Brule and Cinque Hommes Creeks and the adjacent borrow pits. The Orthents are strongly sloping to steep on side slopes and nearly level to gently sloping on the top of the levees. Individual areas are long and continuous. They are about 70 to 80 percent Orthents and 15 to 20 percent water.

Orthents are deep soils consisting of soil material that has been mixed during the construction of levees. They have varying amounts of loamy and clayey material. Permeability varies widely.

Included with this unit in mapping are small areas of the poorly drained Darwin, well drained Haynie, and somewhat poorly drained Waldron soils. These soils are between the levee and the ditches and between the levee and the borrow pits.

The levees and berm areas support fescue, alfalfa, or clover. In a few places the berm is cropped. Trees grow in a few of the borrow pits. Most areas that support grasses or legumes are cut for hay (fig. 11), but a few areas on the levee are grazed. Cottonwood and willow are in most of the wooded areas.

Tree seedlings and cuttings grow well once they are established, but wetness and flooding can hinder tree

Figure 11.—An area of Orthents-Water complex used for hay.

growth. Inaccessibility and wetness are problems if planting and harvesting machinery is used.

The extreme variability of the soil material and the excessive wetness are the major management concerns affecting most sanitary facilities and building site development. This map unit is suited to wildlife habitat and recreational development. The water provides a gathering place for migrating waterfowl, and the levee provides areas for food. The unit is used for fishing, frogging, and hunting to a limited extent.

Orthents-Water complex is not assigned a land capability classification or a woodland ordination symbol.

66—Pits, quarries. This map unit is in areas where soil material has been removed and the underlying limestone mined. Individual areas are irregular in shape and are about 7 to 70 acres in size. They are mostly barren of vegetation. The unit is unsuited to crops, hay, pasture, and trees. It is also unsuited to most engineering uses.

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

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban 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 50,470 acres in the survey area, or nearly 17 percent of the total acreage, meets the soil requirements for prime farmland. Most of the prime farmland occurs as alluvial soils on flood plains and terraces and is used for cultivated crops, pasture, or hay.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

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

Soils that have limitations, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, 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.

About 72,600 acres in Perry County was used for cultivated crops in 1981 (*3*). Also, about 29,600 acres was used for hay. Of the cultivated acreage, 23,900 acres was used for soybeans, 25,000 acres for wheat, 23,700 acres for corn, and 1,800 acres for grain sorghum.

The potential of about 60 percent of the soils in the survey area for increased production of food and fiber is good. The moderately sloping and strongly sloping Menfro soils that now support pasture plants and trees can be used for crop production if adequately protected from erosion.

The paragraphs that follow describe the main management concerns in the areas used for crops and pasture.

Soil drainage is the major concern in managing the bottom land for crops. The soils in these low areas are naturally wet because of their positions on the landscape or slow permeability, or both. Some soils, such as Darwin and Waldron, receive runoff from surrounding areas and are the first soils to receive seep water from the Mississippi River during winter and spring. Darwin soils are ponded during some periods. Excess water is removed from most areas of these soils by a system of drainage ditches. In some areas leveling or smoothing could improve drainage.

Soil erosion is the major management concern on soils in the uplands. A large part of the upland acreage is used for woodland or pasture, and the rest is used for cropland, orchards, or vineyards. Loss of the surface layer through erosion reduces productivity and leaves the soil in poor tilth. The surface layer contains most of the nutrients and organic matter needed for plant growth. When the surface layer is lost and the subsoil is incorporated into the plow layer, maintaining tilth is difficult. The eroded surface layer puddles and crusts. As a result, the water intake rate is substantially lower.

Bucklick, Hildebrecht, Menfro, Minnith, Weingarten, and Weller soils are very susceptible to erosion. Eroded material is transported by water into ponds and streams. Control of erosion improves the quality of water for municipal use, for recreational use, and for fish and other wildlife by minimizing the pollution of streams. Cover crops, a conservation tillage system that leaves all or part of the crop residue on the surface, conservation cropping systems that include pasture or hay crops, terraces, diversions, and a permanent cover of vegetation help to control erosion.

Soil fertility is naturally low in some soils, such as Hildebrecht, Goss, and Lily soils in the uplands. It is medium or high in the soils on bottom land along the Mississippi River. Most of the soils on uplands are significantly more acid than the soils on bottom land. Applications of lime and fertilizer should be based on the results of soil tests, on the need 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 needed.

Soil tilth is an important factor affecting seedbed preparation and crop growth. Soils in which tilth is good have a granular surface layer and are more porous than other soils.

The silt loam surface layer of Haymond, Haynie, Menfro, Minnith, Weingarten, Weller, and Wilbur soils can be easily tilled and is a good seedbed. Maintaining a protective cover of crop residue and returning organic residue to the soil help to prevent surface crusting.

On Darwin, Leta, Parkville, Waldron, and other soils that have a clayey surface layer, preparing a good seedbed is difficult. If these soils are worked when wet, the surface layer tends to become a mass of hard clods when it dries. A cover of crop residue and deep tillage in the fall improve tilth and internal drainage and allow earlier seeding in spring.

Corn, soybeans, and wheat are the most commonly grown crops in the survey area. They are well suited to the soils and the climate of the survey area. Field crops that are suited to the soils and the climate include numerous crops that are not commonly grown. Sunflowers and potatoes could be grown if other conditions were favorable. Oats, barley, clover, and alfalfa are grown on a small acreage.

Pasture and hay crops suited to the soils and climate of Perry County include several legumes, cool-season grasses, and warm-season grasses. Warm-season grasses grow well during the hot summer months. Different management techniques are needed for establishing and grazing these grasses than for establishing and grazing the cool-season grasses. The major management concerns in most of the pastured areas are overgrazing and gully erosion. Grazing should be controlled so that the plants survive and grow well. Keeping pasture plants healthy and at a desirable height helps to control weeds, reduces the runoff rate, and helps to prevent gully erosion.

Yields Per Acre

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

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

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

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

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

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey (*10*).

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production. There are no class V or VIII soils in Perry County.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit, except for the Orthents-Water complex and Pits, quarries, 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, and Rick Kammler, assistant district forester, Missouri Department of Conservation, helped prepare this section.

In the past, Perry County was almost entirely timbered. Clearing began at the time of settlement, during the early 1800's. Only about 105,000 acres, or a third of the total acreage, is currently timbered (*7*).

The forests in Perry County are extremely diverse. In addition to the oak-hickory timber type that grows throughout much of the Midwest, the forests in the county have species more typical of northern forests, such as sugar maple, beech, basswood, and black cherry, and species more typical of southern forests, such as yellow-poplar, sweetgum, Kentucky coffeetree, and shortleaf pine. It is not uncommon for these species to be growing on the same site, particularly in the River Hills area, in the eastern part of the county. Oaks and hickories are the predominant species in the central part of the county. The western part resembles the Ozarks because of the rolling to steep soils on hills that support stands of oak and hickory.

Post oak, blackjack oak, and poor grades of black oak and white oak are common on ridges and on south-facing slopes. The better quality oaks, including white oak, red oak, and black oak, generally grow on the north- and east-facing slopes. Shortleaf pine, not abundant anywhere in the county, grows both in the River Hills area and in the western part of the county.

The Leta-Darwin-Parkville association on bottom land along the Mississippi River has been extensively cleared for cropping. It has only scattered pecan trees, a few small woodlots, and, along drainage ditches and the river side of the levees, some areas that support typical bottom land species, such as elm, cottonwood, and silver maple.

The eastern edge of the Menfro association, commonly called the River Hills area, faces the bottom land along the Mississippi River, is very steep, and is dissected by deep hollows. The soils generally are deep, are well drained, and can support excellent stands of oaks, yellow-poplar, and other species. The western half of this association is an area of rolling hills where cultivation is predominant. The ridges, bottom land, and gentler slopes generally have been cleared. Only the steeper soils support forest vegetation. The stands in these areas are predominantly oak and hickory, some sugar maple, and a few yellow-poplar. On the minor Caneyville and Bucklick soils in this association, eastern redcedar, white ash, and low grade oaks and hickories are common. These soils are more shallow over limestone than the major soils.

The Clarksville-Menfro association is also within the River Hills area. Generally, good quality timber is produced on this association, but the species composition, especially on the Clarksville soils, closely resembles that of the Ozarks, where post oak, blackjack oak, and shortleaf pine are common.

The Goss-Weingarten-Gasconade and Goss-Hildebrecht associations are more typical of the Ozark region than the other associations. Elsah, Midco, Hildebrecht, and Weingarten soils are in valleys, on ridges, and on gentle slopes. They generally are used for crops or pasture. Gasconade and Goss soils generally are in the steeper areas. The forest cover is predominantly oak-hickory and some sugar maple and shortleaf pine. Aspect greatly influences timber growth on these soils. North- and east-facing slopes and hollows have considerably better growth rates than south- and west-facing slopes. Trees on Gasconade soils have a very low production potential and commonly are almost pure stands of eastern redcedar.

The condition of the timber in most of the county varies greatly. Forest fires have been detrimental, and fire damage is evident in many timber stands. Grazing timber stands has resulted in soil compaction, erosion, root damage, and a reduction in the available water capacity of the soils. On many sites it has reduced the growth rates of the timber.

High grade cutting, in which only the best trees are harvested and trees of lesser quality and undesirable species are left, has also significantly degraded the timber stands. It has resulted in stands made up primarily of low grade trees that have little commercial value.

Soils influence site quality, which determines the quantity and quality of the timber. Perry County generally has excellent production potential. In areas where fire has been controlled, livestock grazing has been excluded for many years, and proper forest management has been applied, many sites produce high quality timber. A fairly high percentage of the stands are in poor condition because of a lack of management. Intensified management is important to correct past abuses and to increase production and quality.

Even though the soils in the western part of the county are less productive than those in the eastern part, the productivity of the timber resources can be significantly increased. Thinning dense stands, removing undesirable or cull trees, and planting the species best suited to the site could improve timber stands. Introducing such species as shortleaf pine and yellow-poplar can improve some stands.

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

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

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

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

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

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

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

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

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

Windbreaks and Environmental Plantings

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

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

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

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

Recreation

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

The 1980 Statewide Comprehensive Outdoor Recreation Plan (SCORP) indicates a total of 5,380 acres of recreational areas in Perry County. Ownership of these areas is 7 percent state, 77 percent private, and 16 percent county, municipal, school, and other. The facilities include wildlife viewing areas, a swimming pool, a golf course, hunting and fishing areas, ballfields, playgrounds, game courts, trails, historic sites, fairgrounds, and picnicking areas (*8*).

The Perry County Community Lake, about 103 acres in size, is the largest public recreational area in the county. The Perryville City Park, American Legion Lake, and two small state-owned natural areas are the only other free access areas in the county that are open to the public.

According to the updated 1974 NACD Nationwide Outdoor Recreation Inventory, 18 private or semiprivate commercial recreation enterprises operate in the county (*6*). They include hunting clubs, lake developments, a golf course, a campground, several fee-fishing lakes, and historic sites. According to the committee that prepared the inventory, fishing and camping areas are the two highest priority recreational needs.

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

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

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

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

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

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

Perry County is among 13 counties that make up the North and East Ozark Border Zoogeographic Region in Missouri. Originally, the area was nearly all wooded. Today, less than half of this region remains in this cover type (*5*). An important wildlife habitat feature is the widespread interspersal of woodland and cleared land and the abundant edge growth, which is favorable for upland game.

Topography, plant cover, and land use result in good or excellent habitat for wildlife in all of the associations described under the heading "General Soil Map Units," except for the Leta-Darwin-Parkville association. This highly productive association, which is on bottom land along the Mississippi River, is nearly devoid of woody cover and is being cleared along the river side of the levee. Fall tillage destroys most of the grain residue after harvest. This residue could be available for wildlife. Intensive cultivation in this association has eliminated the diversity, interspersion, and edge effect needed for good wildlife habitat.

About 33 percent of the land in the survey area supports some form of woody vegetation. The remainder is 35 percent cropland and 32 percent hayland and pasture. The wildlife resource is not currently affected by urban pressures, but the county is growing in population and predictions indicate a 21.2 percent increase by 1990 (*4*).

The Goss-Hildebrecht and Clarkville-Menfro associations are the only associations that have a dominance of woody vegetation. The timber in these associations and in the other six associations provide habitat for woodland wildlife. The county has excellent turkey and good deer populations. The carrying capacity for deer has probably not yet been reached, and animals are presently expanding into the available range. The squirrel population is good, and a small population of resident woodcock is in some areas on bottom land.

The population of furbearers is good to excellent. Harvest records indicate that raccoon, opossum, muskrat, coyote, mink, fox, striped skunk, and beaver are the most commonly trapped species in the county. Good to excellent populations of songbirds are throughout the different cover types.

Approximately 67 percent of the county is classified as cropland or grassland. The Leta-Darwin-Parkville, Haymond-Wilbur-Auxvasse, Elsah-Ashton-Auxvasse, and Goss-Weingarten-Gasconade associations provide the majority of the openland wildlife habitat in the county. Populations of quail are very good, and the rabbit population is excellent wherever good habitat is available. An excellent resident population of mourning dove is augmented each fall by migratory flights of this game bird.

The county has virtually no natural wetlands. The Leta-Darwin-Parkville, Elsah-Ashton-Auxvasse, and Haymond-Wilbur-Auxvasse associations have the only remaining wetland and riverine habitat in the county. They also have the best potential for the development of private wetland habitat. Waterfowl are attracted to the larger lakes and to some of the bottom land along the Mississippi River. Very few geese frequent the county. Blue-winged teal, mallards, and wood ducks are the primary species hunted in the county. Excellent wood duck populations are on those parts of the streams and creeks that meet their strict habitat requirements. Overall, the waterfowl population is fair.

There are 147 miles of permanently flowing streams in the county (*4*). The streams rated best for fishing are the Mississippi and Whitewater Rivers and Apple and South Fork Saline Creeks. The principal river fish are channel, blue, and flathead catfish; carp; buffalo; walleye; white bass; crappie; and sturgeon. Commercial fishermen on the Mississippi River generally catch carp, buffalo, sturgeon, and catfish. Other waters in the survey area are fished for largemouth and smallmouth bass, goggleye, channel catfish, and various species of sunfish.

Two major fishing lakes in the county are open to the public on a free access basis. They are the Perry County Community Lake and the American Legion Lake, which is about 10 acres in size. Horse Island Slough and a few privately owned borrow pits are also used for public fishing. Several commercial fee-fishing lakes are in the county. Port Perry, a private real estate development, has the largest impoundment, which is more than 160 acres of surface water. Smaller lake developments provide fishing opportunities on a restricted basis. Probably about half of the estimated 5,000 farm ponds are used for fishing by landowners and invited guests. The primary species stocked in ponds and lakes are largemouth bass, channel catfish, and bluegill. Crappie also is stocked in the larger impoundments.

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

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

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

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, soybeans, 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 slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bluegrass, switchgrass, orchardgrass, clover, alfalfa, indiangrass, birdsfoot trefoil, and crownvetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, ragweed, beggarweed, foxtail, croton, 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, poplar, sumac, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, persimmon, and sassafras. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are wild plum, hazelnut, Amur honeysuckle, 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, spruce, fir, cedar, and juniper.

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

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

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

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

Engineering

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

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

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

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

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

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

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

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

Building Site Development

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

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

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

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of 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, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

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

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

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

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

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

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

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

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

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, 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, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

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

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

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

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

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

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

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

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

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

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

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

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

Soil Properties

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

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

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

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

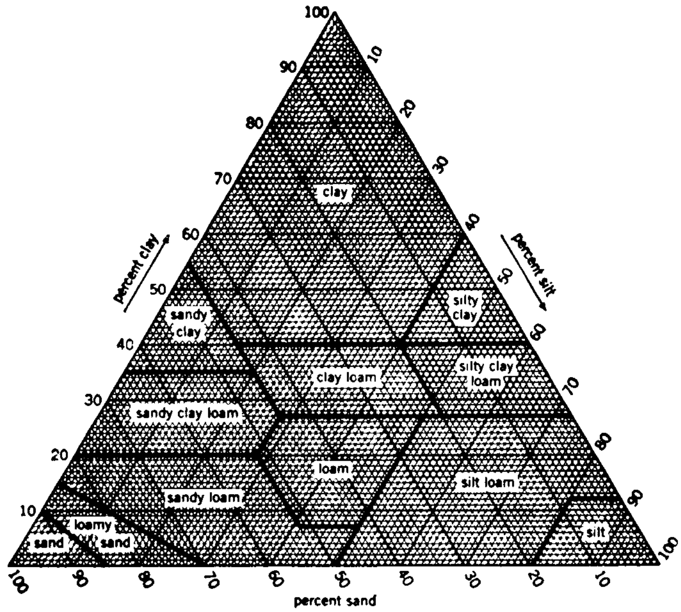


Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 12). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "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-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

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

Physical and Chemical Properties

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

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

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

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

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

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

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

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

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*11*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning flood plain, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Udifluvents (*Udi*, meaning humid, plus *fluvent*, the suborder of the Entisols that are on flood plains).

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

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

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*9*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*11*). 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."

Ashton Series

The Ashton series consists of deep, well drained, moderately permeable soils on stream terraces. These soils formed in silty alluvium. Slopes range from 0 to 3 percent.

Ashton soils commonly are adjacent to Auxvasse, Elsah, and Goss soils. Auxvasse soils have more clay in the B horizon than the Ashton soils. Also, they are higher on the stream terraces. Elsah soils are cherty below the surface layer. They are in the lower landscape positions that are frequently flooded. Goss soils are cherty throughout. They are on side slopes in the uplands.

