United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
Missouri Agricultural
Experiment Station

Soil Survey of Pike County, Missouri

How To Use This Soil Survey

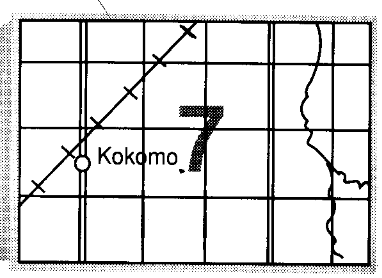
General Soil Map

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.

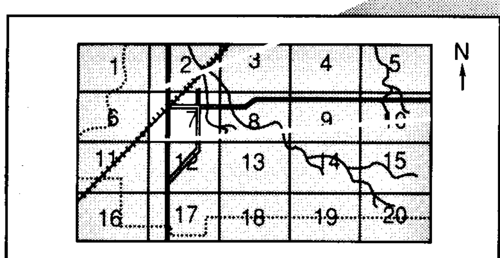
Detailed Soil Maps

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



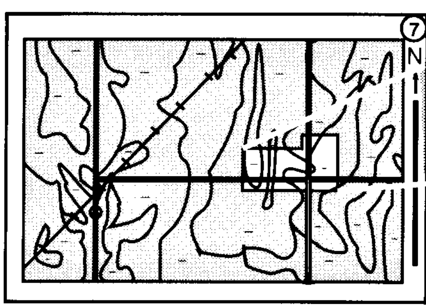
MAP SHEET

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.

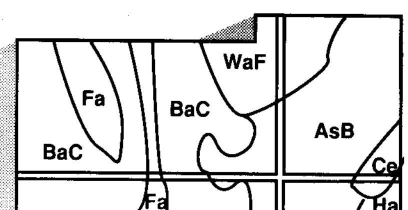


INDEX TO MAP SHEETS

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.



MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1991. Soil names and descriptions were approved in 1991. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1990. This survey was made cooperatively by the Natural Resources Conservation Service and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided a soil scientist to assist with the fieldwork. The Pike County Commission provided office space for the soil survey party. This survey is part of the technical assistance furnished to the Pike County Soil and Water Conservation District. Funding for a district soil scientist was provided by the Missouri Department of Natural Resources and administered through the Pike 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.

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

Cover: An area of the Winfield-Menfro association on uplands. An area of the Chequest-Dockery-Carlow association is on the flood plain along the Mississippi River in the background.

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Issued July 1997

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Summary of Tables

Foreword

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

This soil survey is designed for many different users. Farmers, ranchers, 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 Natural Resources Conservation Service, Forest Service, or Cooperative Extension Service.

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Soil Survey of Pike County, Missouri

By Charles L. Love, Natural Resources Conservation Service

Fieldwork by Charles L. Love, Martha E. Sheppard, and Curtis L. Godfrey, Natural Resources Conservation Service; Mark W. Osborn, Missouri Department of Natural Resources; and Ulf B. Gafvert, Pike County Soil and Water Conservation District

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

PIKE COUNTY is in northeastern Missouri (fig. 1). It has a population of about 17,000. The survey area has a total land area of 430,937 acres, or about 673 square miles. It does not include the total land area of the county. A very small portion along the county line was included in the soil survey of Ralls County, Missouri. Louisiana, the largest town in Pike County, has a population of about 3,800. Bowling Green, the county seat, is near the center of the county. It has a population of about 3,000.

This soil survey updates the survey of Pike County published in 1914 *(18)*. It provides additional interpretive information and larger maps, which show the soils in greater detail.

Figure 1.—Location of Pike County in Missouri.

General Nature of the Survey Area

This section gives general information about the survey area. It describes climate, history and development, natural resources, and relief and drainage.

Climate

The consistent pattern of climate in Pike County is one of cold winters and long, hot summers. Heavy rains occur mainly in spring and early 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.

Tornadoes and severe thunderstorms occur occasionally in the county but are local and of short duration. The damage from these storms varies and is spotty. Hailstorms occur at times during the warmer part of the year but in an irregular pattern and in only small areas.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Elsberry in the period 1951 to 1988. 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 30 degrees F and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Elsberry on January 1, 1979, is -24 degrees. In summer, the average temperature is 75 degrees and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred on July 15, 1954, is 116 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 about 37 inches. Of this, about 22 inches, or 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 5.4 inches at Elsberry on December 3, 1982. Thunderstorms occur on about 46 days each year.

The average seasonal snowfall is about 18 inches. The greatest snow depth at any one time during the period of record was 17 inches. On the average, 16 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 65 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11.8 miles per hour, in spring.

History and Development

The area that became Pike County was inhabited by the Fox and Sauk Indians prior to European settlement. Both France and Spain controlled this area before it was sold to the United States as part of the Louisiana Purchase in 1803. The early surveys of the French and Spanish land grants still influence the roads and property lines in the southern and eastern parts of the county *(11)*.

The Mississippi River influenced early settlement. In 1808, settlers from Kentucky, Tennessee, Virginia, and the Carolinas selected sites for homes near the river. Fort Buffalo was built in 1812. In 1816, Judge James Hart Stark started the first nursery that produced plants west of the Mississippi River. This enterprise, which was in the town of Louisiana, continues to be a major business in the area *(17)*.

Pike County was established in 1818 and was named after the explorer Zebulon Pike. At that time it included most of northeastern Missouri. By 1820, the present boundaries were set *(11)*. During the California gold rush, some residents of Pike County went west *(17)*.

The early agricultural products were tobacco, apples, corn, wheat, and timber. The industries in the area at that time reflected the influence of these crops. Numerous mills for grinding wheat and corn, a vinegar press, a pipe factory, tobacco warehouses, a shell button factory, and a lime kiln were established *(17)*.

During the 1940's, several Amish families of the old order moved into the area southwest of Bowling Green. They continue to farm much like the pioneers did. They use draft horses and raise crops and livestock on small farms *(17)*.

Natural Resources

Land is the major natural resource in the county, and farming is the major land use. Several industries also have developed. Most of the industries are in areas near the Mississippi River, where water can be used as a resource and as a means of transportation. A good highway system crosses the county. A few limestone quarries are in the county, including a large cement company near Clarksville that quarries limestone and shale. Other industries include a clothing manufacturer in the town of Bowling Green and a plastics plant, a chemical plant, and an explosives plant near the town of Louisiana.

Most of the land is used as cropland. The major crops are soybeans, corn, and wheat. Grain sorghum also is grown. About a fourth of the acreage in the county is used for hay and pasture. Hogs and beef cattle are the main livestock raised. About a fourth of the county is forested, mostly in the northeastern part *(12)*.

The Mississippi River borders nearly 40 miles of the county. A grain terminal in the town of Louisiana provides access to railroads and barges, and a highway bridge near Louisiana is conducive to interstate trade. The river also provides opportunities for recreational activities and a small amount of commercial fishing and shelling. Federal and state wildlife areas located along the river provide recreational opportunities and habitat for wildlife.

Relief and Drainage

Pike County is almost equally divided into two major land resource areas—the Central Mississippi Valley Wooded Slopes and the Central Claypan Areas. These major land resource areas are part of the Central Feed Grains and Livestock Region *(21)*.

The Central Claypan Areas major land resource area covers the southwestern part of the county. It has gently rolling uplands that are mostly farmed. It drains toward tributaries of the Cuivre River on the south and tributaries of the Salt River on the north.

The Central Mississippi Valley Wooded Slopes major land resource area covers the northeastern part of the county and drains toward the Salt and Mississippi Rivers and their tributaries. It has steeply sloping uplands. Prominent knobs and ridges formed in the nearly horizontal rock formations. They are the remnants of ancient uplands. Limestone and shale outcrops are on these knobs and in the more dissected valleys. This area also includes the flood plain along the Salt and Mississippi Rivers. The flood plain is as much as 5 miles wide near the Lincoln County line. It is much narrower near the mouth of the Salt River. Most of it is leveed and used for farming. Most of the levees are privately owned and maintained so they vary in height and width. A few islands are in the county. They are flooded frequently, and most are wooded.

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 biological activity.

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

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

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

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

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

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

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of additional soil data, modifications in series concepts, variations in the intensity of mapping or in the extent of soils in the survey areas, or correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more feasible than mapping these soils separately and giving them different names.

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

Soil Descriptions

1. Mexico-Armstrong Association

Very deep, very gently sloping to moderately sloping, somewhat poorly drained and moderately well drained soils formed in loess or in pedisediments and glacial till; on uplands

This association consists of soils on ridgetops, at the head of drainageways, and on broad upland divides that have long side slopes. It makes up about 21 percent of the survey area. It is about 65 percent Mexico soils, 24 percent Armstrong soils, and 11 percent minor soils (fig. 2).

The Mexico soils are very deep and are very gently sloping and gently sloping. They are on broad upland divides, ridgetops, and side slopes. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable silt loam

Subsurface layer:
9 to 13 inches, grayish brown, friable silt loam

Subsoil:
13 to 17 inches, brown, strong brown, and light brownish gray, mottled, friable silty clay loam and silty clay
17 to 39 inches, gray and grayish brown, mottled, firm silty clay

Substratum:
39 to 60 inches, light brownish gray, mottled, firm silty clay

The Armstrong soils are very deep and are gently sloping and moderately sloping. They are on ridgetops and side slopes. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable loam

Subsoil:
9 to 14 inches, dark brown, mottled, firm silty clay loam
14 to 20 inches, brown and reddish brown, mottled, firm clay loam
20 to 60 inches, brown and strong brown, mottled, firm clay loam

Of minor extent in this association are the poorly drained, nearly level Putnam soils. These soils are on the broad divides.

This association is used mainly for cultivated crops. Some small areas are used for pasture or hay. The major soils are suited to corn, soybeans, and small grain. The hazard of water erosion and wetness during spring and winter are the main management concerns in cultivated areas. Erosion caused by overgrazing is a major management concern in pastured areas.

The major soils are used for building site development and onsite waste disposal. The wetness, a high shrink-swell potential, slow permeability, and the slope are the main limitations.

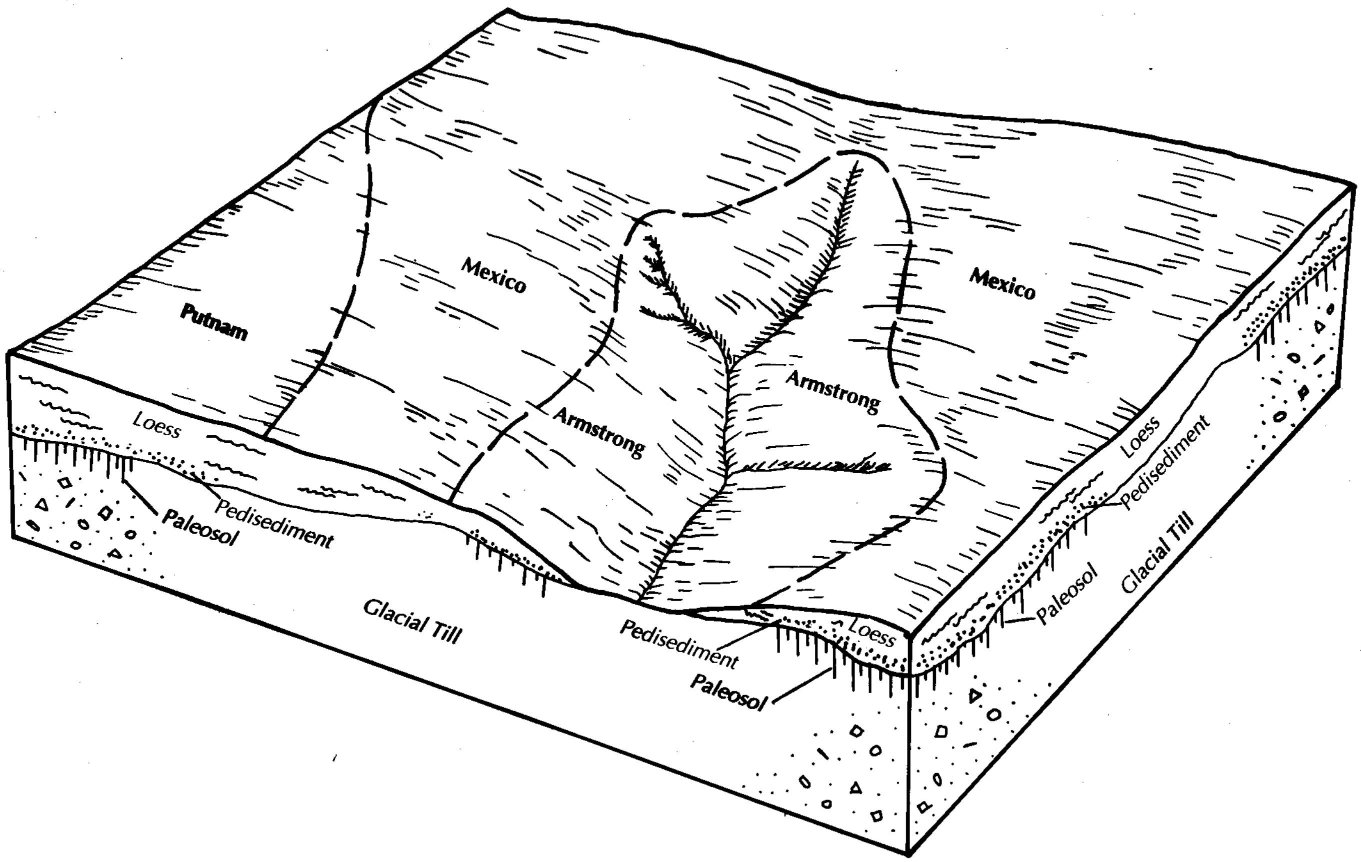

Figure 2.—Typical pattern of soils and parent material in the Mexico-Armstrong association.

2. Keswick-Gorin-Calwoods Association

Very deep, very gently sloping to strongly sloping, moderately well drained and somewhat poorly drained soils formed in weathered glacial till or in loess and pedisediments; on uplands

This association consists of soils on ridgetops and side slopes. It makes up about 24 percent of the survey area. It is about 53 percent Keswick soils, 20 percent Gorin soils, 14 percent Calwoods soils, and 13 percent minor soils (fig. 3).

The Keswick soils are very deep and are moderately sloping and strongly sloping. They are on long side slopes below the Gorin soils. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:

0 to 7 inches, dark grayish brown, friable loam

Subsoil:

7 to 29 inches, brown, mottled, friable clay loam

29 to 40 inches, yellowish brown, mottled, very firm clay

40 to 60 inches, grayish brown, mottled, very firm clay

The Gorin soils are very deep and are gently sloping and moderately sloping. They are on narrow ridgetops and short side slopes. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:

0 to 5 inches, dark grayish brown, friable silt loam

Subsurface layer:

5 to 12 inches, brown, friable silt loam

Subsoil:

12 to 48 inches, dark brown and yellowish brown, mottled, friable silty clay and silty clay loam

48 to 60 inches, light olive brown, mottled, firm silty clay and clay

The Calwoods soils are very deep and are very gently sloping and gently sloping. They are on ridgetops. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 7 inches, dark grayish brown, friable silt loam

Subsurface layer:
7 to 11 inches, grayish brown, mottled, friable silt loam

Subsoil:
11 to 21 inches, dark grayish brown, mottled, firm silty clay loam and silty clay
21 to 60 inches, grayish brown and light brownish gray, mottled, friable silty clay loam

Of minor extent in this association are the Belknap, Goss, and Twomile soils. Belknap soils are somewhat poorly drained. They are in nearly level areas on flood plains. Goss soils are well drained. They are on the steep, dissected, lower side slopes. Twomile soils are poorly drained. They are on high flood plains.

This association is used mainly for cultivated crops, pasture, or hay. The major soils are suited to corn, soybeans, and small grain. The hazard of water erosion is the main management concern. These soils are suited to water-tolerant grasses and legumes for pasture and hay. Seasonal wetness, the hazard of erosion, the slope, and overgrazing are the main management concerns.

Many of the strongly sloping areas support native hardwoods. The major soils are suited to woodland. The seedling mortality rate and the hazard of windthrow are management concerns.

The major soils are suited to building site development and to most kinds of onsite waste disposal. The wetness, a high shrink-swell potential, slow permeability, and the slope are the major management concerns.

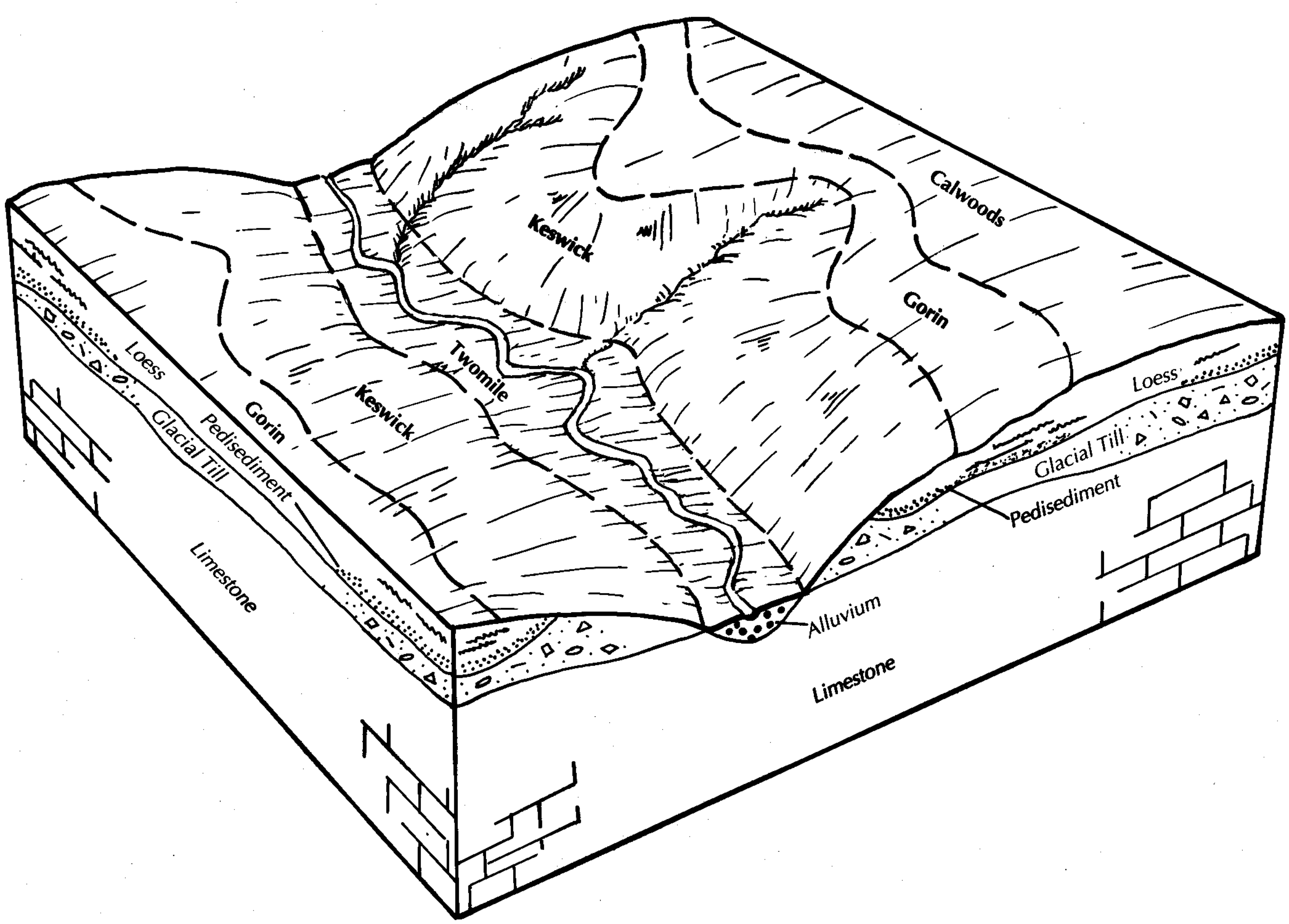

Figure 3.—Typical pattern of soils and parent material in the Keswick-Gorin-Calwoods association.