Typical pedon of Ashton silt loam, 0 to 3 percent slopes, in a cultivated field; about 1,900 feet north and 800 feet west of the bridge at Highway N and Goose Creek, T. 35 N., R. 10 E., UTM coordinates 4181580m N. and 238685m E., zone 16:

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure in the upper part and weak fine subangular blocky in the lower part; friable; common fine roots; many worm casts; neutral; clear smooth boundary.

Bt1—9 to 19 inches; brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; friable; common fine roots; common dark brown (10YR 3/3) worm casts; few faint clay films on faces of some peds; neutral; gradual smooth boundary.

Bt2—19 to 38 inches; brown (7.5YR 4/4) silty clay loam; common fine distinct strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; friable; few faint clay films on faces of some peds; neutral; gradual smooth boundary.

Bt3—38 to 60 inches; brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; friable; few faint clay films on faces of some peds, decreasing in amount with increasing depth; about 2 percent angular gravel; slightly acid.

The thickness of the solum ranges from 40 to more than 60 inches. Reaction is neutral to medium acid throughout the profile, except for surface layers that have been limed.

The Ap horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2 or 3. It typically is silt loam, but loam is within the range.

The Bt horizon has hue of 10YR to 5YR, value of 3 to 5, and chroma of 3 to 6. It is silt loam, silty clay loam, or loam in which the content of clay ranges from 18 to 30 percent.

Auxvasse Series

The Auxvasse series consists of deep, somewhat poorly drained soils on stream terraces. These soils formed in alluvium. Permeability is very slow. Slopes range from 0 to 3 percent.

Auxvasse soils commonly are adjacent to Freeburg, Haymond, Menfro, and Wilbur soils. Freeburg and Menfro soils have less clay in the B horizon than the Auxvasse soils. Freeburg soils are on the lower terraces. Menfro soils are on uplands. Haymond and Wilbur soils have more silt than the Auxvasse soils. They are on flood plains.

Typical pedon of Auxvasse silt loam, 0 to 3 percent slopes, in a cultivated field; about 1,600 feet east and 700 feet south of the northwest corner of sec. 4, T. 33 N., R. 13 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; common fine faint light brownish gray (10YR 6/2) mottles; weak fine granular structure; friable; common fine roots; common fine dark brown concretions of iron and manganese oxides; neutral; clear smooth boundary.

E1—8 to 13 inches; grayish brown (10YR 5/2) silt loam; common medium faint brown (10YR 5/3) and common fine distinct dark yellowish brown (10YR 4/6) mottles; weak fine granular structure; friable; common fine roots; common fine dark brown concretions of iron and manganese oxides; slightly acid; clear smooth boundary.

E2—13 to 17 inches; light brownish gray (10YR 6/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common fine roots; common fine dark brown concretions of iron and manganese oxides; medium acid; clear smooth boundary.

Btg—17 to 36 inches; brown (10YR 5/3) silty clay; many faint grayish brown (10YR 5/2) coatings; common fine prominent strong brown (7.5YR 5/8) mottles; moderate fine subangular blocky structure; firm; few fine roots; common faint clay films; very strongly acid; gradual smooth boundary.

Cg1—36 to 52 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium faint light brownish gray (2.5Y 6/2) and common medium prominent strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; firm; very strongly acid; clear smooth boundary.

Cg2—52 to 60 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; firm; very strongly acid.

The thickness of the solum ranges from about 24 to 41 inches. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is slightly acid or neutral. The E horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It has common or many mottles with hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is very strongly acid or strongly acid. It is clay or silty clay.

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

Bucklick Series

The Bucklick series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in a thin mantle of loess and in the underlying material weathered from limestone or dolomite and thinly interbedded shale. Slopes range from 9 to 20 percent.

Bucklick soils commonly are adjacent to Caneyville, Haymond, and Menfro soils. Caneyville soils are 20 to 40 inches deep to bedrock. They are on the lower side slopes. Haymond soils are silty throughout and do not have a B horizon. They are on flood plains. Menfro soils have less clay in the B horizon than the Bucklick soils. Also, they are higher on the landscape, on ridgetops and side slopes.

Typical pedon of Bucklick silt loam, in a wooded area of Menfro-Bucklick silt loams, 14 to 20 percent slopes; about 1,200 feet east and 1,500 feet south of the northwest corner of sec. 35, T. 34 N., R. 12 E., UTM coordinates 4165855m N. and 263150m E., zone 16:

A—0 to 2 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine and few medium roots; medium acid; clear smooth boundary.

E—2 to 6 inches; brown (7.5YR 4/4) silt loam; weak fine granular structure; friable; many fine and few medium roots; strongly acid; clear smooth boundary.

Bt1—6 to 22 inches; yellowish red (5YR 4/6) silty clay loam; common fine prominent brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; firm; common fine and few medium roots; common pale brown (10YR 6/3) silt coatings; few thin faint clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—22 to 29 inches; reddish brown (5YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; common pale brown (10YR 6/3) silt coatings; common distinct clay films on faces of peds; few black stains; about 5 percent limestone and chert fragments; slightly acid; clear smooth boundary.

Bt3—29 to 45 inches; reddish brown (5YR 4/4) silty clay; common fine distinct yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; firm; common distinct clay films on faces of peds; few black stains; about 5 percent limestone and chert fragments; neutral; clear smooth boundary.

Cr—45 to 47 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) decomposed limestone; neutral; clear irregular boundary.

R—47 inches; hard limestone.

The thickness of the solum ranges from 36 to 50 inches. The depth to hard limestone bedrock ranges from 40 to 60 inches. The content of limestone and chert fragments ranges from 0 to 30 percent in the lower part of the Bt horizon.

The A horizon has value of 3 or 4 and chroma of 2 to 4. It dominantly is silt loam but in some pedons ranges to silty clay loam. It is very strongly acid to neutral where limed. The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4.

The upper part of the Bt horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 to 8. It ranges from very strongly acid to medium acid. It is silty clay loam or silty clay. The lower part of the Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is slightly acid or neutral. It is silty clay loam, silty clay, or the cherty analogs of these textures.

Caneyville Series

The Caneyville series consists of moderately deep, well drained soils on uplands and on the lower side slopes of karst sinkholes. These soils formed in limestone residuum. Permeability is moderately slow. Slopes range from 5 to 60 percent.

Caneyville soils commonly are adjacent to Bucklick, Gasconade, Haymond, and Menfro soils. Bucklick soils are 40 to 60 inches deep over bedrock. They are on the higher side slopes. Gasconade soils are less than 20 inches deep over bedrock. They are on the lower side slopes. Haymond and Menfro soils contain less clay than the Caneyville soils. Haymond soils are on narrow flood plains. Menfro soils are on ridgetops and side slopes above the Caneyville soils.

Typical pedon of Caneyville silt loam, in a wooded area of Menfro-Caneyville silt loams, karst, 5 to 20 percent slopes, eroded; about 2,200 feet west and 2,600 feet north of the southeast corner of sec. 36, T. 34 N., R. 11 E., UTM coordinates 4165655m N. and 255685m E., zone 16:

O—1 inch to 0; hardwood leaf litter, humus, and decomposing organic matter.

A—0 to 3 inches; mixed dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine and medium roots; medium acid; clear smooth boundary.

Bt1—3 to 15 inches; yellowish red (5YR 4/6) silty clay; common fine prominent dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; common fine and medium roots; common faint clay films; neutral; clear smooth boundary.

Bt2—15 to 32 inches; dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), and light olive brown (2.5Y 5/6) clay; weak very fine subangular blocky structure; firm; few fine roots; common distinct clay films; neutral; abrupt smooth boundary.

R—32 inches; hard limestone.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. It commonly is silt loam but in some pedons ranges to silty clay loam. It ranges from very strongly acid to neutral.

The upper part of the Bt horizon has hue of 5YR, 2.5YR, or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It ranges from very strongly acid to neutral. It is silty clay loam, silty clay, or clay. The clay content in this part of the Bt horizon ranges from 35 to 50 percent. It increases with increasing depth. The lower part of the Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 6 and is mottled with shades of red, brown, yellow, or gray. It is silty clay or clay. It ranges from medium acid to mildly alkaline.

Clarksville Series

The Clarksville series consists of deep, somewhat excessively drained soils on uplands. These soils formed in cherty limestone residuum. Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. Slopes range from 20 to 60 percent.

Clarksville soils commonly are adjacent to Auxvasse, Elsah, and Menfro soils. Auxvasse soils do not contain chert, have more clay in the B horizon than the Clarksville soils, and are on terraces. Elsah soils do not have an argillic horizon and are on narrow flood plains. Menfro soils do not contain chert and are on side slopes above the Clarksville soils.

Typical pedon of Clarksville very cherty silt loam, in an area of Clarksville-Menfro complex, 20 to 60 percent slopes; 300 feet south and 600 feet east of the northwest corner of sec. 1, T. 33 N., R. 13 E.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) very cherty silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine and medium roots; about 40 percent chert fragments; strongly acid; clear smooth boundary.

E—2 to 8 inches; yellowish brown (10YR 5/4) very cherty silt loam; weak fine granular structure; friable; common fine and medium roots; about 40 percent chert fragments; very strongly acid; clear smooth boundary.

Bt1—8 to 20 inches; strong brown (7.5YR 4/6) extremely cherty silty clay loam; weak fine subangular blocky structure; friable; few fine roots; few faint clay films on faces of some peds; about 65 percent chert fragments; very strongly acid; clear smooth boundary.

Bt2—20 to 30 inches; mixed reddish yellow (7.5YR 6/6) and light brown (7.5YR 6/4) extremely cherty silt loam; weak fine subangular blocky structure; friable; few fine roots; few faint clay films; about 80 percent chert fragments; very strongly acid; clear smooth boundary.

Bt3—30 to 35 inches; yellowish red (5YR 4/6) extremely cherty silty clay loam; moderate fine subangular blocky structure; friable; few faint clay films on faces of some peds; about 80 percent chert fragments; common light brown (7.5YR 6/4) silt coatings; very strongly acid; clear smooth boundary.

Bt4—35 to 60 inches; red (2.5YR 4/6) very cherty silty clay; common fine prominent brown (7.5YR 5/4) mottles; moderate fine subangular blocky structure; firm; common faint clay films on faces of peds; about 50 percent chert fragments; very strongly acid.

The thickness of the solum ranges from 60 to more than 100 inches. The coarse fragments are dominantly chert, but siltstone and sandstone fragments are in some pedons. The content of chert ranges from 20 to 80 percent in the surface layer and from 20 to 90 percent in the upper 20 inches of the Bt horizon. The content of coarse fragments in the upper 20 inches of the argillic horizon is more than 35 percent. Reaction ranges from very strongly acid to medium acid in the surface soil and is very strongly acid or strongly acid in the subsoil.

The A horizon has hue of 10YR, value of 2 to 6, and chroma of 3 or less. The E horizon has hue of 10YR, value of 4 to 7, and chroma of 2 to 4. It typically is very cherty silt loam, but the range includes cherty silt loam and extremely cherty silt loam.

The Bt horizon has hue of 7.5YR to 2.5YR and value and chroma of 4 to 6. It is the cherty to extremely cherty analogs of silt loam, silty clay loam, or silty clay.

Darwin Series

The Darwin series consists of deep, poorly drained soils in old abandoned river channels and on flood plains. These soils formed in clayey alluvium. Permeability is very slow. Slopes range from 0 to 2 percent.

Darwin soils commonly are adjacent to Dupo, Leta, and Parkville soils. Dupo soils are coarse-silty in the upper part and clayey in the lower part. They are somewhat poorly drained. Leta soils are clayey in the upper part and loamy in the lower part. They have chroma dominantly of 2. Parkville soils are clayey in the upper part and loamy in the lower part. The depth to loamy material is about 12 to 20 inches. All the adjacent soils are slightly higher on the landscape than the Darwin soils.

Typical pedon of Darwin silty clay, in a cultivated field on the Bois Brule bottoms; about 3,700 feet west of the junction of Highway M and Highway H, T. 36 N., R. 10 E., UTM coordinates 4193900m N. and 245455m E., zone 16:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate fine angular blocky structure; firm; mildly alkaline; clear smooth boundary.

A—8 to 15 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; mildly alkaline; clear smooth boundary.

Bg1—15 to 36 inches; dark gray (10YR 4/1) silty clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; mildly alkaline; clear smooth boundary.

Bg2—36 to 50 inches; dark gray and gray (10YR 4/1 and 5/1) silty clay; common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; mildly alkaline; clear smooth boundary.

Bg3—50 to 60 inches; dark gray and gray (10YR 4/1 and 5/1) clay; common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; mildly alkaline; clear smooth boundary.

The thickness of the solum ranges from 40 to more than 60 inches. The thickness of the mollic epipedon ranges from 12 to 23 inches. Reaction ranges from slightly acid to mildly alkaline throughout the profile, except for surface layers that have been limed.

The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is dominantly silty clay, but the range includes silty clay loam and clay.

The B horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay or clay.

Dupo Series

The Dupo series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in recent light colored silty alluvium overlying dark alluvium. Permeability is moderate in the upper part of the profile and slow in the lower part. Slopes range from 0 to 2 percent.

Dupo soils commonly are adjacent to Darwin and Haymond soils. Darwin soils are clayey throughout. They are in the lower landscape positions. Haymond soils are silty throughout. They are on the narrow flood plains along tributaries.

Typical pedon of Dupo silt loam, in a cultivated field on the Bois Brule bottoms; about 2,900 feet north and 1,600 feet west of the junction of McClanahan and Bois Brule Creeks, T. 36 N., R. 11 E., UTM coordinates 4188365m N. and 255170m E., zone 16:

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

C1—7 to 14 inches; brown (10YR 5/3) silt loam; few fine faint grayish brown (10YR 5/2) and few fine prominent strong brown (7.5YR 4/6) mottles; massive; friable; common fine roots; slightly acid; clear smooth boundary.

C2—14 to 28 inches; stratified brown (10YR 5/3) and grayish brown (10YR 5/2) silt loam; many fine faint pale brown (10YR 6/3) and few fine prominent strong brown (7.5YR 4/6) mottles; massive; friable; few fine roots; common black stains in the lower part of the horizon; neutral; abrupt smooth boundary.

2Ab—28 to 56 inches; dark gray (10YR 4/1) silty clay; weak fine and medium subangular blocky structure; firm; common yellowish red (5YR 4/6) stains; mildly alkaline; clear smooth boundary.

2C—56 to 67 inches; dark gray (10YR 4/1) silty clay loam; massive; firm; common yellowish red (5YR 4/6) stains, thin strata of gray (10YR 5/1) and grayish brown (10YR 5/2) silt loam; mildly alkaline.

The depth to the 2Ab horizon ranges from 20 to 40 inches. The Ap horizon typically is dark brown (10YR 4/3), but it has value of 3 to 5 and chroma of 1 to 3. It ranges from medium acid to neutral. The C horizon has value of 3 to 6 and chroma of 1 to 3. It ranges from medium acid to moderately alkaline.

The 2Ab horizon has hue of 10YR, value of 2 to 4, and chroma of 2 or less. It is slightly acid to mildly alkaline. It is silty clay, clay, or silty clay loam. The increase in content of clay from the C horizon to the 2Ab horizon is 25 percent or more. The 2C horizon has colors and textures similar to those of the 2Ab horizon.

Elsah Series

The Elsah series consists of deep, somewhat excessively drained soils on low lying flood plains. These soils formed in cherty alluvium washed from limestone uplands. Permeability is moderate in the upper part of the profile and moderately rapid in the lower part. Slopes range from 0 to 3 percent.

Elsah soils commonly are adjacent to Auxvasse, Goss, Hildebrecht, and Midco soils. Auxvasse soils do not contain chert, have a clayey B horizon, are somewhat poorly drained, and are on terraces. Goss soils have more clay throughout the control section than the Elsah soils and are on upland side slopes. Hildebrecht soils do not have chert in the upper part, have a fragipan, and are on upland ridges and side slopes. Midco soils contain more sand throughout than the Elsah soils and commonly are closer to the stream channels.

Typical pedon of Elsah loam, 0 to 3 percent slopes; about 6,700 feet east and 1,500 feet north of the bridge at South Fork Saline Creek and Highway T, T. 35 N., R. 10 E., UTM coordinates 4175640m N. and 238960m E., zone 16:

A—0 to 12 inches; dark yellowish brown (10YR 3/4) loam, pale brown (10YR 6/3) dry; common fine faint brown (10YR 4/3) mottles; weak fine granular structure; very friable; common fine roots; neutral; clear smooth boundary.

C1—12 to 18 inches; brown (7.5YR 4/4) cherty loam; common fine distinct dark yellowish brown (10YR 3/4) mottles; massive; friable; few fine roots; about 15 percent chert fragments; neutral; clear smooth boundary.

C2—18 to 37 inches; brown (7.5YR 4/4) extremely cherty loam; common fine distinct strong brown (7.5YR 5/6) and brown (10YR 4/3) mottles; massive; friable; few fine roots; about 65 percent chert fragments; few black stains; neutral; clear wavy boundary.

C3—37 to 52 inches; brown (7.5YR 5/4) cherty loam; common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; about 15 percent chert fragments; common black stains; medium acid; clear smooth boundary.

C4—52 to 60 inches; brown (7.5YR 5/4) extremely cherty sand; common fine distinct strong brown (7.5YR 5/6) mottles; single grained; loose; about 75 percent chert fragments; medium acid.