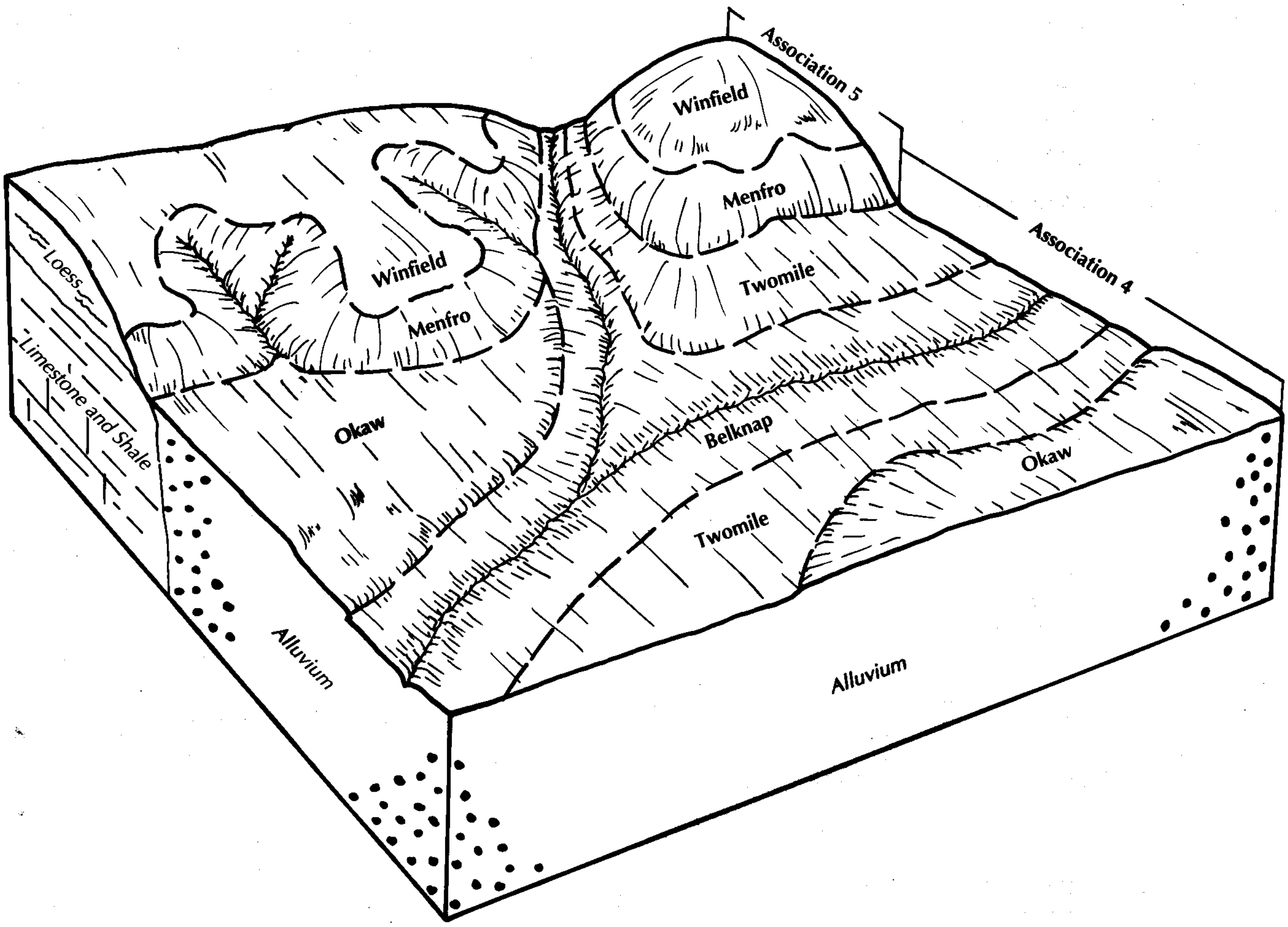

Figure 4.—Typical pattern of soils and parent material in the Goss association.

3. Goss Association

Very deep, strongly sloping to very steep, well drained soils formed in cherty limestone residuum; on uplands

This association is on uplands that are highly dissected by narrow drainageways. Nearly all areas are drained by the Salt and Mississippi Rivers. The association makes up about 18 percent of the survey area. It is about 63 percent Goss and similar soils and 37 percent minor soils (fig. 4).

The Goss soils are on side slopes and on the crest of narrow ridges. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:

0 to 6 inches, dark grayish brown, friable gravelly silt loam

Subsoil:

6 to 11 inches, brown, firm extremely gravelly silty clay loam

11 to 26 inches, yellowish red, firm extremely gravelly silty clay

26 to 60 inches, red, firm gravelly silty clay

Of minor extent in this association are the Crider, Cedargap, Dameron, Menfro, Winfield, and Vanmeter soils. Crider soils are moderately well drained. They are on the upper side slopes. Cedargap and Dameron soils are gravelly. They are on narrow flood plains. Menfro and Winfield soils are silty. Vanmeter soils are moderately deep. Menfro, Vanmeter, and Winfield soils are on side slopes.

More than 85 percent of the acreage in this association supports mixed hardwoods. Most of the cleared areas are pastured. The steep and very steep areas are suited to woodland. Improving the quality of existing stands of trees increases timber production. An equipment limitation and the hazard of erosion are the main management concerns. Most of the less sloping areas have been cleared of trees and are pastured. The hazard of water erosion is the main management concern.

This association is used as a site for sanitary facilities and low-density housing. The slope and the high content of gravel are the main limitations.

4. Belknap-Okaw-Twomile Association

Very deep, nearly level to gently sloping, somewhat poorly drained and poorly drained soils formed in alluvium; on low terraces and flood plains

This association consists of soils on low terraces and flood plains along the Salt River and major creeks in the county. It makes up about 7 percent of the survey area. It is about 27 percent Belknap soils, 21 percent Okaw and similar soils, 18 percent Twomile soils, and 34 percent minor soils (fig. 5).

The Belknap soils are very deep and nearly level. They are on flood plains and are occasionally flooded. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 8 inches, dark grayish brown, friable silt loam

Subsurface layer:
8 to 17 inches, dark grayish brown, mottled, friable silt loam

Substratum:
17 to 32 inches, grayish brown and dark grayish brown, mottled, friable silt loam
32 to 60 inches, dark gray, dark grayish brown, and brown, mottled, friable loam and silt loam

The Okaw soils are very deep and are nearly level to gently sloping. They are on low terraces and are subject to rare flooding. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 8 inches, dark grayish brown, friable silt loam

Subsurface layer:
8 to 15 inches, grayish brown, friable silt loam

Subsoil:
15 to 22 inches, grayish brown, mottled, friable silty clay
22 to 60 inches, grayish brown, mottled, friable silty clay loam

The Twomile soils are very deep and nearly level. They are on high flood plains and are occasionally flooded. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 10 inches, dark grayish brown, friable silt loam

Subsurface layer:
10 to 25 inches, grayish brown and light brownish gray, mottled, friable silt loam

Subsoil:
25 to 32 inches, dark grayish brown, mottled, friable silty clay loam
32 to 60 inches, grayish brown and light brownish gray, mottled, friable silty clay loam

Of minor extent in this association are the Healing, Keswick, Klum, Tice, and Winfield soils. Healing soils are well drained. They are on high flood plains. Keswick and Winfield soils are moderately well drained. They are on the side slopes adjacent to the major soils. Klum soils are sandy. They are on flood plains along small streams. Tice soils have a dark upper layer that is thicker than that of the major soils. They are on narrow flood plains.

This association is used mainly for cultivated crops. Some small areas are used for pasture or hay. The major soils are suited to corn, soybeans, and small grain. The wetness and the flooding are the main management concerns.

The major soils are unsuited to building site development and to onsite waste disposal systems because of the flooding.

5. Winfield-Menfro Association

Very deep, gently sloping to very steep, moderately well drained and well drained soils formed in loess; on uplands

This association consists of soils on ridgetops, side slopes, foot slopes, and hillsides in the uplands. The major drainageways commonly have moderately steep to very steep side slopes. The areas between the drainageways are narrow and are gently sloping to strongly sloping. Some of the ridgetops end in cliffs that overlook the Mississippi River. Slopes range from 2 to 60 percent. This association makes up about 21 percent of the survey area. It is about 45 percent Winfield and similar soils, 37 percent Menfro and similar soils, and 18 percent minor soils (fig. 5).

The Winfield soils are very deep and are gently sloping to strongly sloping. They are on ridgetops and linear, convex side slopes. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 7 inches, dark grayish brown and yellowish brown, friable silt loam

Subsoil:
7 to 23 inches, dark brown, friable silty clay loam

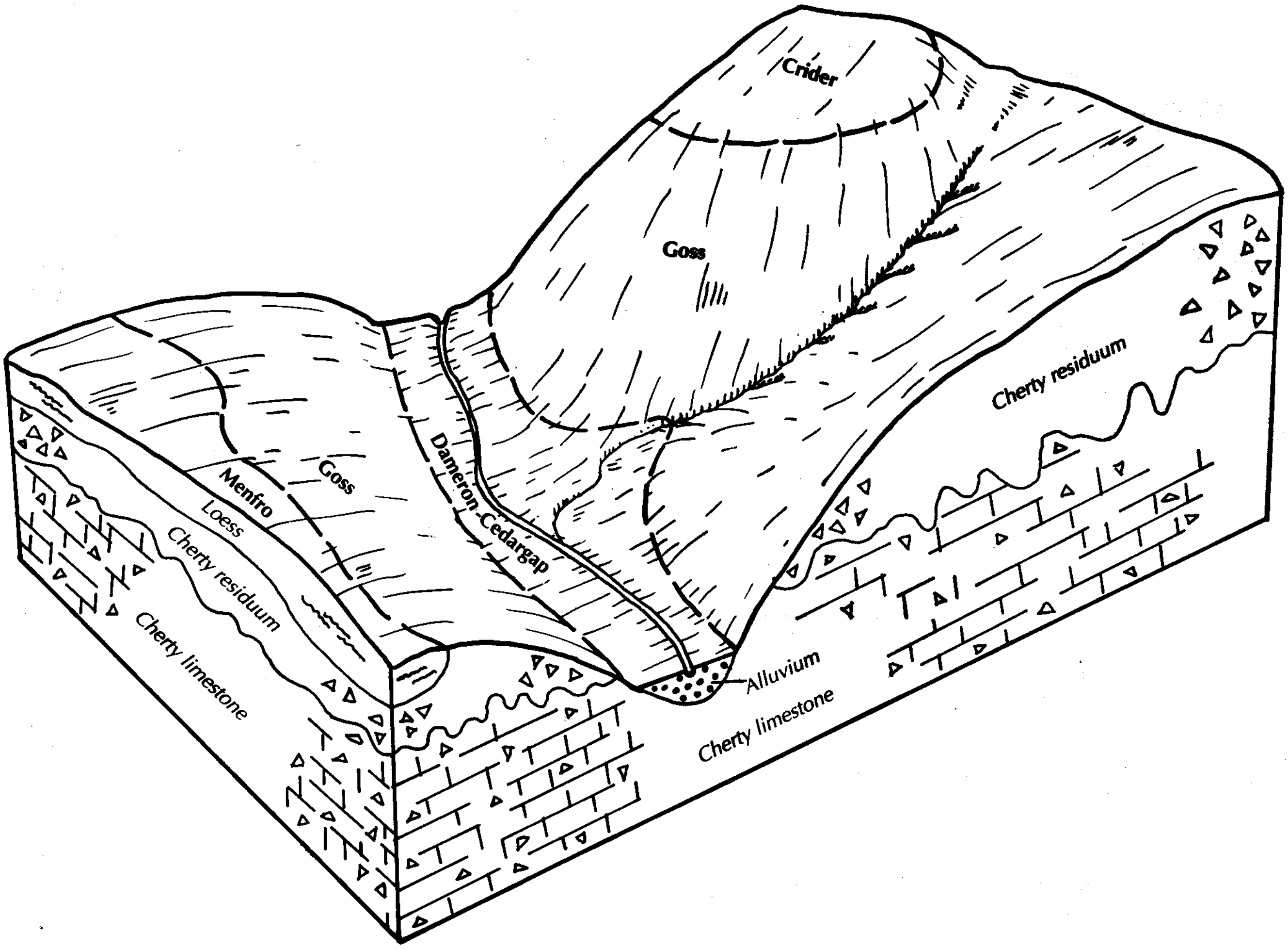

Figure 5.—Typical pattern of soils and parent material in the Belknap-Okaw-Twomile and Winfield-Menfro associations.

23 to 46 inches, dark yellowish brown and yellowish brown, mottled, friable silty clay loam

Substratum:

46 to 60 inches, light brownish gray, mottled, friable silt loam

The Menfro soils are very deep and are gently sloping to very steep. They are on ridgetops and convex side slopes adjacent to the flood plain of the Mississippi River. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:

0 to 4 inches, dark brown, friable silt loam

Subsoil:

4 to 9 inches, dark yellowish brown, friable silt loam
9 to 60 inches, dark yellowish brown, friable silty clay loam and silt loam

Of minor extent in this association are the Belknap, Goss, Haymond, Okaw, Tice, and Weller soils. Belknap and Tice soils are somewhat poorly drained. They are on narrow flood plains. Goss soils are gravelly. They are on steep side slopes in the uplands. Haymond soils are silty. They are on flood plains along drainageways. Okaw soils are poorly drained. They are on low terraces. Weller soils have more clay in the subsoil than the major soils. They are on narrow, convex ridgetops in the uplands.

This association is used mainly for cultivated crops, pasture, or hay. The major soils are suited to corn, soybeans, and small grain. The gently sloping soils are well suited to these crops, and the more sloping soils are moderately suited. The hazard of water erosion and the slope are the main management concerns.

Many of the moderately steep to very steep areas support native hardwoods. The major soils are suited to woodland. The hazard of water erosion and the equipment limitation are management concerns. Good woodland management improves the habitat for woodland wildlife, especially for white-tailed deer and wild turkeys.

This association is suited to building site development and sanitary facilities. The main limitations are the slope, a high shrink-swell potential in the subsoil, and the wetness. In the less sloping areas, the slope is only a moderate limitation. The wetness is a severe limitation on sites for septic tank absorption fields in areas of the Winfield soils.

6. Chequest-Dockery-Carlow Association

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

This association consists of soils on the flood plain along the Mississippi River and in the very lowest part of the mouth of the Salt River. Differences among the soils are mainly a result of the texture of the material in which the soils formed. Differences in elevation are slight. This association makes up about 9 percent of the survey area. It is about 27 percent Chequest soils, 21 percent Dockery and similar soils, 21 percent Carlow soils, and 31 percent minor soils.

The Chequest soils are on flood plains. Most areas of these soils are protected by levees; however, the soils in these areas are still subject to occasional flooding. The soils in the unprotected areas are frequently flooded. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 7 inches, very dark gray, friable silty clay loam

Subsurface layer:
7 to 18 inches, very dark gray, mottled, friable silty clay loam

Subsoil:
18 to 25 inches, dark gray, mottled, friable silty clay loam
25 to 60 inches, gray, mottled, firm silty clay

The Dockery soils are on broad flats and in narrow depressions on flood plains. They are not protected by levees and are frequently flooded for long periods of time. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 8 inches, dark grayish brown, very friable silt loam

Substratum:
8 to 15 inches, stratified dark grayish brown and light brownish gray, mottled, very friable silt loam
15 to 60 inches, stratified dark gray and light brownish gray, mottled, friable silt loam and silty clay loam

The Carlow soils are in broad depressions. Most areas of these soils are protected by levees; however, the soils in these areas are still subject to occasional flooding. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 6 inches, black, friable silty clay

Subsurface layer:
6 to 9 inches, very dark gray, firm silty clay

Subsoil:
9 to 20 inches, dark gray, mottled, very firm silty clay
20 to 60 inches, dark grayish brown and grayish brown, mottled, very firm clay

Of minor extent in this association are the Blackoar, Dupo, Haymond, and Moniteau soils. Blackoar soils are silty. They are in the slightly lower landscape positions. Dupo and Haymond soils are silty. They are on alluvial fans along drainageways bordering loess-covered uplands. Moniteau soils are silty. They are in the slightly higher landscape positions.

This association is used mainly for cultivated crops. Some small areas are used for timber. The major soils are suited to corn, soybeans, and small grain. Most of the stands of timber have not been managed. The wetness and the flooding are the main management concerns.

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

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 the heading "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, 9 to 14 percent slopes, eroded, is a phase of the Menfro series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Dameron-Cedargap complex, 0 to 3 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. The map unit 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

10—Bremer silty clay loam, rarely flooded. This very deep, nearly level, poorly drained soil is mainly on low terraces. Individual areas are irregular in shape and range from about 30 to more than 450 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, black, friable silty clay loam

Subsurface layer:
7 to 17 inches, black, friable silty clay loam

Subsoil:
17 to 31 inches, dark grayish brown, mottled, firm silty clay loam
31 to 60 inches, grayish brown, mottled, friable and firm silty clay and silty clay loam

In some areas the surface layer is very dark grayish brown. In other areas the lower part of the subsoil is loam. In places the slope is more than 2 percent.

Included with this soil in mapping are small areas of Tice, Twomile, and Winfield soils. Tice and Twomile soils have less clay than the Bremer soil. They are on flood plains. Winfield soils are moderately well drained. They are on uplands. Included soils make up about 10 percent of the unit.

Important properties of the Bremer soil—

Permeability: Moderately slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: High
Depth to an apparent water table: 1 to 2 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Wetness is the main management concern. A drainage system that includes land grading and shallow ditches improves surface drainage. Crops can be damaged in some years by the flooding.

This soil is suited to pasture. It is best suited to water-tolerant, shallow-rooted species. It is moderately well suited to reed canarygrass and is moderately suited to birdsfoot trefoil, ladino clover, and redtop. The wetness and the flooding are the main management concerns. The soil is poorly suited to hay. The flooding should be considered when grazing systems are designed. Seedbeds can be easily prepared only during dry periods. Installing a surface drainage system in areas where the deeper rooted species are grown helps to overcome the flooding and the wetness.