Typically, the soils range from medium acid to neutral throughout. The depth to cherty limestone bedrock is more than 60 inches.

The A horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 4. It is less than 10 inches thick in pedons that have value of 3. It typically is loam, but the range includes silt loam, cherty silt loam, and cherty loam. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. The upper part of this horizon typically is cherty loam or cherty silt loam. The chert content commonly increases with increasing depth.

Freeburg Series

The Freeburg series consists of deep, somewhat poorly drained soils on stream terraces. These soils formed in alluvial sediments washed from loess-covered uplands. Permeability is moderately slow. Slopes range from 0 to 3 percent.

Freeburg soils commonly are adjacent to Auxvasse, Elsah, and Haymond soils. Auxvasse soils have more clay in the B horizon than the Freeburg soils. Also, they are higher on the stream terraces. Elsah soils have more sand throughout than the Freeburg soils, have a cherty C horizon, and are on flood plains. Haymond soils do not have a B horizon, have less clay than the Freeburg soils, and are on flood plains.

Typical pedon of Freeburg silt loam, 0 to 3 percent slopes, in a cultivated field; 6,300 feet south and 300 feet east of the junction of Highway M and a levee road, T. 36 N., R. 10 E., UTM coordinates 4190455m N. and 246490m E., zone 16:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; few fine dark brown concretions; neutral; clear smooth boundary.

E—8 to 17 inches; light brownish gray (10YR 6/2) silt loam; common fine faint brown (10YR 5/3) and few fine prominent strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; friable; common fine roots; common dark brown stains; common medium dark brown concretions; medium acid; clear smooth boundary.

Bt—17 to 32 inches; brown (10YR 5/3) silt loam; common fine faint grayish brown (10YR 5/2) and few fine distinct brown (7.5YR 5/4) mottles; weak fine subangular blocky structure; friable; few fine roots; few faint clay films; common medium dark brown concretions and stains; very strongly acid; gradual smooth boundary.

BC—32 to 62 inches; grayish brown (10YR 5/2) silt loam; many fine and medium prominent brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; few dark brown stains; neutral.

The thickness of the solum ranges from 33 to more than 60 inches. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is medium acid to neutral.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6 and has mottles with chroma of 2 or less. It is very strongly acid or strongly acid. The BC horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 1 or 2 and has mottles with higher chroma. It is silt loam or silty clay loam. It is strongly acid to neutral.

Gasconade Series

The Gasconade series consists of shallow, somewhat excessively drained soils on dissected uplands and in isolated glade areas. These soils formed in residuum underlain by dolomite or limestone bedrock. Permeability is moderately slow. Slopes range from 9 to 35 percent.

Gasconade soils commonly are adjacent to Elsah, Goss, Menfro, and Weingarten soils. All of the adjacent soils are more than 60 inches deep over bedrock. The content of chert in Elsah and Goss soils is more than 35 percent. Elsah soils are on flood plains. Goss soils are in positions on the landscape similar to those of the Gasconade soils. Menfro soils are silty throughout. They generally are in the higher landscape positions. Weingarten soils are cherty in the lower part. They are on ridgetops and side slopes above the Gasconade soils.

Typical pedon of Gasconade stony silty clay loam, in a wooded area of Gasconade-Rock outcrop complex, 9 to 35 percent slopes; about 3,400 feet south and 500 feet west of the junction of Goose Creek and South Fork Saline Creek, T. 35 N., R. 10 E., UTM coordinates 4183915m N. and 236380m E., zone 16:

A1—0 to 4 inches; black (10YR 2/1) stony silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; friable; common fine and medium roots; about 30 percent dolomite and chert fragments; neutral; clear wavy boundary.

A2—4 to 9 inches; black (10YR 2/1) very channery silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine and medium subangular blocky structure; friable; common fine and medium roots; about 35 percent dolomite and chert fragments; neutral; clear wavy boundary.

Bw—9 to 14 inches; very dark brown (10YR 2/2) very channery silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate medium subangular blocky structure; firm; common fine roots; about 55 percent dolomite and chert fragments; mildly alkaline; abrupt irregular boundary.

R—14 inches; hard dolomite.

The thickness of the solum ranges from about 4 to 20 inches and commonly is the same as the depth to dolomite bedrock. The content of coarse fragments ranges from 35 to 75 percent throughout the soil profile. The solum ranges from mildly alkaline to slightly acid.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It commonly is stony silty clay loam, but the range includes stony clay loam and stony silty clay.

The B horizon has hue of 7.5YR, 10YR, or 2.5Y and value and chroma of 2 to 4. It is very channery or extremely channery clay loam or silty clay loam or the channery analogs of silty clay loam and silty clay.

Goss Series

The Goss series consists of deep, well drained, moderately permeable soils in the uplands. These soils formed in cherty limestone residuum. Slopes range from 14 to 35 percent.

Goss soils commonly are adjacent to Elsah, Gasconade, Hildebrecht, and Weingarten soils. Elsah soils have less clay than the Goss soils. They are on narrow flood plains. Gasconade soils are shallow over bedrock. They are on the lower side slopes. Hildebrecht soils are not cherty in the upper part and have a fragipan. Typically, they are on ridgetops and foot slopes. Weingarten soils do not have chert in the upper part. They are higher on the landscape than the Goss soils.

Typical pedon of Goss cherty silt loam, 14 to 35 percent slopes, in a wooded area; 2,300 feet north and 1,000 feet east of the southwest corner of sec. 16, T. 34 N., R. 9 E., UTM coordinates 4170655m N. and 760120m E., zone 15:

A—0 to 2 inches; dark grayish brown (10YR 4/2) cherty silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine and medium roots; about 20 percent chert fragments; medium acid; clear smooth boundary.

E—2 to 12 inches; light yellowish brown (10YR 6/4) cherty silt loam; weak fine granular structure; friable; common fine and medium roots; about 25 percent chert fragments; medium acid; clear smooth boundary.

BE—12 to 18 inches; strong brown (7.5YR 5/6) very cherty silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 55 percent chert fragments; very strongly acid; gradual wavy boundary.

Bt1—18 to 25 inches; yellowish red (5YR 5/6) very cherty silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; about 55 percent chert fragments; very strongly acid; gradual wavy boundary.

Bt2—25 to 34 inches; red (2.5YR 4/6) very cherty silty clay; many medium prominent yellowish brown (10YR 5/6) and common medium distinct yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; about 50 percent chert fragments; very strongly acid; diffuse wavy boundary.

Bt3—34 to 59 inches; red (2.5YR 4/6) very cherty clay; many medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular structure; few fine roots; very firm; few faint clay films on faces of peds; 35 percent chert fragments; very strongly acid; diffuse wavy boundary.

Bt4—59 to 75 inches; yellowish brown (10YR 5/6) very cherty clay; many medium prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; very firm; common distinct clay films; about 50 percent chert fragments; very strongly acid.

The thickness of the solum ranges from 55 to more than 100 inches. Reaction ranges from very strongly acid to medium acid throughout the profile, except for surface layers that have been limed. The content of chert ranges from 10 to 70 percent in the A horizon, from 35 to 70 percent in the upper part of the Bt horizon, and from 10 to 70 percent in the lower part of the Bt horizon. The content of coarse fragments in the control section ranges from 35 to 70 percent.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is silt loam, cherty silt loam, very cherty silt loam, or stony silt loam. The Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is the very cherty or extremely cherty analogs of silty clay loam, silty clay, or clay.

Haymond Series

The Haymond series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium washed from the surrounding loess-covered uplands. Slopes range from 0 to 2 percent.

Haymond soils are similar to Wilbur soils and commonly are adjacent to Auxvasse, Freeburg, Menfro, and Wilbur soils. Auxvasse, Freeburg, and Menfro soils have more clay than the Haymond soils. Auxvasse soils are on stream terraces. Freeburg soils are on low terraces. Menfro soils are on uplands. Wilbur soils have gray mottles within a depth of 20 inches.

Typical pedon of Haymond silt loam, in a cultivated field; about 500 feet east and 400 feet north of the junction of Indian Creek and Apple Creek, T. 34 N., R. 13 E., UTM coordinates 4164550m N. and 265790m E., zone 16:

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; friable; common fine roots; neutral; clear smooth boundary.

C1—7 to 28 inches; dark brown (10YR 4/3) silt loam; common fine faint brown (10YR 5/3) mottles; massive; friable; common fine roots; many worm casts; neutral; clear smooth boundary.

C2—28 to 57 inches; dark brown (10YR 4/3) silt loam; common fine faint brown (10YR 5/3) mottles; massive; friable; neutral; clear smooth boundary.

C3—57 to 65 inches; stratified brown (10YR 5/3) and dark brown (10YR 4/3) silt loam; few fine faint grayish brown (10YR 5/2) mottles; massive; friable; neutral.

Reaction ranges from medium acid to neutral throughout the profile, except for surface layers that have been limed. The A and C horizons have value of 4 or 5 and chroma of 3 or 4.

Haynie Series

The Haynie series consists of deep, well drained, moderately permeable soils on flood plains along the Mississippi River. These soils formed in recent loamy and silty alluvium. Slopes range from 0 to 2 percent.

Haynie soils commonly are adjacent to Darwin, Leta, Parkville, and Waldron soils. Darwin soils are clayey throughout. They are poorly drained and are in old river channels and low basins. Leta and Parkville soils are clayey in the upper part and loamy in the lower part. Leta soils are on terraces. Parkville soils are on the higher parts of terraces or are on narrow ridges. Waldron soils have more clay throughout than the Haynie soils. They are somewhat poorly drained and generally are in the lower landscape positions.

Typical pedon of Haynie silt loam, in a cultivated field; about 500 feet east and 900 feet south of the junction of Missouri Highway 51 and a levee road, T. 37 N., R. 11 W., UTM coordinates 4197500m N. and 250215m E., zone 16:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common fine roots; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C1—9 to 13 inches; dark grayish brown (10YR 4/2) silt loam; massive; friable; common fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—13 to 27 inches; brown (10YR 5/3) very fine sandy loam; massive; friable; common fine roots; thin strata of grayish brown (10YR 5/2); strongly effervescent; moderately alkaline; gradual wavy boundary.

C3—27 to 41 inches; dark grayish brown (10YR 4/2) silt loam; few fine faint brown (10YR 5/3) mottles; massive; friable; few fine roots; thin strata of very fine sandy loam; violently effervescent; moderately alkaline; gradual wavy boundary.

C4—41 to 67 inches; dark grayish brown (10YR 4/2) silt loam; massive; friable; thin strata of silty clay loam and grayish brown (10YR 5/2) very fine sandy loam; few yellowish red (5YR 4/6) stains; violently effervescent; moderately alkaline.

Reaction is mildly alkaline or moderately alkaline throughout the profile. The A horizon dominantly is silt loam, but the range includes silty clay loam and very fine sandy loam. The C horizon has value of 4 or 5 and chroma of 2 to 4. It is dominantly silt loam and very fine sandy loam, but some pedons have strata of coarser or finer textured material below a depth of 40 inches.

Hildebrecht Series

The Hildebrecht series consists of deep, moderately well drained soils on uplands. These soils formed in a thin layer of loess and in the underlying dolomite residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 3 to 14 percent.

Hildebrecht soils commonly are adjacent to Elsah, Goss, and Weingarten soils. Elsah soils do not have a fragipan and are on narrow flood plains. Goss soils are cherty throughout, do not have a fragipan, and are on steep side slopes. Weingarten soils do not have a fragipan and are deeper to chert than the Hildebrecht soils. They are in positions on the landscape similar to those of the Hildebrecht soils.

Typical pedon of Hildebrecht silt loam, 9 to 14 percent slopes; about 1,100 feet north and 1,700 feet east of the southwest corner of sec. 16, T. 34 N., R. 9 E., UTM coordinates 4170305m N. and 760365m E., zone 15:

A—0 to 2 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; many fine and very fine roots; strongly acid; clear smooth boundary.

E—2 to 8 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; parting to weak fine granular; friable; common fine and medium roots; very strongly acid; clear smooth boundary.

Bt1—8 to 19 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; friable; common medium and few coarse roots; few distinct clay films on peds; very strongly acid; gradual wavy boundary.

Bt2—19 to 26 inches; strong brown (7.5YR 5/6) silty clay loam; many fine faint reddish yellow (7.5YR 6/6) and common fine prominent light yellowish brown (10YR 6/4) mottles; weak fine subangular blocky structure; friable; common medium and coarse roots; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

2Btx1—26 to 41 inches; brown (7.5YR 4/4) extremely cherty silt loam; common fine prominent light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; firm; brittle; few faint clay films; about 70 percent coarse fragments; very strongly acid; clear smooth boundary.

2Btx2—41 to 51 inches; strong brown (7.5YR 5/6) cherty clay loam; weak subangular blocky structure; firm; brittle; few faint clay films; about 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

2Bt—51 to 60 inches; yellowish red (5YR 5/6) cherty silty clay; weak coarse subangular blocky structure; firm; few distinct clay films on faces of peds; about 15 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 60 to more than 100 inches. The depth to bedrock is 60 inches or more. The depth to the fragipan ranges from about 24 to 36 inches. The content of coarse fragments ranges from 15 to 70 percent in the fragipan.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 3 or 4. The A and E horizons range from very strongly acid to medium acid.

The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is very strongly acid to medium acid.

The 2Bx horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 2 to 6. It is the cherty, very cherty, or extremely cherty analogs of silt loam, silty clay loam, or clay loam. It ranges from extremely acid to strongly acid. The 2Bt horizon has hue of 10YR to 2.5YR, value of 3 to 6, and chroma of 4 to 6. It is very strongly acid to medium acid. It is silty clay loam to clay or the cherty, very cherty, or extremely cherty analogs of these textures. The content of coarse fragments in this horizon ranges from 0 to 70 percent.

Kickapoo Series

The Kickapoo series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in stratified alluvium. Slopes range from 0 to 2 percent.

Kickapoo soils commonly are adjacent to Freeburg, Haymond, Lily, and Minnith soils. Freeburg soils have more clay than the Kickapoo soils. They are on low terraces. Haymond soils have less sand than the Kickapoo soils. They are on flood plains. Lily and Minnith soils are on uplands. They have more clay than the Kickapoo soils. Also, Lily soils are moderately deep.

Typical pedon of Kickapoo fine sandy loam, in a cultivated field; about 4,700 feet south and 3,700 feet west of the junction of U.S. Highway 61 and Highway M at Brewer, Missouri, T. 36 N., R. 10 E., UTM coordinates 4183825m N. and 241215m E., zone 16:

Ap—0 to 8 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; common fine faint dark brown (10YR 3/3) mottles; weak fine granular structure; very friable; neutral; clear smooth boundary.

C1—8 to 28 inches; dark yellowish brown (10YR 3/4) loam; common fine faint dark brown (10YR 3/3) mottles; massive; friable; neutral; gradual smooth boundary.

C2—28 to 42 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; neutral; clear smooth boundary.

2C3—42 to 60 inches; stratified brownish yellow (10YR 6/6) loamy sand and brown (7.5YR 4/4) loam; massive; friable; mildly alkaline.

Reaction ranges from strongly acid to mildly alkaline throughout the profile. The A horizon has hue of 10YR, value of 3 to 5 (5 to 7 dry), and chroma of 1 to 3. In pedons where it has value and chroma of 3 or less, it is less than 7 inches thick. It commonly is fine sandy loam, but the range includes sandy loam, loam, and loamy fine sand.

The C horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 2 to 4. It is loam or fine sandy loam and has strata of finer and coarser textured material in many pedons. The 2C horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 1 to 6. It is loamy sand, loamy fine sand, and sand and in some pedons has strata of finer textured material.

Leta Series

The Leta series consists of deep, somewhat poorly drained soils on flood plains and low terraces along the Mississippi River. These soils formed in clayey alluvium 20 to 38 inches deep over loamy and silty alluvium. Permeability is slow in the upper horizons and moderate in the lower horizons. Slopes range from 0 to 2 percent.

Leta soils are similar to Parkville soils and commonly are adjacent to Darwin, Haynie, Parkville, and Waldron soils. Darwin soils are fine textured throughout. They are poorly drained and are in the slightly lower landscape positions. Haynie soils are silty or loamy throughout. They are well drained and are in the higher landscape positions. Parkville soils have 12 to 20 inches of clayey material over a loamy 2C horizon. They are in the slightly higher landscape positions. Waldron soils are fine textured and stratified throughout. They are in positions on the landscape similar to those of the Leta soils.

Typical pedon of Leta silty clay, in a cultivated field; about 5,200 feet north and 1,400 feet west of the junction of Highway E and a levee road, T. 36 N., R. 12 E., UTM coordinates 4187565m N. and 257455m E., zone 16:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate medium angular blocky structure; firm; mildly alkaline; abrupt smooth boundary.

A—8 to 15 inches; very dark grayish brown (10YR 3/2) silty clay, gray (10YR 5/1) dry; many fine faint dark gray (10YR 4/1) and common fine faint dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; firm; neutral; clear smooth boundary.

Bw—15 to 27 inches; mixed dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) silty clay; few fine faint brown (10YR 4/3) and common fine faint very dark grayish brown (10YR 3/2) mottles; moderate fine subangular blocky structure; firm; neutral; clear smooth boundary.

2C1—27 to 33 inches; gray (10YR 5/1) silt loam; common fine faint dark grayish brown (10YR 4/2) mottles; massive; friable; neutral; clear wavy boundary.

2C2—33 to 46 inches; dark grayish brown (10YR 4/2) very fine sandy loam; common fine faint grayish brown (10YR 5/2), common fine faint brown (10YR 4/3), and few fine prominent strong brown (7.5YR 4/6) mottles; massive; friable; neutral; clear wavy boundary.

2C3—46 to 60 inches; dark grayish brown (10YR 4/2) very fine sandy loam; common fine faint grayish brown (10YR 5/2) and few fine faint brown (10YR 4/3) mottles; massive; friable; neutral.

The depth to the 2C horizon ranges from 20 to 38 inches. Reaction is neutral or mildly alkaline throughout the profile. The solum is dominantly silty clay, but the range includes silty clay loam.

The A horizon has hue of 10YR or 2.5Y, value of 3, and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2 and has mottles with higher chroma. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is silt loam, very fine sandy loam, or sandy loam. Strata of loamy fine sand, 1 to 5 inches thick, are in some pedons.

Lily Series

The Lily series consists of moderately deep, well drained soils on uplands. These soils formed in loamy sandstone residuum. Permeability is moderately rapid. Slopes range from 9 to 30 percent.

Lily soils commonly are adjacent to Kickapoo and Minnith soils. Kickapoo soils have more sand than the Lily soils. They are on flood plains. Minnith soils have more silt than the Lily soils and are deeper to bedrock. They are on ridgetops above the Lily soils.

Typical pedon of Lily loam, in a wooded area of Lily-Minnith complex, 14 to 30 percent slopes; about 3,800 feet east and 600 feet north of the junction of Missouri Highway 51 and Interstate 55, T. 35 N., R. 10 E., UTM coordinates 4177500m N. and 246230m E., zone 16:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine and medium roots; slightly acid; clear smooth boundary.

E—3 to 6 inches; dark grayish brown (10YR 4/2) loam; common fine faint brown (10YR 5/3) mottles; weak medium granular structure; friable; common fine and medium roots; medium acid; clear smooth boundary.

BE—6 to 10 inches; yellowish brown (10YR 5/4) loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; common fine and medium roots; very strongly acid; clear smooth boundary.

Bt1—10 to 22 inches; strong brown (7.5YR 5/6) clay loam; common fine distinct brown (7.5YR 5/4) mottles; moderate fine subangular blocky structure; friable; common fine roots; few faint clay films on faces of some peds; extremely acid; gradual smooth boundary.

Bt2—22 to 28 inches; brown (7.5YR 5/4) clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; common fine roots; few faint clay films on faces of some peds; about 4 percent sandstone fragments; extremely acid.

R—28 inches; hard sandstone.

The thickness of the solum and the depth to sandstone bedrock range from 20 to 40 inches. The content of coarse sandstone fragments ranges from 0 to 10 percent within a depth of about 24 inches and from 0 to 35 percent below that depth. Reaction ranges from strongly acid to extremely acid throughout the profile, unless the surface layer has been limed.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. It commonly is loam, but the range includes fine sandy loam and sandy loam. The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It has the same textures as the A horizon. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 4 to 8. It is loam, sandy clay loam, or clay loam.

Menfro Series

The Menfro series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 60 percent.

Menfro soils are similar to Minnith and Weingarten soils and commonly are adjacent to Bucklick, Caneyville, Clarksville, Haymond, and Minnith soils. Bucklick, Caneyville, and Clarksville soils are lower on side slopes than the Menfro soils. Also, Bucklick and Caneyville soils have more clay in the B horizon. Caneyville soils are underlain by bedrock at a depth of 20 to 40 inches. Clarksville soils are cherty throughout. Haymond soils have less clay than the Menfro soils. They are on narrow flood plains. Minnith soils have mottles with chroma of 2. They have more sand in the lower part than the Menfro soils. Weingarten soils are cherty at a depth of 40 to 60 inches.

Typical pedon of Menfro silt loam, karst, 2 to 14 percent slopes, eroded; about 1,100 feet south and 1,300 feet east of the northwest corner of sec. 5, T. 34 N., R. 12 E., UTM coordinates 4174150m N. and 258580m E., zone 16:

Ap—0 to 4 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine and very fine roots; neutral; abrupt smooth boundary.

Bt1—4 to 8 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; few faint clay films on faces of peds; neutral; clear smooth boundary.

Bt2—8 to 15 inches; brown (7.5YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; common distinct clay films on faces of peds; common pale brown (10YR 6/3) silt coatings; medium acid; clear smooth boundary.

Bt3—15 to 22 inches; brown (7.5YR 4/4) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; common pale brown (10YR 6/3) silt coatings; common distinct clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt4—22 to 36 inches; brown (7.5YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common pale brown (10YR 6/3) silt coatings; common distinct clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt5—36 to 64 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; firm; few pale brown (10YR 6/3) silt coatings; few faint clay films on faces of peds; strongly acid.

The solum ranges from 30 to more than 60 inches in thickness. It is strongly acid to neutral.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Some pedons have an E horizon, which has value of 4 or 5 and chroma of 3 or 4. The B horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. It is silt loam or silty clay loam. The content of clay in the upper 20 inches of this horizon ranges from 27 to 35 percent.

Midco Series

The Midco series consists of deep, somewhat excessively drained soils on narrow flood plains. These soils formed in cherty alluvium washed from upland soils underlain by dolomite. Permeability is moderately rapid. Slopes range from 0 to 3 percent.

Midco soils commonly are adjacent to Elsah, Goss, and Hildebrecht soils. Elsah soils have more silt in the upper 18 inches than the Midco soils, contain less sand, and commonly are farther from the stream channels. Goss soils contain more clay than the Midco soils and are on upland side slopes. Hildebrecht soils are not cherty in the upper part, have a fragipan, and are on uplands.

Typical pedon of Midco very cherty sandy loam, in an area of Midco-Riverwash complex, 0 to 3 percent slopes; 100 feet south and 500 feet east of the northwest corner of sec. 24, T. 34 N., R. 8 E., UTM coordinates 4169760m N. and 755135m E., zone 15:

A—0 to 5 inches; brown (10YR 4/3) very cherty sandy loam, pale brown (10YR 6/3) dry; moderate fine granular structure; very friable; many fine roots; about 45 percent chert fragments; neutral; clear wavy boundary.

C—5 to 11 inches; stratified dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) cherty loamy sand; massive; very friable; many fine roots; about 30 percent chert fragments; medium acid; clear wavy boundary.

Ab—11 to 20 inches; dark brown (10YR 3/3) cherty sandy loam; massive; very friable; common fine and medium roots; about 15 percent chert fragments; strongly acid; clear wavy boundary.

C'1—20 to 28 inches; dark yellowish brown (10YR 4/4) extremely cherty sandy loam; massive; very friable;

common fine roots; about 85 percent chert fragments; medium acid; clear wavy boundary.

C'2—28 to 60 inches; yellowish brown (10YR 5/6) extremely cherty sand; single grained; loose; about 80 percent chert fragments; medium acid.

The content of coarse fragments ranges from 15 to 60 percent in the surface layer and from 20 to 80 percent in the substratum. The A horizon has value of 3 or 4 and chroma of 2 to 4. It commonly is very cherty sandy loam, but the range includes cherty and very cherty silt loam and loam. This horizon is medium acid or slightly acid in all areas, except for those that have been limed.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is the cherty, very cherty, or extremely cherty analogs of sandy loam, loam, loamy sand, or sand. It is strongly acid or medium acid.

Minnith Series

The Minnith series consists of deep, moderately well drained soils on uplands. These soils formed in a thin layer of loess and in the underlying loamy sandstone residuum. Permeability is moderately slow. Slopes range from 3 to 30 percent.

Minnith soils are similar to Menfro and Weingarten soils and commonly are adjacent to Lily, Menfro, and Weingarten soils. Lily soils have bedrock at a depth of 20 to 40 inches. They are on the lower side slopes. Menfro soils have less sand in the substratum than the Minnith soils. Weingarten soils are cherty in the lower part. They are in positions on the landscape similar to those of the Minnith soils.

Typical pedon of Minnith silt loam, 3 to 9 percent slopes, in a pasture; about 6,500 feet east and 2,700 feet north of the junction of Highway K and Interstate 55, T. 35 N., R. 11 E., UTM coordinates 4175745m N. and 248520m E., zone 16:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine platy structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.

Bt1—7 to 12 inches; brown (7.5YR 4/4) silty clay loam; many fine distinct strong brown (7.5YR 4/6) mottles; weak fine subangular structure; friable; few faint clay films; slightly acid; clear smooth boundary.

Bt2—12 to 19 inches; brown (7.5YR 4/4) silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) and common fine faint brown (7.5YR 5/4) mottles; moderate fine and medium subangular blocky structure; friable; many thin silt coatings; few faint clay films; very strongly acid; clear smooth boundary.

Bt3—19 to 30 inches; brown (7.5YR 4/4) silty clay loam; weak fine subangular blocky structure; firm; common thin silt coatings; common prominent clay films; many thick brown (7.5YR 5/2) clay flows; very strongly acid; gradual smooth boundary.

2Bt4—30 to 51 inches; brown (7.5YR 4/4) silt loam; common fine prominent grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; firm; few faint clay films; sand content increasing with increasing depth; very strongly acid; diffuse wavy boundary.

2C—51 to 60 inches; brown (7.5YR 4/4) loam; common fine distinct brown (10YR 5/3) and common fine prominent grayish brown (10YR 5/2) mottles; massive; firm; common black stains; very strongly acid.

The thickness of the solum ranges from 48 to 62 inches. The thickness of the loess ranges from 24 to 40 inches.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It is slightly acid or neutral. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It ranges from very strongly acid to slightly acid. The 2B horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. It has mottles with value of 5 or 6 and chroma of 2 or less. It is silt loam, clay loam, or loam. It ranges from very strongly acid to slightly acid.

The 2C horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. It commonly has mottles with value of 5 to 7 and chroma of 3 or less. It is loam, clay loam, sandy clay loam, or sandy loam. It ranges from very strongly acid to neutral.

Parkville Series

The Parkville series consists of deep, somewhat poorly drained soils on flood plains and terraces along the Mississippi River. These soils formed in clayey alluvium 12 to 20 inches deep over loamy alluvium. Permeability is slow in the upper part of the profile and moderate in the lower part. Slopes range from 0 to 2 percent.

Parkville soils are similar to Leta soils and commonly are adjacent to Darwin, Leta, and Waldron soils. Darwin soils are clayey throughout. They are poorly drained and are in the lower landscape positions. Leta soils have 20 to 38 inches of clayey material over a loamy C horizon. They are in the slightly lower landscape positions. Waldron soils have more clay than the Parkville soils and are stratified throughout. They are in the lower landscape positions.

Typical pedon of Parkville silty clay, in a cultivated field; about 3,700 feet west and 6,400 feet north of the junction of Omete Creek and Cinque Hommes Creek, T. 35 N., R. 12 E., UTM coordinates 4183760m N. and 262670m E., zone 16:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; strong fine granular structure in upper part and moderate fine subangular blocky structure in lower part; firm; common fine roots; neutral; clear smooth boundary.

A—8 to 17 inches; very dark grayish brown (10YR 3/2) silty clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; firm; common fine roots; neutral; abrupt smooth boundary.

2C1—17 to 34 inches; brown (10YR 4/3) silt loam; many fine faint grayish brown (10YR 5/2) mottles; massive; friable; slightly effervescent; mildly alkaline; clear smooth boundary.

2C2—34 to 41 inches; brown (10YR 4/3) very fine sandy loam; many fine faint grayish brown (10YR 5/2) mottles; massive; friable; slightly effervescent; mildly alkaline; clear smooth boundary.

2C3—41 to 55 inches; dark grayish brown (10YR 4/2) very fine sand; single grained; loose; slightly effervescent; mildly alkaline; clear smooth boundary.

2C4—55 to 60 inches; dark grayish brown (10YR 4/2) very fine sandy loam; massive; very friable; slightly effervescent; mildly alkaline.

The depth to the 2C horizon ranges from 12 to 20 inches. Reaction is neutral or mildly alkaline in the A horizon and mildly alkaline or moderately alkaline in the 2C horizon.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3 (4 or 5 dry), and chroma of 1 to 3. It is dominantly silty clay, but the range includes silty clay loam and clay. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It is silt loam, very fine sandy loam, loamy very fine sand, or very fine sand. It typically has thin strata of finer or coarser textured material in the lower part.

Waldron Series

The Waldron series consists of deep, somewhat poorly drained, slowly permeable soils on flood plains along the Mississippi River. These soils formed in clayey and silty alluvium. Slopes range from 0 to 2 percent.

Waldron soils commonly are adjacent to Haynie, Leta, and Parkville soils. All of the adjacent soils are higher on the landscape than the Waldron soils. Haynie soils have more silt than the Waldron soils. They are well drained. Leta soils have 20 to 38 inches of clayey material over a loamy 2C horizon. Parkville soils have 12 to 20 inches of clayey material over a loamy 2C horizon.

Typical pedon of Waldron silty clay, in an alfalfa field; about 1,500 feet west and 3,400 feet north of the junction of Omete Creek and Cinque Hommes Creek, T. 35 N., R. 12 E., UTM coordinates 4182795m N. and 263305m E., zone 16:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; weak medium subangular blocky structure; firm; common fine roots; neutral; clear smooth boundary.

C1—8 to 13 inches; very dark grayish brown (10YR 3/2) silty clay; very dark gray (10YR 3/1) exteriors of peds; few fine prominent yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few thin strata of brown (10YR 4/3) silt loam 1 to 3 millimeters thick; few fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—13 to 35 inches; stratified dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silty clay; few fine prominent yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; firm; few strata of brown (10YR 5/3) silt loam and silty clay loam 2 to 20 millimeters thick; few fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C3—35 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine prominent yellowish red (5YR 5/6), common fine faint dark gray (10YR 4/1), and common fine faint brown (10YR 4/3) mottles; massive; firm; few thin strata of silt loam and silty clay; slightly effervescent; moderately alkaline.

The control section has free carbonates throughout. The Ap horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 or 3, and chroma of 1 to 3. It is neutral or mildly alkaline. It typically is silty clay, but the range includes silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 1 to 4 and has mottles with higher chroma or redder hue. It is mildly alkaline or moderately alkaline. It is silty clay or silty clay loam. Strata less than 6 inches thick, thin lenses, and small pockets of finer or coarser textured material are common in most pedons.

Weingarten Series

The Weingarten series consists of deep, well drained soils on uplands. These soils formed in a thin layer of loess and other silty sediment and in the underlying cherty material weathered from limestone or dolomite. Permeability is moderately slow. Slopes range from 3 to 14 percent.

Weingarten soils are similar to Menfro and Minnith soils and commonly are adjacent to Elsah, Goss, Hildebrecht, and Minnith soils. Elsah soils are cherty. They are on narrow flood plains. Goss soils are cherty throughout the control section. They are moderately steep to very steep and are on side slopes. Hildebrecht soils have a fragipan. They are in positions on the landscape similar to those of the Weingarten soils. Menfro soils do not have a cherty 2B horizon. Minnith soils are moderately well drained.

Typical pedon of Weingarten silt loam, 3 to 9 percent slopes, in a cultivated field; about 400 feet west and

1,900 feet north of the southeast corner of sec. 22, T. 34 N., R. 10 E., UTM coordinates 4168870m N. and 243275m E., zone 16:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; very friable; common fine roots; neutral; clear smooth boundary.

Bt1—6 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; few faint clay films; medium acid; gradual smooth boundary.

Bt2—16 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint brown (10YR 5/3) and common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; common distinct clay films; strongly acid; gradual smooth boundary.

Bt3—24 to 30 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct grayish brown (10YR 5/2) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; common distinct clay films; strongly acid; gradual smooth boundary.

Btx—30 to 50 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; firm; few faint clay films; about 20 percent of matrix is slightly brittle; strongly acid; clear smooth boundary.

2Bt1—50 to 56 inches; strong brown (7.5YR 5/6) very cherty silty clay loam; common fine prominent brown (10YR 5/3) mottles; weak fine subangular blocky structure; firm; few faint clay films; about 55 percent chert fragments; strongly acid; clear smooth boundary.

2Bt2—56 to 60 inches; red (2.5YR 4/6) very cherty silty clay; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common distinct clay films; about 35 percent chert fragments; strongly acid.

The depth to the 2B horizon ranges from 40 to 60 inches. The Ap or A horizon has value of 3 or 4 and chroma of 2 to 4. It is slightly acid or neutral. Some pedons have an E horizon, which has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silt loam. It ranges from very strongly acid to medium acid. The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is silt loam or silty clay loam. It ranges from strongly acid to slightly acid. It is brittle in 15 to 60 percent of the mass.

The 2B horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is clay, silty clay, silty clay loam, or the cherty, very cherty, or extremely cherty analogs of these textures. It ranges from strongly acid to mildly alkaline.

Weller Series

The Weller series consists of deep, moderately well drained, slowly permeable soils on uplands and on high stream terraces. These soils formed in loess. Slopes range from 3 to 9 percent.

Weller soils commonly are adjacent to Elsah, Goss, and Weingarten soils. Elsah soils have a cherty substratum. They are on flood plains. Goss soils are cherty throughout. They are moderately steep to very steep and are on side slopes. Weingarten soils do not have mottles with chroma of 2 in the upper part of the Bt horizon and are cherty in the lower part. They are in the lower landscape positions.

Typical pedon of Weller silt loam, 3 to 9 percent slopes, in a cultivated field; about 350 feet east and 450 feet south of the northwest corner of sec. 15, T. 34 N., R. 10 E., UTM coordinates 4171410m N. and 241945m E., zone 16:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate fine granular structure; very friable; common fine roots; common very fine concretions; neutral; clear smooth boundary.