This soil is suited to trees, but few areas remain wooded. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are management concerns. Equipment should be operated only when the soil is dry or frozen. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Also, ridging the soil and planting on the ridges increase the survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil generally is not used as a site for buildings or onsite waste disposal systems because of the flooding and the wetness.

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

11—Chequest silty clay loam, occasionally flooded. This very deep, nearly level, poorly drained soil is in the lower areas on flood plains, away from the natural stream channels. It is subject to flooding for brief periods. The installation of levees has reduced the frequency of flooding in most areas. Periods of controlled flooding in some areas attract waterfowl. Individual areas are irregular in shape and range from about 50 to more than 800 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, very dark gray, friable silty clay loam

Subsurface layer:
7 to 18 inches, very dark gray, mottled, friable silty clay loam

Subsoil:
18 to 25 inches, dark gray, mottled, friable silty clay loam
25 to 60 inches, dark gray and gray, mottled, friable silty clay

In some places the subsoil has more clay. In other places it has less clay. In a few areas the lower part of the subsoil is stratified.

Included with this soil in mapping are small areas of Dockery, Dupo, and Moniteau soils. Dockery soils have less clay than the Chequest soil and are stratified throughout. They are in landscape positions similar to those of the Chequest soil. Moniteau soils have less clay throughout than the Chequest soil and have a lighter colored surface layer. They are on high flood plains. Dupo soils are somewhat poorly drained. They are on alluvial fans and flood plains along rivers. Included soils make up about 10 percent of the unit.

Important properties of the Chequest soil—

Permeability: Moderately slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Depth to an apparent water table: 1 to 3 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Wetness and the flooding are the main management concerns. Crops are damaged in some years by the flooding. Shallow, parallel surface ditches improve surface drainage. Installing diversions at the base of adjacent uplands helps to control runoff from the soils upslope. A system of conservation tillage that leaves a protective cover of crop residue on the surface or other crop residue management practices help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is suited to pasture. It is best suited to water-tolerant, shallow-rooted species. It is moderately well suited to reed canarygrass and is moderately suited to birdsfoot trefoil, ladino clover, and redtop. The wetness and the flooding are the main management concerns. The soil is poorly suited to hay. The flooding should be considered when grazing systems are designed. Seedbeds can be easily prepared only during dry periods. Installing a surface drainage system in areas where the deeper rooted species are grown helps to overcome the flooding and the wetness.

Some areas support native hardwoods. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are management concerns. Equipment should be operated only when the soil is dry or frozen. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Also, ridging the soil and planting on the ridges increase the survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

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

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

12C2—Armstrong loam, 3 to 7 percent slopes, eroded. This very deep, gently sloping and moderately sloping, moderately well drained soil is on narrow ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 50 to more than 400 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
- 0 to 9 inches, very dark grayish brown, friable loam

Subsoil:
- 9 to 14 inches, dark brown, mottled, firm silty clay loam
- 14 to 20 inches, brown and reddish brown, mottled, firm clay loam
- 20 to 60 inches, brown and strong brown, mottled, firm clay loam

In places the slope is less than 3 percent. In some areas the surface layer is brown. In other areas it is silt loam.

Included with this soil in mapping are areas of Leonard and Mexico soils. Leonard soils are poorly drained. They have more clay than the Armstrong soil. They are on low ridgetops and at the head of drainageways. Mexico soils are grayer and have less glacial sand and pebbles in the subsoil than the Armstrong soil. They are in the slightly higher areas. Included soils make up about 10 percent of the unit.

Important properties of the Armstrong soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Depth to a perched water table: 1 to 3 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a severe hazard if the soil is used for cultivated crops. Areas that are long enough and smooth enough can be terraced, stripcropped, and farmed on the contour. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, winter cover crops, contour farming, stripcropping, and terraces that have suitable drainage outlets help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to ladino clover. It is moderately well suited to birdsfoot trefoil, tall fescue, timothy, big bluestem, and switchgrass and is moderately suited to alfalfa and little bluestem. Water erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to prevent excessive water erosion.

This soil is suited to trees. If the soil is used as woodland, the seedling mortality rate and the hazard of windthrow are management concerns. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential and the wetness are limitations on sites for dwellings and small commercial buildings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Installing drainage tile around footings minimizes the damage caused by excessive wetness. Land shaping is necessary on sites used for small commercial buildings because of the slope. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by frost action and by shrinking and swelling. The soil is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Properly designed sewage lagoons function adequately. Leveling of the site for the lagoon is necessary.

Low strength, the high shrink-swell potential, the wetness, and the potential for frost action are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts for drainage help to prevent the damage to roads and streets caused by shrinking and swelling, wetness, and frost action.

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

13—Tice silt loam, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil generally is on flood plains along minor streams but also is along some of the major streams. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from about 10 to more than 350 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, very friable silt loam

Subsurface layer:
9 to 15 inches, very dark grayish brown, friable silt loam

Subsoil:
15 to 40 inches, brown, mottled, friable silt loam
40 to 60 inches, dark grayish brown, mottled, friable silt loam

In some places the subsoil is grayer. In other places the surface layer is dark and is more than 24 inches thick.

Included with this soil in mapping are areas of the poorly drained Moniteau soils. These soils are on the slightly higher terraces. They make up 5 to 10 percent of the unit.

Important properties of the Tice soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Depth to an apparent water table: 1.5 to 3.0 feet

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Crops can be damaged in some years unless the flooding is controlled. No other major hazards or limitations affect cultivated crops.

This soil is suited to pasture. It is well suited to ladino clover, red clover, tall fescue, and switchgrass and is moderately well suited to orchardgrass, big bluestem, indiangrass, and little bluestem. Seedbeds can be easily prepared. Installing a surface drainage system in areas where the deeper rooted species are grown helps to overcome the flooding and the wetness.

This soil is suited to trees. No major problems affect timber management.

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

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

14—Belknap silt loam, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil is on flood plains along creeks and small rivers. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from about 80 to more than 550 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 8 inches, dark grayish brown, friable silt loam

Subsurface layer:
8 to 17 inches, dark grayish brown, mottled, friable silt loam

Substratum
17 to 32 inches, grayish brown and dark grayish brown, mottled, friable silt loam
32 to 60 inches, dark gray, grayish brown, dark grayish brown, and brown, mottled, friable silt loam and loam

In some areas the substratum has less sand. In other areas, it is gray and the pH is higher.

Included with this soil in mapping are small areas of Klum and Twomile soils. Klum soils are moderately well drained. They have more sand than the Belknap soil. Twomile soils are poorly drained. They have a dense and brittle layer. Klum and Twomile soils are in landscape positions similar to those of the Belknap soil. They make up 5 to 10 percent of the unit.

Important properties of the Belknap soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Depth to an apparent water table: 1 to 3 feet

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Crops are damaged in some years by the flooding. Shallow, parallel surface ditches improve surface drainage. Installing diversions at the base of adjacent uplands helps to control runoff from the soils upslope. A system of conservation tillage that leaves a protective cover of crop residue on the surface or other crop residue management practices help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is suited to pasture. It is moderately suited to birdsfoot trefoil, ladino clover, switchgrass, and redtop and to big bluestem, indiangrass, and little bluestem. Wetness and the flooding are the main management concerns. Seedbeds can be easily prepared. Installing a surface drainage system in areas where the deeper rooted species are grown helps to overcome the flooding and the wetness.

This soil is suited to trees. No major problems affect timber management.

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

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

15B—Gorin silt loam, 2 to 5 percent slopes. This very deep, gently sloping, somewhat poorly drained soil is on narrow ridgetops in the uplands. Individual areas generally are long and narrow and range from about 10 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:

0 to 5 inches, dark grayish brown, friable silt loam

Subsurface layer:

5 to 12 inches, brown, friable silt loam

Subsoil:

12 to 48 inches, dark brown, brown, and yellowish brown, mottled, friable and firm silty clay and silty clay loam

48 to 60 inches, yellowish brown, mottled, firm clay

In some areas, the slope is more than 5 percent and the soil has more glacial sand and gravel. In other areas the surface layer is very dark grayish brown and is 7 or more inches thick.

Included with this soil in mapping are areas of the moderately well drained Winfield soils. These soils are on ridgetops and side slopes. They make up about 3 percent of the unit.

Important properties of the Gorin soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Depth to a perched water table: 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a moderate hazard if the soil is used for cultivated crops. The hazard of erosion can be reduced by applying a system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year. Winter cover crops, contour farming, stripcropping, and terraces that have suitable drainage outlets help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to ladino clover. It is moderately well suited to birdsfoot trefoil, crownvetch, tall fescue, and timothy and to big bluestem, indiangrass, and switchgrass. Water-tolerant species grow best. Water erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to prevent excessive water erosion.

This soil is suited to trees. The seedling mortality rate and the hazard of windthrow are management concerns. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil is suited to building site development if foundations and footings are properly designed and constructed. Adequately reinforcing concrete and backfilling with sand and gravel minimize the damage caused by shrinking and swelling of the soil. Installing tile drains around foundations and footings minimizes the damage caused by excessive wetness. The soil is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the site is leveled.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Constructing roadside ditches and installing culverts help to prevent the damage caused by frost action, wetness, and shrinking and swelling.

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

15C2—Gorin silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, somewhat poorly drained soil is on narrow ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas generally are long and narrow and range from about 10 to more than 80 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 5 inches, dark grayish brown, friable silt loam

Subsoil:
5 to 13 inches, brown, mottled, friable silty clay
13 to 45 inches, dark yellowish brown, mottled, friable silty clay
45 to 60 inches, yellowish brown, mottled, firm clay

In some areas the slope is less than 5 percent. In other areas the surface layer is very dark gray. In places the subsoil has more glacial sand and pebbles.

Included with this soil in mapping are areas of the moderately well drained Winfield soils. These soils have less clay than the Gorin soil. They are in landscape positions similar to those of the Gorin soil. They make up about 3 percent of the unit.

Important properties of the Gorin soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderate
Depth to a perched water table: 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a severe hazard if the soil is used for cultivated crops. Areas that are long enough and smooth enough can be terraced, stripcropped, and farmed on the contour. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, winter cover crops, contour farming, stripcropping, and terraces that have suitable drainage outlets help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to ladino clover. It is moderately well suited to birdsfoot trefoil, crownvetch, tall fescue, timothy, big bluestem, indiangrass, and switchgrass. Water-tolerant species grow best. Water erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to prevent excessive water erosion.

This soil is suited to trees. The seedling mortality rate and the hazard of windthrow are management concerns. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil is suited to building site development if foundations and footings are properly designed and constructed. Adequately reinforcing concrete and backfilling with sand and gravel minimize the damage caused by shrinking and swelling of the soil. Installing tile drains around foundations and footings minimizes the damage caused by excessive wetness. The soil is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons function adequately if the site is leveled.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Constructing roadside ditches and installing culverts help to prevent the damage caused by wetness, shrinking and swelling, and frost action.

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

16F2—Vanmeter silty clay loam, 14 to 35 percent slopes, eroded. This moderately deep, moderately steep to very steep, moderately well drained soil is on side slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 10 to more than 175 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 4 inches, dark brown and dark yellowish brown, friable silty clay loam

Subsoil:
4 to 14 inches, brown and light olive gray, firm silty clay
14 to 31 inches, olive, mottled, firm silty clay

Bedrock:
31 to 60 inches, soft shale

In some areas the slope is less than 14 percent. In other areas it is more than 35 percent. In some places the surface layer is darker and is more than 4 inches thick. In other places it is silt loam.

Included with this soil in mapping are areas of Goss, Healing, and Menfro soils. Goss soils are gravelly. Menfro and Healing soils are silty. Goss and Menfro soils are in landscape positions similar to those of the Vanmeter soil. Healing soils are on stream terraces below the Vanmeter soil. Included soils make up 8 to 10 percent of the unit.

Important properties of the Vanmeter soil—

Permeability: Very slow
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderately low
Shrink-swell potential: Moderate

Most areas support native hardwoods. This soil is suited to trees. A few areas have been cleared of trees and are used as pasture. The seedling mortality rate and the hazard of windthrow are management concerns. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. The slope limits the operation of harvesting equipment. Constructing logging roads and skid trails on the contour helps to control erosion. In places logs must be yarded uphill to the logging roads and skid trails. In most of the existing stands, thinning and selective cutting are needed. New stands should be protected from fire and overgrazing. Good woodland management improves the habitat for woodland wildlife, especially for white-tailed deer and wild turkeys.

This soil is unsuited to cultivated crops because of a severe hazard of water erosion. It is moderately well suited to birdsfoot trefoil, tall fescue, lespedeza, big bluestem, little bluestem, and indiangrass and is moderately suited to orchardgrass and switchgrass. Water erosion during seedbed preparation and overgrazing are the main management concerns. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain the fertility level and control brush are needed.

This soil generally is not used as a site for buildings or onsite waste disposal systems because of the slope. It can be used for low-density urban development if the site is extensively prepared. The cost of such preparation, however, can be prohibitive.

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

17D2—Goss gravelly silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, well drained soil commonly is on side slopes in the uplands, but in some areas it is on the crest of narrow upland ridges. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 20 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 6 inches, dark grayish brown, friable gravelly silt loam

Subsoil:
6 to 11 inches, brown, firm extremely gravelly silty clay loam
11 to 26 inches, yellowish red, firm extremely gravelly silty clay
26 to 41 inches, red, firm gravelly clay
41 to 60 inches, red, mottled, firm gravelly clay

In some places bedrock is within a depth of 60 inches. In other places the subsoil has less gravel. In a few areas the slope is more than 14 percent.

Included with this soil in mapping are areas of Crider, Dameron, Keswick, Menfro, and Vanmeter soils and areas of soils that are very shallow over bedrock. Crider soils have a subsoil that is reddish between depths of 20 and 45 inches. They are on the upper side slopes. Dameron soils have a dark surface layer that is thicker than that of the Goss soil. They are in drainageways. Keswick soils are moderately well drained. Vanmeter soils formed in calcareous shale residuum. Keswick, Menfro, and Vanmeter soils are in landscape positions similar to those of the Goss soil. Included soils make up 5 to 12 percent of the unit.

Important properties of the Goss soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderately low
Shrink-swell potential: Moderate

Most areas are used for pasture. This soil is unsuited to cultivated crops because of the slope and the high content of gravel. It is moderately well suited to crownvetch, lespedeza, tall fescue, big bluestem, indiangrass, and switchgrass and is moderately suited to alfalfa, ladino clover, and orchardgrass. Water erosion during seedbed preparation and overgrazing are management concerns. Timely seeding helps to ensure rapid growth of a good plant cover.

Some areas are used as woodland. In most of the existing timber stands, thinning and selective cutting are needed. New stands should be protected from fire and overgrazing. No other hazards or limitations affect planting or harvesting.

This soil is suited to low-density building site development. Dwellings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Large stones should be removed from the building sites. Constructing footings and foundations with adequately reinforced concrete minimizes the structural damage caused by shrinking and swelling.

This soil is suitable as a site for septic tank absorption fields. The slope, the restricted permeability, and the large stones are limitations. Generally, the site should be shaped and the distribution lines installed across the slope. Enlarging the absorption field helps to overcome the restricted permeability.

Low strength, the potential for frost action, the shrink-swell potential, and the slope are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling. Cutting and filling are needed in some areas.

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

17F—Goss very gravelly silt loam, 14 to 50 percent slopes, very stony. This very deep, moderately steep to very steep, well drained soil commonly is on side slopes in the uplands. The slopes are long, and drainageways are deeply incised into the landscape. About 0.1 to 3.0 percent of the surface is covered with limestone rock fragments that are 10 to 24 inches in size. Individual areas range from about 100 to more than 1,000 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 4 inches, dark grayish brown, friable very gravelly silt loam

Subsurface layer:
4 to 13 inches, brown, friable very gravelly silt loam

Subsoil:
13 to 30 inches, strong brown, friable very gravelly silty clay loam
30 to 60 inches, yellowish red, firm gravelly clay

Some areas do not have stones on the surface. In a few areas the slope is less than 14 percent. In some places the subsoil has less gravel. In other places bedrock is within a depth of 60 inches.

Included with this soil in mapping are areas of Dameron, Menfro, and Vanmeter soils and areas of rock outcrop. Dameron soils are in drainageways. They have a dark surface layer that is thicker than that of the Goss soil. Menfro soils formed in loess. Vanmeter soils formed in calcareous shale residuum. Menfro and Vanmeter soils are in landscape positions similar to those of the Goss soil. The rock outcrop commonly is in the lower, steeper areas. Included areas make up 5 to 10 percent of the unit.

Important properties of the Goss soil—

Permeability: Moderate
Surface runoff: Very rapid
Available water capacity: Moderate
Organic matter content: Moderate
Shrink-swell potential: Moderate

Most areas support native hardwoods. Tree planting is somewhat limited by the stones and droughtiness. In places seedlings should be planted by hand or seeds should be planted because limestone fragments are throughout the surface layer. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate. The slope limits the operation of harvesting equipment. Constructing logging roads and skid trails on the contour helps to control erosion. In places logs must be yarded uphill to the logging roads and skid trails. In most of the existing stands, thinning and selective cutting are needed. New stands should be protected from fire and overgrazing. Good woodland management improves the habitat for woodland wildlife, especially for white-tailed deer and wild turkeys.

This soil is unsuited to cultivated crops and hay because of the slope, the high content of gravel, and the droughtiness. A few areas that are less sloping have been cleared of trees and are used as pasture. The soil is moderately suited to crownvetch, lespedeza, tall fescue, big bluestem, switchgrass, and indiangrass. Water erosion during seedbed preparation is the main management concern. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. If seeds are planted, broadcasting may be necessary because of the stones on the surface and the slope.

This soil generally is not used as a site for buildings or onsite waste disposal systems because of the slope.

It can be used for low-density urban development if the site is extensively prepared. The cost of such preparation, however, can be prohibitive.

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

18C2—Keswick loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, moderately well drained soil is on narrow ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 50 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, dark grayish brown, friable loam

Subsoil:
7 to 29 inches, brown, mottled, friable clay loam
29 to 40 inches, yellowish brown, mottled, very firm clay
40 to 60 inches, grayish brown, mottled, very firm clay

In uneroded areas the surface layer is more than 10 inches thick. In other areas it is very dark grayish brown. In some places the slope is more than 9 percent. In other places the soil has less glacial sand and pebbles.

Included with this soil in mapping are areas of Goss, Okaw, and Twomile soils. Goss soils are very gravelly throughout. They are lower on the side slopes than the Keswick soil. Okaw and Twomile soils are poorly drained. Okaw soils are on low stream terraces below the Keswick soil. Twomile soils are on high flood plains below the Keswick soil.

Important properties of the Keswick soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderately low
Depth to a perched water table: 1 to 3 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. Further water erosion is a severe hazard if the soil is used for cultivated crops. In places water erosion has removed part of the subsoil. Areas that are long enough and smooth enough can be terraced, stripcropped, and farmed on the contour. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, winter cover crops, contour farming, stripcropping, and terraces that have suitable drainage outlets help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to ladino clover. It is moderately well suited to birdsfoot trefoil, tall fescue, timothy, indiangrass, big bluestem, and switchgrass and is moderately suited to alfalfa, red clover, orchardgrass, and little bluestem. Water erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to prevent excessive water erosion.