Bt1—9 to 14 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; common fine roots; few faint clay films; common very fine concretions; strongly acid; clear wavy boundary.

Bt2—14 to 20 inches; brown (10YR 5/3) silty clay loam; common fine faint grayish brown (10YR 5/2) and common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common pale brown (10YR 6/3) silt coatings; few faint clay films on faces of peds; few fine concretions; very strongly acid; gradual wavy boundary.

Bt3—20 to 32 inches; grayish brown (10YR 5/2) silty clay; common medium prominent strong brown (7.5YR 5/6) and common medium faint dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; firm; many pale brown (10YR 6/3) silt coatings; common faint clay films; very strongly acid; gradual wavy boundary.

Bt4—32 to 42 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) and common medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few faint clay films; common very fine concretions; very strongly acid; gradual wavy boundary.

BC—42 to 60 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct grayish brown (10YR 5/2) and many medium prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; strongly acid.

The thickness of the solum typically is more than 5 feet. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It ranges from very strongly acid to neutral. The Bt horizon has hue of 7.5YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. Mottles with chroma of 2 are in the upper 10 inches of the argillic horizon. This horizon ranges from very strongly acid to medium acid.

Wilbur Series

The Wilbur series consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium washed from the surrounding loess-covered uplands. Slopes range from 0 to 2 percent.

Wilbur soils are similar to Haymond soils and commonly are adjacent to Auxvasse, Freeburg, Haymond, and Menfro soils. Auxvasse soils have a clayey B horizon and are on terraces. Freeburg and Menfro soils have more clay in the control section than the Wilbur soils. Freeburg soils are on low terraces. Menfro soils are on uplands. Haymond soils do not have mottles with chroma of 2 within a depth of 20 inches.

Typical pedon of Wilbur silt loam, in a cultivated field; about 2,700 feet east and 200 feet north of the bridge at Highway C and Apple Creek, UTM coordinates 4166575m N. and 271125m E., zone 16:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; common fine faint dark grayish brown (10YR 4/2) mottles; weak fine granular structure; friable; neutral; clear smooth boundary.

C1—7 to 16 inches; brown (10YR 5/3) silt loam; few fine faint grayish brown (10YR 5/2) and common fine faint dark yellowish brown (10YR 4/4) mottles; massive; friable; moderate stratification; slightly acid; gradual smooth boundary.

C2—16 to 35 inches; dark yellowish brown (10YR 4/4) silt loam; common fine faint brown (10YR 5/3) and few fine distinct grayish brown (10YR 5/2) mottles; massive; friable; strongly acid; gradual smooth boundary.

C3—35 to 55 inches; dark yellowish brown (10YR 4/4) silt loam; common fine faint brown (10YR 4/3) and common fine distinct grayish brown (10YR 5/2) mottles; massive; friable; strongly acid; gradual smooth boundary.

C4—55 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; friable; few black (10YR 2/1) stains and concretions; slightly acid.

Reaction is strongly acid to neutral throughout the profile, except for surface layers that have been limed. The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6.

Formation of the Soils

This section relates the factors of soil formation to the soils in the county. It also describes physiography and geology.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the plant and animal life on and in the soil, the climate under which the soil material has accumulated and existed since accumulation, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and vegetation are active forces in soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material affects the kind of profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Generally, a long time is needed for the development of distinct horizons. The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about 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 formation or deposition of this material is the first step in the development of a soil profile. The characteristics of the parent material affect the chemical and mineralogical composition of the soil. Three principal kinds of parent material, alone or in combination, have contributed to the formation of the soils in Perry County. These are loess, or wind-deposited material; residual material weathered from bedrock; and alluvium, or water-deposited material. Of lesser importance is colluvium, which has been transported short distances downslope by the action of water and gravity.

Loess is the most extensive parent material in the survey area. The principal source of the loess was probably the extensive deposits of glacial outwash on the flood plains in the valley of the Mississippi River. The thickest deposits, which are probably more than 20 feet thick, are on the hills bordering the flood plains along the Mississippi River. Farther from the flood plains, the deposits gradually become thinner. Menfro soils formed in this kind of parent material.

Residual parent material develops in place from the underlying bedrock. If typically developed, it has been subject to long and often intense periods of weathering. In a warm, humid climate, such as that of Perry County, it is likely to be thoroughly oxidized and leached. Even though the parent material is limestone residuum, the calcium content is low because the lime has been leached out. Because of intense weathering, the soils formed in this parent material are red and yellow. Goss soils formed in cherty limestone residuum.

The parent material of the soils on flood plains in Perry County is alluvium. Most of this material was transported from the uplands. All of the soils on the flood plain along the Mississippi River formed in alluvium that was sorted when the river overflowed its channel. When the river lost velocity, the sorted soil material was deposited. Sand was deposited first, but very little sand is evident in Perry County. Sediment finer than sand, or silt, was deposited as the floodwater continued to flow. Loamy soils, such as Haynie, formed in this material. In areas where water stood in shallow swamps or in old river channels, clay settled and accumulated. Darwin soils formed in these areas.

The sorting and deposition of sediments were greatly affected by stream meandering and channel migration. In areas of Leta, Parkville, and other soils, stream abandonment of some channels was dramatic and sudden and the change in texture from clay to loam was abrupt. In other areas the soils have a similar pattern but at a greater depth.

Small upland creeks and rivers in the county formed smaller flood plains. Haymond soils formed in alluvium that was transported from eroding silty soils on nearby uplands. These soils are brown because their parent material was predominantly from loess hills. Elsah soils formed in cherty alluvium that eroded from cherty upland soils.

Some soils in the survey area formed in more than one kind of parent material. For example, Minnith soils formed in 24 to 40 inches of loess and in the underlying loamy residuum. Bucklick soils formed in a thin layer of loess and in the underlying material weathered from dolomite or limestone and thinly interbedded shale. Dupo soils formed in silty alluvium over clayey buried slack-water deposits from the Mississippi River.

Climate

Climate has been an important factor in the formation of the soils in Perry County. In the past 1 million years, variations in the climate have drastically affected the area. The county currently has a humid midcontinental climate.

Rainfall and temperature continue to affect soil formation. As a result of the climate in the past, parent material was deposited by ice, wind, and water. Since the time of deposition, climate has affected the soils that formed in this and other material. The rate of geologic erosion varies with the climate, and the shape and character of the landforms are influenced accordingly. Changes in the relative abundance and species composition of the plant and animal life are affected by climatic changes. The present climatic conditions favor the growth of trees.

The higher temperatures and larger amounts of rainfall encourage rapid chemical change and physical disintegration. Calcium carbonate and other soluble salts are removed by leaching, and then fertility declines. Nearly all the upland soils in Perry County show these climatic effects. Unless the soil formed in young alluvium, prominent layers of any kind in a soil indicate that chemical weathering has been intense. An example is the fragipan in Hildebrecht soils.

The influence of the regional climate on soil formation is modified in many areas by local conditions. For example, in the shallow Gasconade soils on steep, south-facing slopes formed under the influence of a microclimate that is warmer and allows for more freeze-thaw action than is typical on north-facing slopes, where the deeper Goss soils formed. These local differences influence the characteristics of the soil and account for some of the local differences among the soils.

Living Organisms

Living organisms in and on the soil have helped to alter the parent material and the properties of the soil. Plants, bacteria, fungi, burrowing animals, and human activities affect the organic matter and nitrogen content, reaction, color, thickness and kinds of horizons, structure, aeration, and other properties of the soil.

Plants greatly affect soil formation. Plant communities vary, depending on soil fertility, available water capacity, drainage, and depth. In Perry County, trees have been the dominant vegetative cover during soil formation. In a small part of the county, however, the soils formed under native grasses. The thick, dark surface layer of Gasconade soils is characteristic of soils that formed under native grasses. Scattered small areas of shallow soils that support prairie grasses are included with Goss soils in mapping and in the Menfro-Bucklick and Menfro-Caneyville complexes. The annual return of grass residue affects the physical, biological, and chemical composition of the surface layer. For example, bases extracted from the soil by plants are eventually returned to the soil.

Micro-organisms are important in the decay and decomposition of plant residue. By reducing raw material to soil humus, they release plant nutrients, enhance soil structure, and improve the general physical condition of the surface layer. Soils that favor biological activity have a high content of organic matter, are medium acid to neutral, are well aerated, have a low bulk density, and are medium textured. Ashton, Elsah, Haymond, and Kickapoo soils show the most noticeable evidence of burrowing rodents, earthworms, and insects.

Intensive cultivation, clearing of trees, and other human activities affect soil formation. In places cultivation has mixed the surface layer with the subsurface layer, lowered the organic matter content, reduced biological activity in the soil, and decreased the stability of soil structure and commonly has increased the runoff rate and the susceptibility to erosion. In some areas erosion has removed the original surface layer, thereby lowering the fertility and productivity of the soil. Introducing new crops and adding chemicals, such as fertilizer and lime, alter soil formation.

Relief

Relief refers to the lay of the land, or the general unevenness of the surface, the variations in elevation, and the nature of the slopes between landforms. The difference in elevation from a ridgetop to an adjacent valley varies from one landform to another. Relief is highest, about 200 feet, in the western part of the county, along the stream valleys and less commonly on some of the relatively broad interstream divides. Eastward on the Perryville Sinkhole Plain, relief ranges from about 40 to 80 feet. Adjacent to the bottom land along the Mississippi River in the River Hills area, it ranges from about 100 to 200 feet.

Relief affects soil formation through its effect on climate, the rate of erosion, the amount of runoff, the rate of water infiltration, the rate of leaching, the movement of clay, and the thickness of the solum. Soil temperature is directly related to aspect and slope.

The rate of erosion depends on the nature of the soil material, the slope, and the runoff rate. Gasconade soils on valley slopes are shallow because of geologic erosion. In contrast, Hildebrecht and Weingarten soils, which are on stable landscapes, are deep.

Time

Time is needed for climate, living organisms, and relief to change the parent material. Climate and living organisms begin to alter soil properties as soon as the parent material is available for weathering. The degree to which soil-forming processes have changed the parent material determines the age of a soil. Thus, the maturity of a soil is inferred from its morphology. The soil properties used in determining the age of the soils in Perry County include low base saturation, the development of an argillic horizon or a fragipan, and the depth of weathering.

The youngest soils in the county formed in alluvial deposits. Dupo, Elsah, Haymond, Haynie, Kickapoo, Midco, Waldron, and Wilbur soils are examples of young soils. Low base saturation and the accompanying acid reaction indicate the age of some soils, such as Clarksville and Lily. The age of Auxvasse soils is indicated by a distinct argillic horizon that is high in content of translocated clay. A distinct fragipan indicates the age of Hildebrecht soils. Some time is needed for the formation of a fragipan.

Physiography and Geology

Kent M. Bratton, assistant director of the Southeast Missouri Regional Planning and Economic Development Commission, helped prepare this section.

Perry County lies on the eastern edge of the Salem Plateau Subprovince of the Ozark Plateau. Within this upland framework, the county can be further divided into an upland hills section, generally west of Perryville; an east-central sinkhole plain that extends from north to south through the entire county; a river hills section adjacent to the bluff line along the Mississippi River; and the flood plain along the Mississippi River. The Mississippi River trench is the eastern edge of the Salem Plateau. The Ozark Plateau extends eastward into the Shawneetown Hills of western Illinois.

The bedrock in Perry County ranges in age from Ordovician to Devonian. The latter is exposed only in a small area south of Wittenberg. Most of the county is underlain by Ordovician sandstone, dolomite, and limestone, all of which dip gently to the east-northeast. The only major structural feature in the county is the Ste. Genevieve Fault Zone, which extends from an area near the intersection of Interstate 55 and the north county line to Wittenberg. Within the fault zone, geologic units have been tilted and their normal sequence has been disrupted in some areas. As a result, soil patterns in these areas are complicated.

Surficial deposits in Perry County are much younger than the bedrock. They range from weathered residual material of undetermined age to Pleistocene and recent alluvial deposits on the flood plain along the Mississippi River and along some of the upland streams. Loess, or wind-deposited material, blankets the uplands throughout much of the county. It is generally thicker on the hills near the Mississippi River than in other areas. Most of the loess was deposited during the late Pleistocene Wisconsinan glacial period.

The topography of the western part of the county resembles that of the Ozarks. This section consists of highly dissected uplands characterized by narrow ridges and narrow creek bottoms. Goss soils, which are on the steeper slopes, formed in material weathered from cherty dolomite of Ordovician age. Hildebrecht soils formed in material capped by a thin layer of loess on the more gently sloping ridges and foot slopes.

Farther east, in a north-south band through the center of the county, the topography is more gentle and the loess is thicker. Weingarten and Minnith soils formed in about 3 to 5 feet of loess overlying Ordovician dolomite, sandy dolomite, and sandstone. Minnith and Lily soils are underlain by sandstone and dolomite beds of the Everton Formation and relatively pure sandstone of the St. Peter Formation, which are also Ordovician in age. These two formations occur in a narrow belt roughly paralleling Interstate 55.

Bordering the St. Peter Formation on the east and lying almost entirely between Interstate 55 and the bluffs along the Mississippi River is the Perry County, or Perryville, Sinkhole Plain. Perry County has more caves than any other county in Missouri. More than 500 were tallied as of 1982. Nearly all of these caves are in this area. The topography in the Sinkhole Plain is noticeably lower than the uplands to the west and the river hills bordering the bluff line to the northeast. The area is characterized by subsurface drainage through sinkholes, which number in the thousands, and fissures, which are open rock joints. Upon entering this underground drainage system of caves and small passages, the water frequently emerges at the surface in springs or what are called cave resurgences. The most spectacular of these is Ball Mill Resurgence, which is northwest of Perryville. Water draining through the Berome Moore Cave system emerges through this spring.

The Perry County Sinkhole Plain is underlain by dolomite of the Joachim Formation and limestone of the Plattin Formation, both of Ordovician age. Menfro soils are dominant in this area. They formed in a layer of loess more than 5 feet deep over bedrock or residual clay. Some soils, such as Bucklick, formed in a thin mantle of loess and in the underlying residual material.

The eastern upland border of the county consists of what are known locally as the River Hills. The topography in this narrow belt along the bluffs of the Mississippi River is very steep, partly as a result of displacement along faults in the Ste. Genevieve system. Bedrock in the area includes Ordovician, Mississippian, Silurian, and Devonian rocks. Thick deposits of loess cover most of this area, although stones, boulders, residual soils, and outcrops of bedrock are fairly common on the southwest faces of fault escarpments.

The soils on the flood plain along the Mississippi River are of major agricultural importance and account for about 10 percent of the total land acreage in the county. The two main sections of flood plain are the Bois Brule

Bottoms in the north-central part of the county and the much smaller Wittenberg Bottoms in the southeastern part. The flood plain also includes Grand Tower Island, which actually lies on the Illinois side of the Mississippi River. The flood plain is essentially flat, but ridges and swales outline abandoned and filled river channels and former natural levees of sand and silt and clayey slack-water sediments are in old channels.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

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.

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.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 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 into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

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.

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 up to 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, up to 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

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 the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

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.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

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.

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 degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

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.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled 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 of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, 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.