This soil is suited to trees. The seedling mortality rate and the hazard of windthrow are management concerns. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential and the wetness are limitations on sites for dwellings and small commercial buildings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Installing drainage tile around footings minimizes the damage caused by excessive wetness. Land shaping is necessary on sites used for small commercial buildings because of the slope. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by shrinking and swelling and by frost action. The soil is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Properly designed sewage lagoons function adequately. Leveling of the site for the lagoon is necessary.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

18D—Keswick loam, 9 to 14 percent slopes. This very deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from about 15 to more than 350 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 5 inches, very dark grayish brown, friable loam

Subsurface layer:
5 to 11 inches, brown, friable loam

Subsoil:
11 to 30 inches, yellowish red and brown, friable clay loam
30 to 60 inches, strong brown, mottled, firm clay loam

In some areas the slope is less than 9 percent. In other areas the soil is well drained and is steeper. In some places the surface layer is silt loam. In other places it is dark brown.

Included with this soil in mapping are areas of Goss soils. These soils are more gravelly throughout than the Keswick soil. They are in the lower areas. They make up 5 to 10 percent of the unit.

Important properties of the Keswick soil—

Permeability: Slow
Surface runoff: Rapid
Available water capacity: High
Organic matter content: Moderate
Depth to a perched water table: 1 to 3 feet
Shrink-swell potential: High

Most areas are used as pasture, hayland, or woodland. This soil is suited to cultivated crops grown on a limited basis in rotations that include pasture and hay. If cultivated crops are grown, water erosion is a severe hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Areas that are long enough and smooth enough can be terraced, stripcropped, and farmed on the contour. Crop residue management and green manure crops help to control erosion, maintain tilth, and increase the content of organic matter and the rate of water infiltration.

This soil is well suited to ladino clover. It is moderately suited to alfalfa, red clover, crownvetch, lespedeza, tall fescue, orchardgrass, big bluestem, and switchgrass. Water erosion is the main management concern. A good ground cover is necessary at all times if forage production is to be maintained. Overgrazing should be avoided. Nurse crops reduce the hazard of water erosion in newly seeded areas.

Most areas support native hardwoods. The seedling mortality rate and the hazard of windthrow are management concerns. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential and the wetness are limitations on sites for dwellings and small commercial buildings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Installing drainage tile around footings minimizes the damage caused by excessive wetness. Land shaping is necessary on sites used for small commercial buildings because of the slope. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by shrinking and swelling and by frost action. The soil is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Properly designed sewage lagoons function adequately. Leveling of the site for the lagoon is necessary.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling. Cutting and filling are needed in the steeper areas.

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

20C2—Leonard silty clay loam, 3 to 7 percent slopes, eroded. This very deep, gently sloping and moderately sloping, poorly drained soil is on low ridgetops and at the head of drainageways in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 20 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silty clay loam

Subsoil:
7 to 32 inches, dark gray, mottled, very firm silty clay
32 to 45 inches, gray, mottled, very firm silty clay
45 to 60 inches, gray, mottled, firm silty clay loam

In some areas the subsoil is not so gray. In other areas the slope is less than 3 percent. In places the dark surface layer is more than 10 inches thick and is silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Armstrong soils. These soils are in the lower landscape positions. They make up about 10 percent of the unit.

Important properties of the Leonard soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderately low
Depth to a perched water table: 0.5 foot to 2.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, winter cover crops, contour farming, stripcropping, and terraces that have suitable drainage outlets help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is moderately well suited to birdsfoot trefoil, reed canarygrass, and switchgrass and is moderately suited to alsike clover, ladino clover, orchardgrass, tall fescue, switchgrass, and big bluestem. Species that can tolerate the wetness grow best. Timely tillage and a quickly established plant cover help to prevent excessive water erosion.

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential and the wetness are limitations on sites for dwellings and small commercial buildings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Installing drainage tile around footings minimizes the damage caused by excessive wetness. Land shaping is necessary on sites used for small commercial buildings because of the slope. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by shrinking and swelling and by frost action. The soil is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability and the wetness. Properly designed sewage lagoons function adequately. Leveling of the site for the lagoon is necessary.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

23B—Menfro silt loam, 2 to 5 percent slopes. This very deep, gently sloping, well drained soil is on narrow ridgetops in the uplands. Individual areas are irregular in shape and range from about 20 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 6 inches, very dark grayish brown, friable silt loam

Subsurface layer:
6 to 11 inches, dark brown, friable silt loam

Subsoil:
11 to 60 inches, dark brown, dark yellowish brown, and brown, friable silty clay loam

In some areas the lower part of the subsoil has gray mottles. In other areas the slope is more than 5 percent. In places the surface layer is darker.

Included with this soil in mapping are areas of Weller soils. These soils have more clay than the Menfro soil. They are in landscape positions similar to those of the Menfro soil. They make up 3 to 5 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderately low
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Water erosion is a hazard where the surface is not protected by crops or crop residue. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Proper management of crop residue and green manure crops improve fertility, increase the organic matter content, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect pasture or hayland. Water erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good plant cover.

This soil is suited to trees. No major problems affect timber management.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential is a limitation on sites for dwellings. Constructing footings, basement walls, and foundations with adequately reinforced concrete minimizes the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Properly installed septic tank absorption fields function adequately. Excessive seepage from sewage lagoons can be prevented by sealing the bottom of the lagoon.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

23C2—Menfro silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, well drained soil is on narrow ridgetops and convex side slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 20 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 9 inches, dark grayish brown, friable silt loam

Subsoil:
9 to 27 inches, dark yellowish brown, friable silty clay loam
27 to 60 inches, brown, friable silty clay loam

In some places the lower part of the subsoil has gray mottles. In other places it is redder. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of Belknap, Goss, and Haymond soils. Belknap soils are somewhat poorly drained. They are on small flood plains. Goss soils are gravelly throughout. They are on the lower side slopes and on knobs above the Menfro soil. Haymond soils have less clay in the subsoil than the Menfro soil. They are on flood plains. Included soils make up 5 to 10 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Low
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain and to orchards, vineyards, and nursery crops. Further water erosion is a severe hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface, terraces, grassed waterways, winter cover crops, and a cropping sequence that includes grasses and legumes help to prevent excessive soil loss. Crop residue management and green manure crops help to control water erosion, improve fertility, minimize crusting, and increase the organic matter content and the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect pasture or hayland. Water erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure rapid growth of a good plant cover.

This soil is suited to trees. No major problems affect timber management.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential is a limitation on sites for dwellings. Constructing footings, basement walls, and foundations with adequately reinforced concrete minimizes the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Properly installed septic tank absorption fields function adequately. Seepage from sewage lagoons can be minimized by sealing the bottom of the lagoon.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

23D2—Menfro silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, well drained soil is on narrow ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. The remainder of the surface layer has been mixed with the upper part of the subsoil. Individual areas generally are long and narrow and range from about 15 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 4 inches, dark brown, friable silt loam

Subsoil:
4 to 39 inches, dark yellowish brown, friable silty clay loam and silt loam

Substratum:
39 to 60 inches, dark yellowish brown, friable silt loam

In some places the lower part of the subsoil has gray mottles. In other places it is redder. In some areas the slope is less than 9 percent.

Included with this soil in mapping are small areas of Belknap, Bucklick, Goss, and Haymond soils. Belknap soils are somewhat poorly drained. They are on small flood plains below the Menfro soil. Bucklick soils have bedrock at a depth of 40 to 60 inches. They are on narrow side slopes in the lower areas. Goss soils are gravelly throughout. They are on the lower side slopes and knobs above the Menfro soil. Haymond soils have less clay in the subsoil than the Menfro soil. They are on flood plains. Included soils make up about 8 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Very high
Organic matter content: Low
Shrink-swell potential: Moderate

Most areas are used for pasture and hay. Some areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a severe hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Many slopes are long enough and smooth enough for terracing and farming on the contour. Gullies should be shaped and seeded to grass. Crop residue management and green manure crops help to control erosion, improve tilth, and increase the organic matter content and the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass and is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most of the other warm-season grasses. Water erosion during seedbed preparation and overgrazing are the main management concerns. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain the fertility level and control brush are needed.

A few areas support native hardwoods. No major problems affect timber management.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential and the slope are limitations. Constructing basement walls, footings, and foundations with adequately reinforced concrete minimizes the damage to buildings caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Dwellings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Septic tank absorption fields function adequately if the distribution lines are installed across the slope.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling. Cutting and filling are needed in the steeper areas.

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

23E2—Menfro silt loam, 14 to 20 percent slopes, eroded. This very deep, moderately steep, well drained soil is on dissected back slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 15 to more than 400 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 6 inches, dark brown, friable silt loam

Subsoil:
6 to 48 inches, dark yellowish brown, friable silty clay loam

Substratum:
48 to 60 inches, dark yellowish brown, friable silt loam

In some places the slope is less than 14 percent. In other places the surface layer is not eroded.

Included with this soil in mapping are areas of Bucklick, Goss, and Vanmeter soils. Bucklick soils have bedrock at a depth of 40 to 60 inches. They are on narrow side slopes in the lower areas. Goss soils are gravelly throughout. They are in the lower landscape positions and on knobs above the Menfro soil. Vanmeter soils formed in calcareous shale residuum. They are in landscape positions similar to those of the Menfro soil. Included soils make up about 10 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Very high
Organic matter content: Low
Shrink-swell potential: Moderate

Most areas are used for pasture and hay. In areas where terraces adequately protect the soil against erosion, cultivated crops can be grown on a limited basis in rotation with pasture and hay. A system of conservation tillage that leaves a protective cover of crop residue on the surface and terraces that have a steep, grass-covered back slope are needed. The soil is highly susceptible to gullying. As a result, waterways should be carefully designed and maintained. Crop residue management and applications of barnyard manure improve fertility and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass and is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most of the other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

A few areas support native hardwoods. Water erosion and the equipment limitation are management concerns. Constructing logging roads and skid trails on the contour and seeding disturbed areas after the trees are harvested help to control erosion. Because of the slope, logs may have to be yarded uphill to logging roads or skid trails.

This soil is suited to building site development and septic tank absorption fields. The slope is a severe limitation. The soil can be used for low-density urban development if the site is extensively prepared. The cost of such preparation, however, can be prohibitive. Dwellings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Properly designing the buildings and constructing the footings and foundations with adequately reinforced concrete minimize the structural damage caused by shrinking and swelling. Measures that control the rapid runoff are needed on construction sites.

Low strength, the potential for frost action, the slope, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling. Cutting and filling are needed in the steeper areas.

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

23F—Menfro silt loam, 20 to 50 percent slopes. This very deep, steep and very steep, well drained soil is on dissected side slopes and back slopes in the uplands. Individual areas are irregular in shape and range from about 50 to more than 400 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 5 inches, dark brown, friable silt loam

Subsurface layer:
5 to 9 inches, yellowish brown, friable silt loam

Subsoil:
9 to 45 inches, dark yellowish brown, friable silty clay loam

Substratum:
45 to 60 inches, dark yellowish brown, friable silt loam

In some places the slope is more than 50 percent. In other places the subsoil has less clay. In places the lower part of the subsoil is redder.

Included with this soil in mapping are small areas of Goss, Healing, and Vanmeter soils. Goss soils are gravelly throughout. Vanmeter soils formed in calcareous shale residuum. Goss and Vanmeter soils are in landscape positions similar to those of the Menfro soil. Healing soils have less clay in the subsoil than the Menfro soil. They are on foot slopes below the Menfro soil. Also included are a few areas of soils that are shallow over bedrock. These areas are generally on the lower side slopes. Included soils make up 5 to 10 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Very rapid
Available water capacity: Very high
Organic matter content: Moderately low
Shrink-swell potential: Moderate

Most areas support native hardwoods. Because of the slope, water erosion and the equipment limitation are management concerns. Special erosion-control measures are needed. Constructing logging roads and skid trails on the contour and seeding disturbed areas after the trees are harvested help to control erosion. Because of the slope, logs should be yarded uphill to logging roads or skid trails. In most of the existing stands, thinning and selective cutting are needed. New stands should be protected from fire and overgrazing. Good woodland management improves the habitat for woodland wildlife, especially for white-tailed deer and wild turkeys.

A few of the less sloping areas are suited to pasture. This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass and is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most of the other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

This soil is unsuited to cultivated crops because of the slope and a severe hazard of erosion. It generally is unsuited to building site development and onsite waste disposal systems because of the slope.

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

24B—Mexico silt loam, 1 to 5 percent slopes. This very deep, very gently sloping and gently sloping, somewhat poorly drained soil is on broad upland divides. Individual areas are irregular in shape and range from about 50 to more than 2,000 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable silt loam

Subsurface layer:
9 to 13 inches, grayish brown, friable silt loam

Subsoil:
13 to 17 inches, brown, strong brown, and light brownish gray, mottled, friable silty clay loam and silt loam
17 to 39 inches, grayish brown and gray, mottled, firm silty clay

Substratum:
39 to 60 inches, light brownish gray, mottled, firm silty clay loam

In eroded areas the surface layer is silty clay loam. In other areas it is brown. In places the subsoil is grayer.

Included with this soil in mapping are areas of Armstrong soils on side slopes. These soils have glacial sand and pebbles throughout. They make up 5 to 10 percent of the unit.

Important properties of the Mexico soil—

Permeability: Very slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Depth to a perched water table: 1.0 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. Water erosion is a hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Most areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Crop residue management and green manure crops improve fertility, minimize crusting, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to ladino clover. It is moderately well suited to crownvetch, tall fescue, switchgrass, timothy, big bluestem, indiangrass, and switchgrass and is moderately suited to alfalfa, red clover, and orchardgrass. The species that can tolerate the wetness grow best. Timely tillage and a quickly established plant cover help to prevent excessive water erosion.

This soil is not suitable as a site for conventional septic tank absorption fields because of the restricted permeability. It is suitable as a site for dwellings and sewage lagoons. The wetness and the shrink-swell potential are limitations. Adequately reinforcing concrete in footings, foundations, and basement walls minimizes the structural damage caused by shrinking and swelling. Installing drainage tile around the footings minimizes the damage caused by excessive wetness. Sewage lagoons function adequately if the site is leveled.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

24B2—Mexico silty clay loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, somewhat poorly drained soil is on narrow ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. The remainder of the surface layer has been mixed with the upper part of the subsoil by tillage. Individual areas are irregular in shape and range from about 50 to more than 400 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
- 0 to 8 inches, very dark grayish brown, friable silty clay loam

Subsoil:
- 8 to 13 inches, dark grayish brown, mottled, friable silty clay loam
- 13 to 36 inches, dark grayish brown, mottled, friable silty clay
- 36 to 60 inches, yellowish brown, mottled, friable silty clay loam

In some areas the surface layer is silt loam. In other areas it is dark grayish brown. In places the soil is severely eroded.

Included with this soil in mapping are areas of Armstrong and Putnam soils. Armstrong soils have glacial sand and pebbles throughout. They are on side slopes below the Mexico soil. Putnam soils are poorly drained. They are in nearly level areas above the Mexico soil. Included soils make up 5 to 10 percent of the unit.

Important properties of the Mexico soil—

Permeability: Very slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Depth to a perched water table: 1.0 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. Further water erosion is a hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Most areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Crop residue management and green manure crops improve fertility, minimize crusting, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to ladino clover and is moderately well suited to crownvetch, tall fescue, switchgrass, timothy, and most of the other warm- or cool-season grasses. It is moderately suited to alfalfa, red clover, and orchardgrass. The species that can tolerate the wetness grow best. Timely tillage and a quickly established plant cover help to prevent excessive water erosion.

This soil is not suitable as a site for septic tank absorption fields because of the restricted permeability. It is suitable as a site for dwellings and sewage lagoons. The wetness and the shrink-swell potential are limitations. Adequately reinforcing the concrete in footings, foundations, and basement walls minimizes the damage caused by shrinking and swelling. Installing drainage tile around the footings minimizes the damage caused by excessive wetness. Sewage lagoons function adequately if the site is leveled.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

25A—Moniteau silt loam, occasionally flooded, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, poorly drained soil is on high flood plains. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from about 20 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 8 inches, dark grayish brown, friable silt loam

Subsurface layer:
8 to 20 inches, grayish brown and light brownish gray, mottled, friable silt loam

Subsoil:
20 to 60 inches, grayish brown and gray, mottled, friable silty clay loam

In some places the subsurface layer is thicker. In other places the surface layer is darker.

Included with this soil in mapping are areas of Chequest, Dupo, and Tice soils. Chequest soils have a darker surface layer than that of the Moniteau soil and have more clay throughout. Dupo soils are somewhat poorly drained. Chequest and Dupo soils are on the slightly lower flood plains. Tice soils are somewhat poorly drained. They are in landscape positions similar to those of the Moniteau soil. Included soils make up about 10 percent of the unit.

Important properties of the Moniteau soil—

Permeability: Moderately slow
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderately low
Depth to an apparent water table: 0 to 1 foot
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Wetness and the flooding are management concerns. A surface drainage system and diversions help to control runoff from the soils upslope. Returning crop residue to the soil helps to maintain fertility and tilth. Crops can be damaged in some years by the flooding.

This soil is well suited to reed canarygrass and moderately well suited to lespedeza, red clover, and tall fescue. It is moderately well suited to switchgrass and moderately suited to other warm-season grasses. The wetness and the flooding are the main management concerns. A surface drainage system is beneficial, especially if deep-rooted species are grown. The flooding should be considered when grazing systems are designed. Seedbeds can be easily prepared.

This soil is suited to trees. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are management concerns. Equipment should be operated only when the soil is dry or frozen. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

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

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

26—Putnam silt loam. This very deep, nearly level, poorly drained soil is on broad upland divides. Individual areas are irregular in shape and range from about 50 to more than 800 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable silt loam

Subsurface layer:
9 to 17 inches, grayish brown, mottled, friable silt loam

Subsoil:
17 to 23 inches, dark grayish brown, mottled, firm clay
23 to 35 inches, dark grayish brown and grayish brown, mottled, firm silty clay
35 to 60 inches, grayish brown, mottled, friable silty clay loam

In some areas the subsoil is brown and grayish brown throughout. In other areas the soil has a thinner dark surface layer.

Important soil properties—

Permeability: Very slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderately low
Depth to a perched water table: 0.5 foot to 1.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. The slow runoff and the wetness are management concerns after heavy rains. In some areas a surface drainage system is needed. The wetness sometimes delays fieldwork in the spring. Applications of lime and fertilizer improve and help to maintain fertility. Crop residue management and green manure crops help to maintain the organic matter content and tilth.

This soil is moderately well suited to birdsfoot trefoil, reed canarygrass, and switchgrass and is moderately well suited to alsike clover, ladino clover, and tall fescue. The wetness is the main management concern. A surface drainage system in areas where the deep-rooted species are grown helps to overcome the flooding and the wetness. A good seedbed can be easily prepared.

This soil is unsuitable as a site for conventional septic tank absorption fields because of the restricted permeability. It is suited to building site development and sewage lagoons. The wetness and the shrink-swell potential are severe limitations on sites for dwellings. Constructing foundations and footings with adequately reinforced concrete minimizes the structural damage caused by shrinking and swelling. Grading and filling, establishing shallow surface ditches, and installing drainage tile around footings minimize the damage caused by the wetness. If dwellings with basements are constructed, a suitable outlet is needed for the drainage tile or sump pump. Sewage lagoons function adequately.

Low strength, the wetness, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, building on raised, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by shrinking and swelling, wetness, and frost action.

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

30B—Weller silt loam, 1 to 5 percent slopes. This very deep, very gently sloping and gently sloping, moderately well drained soil is on convex ridgetops in the uplands. Individual areas are irregular in shape and range from about 20 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 4 inches, dark grayish brown, friable silt loam

Subsurface layer:
4 to 8 inches, grayish brown, friable silt loam

Subsoil:
8 to 15 inches, yellowish brown, firm silty clay loam
15 to 34 inches, yellowish brown and brown, mottled, firm silty clay
34 to 60 inches, light brownish gray, mottled, friable silty clay loam

In places the slope is more than 5 percent. In some areas the subsoil is grayer throughout. In other areas the lower part of the subsoil has glacial sand or pebbles.

Included with this soil in mapping are areas of Winfield soils. These soils have less clay in the subsoil than the Weller soil. They are in landscape positions similar to those of the Weller soil. They make up about 5 percent of the unit.

Important properties of the Weller soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Depth to a perched water table: 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, water erosion is a hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, winter cover crops, and contour farming help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to ladino clover. It is moderately well suited to birdsfoot trefoil, tall fescue, timothy, and switchgrass and is moderately suited to alfalfa, orchardgrass, and little bluestem. Water erosion during seedbed preparation is the main management concern. Timely tillage and a quickly established ground cover help to prevent excessive erosion.

This soil is suited to trees. The seedling mortality rate and the hazard of windthrow are management concerns. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential and the wetness are limitations on sites for dwellings and small commercial buildings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Installing drainage tile around footings minimizes the damage caused by excessive wetness. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by shrinking and swelling and by frost action. The soil is unsuitable as a site for conventional septic tank absorption fields because of the wetness and the slow permeability. Properly designed sewage lagoons function adequately. Leveling of the lagoon site may be necessary.

Low strength, the high shrink-swell potential, the wetness, and the potential for frost action are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts for drainage help to prevent the damage to roads and streets caused by shrinking and swelling, wetness, and frost action.

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

31B—Winfield silt loam, 2 to 5 percent slopes. This very deep, gently sloping, moderately well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from about 20 to more than 150 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 10 inches, dark grayish brown, friable silt loam

Subsoil:
10 to 17 inches, dark yellowish brown, friable silt loam
17 to 28 inches, yellowish brown, friable silty clay loam
28 to 60 inches, brown and strong brown, mottled, friable silt loam

In some areas the slope is more than 5 percent. In other areas the lower part of the subsoil does not have gray mottles.

Included with this soil in mapping are areas of Okaw and Weller soils. Okaw soils are poorly drained. They are on stream terraces. Weller soils have more clay in the subsoil than the Winfield soil. They are in landscape positions similar to those of the Winfield soil. Included soils make up 5 to 10 percent of the unit.

Important properties of the Winfield soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Low
Depth to perched water table: 2.5 to 4.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, water erosion is a hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, stripcropping, and winter cover crops help to prevent excessive water erosion. Many areas are smooth enough and large enough to be terraced and farmed on the contour. Crop residue management and green manure crops help to control water erosion, improve tilth, and increase the content of organic matter and the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to most of the commonly grown legumes and warm- and cool-season grasses. No serious problems affect pasture or hayland. Water erosion is a management concern in newly seeded areas. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid growth of a good plant cover.

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

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential and the wetness are limitations on sites for dwellings and small commercial buildings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Installing drainage tile around footings minimizes the damage caused by excessive wetness. Land shaping is necessary on sites for small commercial buildings because of the slope. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by shrinking and swelling and by frost action. Some areas are suitable as sites for septic tank absorption fields if perimeter drains lower the water table and long laterals help to overcome the restricted permeability. Sewage lagoons function adequately. Leveling of the site for the lagoon is necessary. Sealing the bottom and sides of the lagoon helps to prevent contamination of the ground water by seepage.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage to roads and streets caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts for drainage help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

31C2—Winfield silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, moderately well drained soil is on ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. The remainder of the surface layer has been mixed with the upper part of the subsoil by tillage. Individual areas are irregular in shape and range from about 50 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, dark grayish brown and yellowish brown, friable silt loam

Subsoil:
7 to 23 inches, yellowish brown and dark brown, friable silt loam and silty clay loam
23 to 46 inches, dark yellowish brown and yellowish brown, mottled, friable silty clay loam

Substratum:
46 to 60 inches, light brownish gray, mottled, friable silt loam

In some areas the slope is less than 5 percent. In other areas it is more than 9 percent. In some places the lower part of the subsoil does not have grayish brown mottles. In other places it is red.

Included with this soil in mapping are areas of Goss, Haymond, Okaw, Tice, and Weller soils. Goss soils are gravelly throughout. They are on the lower side slopes and on knobs above the Winfield soil. Haymond and Tice soils formed in alluvium on narrow flood plains. They are subject to flooding. Okaw soils are poorly drained. They are on stream terraces. Weller soils have more clay in the subsoil than the Winfield soil. They are in the higher landscape positions. Included soils make up 5 to 10 percent of the unit.

Important properties of the Winfield soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Low
Depth to a perched water table: 2.5 to 4.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a severe hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, stripcropping, and winter cover crops help to prevent excessive erosion. Many areas are smooth enough and large enough to be terraced and farmed on the contour. Crop residue management and green manure crops help to control water erosion, increase the content of organic matter, maintain tilth, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion (fig. 6). This soil is well suited to most commonly grown legumes and warm- and cool-season grasses. No serious problems affect pasture or hayland. Water erosion is a management concern in newly seeded areas. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid growth of a good plant cover.

This soil is suited to trees. No major problems affect timber management.

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential and the wetness are limitations on sites for dwellings and small commercial buildings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Installing drainage tile around footings minimizes the damage caused by excessive wetness. Land shaping is necessary on sites for small commercial buildings because of the slope. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by shrinking and swelling and by frost action. In places the soil is suitable as a site for septic tank absorption fields if

Figure 6.—Grass-legume hay in an area of Winfield silt loam, 5 to 9 percent slopes, eroded. Goss very gravelly silt loam, 14 to 50 percent slopes, very stony, is in the background.

perimeter drains lower the water table and long laterals help to overcome the restricted permeability. Sewage lagoons function adequately. Leveling of the site for the lagoon is necessary. Sealing the bottom and sides of the lagoon helps to prevent contamination of the ground water by seepage.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

31D2—Winfield silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 30 to more than 150 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 5 inches, brown, friable silt loam

Subsoil:
5 to 22 inches, yellowish brown, friable silty clay loam
22 to 38 inches, pale brown, mottled, friable silt loam
38 to 60 inches, brown and light brownish gray, mottled, friable silt loam

In some places the lower part of the subsoil is red. In other places the upper part of the subsoil has grayish brown or dark grayish brown mottles. In some areas the slope is less than 9 percent.

Included with this soil in mapping are areas of Goss and Tice soils. Goss soils are gravelly throughout. They are on the lower side slopes and on knobs above the Winfield soil. Tice soils formed in alluvium in drainageways. They are subject to flooding. Included soils make up 3 to 7 percent of the unit.

Important properties of the Winfield soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Very high
Organic matter content: Low
Depth to a perched water table: 2.5 to 4.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a severe hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, stripcropping, terraces, grassed waterways, and suitable crop rotations help to prevent excessive soil loss. The terraces should have a steep, grass-covered back slope. Gullying is a serious problem, and waterways require careful design and maintenance. Crop residue management and green manure crops help to control water erosion, increase the content of organic matter, maintain tilth, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to birdsfoot trefoil, red clover, tall fescue, timothy, and switchgrass and is moderately well suited to alfalfa, orchardgrass, big bluestem, and indiangrass. Water erosion during seedbed preparation and overgrazing are the main management concerns. Seedbeds should be prepared on the contour. Timely seedbed preparation helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain the fertility level and control brush are needed.

Some areas support native hardwoods. No major problems affect timber management.

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential, the slope, and the wetness are limitations on sites for dwellings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Installing drainage tile around footings minimizes the damage caused by excessive wetness. Dwellings should be designed so that they conform to the natural slope of the land, or the site can be altered by land shaping. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by shrinking and swelling and by wetness. In places the soil is suitable as a site for septic tank absorption fields if perimeter drains lower the water table and long laterals help to overcome the restricted permeability. Properly designed sewage lagoons function adequately if the site can be leveled. Sealing the bottom and sides of the lagoon helps to prevent contamination of the ground water by seepage.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts for drainage minimize the damage to roads and streets caused by frost action and by shrinking and swelling. Cutting and filling may be needed in the steeper areas.

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

32—Carlow silty clay, occasionally flooded. This very deep, nearly level, poorly drained soil is in old stream channels and broad depressional areas on the flood plains along the Mississippi River. It is subject to flooding for brief periods. The installation of levees in most areas has reduced the incidence of flooding. In some areas controlled flooding helps to attract waterfowl. Individual areas generally are long and broad and range from about 50 to more than 800 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 6 inches, black, firm silty clay

Subsurface layer:
6 to 9 inches, very dark gray, firm silty clay

Subsoil:
9 to 20 inches, very dark grayish brown, mottled, very firm silty clay
20 to 60 inches, dark grayish brown and grayish brown, mottled, very firm clay

In some places the subsoil has more clay. In other places the soil has an overwash layer of silt loam. In some areas the soil has less clay throughout.

Included with this soil in mapping are areas of Blackoar, Dockery, Dupo, and Moniteau soils. Blackoar, Dockery, and Moniteau soils have less clay throughout the profile than the Carlow soil. Dupo soils formed in silty alluvium over clayey alluvium. Blackoar, Dockery, and Dupo soils are in landscape positions similar to those of the Carlow soil. Moniteau soils are in the slightly higher areas on the flood plains. Also included are a few small areas of Carlow soils that are subject to ponding. Included soils make up about 10 percent of the unit.

Important properties of the Carlow soil—

Permeability: Very slow
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Depth to an apparent water table: 0 to 1 foot
Shrink-swell potential: High

Most areas are used for cultivated crops. Because of wetness in spring and fall, the best suited crops are those that require a short growing season. The main management concerns are the wetness, the flooding, and the clayey surface layer. Seedbeds should be prepared when the moisture content is optimal. Shallow, parallel surface ditches improve surface drainage. Installing diversions at the base of adjacent uplands helps to control runoff from the soils upslope. A system of conservation tillage that leaves a protective cover of crop residue on the surface or other crop residue management practices help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is moderately well suited to reed canarygrass and moderately suited to alsike clover, bluegrass, switchgrass, and redtop. It is poorly suited to hay. The wetness and the flooding are the main management concerns. The flooding should be considered when grazing systems are designed. Because of the wetness, maintaining stands of desirable species is difficult in the depressional areas. A surface drainage system in areas where the deeper rooted species are grown helps to overcome the flooding and the wetness.

A few areas support native timber. This soil is suited to water-tolerant trees. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are the major management concerns. Equipment should be operated only when the soil is dry or frozen. Ridging the soil and then reinforcement planting or planting container-grown nursery stock on the ridges increase the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

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

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

34D—Bucklick silt loam, 9 to 14 percent slopes. This deep, strongly sloping, well drained soil is on narrow, convex ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from about 15 to more than 400 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 8 inches, dark grayish brown, friable silt loam

Subsoil:
8 to 29 inches, dark yellowish brown and dark brown, friable and firm silty clay loam
29 to 36 inches, reddish brown, firm gravelly silty clay
36 to 47 inches, red, firm silty clay

Bedrock:
47 inches, hard limestone bedrock

In some eroded areas the surface layer is silty clay loam. Other areas have karst topography.

Included with this soil in mapping are areas of Crider and Menfro soils. Crider soils have less clay than the Bucklick soil. Menfro soils formed in very deep loess. Crider and Menfro soils are on the upper side slopes above the Bucklick soil. They make up about 10 percent of the unit.

Important properties of the Bucklick soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderate
Shrink-swell potential: High

Most areas are used as pasture or woodland. Water erosion is a severe hazard if this soil is cultivated. Where the size and shape of areas are favorable, the soil is suited to row crops grown on a limited basis in a rotation that includes pasture and hay. A system of conservation tillage that leaves a protective cover of crop residue on the surface, grassed waterways, and crop rotations that include grasses and legumes help to prevent excessive soil loss. Because the soil is highly susceptible to gullying, waterways should be carefully designed and maintained. Crop residue management and green manure crops help to control erosion, improve fertility, and increase the rate of water infiltration.

This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass and moderately well suited to alfalfa and orchardgrass. It is moderately well suited to indiangrass and most of the other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management concerns. Seedbeds should be prepared on the contour. Timely seedbed preparation ensures rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain the fertility level and control brush are needed.

Some areas support native hardwoods. Seedlings survive and grow well if competing vegetation is removed or controlled by proper site preparation, spraying, or selective cutting. No other hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential, the restricted permeability, and the slope are limitations. Constructing foundations, basement walls, and footings with adequately reinforced concrete minimizes the damage to buildings caused by shrinking and swelling. The design of dwellings and septic tank absorption fields should compensate for the natural slope of the land and the limited depth to bedrock. Land shaping or blasting of bedrock may be necessary. Enlarging the absorption fields helps to overcome the restricted permeability. Sewage lagoons function properly if the site can be leveled and if enough soil material is available for the bottom of the lagoon and for berms.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling. Cutting and filling are needed in some areas.

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

35A—Okaw silt loam, rarely flooded, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, poorly drained soil is on low terraces. Individual areas are irregular in shape and range from about 30 to more than 700 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 8 inches, dark grayish brown, friable silt loam

Subsurface layer:
8 to 15 inches, grayish brown, friable silt loam

Subsoil:
15 to 22 inches, grayish brown, mottled, firm silty clay
22 to 60 inches, grayish brown, mottled, friable silty clay loam

In some areas the subsoil is browner. In other areas it has less clay throughout. In some places the slope is more than 3 percent. In other places the surface layer is darker.

Included with this soil in mapping are areas of Keswick, Twomile, and Winfield soils. Keswick soils are moderately well drained. They formed in pedisediments and the underlying weathered glacial till. They are on side slopes above the Okaw soil. Twomile soils have less clay in the subsoil than the Okaw soil. They are on high flood plains. Winfield soils are moderately well drained. They formed in loess. They are on side slopes above the Okaw soil. Included soils make up 5 to 10 percent of the unit.

Important properties of the Okaw soil—

Permeability: Very slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderately low
Depth to an apparent water table: 0 to 1 foot
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Wetness is the main management concern. A surface drainage system and diversions help to control runoff from the soils upslope. Returning crop residue to the soil helps to maintain fertility and tilth. Crops can be damaged in some years by the flooding.

This soil is well suited to ladino clover. It is moderately well suited to birdsfoot trefoil, lespedeza, red fescue, tall fescue, and switchgrass and moderately suited to other warm-season grasses. The wetness and the flooding are the main management concerns. A surface drainage system is beneficial, especially if deep-rooted species are grown. A good seedbed can be easily prepared.

This soil is suited to trees. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are management concerns. Equipment should be operated only when the soil is dry or frozen. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil generally is unsuitable as a site for buildings and onsite waste disposal systems because of the wetness and the flooding.

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

36D—Ranacker flaggy silty clay loam, 9 to 14 percent slopes. This shallow, strongly sloping, well drained soil generally is on side slopes in the uplands. In some areas it is on the crest of narrow upland ridges. Individual areas are irregular in shape and range from about 5 to more than 150 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 4 inches, very dark grayish brown, firm flaggy silty clay loam

Subsurface layer:
4 to 9 inches, very dark grayish brown, firm flaggy silty clay loam

Subsoil:
9 to 18 inches, reddish brown, firm very flaggy silty clay

Bedrock:
18 inches, hard limestone bedrock

Included with this soil in mapping are areas of Bucklick and Goss soils and areas of rock outcrop. Bucklick soils are more than 20 inches deep over bedrock. Goss soils are very deep and are gravelly or very gravelly. Bucklick and Goss soils are on the upper side slopes. The rock outcrop consists of nearly vertical ledges and horizontal exposures of limestone bedrock. The exposures range from about 1 square yard to several square yards in size. Included areas make up about 15 percent of the unit.

Important properties of the Ranacker soil—

Permeability: Moderately slow
Surface runoff: Rapid
Available water capacity: Very low
Organic matter content: Moderate
Shrink-swell potential: Moderate

Most areas are used as pasture. The native vegetation is prairie grass and scattered trees. This soil is poorly suited to alsike clover, big bluestem, little bluestem, and indiangrass because of the depth to bedrock and droughtiness.

Some areas support eastern redcedar, black oak, white oak, and post oak. Eastern redcedar is harvested for fenceposts and furniture, and post oak is cut for firewood. Most of the timber is harvested as posts or small logs. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are management concerns. Constructing logging roads and skid trails on the contour helps to control erosion. Because productivity is restricted, extensive timber management is not warranted.

This soil generally is not used as a site for buildings and onsite waste disposal systems because of the slope and the depth to bedrock.

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

38—Chequest silty clay loam, frequently flooded. This very deep, nearly level, poorly drained soil is in long, narrow swales, on broad flats, and in overflow channels on the flood plain between levees and the Mississippi River. It is subject to flooding for long periods. Individual areas are irregular in shape and range from about 50 to more than 800 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, very dark gray, friable silty clay loam

Subsurface layer:
7 to 18 inches, very dark gray, friable silty clay loam

Subsoil:
18 to 25 inches, dark gray, mottled, friable silty clay loam
25 to 60 inches, dark gray and gray, mottled, firm silty clay

In some areas the subsoil has less clay throughout. In other areas as much as 20 inches of overwash is on the surface. In places the soil has more clay throughout.

Included with this soil in mapping are small areas of the moderately well drained Klum soils. These soils are in the slightly higher landscape positions. Also included are scattered areas of shallow water. Included areas make up 6 to 10 percent of the unit.

Important properties of the Chequest soil—

Permeability: Moderately slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Depth to an apparent water table: 1 to 3 feet
Shrink-swell potential: High

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

Trees grow rapidly on this soil. The native species include eastern cottonwood, silver maple, ash, pin oak, and sycamore. Thinning is needed in most of the stands. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are management concerns. Some replanting or reinforcement planting may be necessary.

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

The land capability classification is Vw. The woodland ordination symbol is 2W.

41—Klum loam, sandy substratum, occasionally flooded. This very deep, nearly level, moderately well drained soil is on flood plains along small streams and their tributaries. It is subject to flooding for brief periods. Individual areas are long and irregularly shaped and range from about 20 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, friable loam

Substratum:
8 to 20 inches, stratified dark brown and yellowish brown, very friable fine sandy loam
20 to 45 inches, stratified very dark grayish brown and yellowish brown, very friable loam, sandy loam, and fine sandy loam
45 to 60 inches, stratified dark brown and yellowish brown, loose loamy fine sand and loamy sand

In some areas a buried soil is in the lower part of the profile. In other areas the surface layer has more sand. In places the soil has less sand throughout.