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 wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

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 surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, 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.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-80 at Marble Hill, Missouri]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	43.4	21.0	32.2	69	-10	15	2.74	1.30	3.98	5	3.7
February---	48.9	24.8	36.9	74	-2	22	3.03	1.53	4.33	6	3.4
March------	58.4	33.3	45.9	82	8	95	4.88	2.34	7.07	8	2.4
April------	70.9	44.4	57.7	88	22	245	4.15	2.17	5.88	8	.0
May--------	79.2	52.4	65.8	92	30	490	4.63	2.32	6.63	8	.0
June-------	87.2	60.8	74.0	99	43	720	3.83	1.61	5.70	6	.0
July-------	90.6	65.0	77.8	102	47	862	3.79	1.48	5.72	6	.0
August-----	89.5	62.8	76.2	102	46	812	3.63	1.79	5.22	6	.0
September--	82.8	55.4	69.1	96	34	573	3.65	1.11	5.70	6	.0
October----	72.9	42.8	57.9	90	22	261	2.51	.84	3.89	5	.0
November---	58.4	32.9	45.7	79	9	40	3.91	1.80	5.72	6	.8
December---	47.1	25.4	36.3	70	0	9	3.62	1.61	5.34	7	1.3
Yearly:											
Average--	69.1	43.4	56.3	---	---	---	---	---	---	---	---
Extreme--	---	---	---	103	-11	---	---	---	---	---	---
Total----	---	---	---	---	---	4,144	44.37	35.75	52.55	77	11.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-80 at Marble Hill, Missouri]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 12	April 27	May 8
2 years in 10 later than--	April 8	April 22	May 3
5 years in 10 later than--	March 30	April 12	April 24
First freezing temperature in fall:			
1 year in 10 earlier than--	October 19	October 8	September 28
2 years in 10 earlier than--	October 24	October 12	October 2
5 years in 10 earlier than--	November 3	October 21	October 10

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-80 at Marble Hill, 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	200	170	149
8 years in 10	206	177	156
5 years in 10	216	192	168
2 years in 10	227	206	181
1 year in 10	233	214	188

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1C	Menfro silt loam, 3 to 9 percent slopes	10,200	3.4
1D2	Menfro silt loam, 9 to 14 percent slopes, eroded	13,400	4.4
1E2	Menfro silt loam, 14 to 30 percent slopes, eroded	21,750	7.2
1F	Menfro silt loam, 30 to 50 percent slopes	7,300	2.4
2F	Clarksville-Menfro complex, 20 to 60 percent slopes	7,600	2.5
3D2	Menfro silt loam, karst, 2 to 14 percent slopes, eroded	40,830	13.5
3E2	Menfro silt loam, karst, 9 to 35 percent slopes, eroded	26,500	8.7
4D2	Menfro-Bucklick silt loams, 9 to 14 percent slopes, eroded	2,100	0.7
4E	Menfro-Bucklick silt loams, 14 to 20 percent slopes	5,400	1.8
5C	Minnith silt loam, 3 to 9 percent slopes	9,300	3.1
7E2	Menfro-Caneyville silt loams, karst, 5 to 20 percent slopes, eroded	5,300	1.7
8D2	Minnith-Lily complex, 9 to 14 percent slopes, eroded	14,800	4.9
9C	Hildebrecht silt loam, 3 to 9 percent slopes	4,150	1.4
9D	Hildebrecht silt loam, 9 to 14 percent slopes	10,200	3.4
10F	Menfro-Caneyville-Rubble land complex, 20 to 60 percent slopes	4,450	1.5
11E	Goss cherty silt loam, 14 to 35 percent slopes	41,500	13.7
12E	Lily-Minnith complex, 14 to 30 percent slopes	2,650	0.9
15E	Gasconade-Rock outcrop complex, 9 to 35 percent slopes	3,350	1.1
18C	Weller silt loam, 3 to 9 percent slopes	730	0.2
19C	Weingarten silt loam, 3 to 9 percent slopes	5,100	1.7
19D	Weingarten silt loam, 9 to 14 percent slopes	12,100	4.0
20	Wilbur silt loam	2,500	0.8
21	Haymond silt loam	6,700	2.2
24A	Elsah loam, 0 to 3 percent slopes	6,400	2.1
25A	Midco-Riverwash complex, 0 to 3 percent slopes	680	0.2
26A	Auxvasse silt loam, 0 to 3 percent slopes	1,950	0.6
27A	Ashton silt loam, 0 to 3 percent slopes	870	0.3
28A	Freeburg silt loam, 0 to 3 percent slopes	1,700	0.5
29	Kickapoo fine sandy loam	1,050	0.3
32E	Gasconade-Caneyville complex, 14 to 35 percent slopes	1,400	0.5
50	Darwin silty clay	5,400	1.8
52	Parkville silty clay	4,750	1.6
53	Leta silty clay	7,800	2.6
54	Waldron silty clay	4,150	1.4
55	Haynie silt loam	2,100	0.7
58	Dupo silt loam	2,150	0.7
62A	Haynie-Waldron complex, 0 to 3 percent slopes	2,950	1.0
65	Orthents-Water complex	1,700	0.5
66	Pits, quarries	74	*
	Total land area	303,034	100.0
	Water areas larger than 40 acres	6,720	
	Total area	309,754	

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
20	Wilbur silt loam (where protected from flooding or where not frequently flooded during the growing season)
21	Haymond silt loam (where protected from flooding or where not frequently flooded during the growing season)
24A	Elsah loam, 0 to 3 percent slopes (where protected from flooding or where not frequently flooded during the growing season)
26A	Auxvasse silt loam, 0 to 3 percent slopes (where drained)
27A	Ashton silt loam, 0 to 3 percent slopes
28A	Freeburg silt loam, 0 to 3 percent slopes
29	Kickapoo fine sandy loam (where protected from flooding or where not frequently flooded during the growing season)
50	Darwin silty clay (where drained)
52	Parkville silty clay
53	Leta silty clay
54	Waldron silty clay (where drained)
55	Haynie silt loam
58	Dupo silt loam
62A	Haynie-Waldron complex, 0 to 3 percent slopes (where drained)

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	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
1C------------- Menfro	IIIe	96	36	90	40	3.7	7.5
1D2------------ Menfro	IIIe	80	30	80	35	3.2	7.0
1E2------------ Menfro	VIe	---	---	---	---	2.8	6.5
1F------------- Menfro	VIIe	---	---	---	---	---	3.5
2F------------- Clarksville-Menfro	VIIe	---	---	---	---	2.0	3.0
3D2------------ Menfro	IIIe	80	30	80	35	3.2	7.0
3E2------------ Menfro	VIe	---	---	---	---	2.8	6.5
4D2------------ Menfro-Bucklick	IVe	75	26	75	29	3.0	6.0
4E------------- Menfro-Bucklick	VIe	---	---	---	---	2.7	5.5
5C------------- Minnith	IIIe	90	34	77	37	4.0	7.5
7E2------------ Menfro-Caneyville	VIe	---	---	---	---	3.0	5.5
8D2------------ Minnith-Lily	IVe	71	22	65	26	3.0	5.5
9C------------- Hildebrecht	IIIe	80	30	70	32	3.6	7.0
9D------------- Hildebrecht	IVe	70	25	62	26	3.4	6.0
10F------------ Menfro-Caneyville-Rubble land	VIIe	---	---	---	---	---	3.0
11E------------ Goss	VIIs	---	---	---	---	---	5.0
12E------------ Lily-Minnith	VIe	---	---	---	---	---	5.0
15E------------ Gasconade-Rock outcrop	VIIs	---	---	---	---	---	2.0
18C------------ Weller	IIIe	90	34	90	40	3.8	7.5
19C------------ Weingarten	IIIe	84	31	72	35	3.7	7.0

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	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
19D------------- Weingarten	IVe	66	24	60	27	3.0	6.0
20-------------- Wilbur	IIw	120	44	90	50	4.1	8.2
21-------------- Haymond	IIw	110	39	95	42	3.7	8.0
24A------------- Elsah	IIs	90	30	80	39	4.6	7.0
25A------------- Midco-Riverwash	IVs	---	---	---	---	2.5	5.0
26A------------- Auxvasse	IIIw	85	31	72	35	3.7	7.5
27A------------- Ashton	I	115	42	90	45	5.0	8.0
28A------------- Freeburg	IIw	92	35	80	38	4.0	7.5
29-------------- Kickapoo	IIIw	80	30	70	35	4.5	7.0
32E------------- Gasconade-Caneyville	VIIe	---	---	---	---	---	3.0
50-------------- Darwin	IIIw	100	35	80	38	3.0	7.0
52-------------- Parkville	IIw	110	38	88	42	4.5	8.0
53-------------- Leta	IIw	115	38	88	42	4.3	8.0
54-------------- Waldron	IIw	110	40	80	38	3.8	8.0
55-------------- Haynie	I	115	42	90	45	3.6	8.0
58-------------- Dupo	IIw	110	40	80	40	5.2	8.0
62A------------- Haynie-Waldron	IIw	110	40	85	40	3.7	8.0
65. Orthents-Water							
66**. Pits							

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
1C, 1D2 Menfro	3a	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
1E2 Menfro	3r	Moderate	Moderate	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
1F Menfro	3r	Severe	Severe	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
2F*: Clarksville	4r	Moderate	Severe	Severe	Slight	White oak Shortleaf pine Black oak Northern red oak	58 61 61 61	White oak, shortleaf pine, yellow-poplar.
Menfro	3r	Severe	Severe	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
3D2 Menfro	3a	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
3E2 Menfro	3r	Moderate	Moderate	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
4D2*: Menfro	3a	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
Bucklick	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	61 ---	Yellow-poplar, green ash, white oak, eastern white pine, shortleaf pine, loblolly pine.
4E*: Menfro	3r	Moderate	Moderate	Slight	Slight	White oak Northern red oak Black oak White ash Sugar maple	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
Bucklick	3r	Moderate	Moderate	Slight	Slight	White oak Northern red oak	61 ---	Yellow-poplar, green ash, white oak, eastern white pine, shortleaf pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
5C------------------ Minnith	3a	Slight	Slight	Slight	Slight	Shortleaf pine------ Northern red oak---- White oak-----------	70 70 45	Shortleaf pine, white ash, yellow-poplar, white oak, northern red oak, black oak, loblolly pine.
7E2*:								
Menfro------------	3r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak---- Black oak----------- White ash----------- Sugar maple---------	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
Caneyville--------	4r	Moderate	Moderate	Moderate	Slight	Northern red oak---- Yellow-poplar------- Eastern redcedar----	65 80 45	Eastern redcedar, Virginia pine, eastern white pine, shortleaf pine, loblolly pine.
8D2*:								
Minnith-----------	3a	Slight	Slight	Slight	Slight	Shortleaf pine------ Northern red oak---- White oak-----------	70 70 45	Shortleaf pine, white ash, yellow-poplar, white oak, northern red oak, black oak, loblolly pine.
Lily--------------	4a	Slight	Slight	Slight	Slight	Shortleaf pine------ Virginia pine-------	63 65	Loblolly pine, shortleaf pine, Virginia pine, white oak.
9C, 9D------------- Hildebrecht	4d	Slight	Slight	Slight	Moderate	Scarlet oak--------- Northern red oak---- Black oak----------- White oak-----------	56 --- --- ---	Shortleaf pine, loblolly pine.
10F*:								
Menfro------------	3r	Severe	Severe	Slight	Slight	White oak----------- Northern red oak---- Black oak----------- White ash----------- Sugar maple---------	65 75 73 70 68	Shortleaf pine, green ash, black walnut, yellow-poplar, white oak, eastern white pine, loblolly pine.
Caneyville--------	4r	Severe	Severe	Moderate	Slight	Scarlet oak--------- Eastern redcedar----	65 45	Eastern redcedar, Virginia pine, eastern white pine, shortleaf pine.
Rubble land.								
11E---------------- Goss	4r	Moderate	Severe	Moderate	Slight	White oak----------- Shortleaf pine------ Post oak------------ Blackjack oak------- Black oak-----------	60 --- --- --- ---	Yellow-poplar, white ash, shortleaf pine.
12E*:								
Lily--------------	4r	Moderate	Moderate	Slight	Slight	Shortleaf pine------ Virginia pine-------	63 65	Loblolly pine, shortleaf pine, Virginia pine, white oak.
Minnith-----------	3r	Moderate	Moderate	Slight	Slight	Shortleaf pine------ Northern red oak---- White oak-----------	70 70 45	Shortleaf pine, white ash, yellow-poplar, white oak, northern red oak, black oak, loblolly pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
15E*:								
Gasconade	5r	Moderate	Severe	Moderate	Moderate	Eastern redcedar	30	Eastern redcedar.
						Chinkapin oak	---	
						White ash	---	
						Sugar maple	---	
						Post oak	---	
						Blackjack oak	---	
Rock outcrop.								
18C Weller	4c	Slight	Slight	Severe	Severe	White oak	55	Eastern white pine, loblolly pine, white oak, sugar maple.
19C, 19D Weingarten	3a	Slight	Slight	Slight	Slight	Northern red oak	70	Black oak, northern red oak, shortleaf pine, yellow-poplar, loblolly pine.
						White oak	66	
						Black oak	---	
						Shortleaf pine	---	
20 Wilbur	1a	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar, eastern cottonwood.
21 Haymond	1a	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar, eastern cottonwood.
						White oak	90	
						Black walnut	70	
24A Elsah	4f	Slight	Slight	Moderate	Slight	Eastern cottonwood	85	White oak, shortleaf pine.
						American sycamore	---	
						Sweetgum	---	
						Red maple	---	
25A*:								
Midco	4f	Slight	Slight	Moderate	Slight	White oak	55	White oak, shortleaf pine.
						American sycamore	---	
						Shortleaf pine	---	
						Black oak	60	
Riverwash.								
26A Auxvasse	4w	Slight	Severe	Moderate	Moderate	Pin oak	75	Pin oak, white oak, green ash, eastern cottonwood.
						Northern red oak	---	
						Silver maple	---	
						Green ash	---	
27A Ashton	2a	Slight	Slight	Slight	Slight	Northern red oak	85	Eastern white pine, yellow-poplar, black walnut, sweetgum, cherrybark oak.
						Yellow-poplar	95	
						Sweetgum	77	
28A Freeburg	3a	Slight	Slight	Slight	Slight	White oak	65	White oak, green ash, eastern cottonwood, yellow-poplar, black oak, pecan.
29 Kickapoo	3a	Slight	Slight	Slight	Slight	Northern red oak	66	Silver maple, black walnut, eastern white pine, northern red oak, yellow-poplar.
						Sugar maple	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Common trees	Site index	
32E*: Gasconade	5r	Moderate	Severe	Moderate	Moderate	Eastern redcedar Chinkapin oak White ash Sugar maple Post oak Blackjack oak	30 --- --- --- --- ---	Eastern redcedar.
Caneyville	4r	Severe	Severe	Moderate	Slight	Scarlet oak Eastern redcedar	65 45	Eastern redcedar, Virginia pine, eastern white pine, shortleaf pine.
50 Darwin	3w	Slight	Severe	Severe	Slight	Pin oak Eastern cottonwood Green ash American sycamore	80 --- --- ---	Eastern cottonwood, American sycamore, green ash, pin oak, silver maple.
52 Parkville	2c	Slight	Moderate	Severe	Slight	Eastern cottonwood Pin oak	100 90	Eastern cottonwood, pin oak, pecan, sweetgum, American sycamore.
53 Leta	3c	Slight	Moderate	Severe	Slight	Eastern cottonwood Black willow	90 ---	Sweetgum, pecan, eastern cottonwood, silver maple, green ash.
54 Waldron	2c	Slight	Moderate	Severe	Slight	Eastern cottonwood Pin oak	100 80	Pin oak, pecan, eastern cottonwood, green ash, silver maple, sweetgum.
55 Haynie	1a	Slight	Slight	Slight	Slight	Eastern cottonwood American sycamore Black walnut Green ash	110 110 --- ---	Black walnut, eastern cottonwood, American sycamore, green ash.
62A*: Haynie	1a	Slight	Slight	Slight	Slight	Eastern cottonwood American sycamore Black walnut Green ash	110 110 --- ---	Black walnut, eastern cottonwood, American sycamore, green ash.
Waldron	2c	Slight	Moderate	Severe	Slight	Eastern cottonwood Pin oak	100 80	Pin oak, pecan, eastern cottonwood, green ash, silver maple, sweetgum.

* 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
1C, 1D2, 1E2, 1F-- 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.
2F*: Clarksville	Siberian peashrub	Eastern redcedar, radiant crab-apple, Washington hawthorn, autumn-olive, Tatarian honeysuckle, Amur honeysuckle, lilac.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
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.
3D2, 3E2-- 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.
4D2*, 4E*: 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.
Bucklick	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
5C-- Minnith	---	Lilac, Amur honeysuckle, Amur maple, autumn-olive.	Russian-olive, hackberry, eastern redcedar.	Honeylocust, Norway spruce, green ash, pin oak, eastern white pine.	---
7E2*: 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.
Caneyville	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Austrian pine, bur oak, eastern red-cedar, Russian-olive, hackberry, green ash.	Honeylocust, Siberian elm.	---
8D2*: Minnith	---	Lilac, Amur honeysuckle, Amur maple, autumn-olive.	Russian-olive, hackberry, eastern redcedar.	Honeylocust, Norway spruce, green ash, pin oak, eastern white pine.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
8D2*:					
Lily	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Eastern redcedar, Russian-olive, Austrian pine, bur oak, hackberry, green ash.	Honeylocust, Siberian elm.	---
9C, 9D Hildebrecht	Lilac	Autumn-olive, Amur honeysuckle, Amur maple, Manchurian crabapple.	Russian-olive, hackberry, jack pine, eastern redcedar, green ash, Austrian pine.	Honeylocust	---
10F*:					
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.
Caneyville	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Eastern redcedar, Russian-olive, Austrian pine, bur oak, hackberry, green ash.	Honeylocust, Siberian elm.	---
Rubble land.					
11E Goss	Siberian peashrub	Lilac, Amur honeysuckle, autumn-olive, Tatarian honeysuckle, eastern redcedar, Washington hawthorn, radiant crabapple.	Eastern white pine, jack pine, red pine, Austrian pine.	---	---
12E*:					
Lily	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Eastern redcedar, Russian-olive, Austrian pine, bur oak, hackberry, green ash.	Honeylocust, Siberian elm.	---
Minnith	---	Lilac, Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, hackberry, eastern redcedar, Austrian pine, jack pine, green ash.	Honeylocust	---
15E*:					
Gasconade.					
Rock outcrop.					