Included with this soil in mapping are areas of Belknap and Twomile soils. Belknap soils are somewhat poorly drained. Twomile soils are poorly drained. Belknap and Twomile soils are in landscape positions similar to those of the Klum soil. They make up about 8 percent of the unit.

Important properties of the Klum soil—

Permeability: Moderately rapid
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderately low
Depth to an apparent water table: 3 to 6 feet

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Crops are damaged in some years by the flooding. Insufficient soil moisture often affects row crops during hot summer months. Irrigation is needed in most years. Reducing the number of plants helps to increase productivity. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is well suited to ladino clover, bluegrass, tall fescue, and switchgrass and is moderately well suited to lespedeza and orchardgrass. It also is moderately well suited to indiangrass and most of the other warm-season grasses. The droughtiness and the flooding are the main management concerns. Species that can withstand the flooding should be selected for planting.

Some areas support native hardwoods. No major hazards affect timber management.

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

The land capability classification is IIs. The woodland ordination symbol is 8A.

45C2—Minnith silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, well drained soil is on ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 20 to more than 250 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, dark grayish brown, friable silt loam

Subsoil:
7 to 18 inches, brown and dark yellowish brown, friable silt loam
18 to 60 inches, yellowish brown and strong brown, friable silty clay loam

In some areas the slope is less than 5 percent. In other areas the subsoil is grayer.

Included with this soil in mapping are areas of Goss, Keswick, Okaw, Tice, and Weller soils. Goss soils are gravelly throughout. They are on the lower side slopes. Keswick soils formed in glacial till. Okaw soils are poorly drained. They are on stream terraces. Tice soils formed in alluvium. They are in drainageways and are subject to flooding. Weller soils have more clay in the subsoil than the Minnith soil. Keswick and Weller soils are in landscape positions similar to those of the Minnith soil. Included soils make up 5 to 10 percent of the unit.

Important properties of the Minnith soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderately low
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a severe hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year, stripcropping, and winter cover crops help to prevent excessive water erosion. Many areas are smooth enough and large enough to be terraced and farmed on the contour. Crop residue management and green manure crops help to control water erosion, maintain the content of organic matter and tilth, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to alfalfa, red clover, tall fescue, timothy, big bluestem, indiangrass, and other commonly grown warm- and cool-season grasses and legumes. No serious problems affect pasture or hayland. Water erosion is a management concern when new seedlings are becoming established. Seedbed preparation on the contour reduces the hazard of water erosion. Timely seedbed preparation helps to ensure rapid growth of a good plant cover.

This soil is suited to trees. No major problems affect timber management.

This soil is suited to building site development and some onsite waste disposal systems. The shrink-swell potential is a limitation on sites for dwellings and small commercial buildings. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling of the soil. Land shaping is needed on sites for small commercial buildings because of the slope. Reinforcement steel, expansion joints, and a sand or gravel base for sidewalks and driveways minimize the damage caused by shrinking and swelling and by frost action. This soil is suited to septic tank absorption fields if long laterals help to overcome the restricted permeability. Sewage lagoons function adequately. Leveling of the site for the lagoon is necessary. Sealing the bottom and sides of the lagoon helps to prevent contamination of the ground water by seepage.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

46—Pits, quarries. This map unit consists of areas that currently are or formerly were quarried for limestone (fig. 7). These areas generally are made up of quarry pits, stockpiles of lime and crushed rock, sites used for storing equipment, and roads used for transporting the quarried material. Individual areas range from about 5 to more than 200 acres in size.

Included in this unit in mapping are piles of overburden and clay pits. These inclusions are vegetated, primarily with small hardwoods, annual weeds, and perennial grasses. They make up about 15 percent of the unit.

The active quarry pits are dry, but some of the abandoned ones contain water. Onsite investigation is needed to determine the suitability for any proposed use of the abandoned areas and the limitations affecting the use.

No land capability classification or woodland ordination symbol is assigned.

47—Twomile silt loam, occasionally flooded. This very deep, nearly level, poorly drained soil is on high flood plains. It is subject to flooding for brief periods. Individual areas are irregular in shape and range from about 50 to more than 750 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 10 inches, dark grayish brown, friable silt loam

Subsurface layer:
10 to 25 inches, grayish brown and light brownish gray, mottled, friable silt loam

Subsoil:
25 to 32 inches, dark grayish brown, mottled, friable silty clay loam
32 to 60 inches, grayish brown and light brownish gray, mottled, friable silty clay loam

Figure 7.—An area of Pits, quarries.

In some areas the subsurface layer is thinner. In other areas the lower part of the subsurface layer is not brittle.

Included with this soil in mapping are areas of Belknap, Healing, Klum, and Okaw soils. Belknap soils are somewhat poorly drained. They are lower on the flood plains than the Twomile soil. Healing soils are well drained. They are on foot slopes. Klum soils have more sand throughout the profile than the Twomile soil. They are in landscape positions similar to those of the Twomile soil. Okaw soils have more clay in the subsoil than the Twomile soil. They are on the higher terraces. Included soils make up about 8 percent of the unit.

Important properties of the Twomile soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderately low
Depth to a perched water table: 1 to 2 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. The movement of water is restricted by the dense, compact subsurface layer. As a result, the soil is wet during the winter and spring and droughty during the summer. A surface drainage system is needed. Irrigation is needed in the summer, during the growing season for annual crops. Crops can be damaged in some years by the flooding.

This soil is better suited to water-tolerant, shallow-rooted grasses for hay and pasture than to other forage species. It is moderately well suited to alsike clover and reed canarygrass and poorly suited to crownvetch, ladino clover, tall fescue, and switchgrass. The wetness and the flooding are the main management concerns. The flooding and the wetness should be considered when grazing systems are designed. A seedbed cannot be easily prepared when the soil is wet. A surface drainage system improves the growth of the deeper rooted species and helps to overcome the flooding and the wetness.

This soil is suited to trees. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are management concerns. Equipment should be operated only when the soil is dry or frozen. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil generally is not used as a site for buildings or onsite waste disposal systems because of the wetness and the flooding.

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

48—Dockery silt loam, frequently flooded. This very deep, nearly level, somewhat poorly drained soil is on broad flats and in narrow depressions on flood plains along the Salt and Mississippi Rivers. It is subject to flooding for long periods. Individual areas are irregular in shape and range from about 50 to more than 600 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 8 inches, dark grayish brown, very friable silt loam

Subsurface layer:
8 to 15 inches, stratified dark grayish brown and light brownish gray, mottled, very friable silt loam

Substratum:
15 to 60 inches, stratified dark gray and light brownish gray, mottled, friable silt loam and silty clay loam

In some areas the substratum is browner. In other areas it has less clay and more sand. In places the surface layer is very dark grayish brown.

Included with this soil in mapping are areas of Carlow and Chequest soils. These soils are clayey throughout. They are in landscape positions similar to those of the Dockery soil. Also included are scattered areas of shallow water. Included areas make up about 10 percent of the unit.

Important properties of the Dockery soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Depth to an apparent water table: 2 to 3 feet

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

Trees grow rapidly on this soil. The native species include eastern cottonwood, silver maple, ash, pin oak, and sycamore. Thinning is needed in most of the stands. The equipment limitation is a management concern. Equipment should be operated only when the soil is dry or frozen.

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

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

50A—Dameron-Cedargap complex, 0 to 3 percent slopes. These very deep, nearly level and very gently sloping, well drained soils are on flood plains along small streams. The Dameron soil is occasionally flooded, and the Cedargap soil is frequently flooded. The flooding is very brief on both soils. The Dameron soil generally is slightly higher on the landscape than the Cedargap soil. Individual areas are long and narrow and range from about 15 to more than 250 acres in size. They are about 75 percent Dameron soil and 15 percent Cedargap soil. These soils could not be mapped separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers in the Dameron soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silt loam

Subsurface layer:
7 to 16 inches, very dark grayish brown, friable silt loam
16 to 25 inches, dark brown, friable silt loam

Substratum:
25 to 60 inches, dark brown, firm gravelly loam and gravelly and very gravelly sandy clay loam

In some areas the dark surface soil is less than 24 inches thick. In other areas the substratum has more clay.

Important properties of the Dameron soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate

The typical sequence, depth, and composition of the layers in the Cedargap soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silt loam

Subsurface layer:
7 to 24 inches, dark brown, friable extremely gravelly silt loam

Substratum:
24 to 60 inches, very dark grayish brown and dark brown, friable extremely gravelly silt loam

In some areas the dark surface soil is less than 24 inches thick. In other areas the lower part of the substratum has more sand.

Important properties of the Cedargap soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Low
Organic matter content: Moderate

Included with these soils in mapping are areas of Goss and Healing soils. Goss soils formed in residuum. They have more clay than the Dameron and Cedargap soils. They have a red subsoil and are on side slopes above the Dameron and Cedargap soils. Healing soils do not contain coarse fragments. They are in the higher landscape positions. Included soils make up about 10 percent of the unit.

Many areas are used for cultivated crops, hay, or pasture. These soils are suited to corn, soybeans, and small grain. Crops are damaged in some years by the flooding. Insufficient soil moisture often affects row crops during hot summer months. Irrigation is needed in most years to maintain yields. Returning crop residue to the soils or regularly adding other organic material improves fertility and increases the rate of water infiltration.

These soils are well suited to ladino clover, bluegrass, tall fescue, and switchgrass. They are moderately well suited to lespedeza and orchardgrass and to indiangrass and most of the other warm-season grasses. The droughtiness and the flooding are the main management concerns. Water-tolerant species should be selected for planting.

A few areas support native hardwoods. The equipment limitation is a management concern on the Cedargap soil. Equipment should be operated only when the soil is dry or frozen. No major hazards or limitations affect planting or harvesting on the Dameron soil.

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

The land capability classification is IIw in areas of the Dameron soil and IIIw in areas of the Cedargap soil. The woodland ordination symbol is 5A in areas of the Dameron soil and 3W in areas of the Cedargap soil.

51A—Haymond silt loam, occasionally flooded, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, well drained soil is on flood plains along rivers and the smaller tributaries. It is flooded for brief periods. Individual areas generally are long and vary in width. They range from about 10 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 8 inches, dark brown, very friable silt loam

Subsoil:
8 to 36 inches, dark brown and brown, very friable silt loam

Substratum:
36 to 60 inches, dark brown, very friable silt loam

In some areas the surface layer is dark. In other areas the subsoil has more sand. In places the lower part of the subsoil is grayer.

Included with this soil in mapping are a few areas of Belknap and Menfro soils. Belknap soils are somewhat poorly drained. They are lower on the flood plains than the Haymond soil. Menfro soils have more clay throughout than the Haymond soil. They are on adjacent side slopes above the Haymond soil. Included soils make up 5 to 10 percent of the unit.

Important properties of the Haymond soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate

Nearly all areas are used for row crops. This soil is suited to corn, soybeans, and small grain. The flooding and erosion along streambanks are minor management concerns. In some years planting is delayed because of the flooding.

This soil is well suited to alfalfa, red clover, tall fescue, orchardgrass, and switchgrass. It is moderately well suited to lespedeza and smooth brome and to indiangrass and most of the other warm-season grasses. The flooding is the main management concern. It should be considered when haying or grazing systems are designed.

A few small areas support timber. No major hazards or limitations affect planting or harvesting.

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

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

55—Blackoar silt loam, occasionally flooded. This very deep, nearly level, poorly drained soil is on flood plains along streams and along the Mississippi River. It is subject to flooding for brief periods. The installation of levees in most areas has reduced the incidence of flooding. Individual areas are irregular in shape and range from about 30 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, very dark gray, friable silt loam

Subsurface layer:
7 to 14 inches, very dark gray, friable silt loam

Subsoil:
14 to 36 inches, dark gray, mottled, friable silt loam
36 to 60 inches, gray, mottled, friable silt loam

In some places the subsoil is browner throughout. In other places it has more clay. In some areas the lower part of the subsoil has more sand.

Included with this soil in mapping are a few areas of Carlow soils. These soils have more clay than the Blackoar soil. They are lower on the flood plain than the Blackoar soil. They make up about 9 percent of the unit.

Important properties of the Blackoar soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Depth to an apparent water table: 0 to 1 foot

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Wetness and the flooding are the main management concerns. The flooding delays planting and interferes with harvesting during some years. Crops can be damaged in some years. A drainage system that includes shallow ditches and land grading helps to overcome the wetness. Returning crop residue to the soil helps to maintain fertility and tilth.

This soil is best suited to water-tolerant, shallow-rooted forage species. The wetness and the flooding are the main management concerns. The flooding should be considered when grazing systems are designed. The soil is moderately suited to alsike clover and reed canarygrass. It is poorly suited to hay because of the flooding. A surface drainage system in areas where the deeper rooted species are grown helps to overcome the flooding and the wetness. Seedbeds can be easily prepared.

This soil is suited to trees. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are management concerns. Equipment should be operated only when the soil is dry or frozen. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil generally is not used as a site for buildings and onsite waste disposal systems because of the flooding.

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

74A—Healing silt loam, rarely flooded, 1 to 3 percent slopes. This very deep, nearly level and very gently sloping, well drained soil is on high flood plains. Individual areas are irregular in shape and range from about 10 to more than 150 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, very friable silt loam

Subsurface layer:
9 to 15 inches, very dark grayish brown, very friable silt loam

Subsoil:
15 to 60 inches, dark yellowish brown and brown, friable silt loam

In some places the dark surface layer is more than 24 inches thick. In other places the subsoil has more clay throughout. In some areas the lower part of the subsoil is grayer. In other areas the slope is more than 3 percent.

Included with this soil in mapping are areas of Menfro, Vanmeter, and Wakenda soils. Menfro soils have a surface layer that commonly is lighter colored and thinner than that of the Healing soil. Vanmeter soils are moderately well drained. Wakenda soils have more clay in the subsoil than the Healing soil. The included soils are on side slopes above the Healing soil. They make up about 10 percent of the unit.

Important properties of the Healing soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. The flooding and the hazard of water erosion are management concerns. In some years planting is delayed because of the flooding.

This soil is well suited to ladino clover, reed canarygrass, and tall fescue. It is moderately well suited to lespedeza and smooth brome and to indiangrass and most of the other warm-season grasses. Species that can withstand the flooding should be selected for planting.

A few small areas support timber. No major problems affect timber management.

This soil generally is not used as a site for buildings and onsite waste disposal systems because of the flooding.

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

77B—Calwoods silt loam, 1 to 5 percent slopes. This very deep, very gently sloping and gently sloping, somewhat poorly drained soil is on ridgetops in the uplands. Individual areas are irregular in shape and range from about 25 to more than 1,000 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, dark grayish brown, friable silt loam

Subsurface layer:
7 to 11 inches, grayish brown, mottled, friable silt loam

Subsoil:
11 to 21 inches, dark grayish brown, mottled, firm silty clay loam and silty clay
21 to 60 inches, grayish brown and light brownish gray, mottled, firm and friable silty clay loam

In some areas the surface layer is very dark grayish brown. In other areas the subsoil has fewer red mottles and is grayer. In some places the lower part of the subsoil contains pebbles. In other places, the soil is eroded and the surface layer is silty clay loam.

Included with this soil in mapping are areas of the moderately well drained Keswick soils. These soils are on the lower side slopes. They make up 8 to 10 percent of the unit.

Important properties of the Calwoods soil—

Permeability: Very slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low
Depth to a perched water table: 1.0 to 2.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, water erosion is a hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Most areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Wetness delays planting or harvesting in some years. Crop residue management and green manure crops improve fertility, minimize crusting, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to ladino clover. It is moderately well suited to crownvetch, tall fescue, switchgrass, timothy, and most of the other warm- and cool-season grasses and moderately suited to alfalfa and orchardgrass. The species that can tolerate the wetness grow best. Timely tillage and a quickly established plant cover reduce the hazard of water erosion.

This soil is suited to trees. The seedling mortality rate and the hazard of windthrow are management concerns. Reinforcement planting or planting container-grown nursery stock increases the seedling survival rate. Stands on this soil should be thinned less intensively and more frequently than stands on other soils where windthrow is less likely to occur.

This soil is not suitable as a site for septic tank absorption fields because of the restricted permeability. It is suitable as a site for dwellings and sewage lagoons. The wetness and the shrink-swell potential are limitations. Adequately reinforcing the concrete in footings, foundations, and basement walls minimizes the structural damage caused by shrinking and swelling. Installing drainage tile around the footings minimizes the damage caused by excessive wetness. Sewage lagoons function adequately if the site is leveled.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

78—Dupo silt loam, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil is on alluvial fans and on flood plains along rivers. It is subject to flooding for brief periods. The installation of levees in most areas has reduced the incidence of flooding. Individual areas are irregular in shape and range from about 25 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, dark grayish brown, friable silt loam

Subsurface layer:
7 to 14 inches, dark grayish brown and brown, friable silt loam

Substratum:
14 to 34 inches, dark grayish brown, grayish brown, and very dark grayish brown, mottled, friable silt loam
34 to 60 inches, very dark gray and black, mottled, firm silty clay

In places the buried soil is at a depth of more than 40 inches.

Included with this soil in mapping are small areas of the poorly drained Carlow and Chequest soils. These soils are lower on the flood plains than the Dupo soil. They make up about 10 percent of the unit.

Important properties of the Dupo soil—

Permeability: Moderate in the upper part of the profile and slow in the lower part
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderately low
Depth to an apparent water table: 1.5 to 3.5 feet
Shrink-swell potential: High

Nearly all areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Wetness and the flooding are management concerns. Planting or harvesting is delayed in some years by the wetness and the flooding. Shallow, parallel surface ditches improve surface drainage. Installing diversions at the base of adjacent uplands helps to control runoff from the soils upslope. A system of conservation tillage that leaves a protective cover of crop residue on the surface or other crop residue management practices help to maintain the content of organic matter, improve tilth, and increase the rate of water infiltration.

This soil is well suited to reed canarygrass and moderately well suited to lespedeza, red clover, and tall fescue. It is moderately well suited to switchgrass and moderately suited to other warm-season grasses. The wetness and the flooding are the main management concerns. A surface drainage system is needed, especially if deep-rooted species are grown. Seedbeds can be easily prepared.

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

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

86—Udorthents, sloping. These very deep, very gently sloping to strongly sloping, somewhat poorly drained and moderately well drained soils are in the uplands. They are mainly along cloverleaf interchanges and in areas that have been reclaimed after surface mining. Individual areas range from about 5 to more than 600 acres in size.

The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer:
0 to 10 inches, dark grayish brown, brown, and dark brown, friable silt loam

Substratum:
10 to 60 inches, strong brown and yellowish brown, mottled, firm and very firm silty clay

In some areas the surface soil is more than 2 feet thick. In other areas the soil has a higher content of coarse fragments. In places the slope is less than 2 percent.

Included with these soils in mapping are Dockery, Goss, and Winfield soils. Dockery soils are poorly drained. They are on small flood plains below the Udorthents. Goss soils are gravelly throughout. They are on small knobs. Winfield soils are silty. They are on the upper side slopes. Included soils make about 5 to 10 percent of the unit.

Important properties of the Udorthents—

Permeability: Moderately slow
Surface runoff: Medium and rapid
Available water capacity: High
Organic matter content: Moderately low
Depth to a perched water table: 1.5 to 3.5 feet
Shrink-swell potential: Moderate

Most areas are used for hay or pasture. Some of the acreage is idle land.

These soils generally are unsuited to cultivated crops, building site development, and onsite waste disposal systems because of the slope, compaction, the wetness, and stoniness. They can be used as wildlife habitat.

These soils are moderately suited to tall fescue, alfalfa, red clover, crownvetch, lespedeza, orchardgrass, big bluestem, and switchgrass. The hazard of water erosion on short slopes and in depressions and scattered stones on the surface are management concerns. Overgrazing should be avoided. Nurse crops help to control water erosion in newly seeded areas.

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

87C2—Crider silt loam, karst, undulating, eroded. This very deep, undulating, well drained soil is on uplands that have numerous sinkholes. Slopes range from 3 to 9 percent. The sinkholes generally are 5 to 15 feet deep but range from a few feet to more than 50 feet deep. They range from a few square yards to more than 1 acre in size. They commonly are funnel-shaped depressions, but the shape varies. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 10 to more than 450 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, dark brown, friable silt loam

Subsoil:
7 to 30 inches, dark yellowish brown, yellowish brown, and brown, friable silty clay loam
30 to 40 inches, reddish brown, firm silty clay loam
40 to 60 inches, yellowish red, mottled, firm silty clay

In some areas, the soil is severely eroded and the reddish layer is at a depth of less than 20 inches. In some places the subsoil does not have reddish colors. In other places the slope is less than 3 percent. Some areas do not have karst topography.

Included with this soil in mapping are a few areas of Bucklick, Calwoods, Goss, and Keswick soils. Bucklick soils have bedrock at a depth of 40 to 60 inches. They are on narrow, steep side slopes below the Crider soil. Calwoods soils are somewhat poorly drained. They are on the narrow ridgetops in areas above the Crider soil. Goss soils have cherty gravel throughout. They are on the narrow, steep side slopes below the Crider soil. Keswick soils are moderately well drained. They are on side slopes. Included soils make up about 10 percent of the unit.

Important properties of the Crider soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Further water erosion is a hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Crop residue management and green manure crops help to control water erosion, maintain or increase the organic matter content, improve tilth, and increase the rate of water infiltration. They also reduce the hazard of contamination of the underground water supply by fertilizer and other material that erodes into the sinkholes.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect pasture or hayland. Water erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good plant cover.

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

This soil is suited to building site development and septic tank absorption fields. Extra precautions may be needed because of the limestone sinkholes. Septic tank absorption fields function well if they are properly installed; however, their size and efficiency may be limited by the sinkholes. Sewage effluent that is released into sinkholes rapidly contaminates the underground water supply. Long laterals help to overcome the restricted permeability. Sewage lagoons function adequately if the site is leveled. Sealing the berms and bottoms of the lagoons with slowly permeable material minimizes seepage. The karst areas generally are not suited to water impoundment structures because plugging the sinkhole is difficult and the chance of failure is relatively high. Sinkholes have been plugged by natural processes in places. As a result, water is impounded or a marshy area forms. Detailed, onsite soil and geologic investigations are needed to locate suitable sites for buildings. Piers or footings that are wider than normal help to provide additional support for buildings and compensate for low strength in fill areas.

Low strength, the sinkholes, and the potential for frost action are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. The sinkholes should be avoided when the roads are constructed. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action.

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

88C2—Crider silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, well drained soil is on ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 10 to more than 400 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, dark grayish brown, friable silt loam

Subsoil:
7 to 17 inches, dark yellowish brown, friable silty clay loam
17 to 26 inches, brown, friable silty clay loam
26 to 60 inches, red and yellowish red, friable silty clay loam and silty clay

In some areas, the soil is severely eroded and the reddish layer is within a depth of 20 inches. In other areas the entire subsoil is brown. In places the slope is more than 9 percent. Some areas have karst topography.

Included with this soil in mapping are a few areas of Bucklick, Calwoods, Goss, and Keswick soils. Bucklick soils have bedrock at a depth of 40 to 60 inches. They are on the narrow, steep side slopes in areas below the Crider soil. Calwoods soils are somewhat poorly drained. They are on the narrow ridgetops in areas above the Crider soil. Goss soils have cherty gravel throughout. They are on the lower, narrow, steep side slopes. Keswick soils are moderately well drained. They are on side slopes. Included soils make up about 10 percent of the unit.

Important properties of the Crider soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderately low

Most areas are used for pasture and hay. This soil is suited to corn, soybeans, and small grain. Further water erosion is a severe hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. In some areas slopes are long and smooth enough for terracing and farming on the contour. Crop residue management and green manure crops help to control water erosion, maintain or increase the organic matter content, improve tilth, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect pasture or hayland. Water erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good plant cover.

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

This soil is suited to building site development and septic tank absorption fields. The absorption fields function well if they are properly installed. Long laterals help to overcome the restricted permeability. Sewage lagoons function adequately if the site is leveled. Sealing the berms and bottom of the lagoons with slowly permeable material minimizes seepage.

Low strength and the potential for frost action are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action.

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

88D2—Crider silt loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, well drained soil is on narrow, convex ridgetops and side slopes in the uplands. Water erosion has removed some of the original surface layer. The remainder of the surface layer has been mixed with the upper part of the subsoil. Individual areas are irregular in shape and range from about 15 to more than 175 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 7 inches, dark brown, friable silt loam

Subsoil:

7 to 13 inches, yellowish brown, friable silt loam

13 to 39 inches, dark yellowish brown and yellowish brown, friable silty clay loam

39 to 60 inches, yellowish red, firm silty clay loam and silty clay

In some areas, the soil is severely eroded and the reddish layer is within a depth of 20 inches. In other areas the subsoil does not have reddish colors. In places the slope is more than 14 percent. Some areas have karst topography.

Included with this soil in mapping are a few areas of Bucklick and Goss soils. Bucklick soils have bedrock at a depth of 40 to 60 inches. Goss soils have cherty gravel throughout. Bucklick and Goss soils are on the narrow, steep side slopes below the Crider soil. They make up about 8 percent of the unit.

Important properties of the Crider soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: High
Organic matter content: Moderately low

Most areas are used for pasture, hay, or woodland. Where the size and shape of areas are favorable, this soil is suited to row crops grown on a limited basis in rotations that include pasture and hay. Further water erosion is a severe hazard if the soil is used for cultivated crops. A system of conservation tillage that leaves a protective cover of crop residue on the surface, terraces, grassed waterways, and crop rotations that include grasses and legumes help to prevent excessive soil loss. Because the soil is highly susceptible to gullying, waterways should be carefully designed and maintained. Crop residue management and green manure crops help to control erosion, maintain or increase the organic matter content, improve tilth, and increase the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass and moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most of the other warm-season grasses. Water erosion during seedbed preparation and overgrazing are management concerns. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are needed.

Some areas support native hardwoods. Seedlings survive and grow well if competing vegetation is removed or controlled by proper site preparation, spraying, or selective cutting. No other hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The slope is a limitation. Dwellings should be designed so that they conform to the natural slope of the land. Septic tank absorption fields should be installed across the slope. Long laterals help to overcome the restricted permeability. Land shaping is needed in some areas.

Low strength and the potential for frost action are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts minimize the damage to roads and streets caused by frost action. Cutting and filling are needed in the steeper areas.

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

90B—Wakenda silt loam, 2 to 5 percent slopes. This very deep, gently sloping, well drained soil is on side slopes and ridgetops in the uplands. Individual areas are irregular in shape and range from about 10 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:

0 to 7 inches, very dark grayish brown, friable silt loam

Subsurface layer:

7 to 21 inches, very dark grayish brown and dark grayish brown, friable silt loam

Subsoil:

21 to 47 inches, brown, dark yellowish brown, and yellowish brown, friable silty clay loam and silt loam

Substratum:

47 to 60 inches, yellowish brown, friable silt loam

In some places the upper part of the subsoil has gray mottles. In other places the surface layer is lighter in color. In some areas the subsoil has less clay. In other areas, the soil is eroded and has a surface layer of silty clay loam or the slope is more than 5 percent.

Included with this soil in mapping are areas of the somewhat poorly drained Tice soils. These soils are on flood plains below the Wakenda soil. They make up 6 to 10 percent of the unit.

Important properties of the Wakenda soil—

Permeability: Moderate

Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderate
Depth to a perched water table: 4 to 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Water erosion is a hazard if the soil is not protected by crops or crop residue. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Crop residue management and green manure crops help to improve fertility and increase the organic matter content and the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect pasture or hayland. Water erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good plant cover.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential is a limitation on sites for dwellings. Constructing footings, basement walls, and foundations with adequately reinforced concrete minimizes the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Properly installed septic tank absorption fields function adequately. Perimeter drains may be necessary to lower the water table. Excessive seepage from sewage lagoons can be minimized by sealing the bottom of the lagoons.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

90C—Wakenda silt loam, 5 to 9 percent slopes. This very deep, moderately sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from about 10 to more than 170 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable silt loam

Subsurface layer:
9 to 13 inches, very dark grayish brown, friable silt loam

Subsoil:
13 to 17 inches, dark grayish brown, friable silt loam
17 to 60 inches, dark yellowish brown, friable silty clay loam

In some places the surface layer is lighter colored. In other places the subsoil has less clay. In some uneroded areas the soil has a thicker dark surface layer. In other areas the slope is more than 9 percent

Included with this soil in mapping are areas of Tice soils. These soils are somewhat poorly drained. They are on flood plains below the Wakenda soil. They make up 6 to 10 percent of the unit.

Important properties of the Wakenda soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderate
Depth to a perched water table: 4 to 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain and to orchards, vineyards, and nursery crops. If cultivated crops are grown, water erosion is a hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface, terraces, grassed waterways, winter cover crops, and a cropping sequence that includes grasses and legumes help to prevent excessive soil loss. Crop residue management and green manure crops help to control water erosion, improve fertility, minimize crusting, and increase the organic matter content and the rate of water infiltration.

A cover of grasses or legumes helps to control water erosion. This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect pasture or hayland. Water erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure rapid growth of a good plant cover.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential is a limitation on sites for dwellings. Constructing footings, basement walls, and foundations with adequately reinforced concrete minimizes the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Properly installed septic tank absorption fields function adequately. Perimeter drains help to overcome the wetness. Sewage lagoons function adequately if the site is leveled. Seepage from sewage lagoons can be minimized by sealing the bottom of the lagoons.

Low strength, the potential for frost action, and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, providing adequate roadside ditches, and installing culverts help to prevent the damage to roads and streets caused by frost action and by shrinking and swelling.

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

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or 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 expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges from 0 to 7 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 201,645 acres in the county, or nearly 46 percent of the total acreage, meets the soil requirements for prime farmland. The largest acreage of prime farmland is in associations 1, 2, 4, and 6, which are described under the heading "General Soil Map Units." The main crops grown on this land are corn and soybeans. An estimated 75 percent of the total cropland in the county is prime farmland.

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."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify as prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

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

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

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

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in 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

Charlie R. Wright, Sr., district conservationist, Natural Resources Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources 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 the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

In 1972, about 311,300 acres, or 71 percent of the total acreage in the county, was used for crops or pasture. Of this total, about 119,500 acres was used for permanent pasture and 191,800 acres for cultivated crops, mainly soybeans, corn, wheat, and grain sorghum *(23)*.

The potential of the soils in the county for sustained production of food is good. Adequate conservation measures are applied on less than half of the cropland in the county. Conservation measures generally are not applied in the uplands where water erosion is in excess of what is considered tolerable for sustained production. Marginal land planted to row crops should be converted to grassland, or adequate conservation measures should be applied.

Water erosion is the major problem on nearly all of the sloping cropland and overgrazed pasture in the county. If the slope is more than 2 percent, erosion is a hazard. Armstrong, Calwoods, Gorin, Leonard, Menfro, Vanmeter, and Winfield soils are susceptible to erosion. As all or part of the surface layer of these soils is lost through erosion and part of the subsoil is incorporated into the plow layer, productivity is reduced. Loss of the surface layer is especially damaging on soils that have a clayey subsoil. Erosion also reduces the productivity of moderately deep soils, such as Vanmeter soils, which tend to be droughty.

Erosion on farmland results in sedimentation of streams, lakes, and ponds. Controlling erosion minimizes this pollution and improves the quality of water for municipal and recreational use and for fish and wildlife. It also prolongs the useful life of the ponds and lakes by preventing sedimentation.

Many fields have clayey spots where seedbed preparation and tillage are difficult because the original friable surface soil has been eroded away. These eroded spots occur in areas of the Armstrong, Calwoods, Gorin, Keswick, Leonard, and Mexico soils.

On most of the cropland in the county, conservation measures help to control erosion in specific areas and situations. These measures help to protect the surface of the soil, reduce the rate of runoff, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the soil for extended periods reduces the hazard of erosion and helps to maintain the productive capacity of the soil. Growing grasses and legumes for pasture and hay helps to control erosion. Including legumes, such as clover and alfalfa, in the cropping sequence helps to improve tilth and provide nitrogen.

Terraces shorten the length of slopes and thus reduce the rate of runoff and help to control erosion. Special construction methods are necessary if terraces are to be effective in most of the moderately sloping or strongly sloping areas of the eroded Armstrong, Keswick, Leonard, Winfield, and Menfro soils. Terraces and a cropping system that provides a substantial cover of vegetation are needed on these soils.

Conservation tillage systems, which provide a protective cover of vegetation, reduce the rate of runoff and help to increase the rate of water infiltration. These systems leave much of the crop residue on the surface.

Leaving a permanent cover of grasses and legumes in strips on the contour, or contour stripcropping, also helps to control erosion. Hay generally is planted in the strips, and row crops are planted on the contour in the areas between the strips.

Wetness and flooding are management concerns on all of the soils on flood plains in the county. Flooding is a problem on Blackoar, Belknap, Bremer, Carlow, Cedargap, Chequest, Dameron, Dockery, Dupo, Haymond, Healing, Klum, Moniteau, Okaw, Tice, and Twomile soils. It commonly occurs during the period November through May. Bremer and Okaw soils are naturally so wet that crop production tends to be reduced. The nearly level Putnam soils, which are on the broad top of ridges in the uplands, are very slowly permeable. When these soils receive excess water, they stay wet for long periods. Excess water can be removed from most of the soils by land grading and installing field ditches.

Few irrigation systems are currently used in the county. Some areas are irrigated by a center-pivot or traveling-gun system. Irrigation increases yields by supplying supplemental water during critical periods of crop growth.

Soil fertility is naturally lower in most eroded soils than in uneroded soils. Additions of plant nutrients improve the productivity of all soils. Most of the soils in the county are naturally acid in the upper part of the root zone. Applications of ground limestone are needed to raise the pH and calcium levels sufficiently for optimum plant growth. Applications of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water. Soils that have good tilth are granular and porous. Most of the soils in the uplands, on terraces, and on flood plains along small streams have a surface layer of silt loam that can be easily tilled and makes a good seedbed. Tillage and compaction generally weaken the structure of the silt loam, and a surface crust forms during periods of intensive rainfall. The crust is hard when dry. As a result, it reduces the rate of water infiltration and increases the runoff rate. Regularly adding crop residue, manure, and other organic material improves soil structure and tilth.

All of the eroded soils on uplands have more clay in the surface layer than is typical in uneroded soils. As a result, tilth is poorer, the rate of water infiltration is slower, and the rate of runoff is more rapid. Measures that control erosion help to prevent further deterioration of tilth in the eroded soils.

Fall plowing is common in the county, but it generally is not a good means of improving tilth in the soils on uplands. These soils generally are sloping and are more likely to erode if they are plowed in the fall.

Preparing a good seedbed is difficult on Chequest, Carlow, and other soils that have a high content of clay in the surface layer. If these soils are worked when wet, the surface layer tends to become a mass of hard clods as it dries. A cover of crop residue and deep tillage in the fall improve tilth and drainage and are conducive to planting earlier in the spring.

Corn, soybeans, and wheat are the most commonly grown crops in the county. They are well suited to the soils and the climate in the county. Grain sorghum and sunflowers are grown on a few acres.

Pasture plants and hay crops that are suited to the soils and the climate in the county include several types of legumes, cool-season grasses, and warm-season native grasses. The cool-season grasses are tall fescue, orchardgrass, brome, reed canarygrass, timothy, and bluegrass. Alfalfa, red clover, and lespedeza are the most common legumes grown for hay. They also are seeded in mixtures that include brome, orchardgrass, or tall fescue. Birdsfoot trefoil can be seeded alone or in mixtures that include brome, orchardgrass, tall fescue, or bluegrass. Suitable warm-season grasses include big bluestem, indiangrass, and switchgrass. These grasses grow well during the summer, when the cool-season species are dormant. The management needed for warm-season grasses differs from that needed for cool-season grasses. Very deep, well drained and moderately well drained soils, such as Menfro and Winfield soils, are well suited to alfalfa. Other legumes and most grasses generally grow well on these soils in the uplands. Chequest and Carlow soils are often flooded and remain wet for long periods. They are better suited to short-season annuals or water-tolerant species, such as reed canarygrass.

The major concerns in managing pasture are overgrazing and the hazard of erosion. A controlled grazing system helps to maintain maximum forage production. Keeping the grasses at a desirable height reduces the rate of runoff and helps to control erosion.

Specialty crops grown in the county include apples, peaches, nursery plants, and various garden vegetables. The latest information about growing these crops can be obtained from the local office of the Cooperative Extension Service or the Natural Resources Conservation Service.

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 also is shown in the table.

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources 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 or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit *(19)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Douglas C. Wallace, forester, Natural Resources Conservation Service, helped prepare this section.

In 1986, about 23 percent of the county, or 101,020 acres, was forested. The woodland on uplands was primarily in small, private holdings of 10 to 50 acres and was essentially unmanaged *(6).* Larger continuous tracts of timber were along the bluffs in the valley of the Mississippi River. The trees on the flood plains occur in long, narrow bands bordering streams and rivers. Tree species and growth rates in the county vary, depending on soil properties, site characteristics, and past management.

Properties that affect the growth of trees include reaction (pH), fertility, drainage, texture, structure, and depth of the soil. The soil also stores moisture, provides an anchor for roots, and supplies essential plant nutrients. Trees grow best on soils that do not have extremes of these properties and have an effective rooting depth of more than 40 inches.

Site characteristics that affect the growth of trees include aspect and topographic position. These characteristics influence the amount of available sunlight, air drainage, soil temperature, soil moisture, and relative humidity. Generally, north and east aspects and the lower slopes, which are cooler and have better moisture conditions, are the best sites for trees in the uplands. Deep, moderately well drained soils that are only occasionally flooded generally are the most productive soils on bottom land.

Management activities affect woodland productivity and should help to eliminate factors causing stress to the trees. Generally, they include thinning overstocked, young stands; harvesting mature trees; and preventing destructive fire and grazing. Fire and grazing have very negative impacts on the growth and quality of trees in forests. While forest fires are no longer a major problem in the county, about 50 percent of the woodland is still subject to grazing. Grazing destroys the leaf layer on the surface, compacts the soils, and destroys or damages tree seedlings. Woodland sites that have not been grazed and burned have the highest potential for optimum timber production.