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
18C----------------- Weller	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Washington hawthorn, Amur privet, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
19C, 19D----------- Weingarten	---	Lilac, Amur honeysuckle, Amur maple, autumn-olive.	Russian-olive, hackberry, eastern redcedar.	Honeylocust, Norway spruce, green ash, pin oak, eastern white pine.	---
20----------------- Wilbur	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
21----------------- 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.
24A---------------- Elsah	---	Amur maple, Amur honeysuckle, autumn-olive.	Eastern redcedar	Austrian pine, eastern white pine, hackberry, green ash, honeylocust, pin oak.	Eastern cottonwood.
25A*:					
Midco-------------	---	Autumn-olive, Amur honeysuckle, Amur maple, lilac.	Eastern redcedar	Austrian pine, honeylocust, pin oak, eastern white pine, hackberry, green ash.	Eastern cottonwood.
Riverwash.					
26A---------------- Auxvasse	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	Austrian pine, northern white-cedar, white fir, blue spruce, Washington hawthorn, eastern redcedar, Norway spruce.	Eastern white pine	---
27A---------------- Ashton	---	Amur maple, Amur honeysuckle, autumn-olive, lilac.	Eastern redcedar, hackberry, yellow-poplar.	Norway spruce, green ash, honeylocust, Russian-olive, eastern white pine.	---
28A---------------- Freeburg	---	Autumn-olive, Amur honeysuckle, Amur maple, lilac.	Eastern redcedar	Austrian pine, honeylocust, pin oak, eastern white pine, hackberry, green ash.	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
29 Kickapoo	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Eastern redcedar	Austrian pine, honeylocust, pin oak, eastern white pine, green ash.	Eastern cottonwood.
32E*: Gasconade.					
Caneyville	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive	Austrian pine, bur oak, eastern redcedar, Russian-olive, hackberry, green ash.	Honeylocust, Siberian elm.	---
50 Darwin	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, Washington hawthorn, white fir.	Eastern white pine, bur oak.	---
52 Parkville	---	Tatarian honeysuckle, Siberian peashrub.	Green ash, osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow	Eastern cottonwood.
53 Leta	---	Tatarian honeysuckle, Siberian peashrub.	Green ash, osageorange, eastern redcedar, northern white-cedar, white spruce, nannyberry viburnum, Washington hawthorn.	Black willow	Eastern cottonwood.
54 Waldron	---	Siberian peashrub, Tatarian honeysuckle.	Washington hawthorn, nannyberry viburnum, eastern redcedar, white spruce, northern white-cedar, green ash, osageorange.	Black willow	Eastern cottonwood.
55 Haynie	---	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, osageorange, eastern redcedar, Washington hawthorn, green ash, northern white-cedar, white spruce, nannyberry viburnum.	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
58----------------- Dupo	---	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.
62A*:					
Haynie------------	---	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, osageorange, eastern redcedar, Washington hawthorn, green ash, northern white-cedar, white spruce, nannyberry viburnum.	Black willow------	Eastern cottonwood.
Waldron-----------	---	Siberian peashrub, Tatarian honeysuckle.	Washington hawthorn, nannyberry viburnum, eastern redcedar, white spruce, northern white-cedar, green ash, osageorange.	Black willow------	Eastern cottonwood.
65*: Orthents.					
Water.					
66*. Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1C: Menfro	Slight	Slight	Severe: slope.	Slight	Slight.
1D2: Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
1E2: Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
1F: Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
2F*:					
Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
3D2: Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
3E2: Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
4D2*:					
Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Bucklick	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
4E*:					
Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Bucklick	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
5C: Minnith	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
7E2*:					
Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Caneyville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
8D2*:					
Minnith	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: 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
8D2*:					
Lily	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer.
9C Hildebrecht	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Slight.
9D Hildebrecht	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: slope.
10F*:					
Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Rubble land.					
11E Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: droughty, slope.
12E*:					
Lily	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Minnith	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
15E*:					
Gasconade	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
Rock outcrop.					
18C Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight	Slight.
19C Weingarten	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
19D Weingarten	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
20 Wilbur	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
21 Haymond	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
24A Elsah	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
25A*:					
Midco	Severe: flooding, small stones.	Moderate: flooding, small stones.	Severe: small stones, flooding.	Moderate: flooding.	Severe: droughty, flooding.
Riverwash.					
26A Auxvasse	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
27A Ashton	Severe: flooding.	Slight	Slight	Slight	Slight.
28A Freeburg	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
29 Kickapoo	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
32E*:					
Gasconade	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
50 Darwin	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
52 Parkville	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: too clayey.	Severe: too clayey.
53 Leta	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
54 Waldron	Severe: wetness, too clayey, flooding.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
55 Haynie	Severe: flooding.	Slight	Slight	Slight	Slight.
58 Dupo	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
62A*:					
Haynie	Severe: flooding.	Slight	Slight	Slight	Slight.
Waldron	Severe: wetness, too clayey, flooding.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.

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
65*:					
Orthents.					
Water.					
66*.					
Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1C, 1D2: Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1E2: Menfro	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1F: Menfro	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
2F*:										
Clarksville	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Menfro	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
3D2: Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
3E2: Menfro	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
4D2*:										
Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Bucklick	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
4E*:										
Menfro	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Bucklick	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
5C: Minnith	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
7E2*:										
Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Caneyville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
8D2*:										
Minnith	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Lily	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
9C: Hildebrecht	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
9D: Hildebrecht	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
10F*:										
Menfro	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	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
10F*:										
Caneyville	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rubble land.										
11E Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
12E*:										
Lily	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Minnith	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
15E*:										
Gasconade	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
18C Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
19C, 19D Weingarten	Fair	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.
20 Wilbur	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
21 Haymond	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
24A Elsah	Fair	Fair	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
25A*:										
Midco	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Riverwash.										
26A Auxvasse	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
27A Ashton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
28A Freeburg	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
29 Kickapoo	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
32E*:										
Gasconade	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Caneyville	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
50 Darwin	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
52------------------- Parkville	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Good	Poor.
53------------------- Leta	Fair	Fair	Poor	Good	Good	Poor	Fair	Fair	Fair	Poor.
54------------------- Waldron	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
55------------------- Haynie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
58------------------- Dupo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
62A*:										
Haynie---------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Waldron--------------	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
65*: Orthents.										
Water.										
66*. Pits										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1C------------------- Menfro	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
1D2----------------- Menfro	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
1E2, 1F------------ Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
2F*:						
Clarksville-------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Menfro------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
3D2----------------- Menfro	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
3E2----------------- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
4D2*:						
Menfro------------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
Bucklick----------	Moderate: depth to rock, too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
4E*:						
Menfro------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Bucklick----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
5C------------------ Minnith	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
7E2*:						
Menfro------------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
7E2*: Caneyville-------	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
8D2*: Minnith----------	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Lily-------------	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Moderate: slope, thin layer.
9C---------------- Hildebrecht	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.
9D---------------- Hildebrecht	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.
10F*: Menfro-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Caneyville-------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Rubble land.						
11E--------------- Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
12E*: Lily-------------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Minnith----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
15E*: Gasconade--------	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, thin layer.
Rock outcrop.						
18C--------------- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
19C--------------- Weingarten	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
19D--------------- Weingarten	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
20----------------- Wilbur	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
21----------------- Haymond	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
24A---------------- Elsah	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
25A*:						
Midco--------------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty, flooding.
Riverwash.						
26A---------------- Auxvasse	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
27A---------------- Ashton	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
28A---------------- Freeburg	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Moderate: wetness.
29----------------- Kickapoo	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
32E*:						
Gasconade---------	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, thin layer.
Caneyville--------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
50----------------- Darwin	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding, too clayey.
52----------------- Parkville	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Moderate: low strength, wetness, flooding.	Severe: too clayey.
53----------------- Leta	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Severe: too clayey.
54----------------- Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, frost action.	Severe: too clayey.
55----------------- Haynie	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
58----------------- Dupo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.

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
62A*:						
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: low strength, frost action.	Severe: too clayey.
65*:						
Orthents.						
Water.						
66*. Pits						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1C: Menfro	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
1D2: Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
1E2, 1F: Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
2F*:					
Clarksville	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.
Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
3D2: Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
3E2: Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
4D2*:					
Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Bucklick	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey.
4E*:					
Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Bucklick	Severe: slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, slope.
5C: Minnith	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, wetness.
7E2*:					
Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Caneyville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
8D2*:					
Minnith	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, slope, wetness.
Lily	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
9C Hildebrecht	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: small stones.
9D Hildebrecht	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Poor: small stones.
10F*:					
Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Rubble land.					
11E Goss	Severe: slope.	Severe: seepage, slope.	Severe: slope, too clayey, large stones.	Severe: seepage, slope.	Poor: too clayey, small stones, slope.
12E*:					
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: area reclaim, slope.
Minnith	Severe: wetness, percs slowly, slope.	Severe: seepage, slope, wetness.	Severe: seepage, wetness, slope.	Severe: wetness, slope.	Poor: slope.
15E*:					
Gasconade	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					
18C Weller	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.
19C Weingarten	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
19D Weingarten	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
20 Wilbur	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
21 Haymond	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
24A Elsah	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding.	Severe: flooding, seepage.	Poor: small stones.
25A*:					
Midco	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
Riverwash.					
26A Auxvasse	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
27A Ashton	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Fair: too clayey.
28A Freeburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: flooding, wetness.	Fair: too clayey, wetness.
29 Kickapoo	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.
32E*:					
Gasconade	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
50 Darwin	Severe: ponding, percs slowly.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
52 Parkville	Severe: wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
53 Leta	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
54 Waldron	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
55 Haynie	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
58------------------- Dupo	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
62A*:					
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.
65*:					
Orthents.					
Water.					
66*. Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1C Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
1D2 Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
1E2 Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
1F Menfro	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
2F*:				
Clarksville	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Menfro	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
3D2 Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
3E2 Menfro	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
4D2*:				
Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
Bucklick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
4E*:				
Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Bucklick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
5C Minnith	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
7E2*:				
Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
8D2*:				
Minnith	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Lily	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
9C, 9D Hildebrecht	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
10F*:				
Menfro	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Caneyville	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Rubble land.				
11E Goss	Fair: low strength, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
12E*:				
Lily	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Minnith	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
15E*:				
Gasconade	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
18C Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
19C Weingarten	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
19D Weingarten	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
20 Wilbur	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
21 Haymond	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
24A Elsah	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
25A*:				
Midco	Fair: large stones.	Probable	Probable	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
25A*: Riverwash.				
26A Auxvasse	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
27A Ashton	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
28A Freeburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
29 Kickapoo	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
32E*: Gasconade	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
50 Darwin	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
52 Parkville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
53 Leta	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
54 Waldron	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
55 Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
58 Dupo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
62A*: Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Waldron	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
65*: Orthents.				
Water.				
66*. Pits				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1C. Menfro	Moderate: slope, seepage.	Slight	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
1D2, 1E2, 1F. Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
2F*:						
Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
3D2, 3E2. Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
4D2*, 4E*:						
Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Bucklick	Severe: slope.	Moderate: thin layer.	Deep to water	Slope	Slope	Slope.
5C. Minnith	Moderate: seepage, slope.	Moderate: piping, wetness.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
7E2*:						
Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Caneyville	Moderate: depth to rock.	Severe: thin layer, hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock.	Slope, depth to rock.
8D2*:						
Minnith	Severe: slope.	Moderate: piping, wetness.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Lily	Severe: seepage, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
9C. Hildebrecht	Moderate: seepage, slope.	Moderate: piping, wetness.	Percs slowly, slope.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness.	Erodes easily, rooting depth.
9D. Hildebrecht	Severe: slope.	Moderate: piping, wetness.	Percs slowly, slope.	Wetness, percs slowly, rooting depth.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
10F*:						
Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Caneyville	Severe: slope.	Severe: thin layer, hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock.	Slope, depth to rock.
Rubble land.						

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
11E-------------- Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
12E*:						
Lily-------------	Severe: seepage, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Minnith----------	Severe: slope.	Moderate: piping, wetness.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
15E*:						
Gasconade--------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
18C-------------- Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily.	Percs slowly, erodes easily.
19C-------------- Weingarten	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
19D-------------- Weingarten	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
20--------------- Wilbur	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Erodes easily.
21--------------- Haymond	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
24A-------------- Elsah	Severe: seepage.	Moderate: thin layer, seepage, piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
25A*:						
Midco------------	Severe: seepage.	Severe: seepage.	Deep to water	Large stones, droughty, flooding.	Large stones, too sandy.	Large stones, droughty.
Riverwash.						
26A-------------- Auxvasse	Slight---------	Moderate: wetness.	Percs slowly---	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
27A-------------- Ashton	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
28A-------------- Freeburg	Slight---------	Moderate: wetness.	Frost action---	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
29--------------- Kickapoo	Moderate: seepage.	Slight---------	Deep to water	Soil blowing, flooding.	Too sandy, soil blowing.	Favorable.
32E*:						
Gasconade--------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Caneyville-------	Severe: slope.	Severe: thin layer, hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock.	Slope, depth to rock.

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
50. Darwin	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
52. Parkville	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, cutbanks cave.	Wetness, slow intake, percs slowly.	Wetness	Wetness, percs slowly.
53. Leta	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness	Wetness, percs slowly.
54. Waldron	Slight	Severe: hard to pack.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
55. Haynie	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
58. Dupo	Moderate: seepage.	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
62A*:						
Haynie	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
Waldron	Slight	Severe: hard to pack.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
65*:						
Orthents.						
Water.						
66*. Pits						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
1C, 1D2, 1E2, 1F-- Menfro	0-4	Silt loam	CL	A-6	0	100	100	95-100	92-100	25-35	11-20
	4-48	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	48-60	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	92-100	25-35	5-15
2F*:											
Clarksville	0-8	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-20	30-70	10-60	5-50	5-35	20-40	5-15
	8-35	Extremely cherty silt loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	35-60	Very cherty silty clay, very cherty clay.	GC, SC, GP-GC, SP-SC	A-7, A-2-7	5-20	30-70	10-60	10-50	10-45	55-75	35-55
Menfro	0-8	Silt loam	CL	A-6	0	100	100	95-100	92-100	25-35	11-20
	8-52	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	52-60	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	92-100	25-35	5-15
3D2, 3E2-- Menfro	0-4	Silt loam	CL	A-6	0	100	100	95-100	92-100	25-35	11-20
	4-36	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	36-64	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	92-100	25-35	5-15
4D2*, 4E*:											
Menfro	0-6	Silt loam	CL	A-6	0	100	100	95-100	92-100	25-35	11-20
	6-42	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	42-60	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	92-100	25-35	5-15
Bucklick	0-6	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	6-45	Silty clay loam, silty clay, silt loam.	CL	A-7	0-10	95-100	85-100	80-100	75-99	40-50	20-30
	45-47	Weathered bedrock	---	---	---	---	---	---	---	---	---
	47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
5C-- Minnith	0-7	Silt loam	CL, CL-ML	A-6, A-4	0	100	100	90-100	90-95	20-35	5-15
	7-51	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-90	30-50	10-20
	51-60	Loam, clay loam, silt loam.	CL, SC	A-6	0-5	95-100	90-100	60-90	40-80	25-40	10-20
7E2*:											
Menfro	0-3	Silt loam	CL	A-6	0	100	100	95-100	92-100	25-35	11-20
	3-50	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	50-60	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	92-100	25-35	5-15
Caneyville	0-3	Silt loam	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	3-15	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	15-32	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
8D2*:											
Minnith	0-4	Silt loam	CL, CL-ML	A-6, A-4	0	100	100	90-100	90-95	20-35	5-15
	4-51	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-90	30-50	10-20
	51-60	Loam, clay loam, silt loam.	CL, SC	A-6	0-5	95-100	90-100	60-90	40-80	25-40	10-20
Lily	0-4	Loam	ML	A-4	0-5	90-100	85-100	70-95	55-75	<35	NP-7
	4-27	Clay loam, sandy clay loam, loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	75-100	40-80	<35	3-15
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
9C, 9D----------- Hildebrecht	0-8	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	90-100	20-30	3-10
	8-26	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	12-22
	26-51	Silt loam, very cherty silt loam, very cherty clay loam.	GC, CL, SC, SM-SC	A-6, A-2, A-4, A-7	0-10	60-95	30-80	30-75	25-70	25-45	6-22
	51-60	Very cherty clay, clay, cherty silty clay.	CL, CH, SC, GC	A-7, A-2-7	0-10	60-100	30-100	30-100	25-95	45-75	22-40
10F*:											
Menfro----------	0-17	Silt loam--------	CL	A-6	0	100	100	95-100	92-100	25-35	11-20
	17-50	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	50-60	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	92-100	25-35	5-15
Caneyville------	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	9-12	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	12-34	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rubble land.											
11E-------------- Goss	0-12	Cherty silt loam	ML, CL, CL-ML	A-4	0-10	65-90	65-90	65-90	65-85	20-30	2-8
	12-18	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-8
	18-75	Cherty silty clay loam, very cherty silty clay, very cherty clay.	GC	A-7	10-45	45-70	40-65	40-50	35-45	50-70	30-40
12E*:											
Lily------------	0-6	Loam-------------	ML	A-4	0-5	90-100	85-100	70-95	55-75	<35	NP-7
	6-28	Clay loam, sandy clay loam, loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	75-100	40-80	<35	3-15
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Minnith---------	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	90-100	90-95	20-35	5-15
	8-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-90	30-50	10-20
	27-60	Clay loam, loam	CL, SC	A-6, A-7	0-5	95-100	90-100	65-95	45-80	30-50	10-30
15E*:											
Gasconade-------	0-4	Stony silty clay loam.	CL	A-7-6	5-15	75-90	70-85	60-75	55-65	40-45	20-25
	4-14	Very channery silty clay loam.	GC	A-2-7, A-7-6	15-40	40-60	30-50	30-50	25-40	40-45	20-25
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
18C-------------- Weller	0-9	Silt loam--------	ML, CL	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	9-32	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-65	30-40
	32-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	30-55	10-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
19C, 19D---------- Weingarten	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	6-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	95-100	95-100	30-45	11-25
	30-50	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	95-100	95-100	95-100	25-40	7-18
	50-60	Cherty clay, very cherty silty clay, very cherty silty clay loam.	GC, CL, CH, SC	A-7	0-25	45-95	40-90	40-90	35-85	45-65	25-40
20--------------- Wilbur	0-7	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	70-90	<25	3-7
	7-60	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	70-90	<25	3-7
21--------------- Haymond	0-7	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	7-57	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	57-65	Fine sandy loam, silt loam, loam.	ML, SM	A-4	0	95-100	90-100	80-100	35-90	27-36	4-10
24A-------------- Elsah	0-12	Loam-------------	CL-ML, CL	A-4, A-6	0	100	95-100	85-95	60-70	25-35	5-15
	12-52	Stratified cherty loam to extremely cherty loam.	GM, SC	A-2-4, A-4	5-10	30-90	25-75	25-65	20-50	20-30	5-10
	52-60	Extremely cherty sand.	GW-GM	A-1-a, A-2-4	5-10	30-35	25-30	15-20	5-10	10-20	NP
25A*: Midco------------	0-5	Very 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
	5-60	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
Riverwash.											
26A-------------- Auxvasse	0-17	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
	17-36	Silty clay, clay	CH	A-7	0	100	100	95-100	90-100	50-65	30-40
	36-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	90-96	35-45	20-25
27A-------------- Ashton	0-9	Silt loam--------	ML, CL	A-4	0	95-100	90-100	75-100	60-95	<35	NP-10
	9-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	80-100	25-42	5-20
28A-------------- Freeburg	0-17	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	90-100	15-35	5-15
	17-32	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	85-100	85-100	30-45	15-25
	32-62	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	85-100	85-100	30-45	15-25
29--------------- Kickapoo	0-8	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	100	70-85	40-55	<26	3-8
	8-60	Stratified sandy loam to sand.	SM-SC, SC	A-4	0	100	100	65-75	35-45	<28	6-9
32E*: Gasconade--------	0-4	Silty clay loam	CL	A-7-6	0-15	90-95	85-90	80-85	75-80	40-45	20-25
	4-11	Very channery silty clay loam.	GC	A-2-7, A-7-6	15-40	40-60	30-50	30-50	25-40	40-45	20-25
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Caneyville-------	0-3	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	3-15	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	15-26	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
50----------------- Darwin	0-15	Silty clay--------	CH	A-7	0	100	100	100	95-100	50-85	30-55
	15-60	Silty clay, clay	CH	A-7	0	100	100	100	95-100	50-85	30-55
52----------------- Parkville	0-17	Silty clay--------	CH	A-7	0	100	100	97-100	95-100	55-80	30-55
	17-41	Stratified very fine sand to silt loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	NP-15
	41-60	Stratified loamy fine sand to very fine sandy loam.	SM, SM-SC	A-2, A-4	0	100	100	75-95	20-50	<20	NP-5
53----------------- Leta	0-15	Silty clay--------	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	15-27	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-65	20-40
	27-60	Stratified silt loam to sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	80-100	51-95	20-35	5-15
54----------------- Waldron	0-8	Silty clay--------	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	8-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-65	20-45
55----------------- Haynie	0-9	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	25-40	5-15
	9-67	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	85-100	25-35	5-15
58----------------- Dupo	0-7	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	1-15
	7-28	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	28-67	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	100	98-100	35-55	15-30
62A*:											
Haynie-----------	0-8	Silt 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----------	0-12	Silty clay--------	CL, CH	A-7	0	100	100	95-100	95-100	45-65	30-45
	12-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-65	20-45
65*:											
Orthents.											
Water.											
66*. Pits											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cm^3	In/hr	In/in	pH					Pct
1C, 1D2, 1E2, 1F-- Menfro	0-4	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
	4-48	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	48-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
2F*:											
Clarksville-----	0-8	14-20	1.30-1.60	2.0-6.0	0.07-0.12	4.5-6.0	Low----------	0.28	2	8	1-2
	8-35	25-35	1.40-1.65	2.0-6.0	0.06-0.10	4.5-5.5	Low----------	0.28			
	35-60	40-75	1.40-1.80	0.6-2.0	0.05-0.08	4.5-5.5	Low----------	0.28			
Menfro----------	0-8	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	.5-2
	8-52	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	52-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
3D2, 3E2--------- Menfro	0-4	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
	4-36	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	36-64	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
4D2*, 4E*:											
Menfro----------	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
	6-42	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	42-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
Bucklick--------	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
	6-45	35-45	1.25-1.35	0.6-2.0	0.10-0.18	4.5-7.3	Moderate-----	0.32			
	45-47	---	---	---	---	---	-------------	----			
	47	---	---	---	---	---	-------------	----			
5C-------------- Minnith	0-7	10-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	5	1-2
	7-51	25-35	1.30-1.60	0.2-2.0	0.20-0.22	4.5-6.5	Moderate-----	0.37			
	51-60	15-35	1.40-1.60	0.2-6.0	0.14-0.22	4.5-7.3	Moderate-----	0.37			
7E2*:											
Menfro----------	0-3	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
	3-50	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	50-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
Caneyville------	0-3	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-7.3	Low----------	0.43	3	5	1-2
	3-15	36-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-7.3	Moderate-----	0.28			
	15-32	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate-----	0.28			
	32	---	---	---	---	---	-------------	----			
8D2*:											
Minnith---------	0-4	10-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	5	1-2
	4-51	25-35	1.30-1.60	0.2-2.0	0.20-0.22	4.5-6.5	Moderate-----	0.37			
	51-60	15-35	1.40-1.60	0.2-6.0	0.14-0.22	4.5-7.3	Moderate-----	0.37			
Lily------------	0-4	7-27	1.20-1.40	0.6-6.0	0.13-0.18	3.6-6.5	Low----------	0.28	3	5	.5-2
	4-27	18-35	1.25-1.35	2.0-6.0	0.12-0.18	3.6-5.5	Low----------	0.28			
	27	---	---	---	---	---	-------------	----			
9C, 9D---------- Hildebrecht	0-8	8-20	1.35-1.45	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.43	4	5	1-2
	8-26	20-35	1.40-1.50	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.43			
	26-51	12-35	1.60-1.80	0.06-0.2	0.03-0.05	3.6-5.5	Low----------	0.43			
	51-60	35-70	1.30-1.40	0.2-0.6	0.11-0.15	4.5-6.0	Moderate-----	0.28			
10F*:											
Menfro----------	0-17	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
	17-50	27-35	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	50-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cm3	In/hr	In/in	pH					Pct
10F*:											
Caneyville------	0-9	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-7.3	Low----------	0.43	3	5	1-2
	9-12	36-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-7.3	Moderate-----	0.28			
	12-34	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate-----	0.28			
	34	---	---	---	---	---	-------------	----			
Rubble land.											
11E-------------- Goss	0-12	7-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.0	Low----------	0.24	2	6	1-2
	12-18	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.24			
	18-75	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate-----	0.24			
12E*:											
Lily------------	0-6	7-27	1.20-1.40	0.6-6.0	0.13-0.18	3.6-6.5	Low----------	0.28	3	5	.5-4
	6-28	18-35	1.25-1.35	2.0-6.0	0.12-0.18	3.6-5.5	Low----------	0.28			
	28	---	---	---	---	---	-------------	----			
Minnith---------	0-8	10-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	5	1-2
	8-27	25-35	1.30-1.60	0.2-2.0	0.20-0.22	4.5-6.5	Moderate-----	0.37			
	27-60	15-40	1.40-1.60	0.2-0.6	0.16-0.20	4.5-6.5	Moderate-----	0.37			
15E*:											
Gasconade-------	0-4	35-40	1.35-1.50	0.6-2.0	0.10-0.12	6.1-7.8	Moderate-----	0.20	2	8	2-4
	4-14	35-40	1.35-1.50	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20			
	14	---	---	---	---	---	-------------	----			
Rock outcrop.											
18C-------------- Weller	0-9	16-27	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	6	1-2
	9-32	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High---------	0.43			
	32-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.0	High---------	0.43			
19C, 19D--------- Weingarten	0-6	10-27	1.30-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.37	5	5	1-2
	6-30	20-35	1.30-1.60	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	30-50	15-30	1.50-1.70	0.2-0.6	0.10-0.15	5.1-6.5	Low----------	0.37			
	50-60	35-60	1.30-1.50	0.6-2.0	0.05-0.10	5.1-7.8	Moderate-----	0.24			
20--------------- Wilbur	0-7	10-17	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5	1-3
	7-60	10-17	1.30-1.45	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37			
21--------------- Haymond	0-7	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
	7-57	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
	57-65	10-18	1.30-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.37			
24A-------------- Elsah	0-12	15-25	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37	3	5	1-2
	12-52	10-20	1.30-1.50	2.0-6.0	0.08-0.14	5.6-7.3	Low----------	0.15			
	52-60	5-10	1.50-1.60	6.0-2.0	0.02-0.03	5.6-7.3	Low----------	0.10			
25A*:											
Midco-----------	0-5	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
	5-60	5-25	1.10-1.30	2.0-6.0	0.02-0.06	5.1-7.3	Low----------	0.24			
Riverwash.											
26A-------------- Auxvasse	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
	17-36	45-60	1.35-1.50	<0.06	0.09-0.11	4.5-5.5	High---------	0.43			
	36-60	25-40	1.35-1.50	0.2-0.6	0.18-0.20	4.5-5.5	Moderate-----	0.43			
27A-------------- Ashton	0-9	10-25	1.20-1.40	0.6-2.0	0.16-0.23	5.6-7.3	Low----------	0.32	5	5	2-4
	9-60	18-34	1.20-1.50	0.6-2.0	0.18-0.23	5.6-7.3	Low----------	0.43			
28A-------------- Freeburg	0-17	12-25	1.20-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	.5-2
	17-32	25-35	1.40-1.50	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	32-62	25-32	1.35-1.50	0.2-0.6	0.16-0.20	5.1-7.3	Moderate-----	0.37			
29--------------- Kickapoo	0-8	8-16	1.20-1.55	0.6-2.0	0.16-0.18	5.1-7.8	Low----------	0.24	5	3	2-4
	8-60	12-18	1.50-1.60	0.6-2.0	0.12-0.16	5.1-7.8	Low----------	0.24			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cm3	In/hr	In/in	pH					Pct
32E*:											
Gasconade--------	0-4	35-40	1.35-1.50	0.6-2.0	0.12-0.15	6.1-7.8	Moderate------	0.32	2	7	2-4
	4-11	35-40	1.35-1.50	0.2-0.6	0.05-0.07	6.1-7.8	Moderate------	0.20			
	11	---	---	---	---	---	-------------	-----			
Caneyville-------	0-3	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-7.3	Low-----------	0.43	3	5	2-4
	3-15	36-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-7.3	Moderate------	0.28			
	15-26	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate------	0.28			
	26	---	---	---	---	---	-------------	-----			
50---------------- Darwin	0-15	35-45	1.20-1.40	<0.06	0.11-0.14	6.1-7.8	Very high----	0.28	3	4	4-5
	15-60	42-55	1.30-1.50	<0.06	0.11-0.14	6.1-7.8	Very high----	0.28			
52---------------- Parkville	0-17	40-70	1.30-1.50	<0.06	0.11-0.13	6.6-8.4	High----------	0.28	5	4	1-3
	17-41	4-25	1.40-1.60	0.6-2.0	0.18-0.22	7.4-8.4	Low-----------	0.28			
	41-60	4-25	1.40-1.60	2.0-6.0	0.08-0.18	7.4-8.4	Low-----------	0.28			
53---------------- Leta	0-15	40-48	1.30-1.50	0.06-0.2	0.12-0.14	6.6-7.8	High----------	0.28	5	4	2-4
	15-27	35-48	1.30-1.50	0.06-0.2	0.11-0.19	6.6-7.8	High----------	0.28			
	27-60	10-27	1.30-1.50	0.6-2.0	0.14-0.22	6.6-8.4	Low-----------	0.28			
54---------------- Waldron	0-8	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
	8-60	35-50	1.45-1.60	0.06-0.2	0.10-0.18	7.4-8.4	High----------	0.32			
55---------------- Haynie	0-9	15-25	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.37	5	4L	1-3
	9-67	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.37			
58---------------- Dupo	0-7	10-18	1.25-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-2
	7-28	10-18	1.30-1.50	0.6-2.0	0.20-0.22	5.6-8.4	Low-----------	0.37			
	28-67	35-45	1.35-1.60	0.06-0.6	0.08-0.19	6.6-7.8	High----------	0.37			
62A*:											
Haynie-----------	0-8	15-25	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.37	5	4L	1-3
	8-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.37			
Waldron----------	0-12	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
	12-60	35-50	1.45-1.60	0.06-0.2	0.10-0.18	7.4-8.4	High----------	0.32			
65*:											
Orthents.											
Water.											
66*. Pits											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
1C, 1D2, 1E2, 1F-- Menfro	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
2F*:												
Clarksville------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	High.
Menfro-----------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
3D2, 3E2---------- Menfro	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
4D2*, 4E*:												
Menfro-----------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate
Bucklick---------	C	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Moderate.
5C---------------- Minnith	C	None--------	---	---	3.0-5.0	Apparent	Nov-Apr	>60	---	Moderate	Moderate	Moderate.
7E2*:												
Menfro-----------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
Caneyville-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	High-----	Moderate.
8D2*:												
Minnith----------	C	None--------	---	---	3.0-5.0	Apparent	Nov-Apr	>60	---	Moderate	Moderate	Moderate.
Lily-------------	B	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	High.
9C, 9D------------ Hildebrecht	C	None--------	---	---	2.0-2.5	Perched	Nov-May	>60	---	Moderate	Moderate	High.
10F*:												
Menfro-----------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
Caneyville-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	High-----	Moderate.
Rubble land.												
11E--------------- Goss	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
12E*:												
Lily-------------	B	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	High.
Minnith----------	C	None--------	---	---	3.0-5.0	Apparent	Nov-Apr	>60	---	Moderate	Moderate	Moderate.
15E*:												
Gasconade--------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
15E*: Rock outcrop.												
18C---------------- Weller	C	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	High.
19C, 19D---------- Weingarten	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
20----------------- Wilbur	B	Frequent----	Brief-----	Oct-Jun	1.5-3.0	Apparent	Mar-Apr	>60	---	High-----	Moderate	Moderate.
21----------------- Haymond	B	Frequent----	Brief-----	Jan-May	>6.0	---	---	>60	---	High-----	Low------	Low.
24A---------------- Elsah	B	Frequent----	Brief-----	Jan-May	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
25A*:												
Midco-------------	A	Frequent----	Very brief	Nov-Apr	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
Riverwash.												
26A---------------- Auxvasse	D	Rare---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	Moderate	High-----	High.
27A---------------- Ashton	B	Rare---------	---	---	>6.0	---	---	>60	---	---	Low------	Low.
28A---------------- Freeburg	C	Rare---------	---	---	1.5-3.0	Perched	Nov-May	>60	---	High-----	High-----	High.
29----------------- Kickapoo	B	Frequent----	Brief-----	Nov-May	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
32E*:												
Gasconade---------	D	None---------	---	---	>6.0	---	---	4-20	Hard	Moderate	High-----	Low.
Caneyville--------	C	None---------	---	---	>6.0	---	---	20-40	Hard	---	High-----	Moderate.
50----------------- Darwin	D	Rare---------	---	---	+.5-2.0	Apparent	Jan-Jun	>60	---	Moderate	High-----	Low.
52----------------- Parkville	C	Rare---------	---	---	1.0-2.0	Apparent	Nov-Apr	>60	---	Moderate	High-----	Low.
53----------------- Leta	C	Rare---------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
54----------------- Waldron	D	Rare---------	---	---	1.0-3.0	Perched	Nov-May	>60	---	High-----	High-----	Low.
55----------------- Haynie	B	Rare---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
58----------------- Dupo	C	Rare---------	---	---	1.0-3.0	Apparent	Jan-Jun	>60	---	High-----	High-----	Moderate.
62A*:												
Haynie------------	B	Rare---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
Waldron-----------	D	Rare---------	---	---	1.0-3.0	Perched	Nov-May	>60	---	High-----	High-----	Low.
65*: Orthents.												
Water.												
66*. Pits												

* 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
Ashton	Fine-silty, mixed, mesic Mollic Hapludalfs
Auxvasse	Fine, montmorillonitic, mesic Aeric Albaqualfs
Bucklick	Fine, mixed, mesic Typic Hapludalfs
Caneyville	Fine, mixed, mesic Typic Hapludalfs
Clarksville	Loamy-skeletal, siliceous, mesic Typic Paleudults
Darwin	Fine, montmorillonitic, mesic Vertic Haplaquolls
Dupo	Coarse-silty over clayey, mixed, nonacid, mesic Aquic Udifluvents
Elsah	Loamy-skeletal, mixed, nonacid, mesic Typic Udifluvents
Freeburg	Fine-silty, mixed, mesic Aquic Hapludalfs
Gasconade	Clayey-skeletal, mixed, mesic Lithic Hapludolls
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Haymond	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
Hildebrecht	Fine-silty, mixed, mesic Typic Fragiudalfs
Kickapoo	Coarse-loamy, mixed, nonacid, mesic Typic Udifluvents
Leta	Clayey over loamy, montmorillonitic, mesic Fluvaquentic Hapludolls
Lily	Fine-loamy, siliceous, mesic Typic Hapludults
Menfro	Fine-silty, mixed, mesic Typic Hapludalfs
Midco	Loamy-skeletal, siliceous, nonacid, mesic Typic Udifluvents
Minnith	Fine-silty, mixed, mesic Typic Hapludalfs
Orthents	Mesic Udorthents
Parkville	Clayey over loamy, montmorillonitic, mesic Fluvaquentic Hapludolls
Waldron	Fine, montmorillonitic (calcareous), mesic Aeric Fluvaquents
Weingarten	Fine-silty, mixed, mesic Typic Hapludalfs
Weller	Fine, montmorillonitic, mesic Aquic Hapludalfs
Wilbur	Coarse-silty, mixed, nonacid, mesic Aquic Udifluvents

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