The largest acreage of upland forest is in areas of the Winfield, Menfro, and Goss soils in the northeastern and central parts of the county. White oak, northern red oak, black oak, and sugar maple typically grow in these areas. Post oak, black oak, shagbark hickory, and blackjack oak grow on the less productive Keswick soils in the southwestern part of the county. The undisturbed forested areas of Winfield and Menfro soils are very productive.

The Chequest, Carlow, and Dockery soils along the major watercourses on bottom land support hardwoods that can tolerate wetness and flooding. Most of these areas have been cleared of trees and are used for crops. The remaining areas of woodland typically support silver maple, hackberry, American elm, swamp white oak, sycamore, cottonwood, and pin oak. Bur oak, shellbark hickory, and walnut are common along the smaller stream bottoms and the higher terraces along the major streams. The potential for excellent forest growth is high in these areas.

Planting trees, such as Christmas trees, nut trees, or fuelwood trees, for special uses can be very successful. Christmas tree plantings can be established on any soil that is not poorly drained or very poorly drained. Scotch pine, Austrian pine, white pine, and Douglas-fir are the best suited species to plant in the county. Nut trees, such as black walnut, are best suited to very deep, medium textured soils, such as the moderately well drained or well drained Winfield and Menfro soils on uplands and the somewhat poorly drained Belknap soils on bottom land. They also are suited to other soils in the county, but production may not be as good. The potential is good for plantations of fast-growing trees used for fuelwood. Green ash, black locust, sycamore, and silver maple are the best suited species for this use.

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

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

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

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

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

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

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

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

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

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

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

Windbreaks and Environmental Plantings

Douglas C. Wallace, forester, Natural Resources Conservation Service, helped prepare this section.

Living plants play an important role in supporting life and in improving living conditions. If properly used and maintained, plantings can solve many problems existing in our contemporary environment. Windbreaks and environmental plantings fulfill a variety of engineering, climatological, and esthetic needs.

Windbreaks can be grown successively in most areas of the county. When farmstead and field windbreaks are planned, design and layout, species selection, site preparation, seedling handling, weed management, irrigation, and protection from diseases, insects, and livestock should be considered.

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 *(4)*.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise *(15, 16)*. 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 Natural Resources Conservation Service, the Missouri Department of Conservation, or the Cooperative Extension Service or from a commercial nursery.

Recreation

Keith Jackson, wildlife services biologist, Missouri Department of Conservation, helped prepare this section.

Recreational facilities in Pike County include swimming pools and other areas used for water sports, golf courses, ballfields, playgrounds, campgrounds, picnic areas, nature areas, trails, fairgrounds, historic sites, areas for hunting and fishing, and areas for viewing wildlife. The potential for further recreational development is very high throughout the county.

Dupont, Clarksville, Edward Anderson, Ranacker, and Ted Shanks Wildlife Areas make up about 1,269 acres of land that is open to the public. They provide opportunities for primitive camping, hiking, hunting, observing nature, viewing wildlife, and other forms of outdoor recreation. The Clarence Cannon Wildlife Refuge Area, which makes up 3,747 acres, provides areas for viewing wildlife. Several Federal, State, and municipal access sites on the Mississippi River provide launching facilities for boats. City parks at Bowling Green and Louisiana and federally owned islands in the Mississippi River also are used for recreational activities.

In 1974, several private and semiprivate commercial recreational enterprises were in the county *(14)*. They included hunting clubs, fishing lakes, boat rental enterprises, country clubs, historic sites, and campgrounds.

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

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

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

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

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

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

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Keith Jackson, wildlife services biologist, Missouri Department of Conservation, helped prepare this section.

Pike County is one of 21 counties in Missouri that make up the Northeast Riverbreak Zoogeographic Region *(13)*. Because of the diversity of different cover types, this region is one of the richest game areas in the State. As the transition zone between the prairie and the Ozark Border, the region provides a variety and profusion of edge growth that makes excellent wildlife habitat. The problems affecting the wildlife resources are conversion of woodland to grassland and cropland and loss of hedgerows and brushy waterways. Also, fall tillage of cropland decreases the amount of food available to wildlife.

More than 300 fish and wildlife species have been recorded for Pike County. Some birds, like the Mississippi kite, are only very rarely found in the county, while many others migrate through the area in spring and fall. Typical nongame species include red-winged blackbird, house wren, red-tailed hawk, eastern garter snake, fathead minnow, western chorus frog, and deer mouse. The most common game species include bobwhite quail, white-tailed deer, eastern wild turkey, fox and gray squirrels, eastern cottontail rabbit, largemouth bass, channel catfish, bluegill, common snapping turtle, and raccoon.

The Federal government has identified many endangered species. Of these species, the bald eagle, fat pocketbook pearly mussel, Indiana bat, gray bat, and least tern are in the county. Fifteen additional members of the State's rare and endangered species list have also been found in the survey area, including osprey, upland sandpiper, lake sturgeon, least weasel, and black-crowned night heron.

The Mexico-Armstrong, Belknap-Okaw-Twomile, and Chequest-Dockery-Carlow associations, which are described under the heading "General Soil Map Units," provide most of the openland wildlife habitat in the county. Some areas of hayland and grassland are in the Keswick-Gorin-Calwoods and Winfield-Menfro associations. Scattered, small blocks of timber, waterways, hedgerows, fence rows, and other areas providing woody or brushy cover are common throughout these associations. Such "hard cover" areas provide an important habitat component that is rapidly disappearing in many areas of the intensively agricultural sections of the county. Typical openland species include bobwhite quail, dickcissel, eastern meadowlark, and coyote.

Bobwhite quail is one of the most popular game species in the county. The heavily timbered areas of the county have a low population of bobwhite quail, and the openland areas have a fair population. The best habitat areas are the exception. The rabbit population is good. The dove population is poor, and fall migratory flights of doves are erratic.

The furbearer population is good. Trapping activity varies with the demand for furs. Raccoon, muskrat, opossum, coyote, red and gray fox, beaver, and mink are the main species trapped.

The Goss and Winfield-Menfro associations provide most of the woodland wildlife habitat in the county. About 23 percent of the county provides wooded habitat, which includes areas of smaller, brushy plants. Common woodland wildlife species include turkey, raccoon, short-tailed shrew, blue-tailed skink (also called five-lined lizard), downy woodpecker, and white-breasted nuthatch.

The county has a good population of deer. Interest in deer hunting is very high from county residents. The turkey population is very good. Hunter interest in this game bird is high. The squirrel population is good, but hunter interest is light. Woodcocks are scarce, and hunter interest is low because of the limited migratory flights of woodcocks.

Nearly all of the wetland habitat in the county is in areas of the Chequest-Dockery-Carlow and Belknap-Okaw-Twomile associations along the Mississippi and Salt Rivers. The Clarence Cannon Wildlife Refuge, the Clarksville Wildlife Refuge, and the Ted Shanks Wildlife Area attract waterfowl during the spring and fall. These areas serve as aggregation areas for Canada geese, snow geese, mallards, herons, pintail, scaup, and teal. Wooded areas support a good population of resident wood ducks along the major rivers and on the wooded islands in the rivers. River otters have been stocked by the Missouri Department of Conservation, and the number of these mammals should increase along the rivers and streams.

More than 70 species of fish inhabit the waters of the county. Prime opportunities for fishing are available on rivers, streams, lakes, and farm ponds. About 200 miles of perennial streams drain the county. The Mississippi River borders the county for 40 miles. Commercial fishermen on the Mississippi River generally catch carp, buffalofish, catfish, or sturgeon. Other major fishing areas are the Salt River and Buffalo Creek, Indian Creek, Noix Creek, and Spencer Creek. Bass, crappie, walleye, sunfish, drum, carp, bluegill, and catfish are in these watercourses.

The Bowling Green City Reservoirs, Vandalia Reservoir, and Bowling Green Lake provide opportunities for impoundment fishing. Bowling Green Lake, which is 50 acres in size, is the largest impoundment in the county. The Ted Shanks Wildlife Refuge Area includes four lakes and sloughs, which are open to the public. These areas are fished for bass, catfish, crappie, bluegill, or carp. About 3,600 farm ponds and small lakes are privately owned. Most of these are stocked with bass, catfish, or bluegill.

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

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

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

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

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

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, flooding, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are fescue, lovegrass, brome, clover, and alfalfa.

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

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

Coniferous plants furnish 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, saltgrass, 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. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

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

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas (fig. 8). Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Engineering

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

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

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

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

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

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems,

Figure 8.—A small pond in an area of Keswick loam, 5 to 9 percent slopes, eroded, provides habitat for wildlife.

ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

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

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

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

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

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

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

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

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

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

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

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

Construction Materials

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

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

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

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

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of 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. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is 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 high water table at or near the surface.

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

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, 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 the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

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

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

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

Soil Properties

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

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

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

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

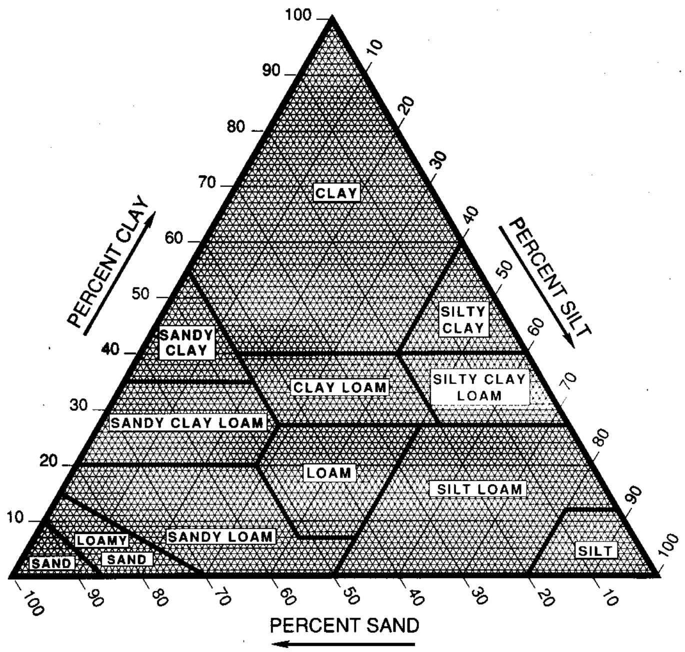

Figure 9.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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 the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 9). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

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

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

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

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

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

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

Physical and Chemical Properties

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

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated 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, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

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

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

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

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

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

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

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

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of rock fragments on the surface or because of surface wetness.

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

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

Soil and Water Features

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

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

The four hydrologic soil groups are:

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

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

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

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

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 (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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 little or no horizon development.

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

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

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

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

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

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(20)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is 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 water-deposited material, 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 (*Ud*, meaning humid, plus *fluvent*, the suborder of the Entisols that has an aquic moisture regime).

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

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, nonacid, mesic Aquic 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. 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" *(22)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(20)*. 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."

Armstrong Series

The Armstrong series consists of very deep, moderately well drained, slowly permeable soils on uplands. These soils formed in a thin layer of pedisediments and in the underlying weathered glacial till. Slopes range from 3 to 7 percent.

Typical pedon of Armstrong loam, 3 to 7 percent slopes, eroded, 2,200 feet south and 190 feet west of the northeast corner of sec. 13, T. 51 N., R. 5 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; dark brown (7.5YR 4/4) silty clay loam; common fine prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; firm; few very fine roots; few distinct clay films and few distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

2Bt2—14 to 20 inches; brown (7.5YR 5/4) and reddish brown (5YR 4/4) clay loam; few fine prominent grayish brown (10YR 5/2) mottles; weak fine angular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; moderately acid; clear smooth boundary.

2Bt3—20 to 28 inches; brown (7.5YR 5/4) clay loam; few fine distinct reddish brown (5YR 4/4) and few fine prominent dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; moderately acid; clear smooth boundary.

2Bt4—28 to 36 inches; strong brown (7.5YR 5/6) clay loam; few medium prominent dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; moderately acid; clear smooth boundary.

2Bt5—36 to 41 inches; strong brown (7.5YR 5/6) clay loam; few fine prominent dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; about 1 percent rounded pebbles; moderately acid; clear smooth boundary.

2BC—41 to 60 inches; strong brown (7.5YR 5/6) clay loam; few medium prominent dark grayish brown (10YR 4/2) mottles; weak coarse subangular blocky structure; firm; few fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; moderately acid.

The Ap horizon has chroma of 1 or 2. Some pedons have a BE horizon. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam or clay loam. The 2Bt horizon has hue of 5YR to 10YR and chroma of 2 to 6. It is clay loam, silty clay loam, or clay.

Belknap Series

The Belknap series consists of very deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in silty, acid alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Belknap silt loam, occasionally flooded, 1,200 feet north and 200 feet west of the southeast corner of sec. 30, T. 55 N., R. 2 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine roots; strongly acid; clear smooth boundary.

A—8 to 17 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine granular structure; friable; few very fine roots; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Cg1—17 to 24 inches; stratified grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silt loam; few fine and medium faint brown (10YR 4/3) mottles; massive; friable; few very fine roots; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Cg2—24 to 32 inches; stratified grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silt loam; common fine and medium prominent dark yellowish brown (10YR 4/6) mottles; massive; friable; few very fine roots; common fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Cg3—32 to 43 inches; stratified dark gray (10YR 4/1) and grayish brown (10YR 5/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles; massive; friable; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Cg4—43 to 60 inches; stratified dark grayish brown (10YR 4/2) and brown (10YR 5/3) loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few fine accumulations of iron and manganese oxide; moderately acid.

The Ap horizon has value of 4 or 5. The C horizon has value of 4 to 6 and chroma of 1 to 3. It is silt loam or loam.

Blackoar Series

The Blackoar series consists of very deep, poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Blackoar silt loam, occasionally flooded, 2,300 feet north and 2,800 feet west of the junction of Highway H and Highway 79 at Annada, Missouri, T. 52 N., R. 1 E., UTM coordinates 4348488m N. and 686640m E., zone 15:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; common very fine roots; neutral; clear smooth boundary.

A—7 to 14 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; few very fine roots; neutral; clear smooth boundary.

Bg1—14 to 22 inches; dark gray (10YR 4/1) silt loam; weak fine subangular blocky structure; few fine distinct dark gray (N 4/0) mottles; friable; few distinct organic coatings on faces of peds; few very fine roots; neutral; clear smooth boundary.

Bg2—22 to 31 inches; dark gray (10YR 4/1) silt loam; few fine prominent dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; friable; few fine roots; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Bg3—31 to 36 inches; dark gray (10YR 4/1) silt loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; friable; few very fine roots; common fine and medium concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bg4—36 to 60 inches; gray (10YR 5/1) silt loam; common fine prominent yellowish brown (10YR 5/8) mottles; friable; common fine and medium concretions of iron and manganese oxide; slightly acid.

The mollic epipedon is 14 to 22 inches thick. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has value of 4 or 5 and chroma of 1 or 2.

Bremer Series

The Bremer series consists of very deep, poorly drained, moderately slowly permeable soils on low terraces. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Bremer silty clay loam, rarely flooded, 1,725 feet north and 1,500 feet east of the southwest corner of sec. 19, T. 55 N., R. 2 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A—7 to 17 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; few very fine roots; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg1—17 to 23 inches; dark grayish brown (2.5Y 4/2) silty clay loam, grayish brown (2.5Y 5/2) dry; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg2—23 to 31 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine prominent light olive brown (2.5Y 5/6) mottles; weak fine prismatic structure; firm; few very fine roots; few distinct clay films on faces of peds; few medium accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

2Btg3—31 to 43 inches; grayish brown (2.5Y 5/2) silty clay; common fine prominent olive yellow (2.5Y 6/8) mottles; weak medium prismatic structure; firm; few very fine roots; many distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

2BCg—43 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine prominent olive yellow (2.5Y 6/8) mottles; weak medium subangular blocky structure; friable; common fine accumulations of iron and manganese oxide; slightly acid.

The Ap horizon has value of 2 or 3. The Btg horizon has value of 3 to 5. The 2Btg horizon has hue of 10YR to 5Y and value of 4 or 5.

Bucklick Series

The Bucklick series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in a thin layer of loess and in the underlying clayey material or in material weathered from limestone and shale. Slopes range from 9 to 14 percent.

Typical pedon of Bucklick silt loam, 9 to 14 percent slopes, 4,820 feet north and 4,800 feet west of the junction of Highway 00 and County Road 186, west of Eolia, Missouri, in the northwestern part of Spanish survey 1727, T. 52 N., R. 2 W., UTM coordinates 4344244m N. and 664305m E., zone 15:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many fine and very fine roots; slightly acid; clear smooth boundary.
BE—8 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; common distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; slightly acid; clear smooth boundary.
2Bt1—14 to 29 inches; dark brown (7.5YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; common distinct silt coatings and common distinct clay films on faces of peds; about 1 percent cherty pebbles; moderately acid; clear wavy boundary.
2Bt2—29 to 36 inches; reddish brown (5YR 4/4) gravelly silty clay; few fine distinct brown (7.5YR 5/4) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common distinct silt coatings and common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 25 percent cherty pebbles; strongly acid; clear wavy boundary.
2Bt3—36 to 47 inches; red (2.5YR 4/6) silty clay; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 10 percent cherty pebbles; strongly acid; clear wavy boundary.
3R—47 inches; limestone bedrock.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The 2Bt horizon has hue of 7.5YR to 2.5YR. It is silty clay loam or silty clay. The content of gravel in the 2Bt horizon ranges from 0 to 35 percent.

Calwoods Series

The Calwoods series consists of very deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in loess and the underlying pedisediments. Slopes range from 1 to 5 percent.

Typical pedon of Calwoods silt loam, 1 to 5 percent slopes, 150 feet south and 150 feet west of the northeast corner of sec. 16, T. 52 N., R. 4 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; few fine roots; neutral; clear smooth boundary.
E—7 to 11 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; common fine prominent reddish brown (2.5YR 4/4) and few fine faint gray (10YR 5/1) mottles; weak thin platy structure parting to weak very fine subangular blocky; friable; few fine roots; common fine pores; strongly acid; clear smooth boundary.
Bt—11 to 14 inches; dark brown (10YR 4/3) silty clay loam; many fine prominent dark reddish brown (2.5YR 3/4) mottles; moderate fine subangular blocky structure; firm; few fine roots; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; strongly acid; clear smooth boundary.
Btg1—14 to 21 inches; dark grayish brown (10YR 4/2) silty clay; common fine prominent weak red (2.5YR 4/2) and few fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; strongly acid; clear smooth boundary.
Btg2—21 to 28 inches; grayish brown (10YR 5/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; moderately acid; clear smooth boundary.
Btg3—28 to 44 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure; friable; few fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.
2Btg4—44 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common medium prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure; friable; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; few sand grains; moderately acid.

The Ap horizon has chroma of 2 or 3. The E horizon has value of 5 or 6 and chroma of 2 or 3. The Bt horizon has value of 4 to 6 and chroma of 2 or 3. Some pedons have a C horizon, which has hue of 5YR or 2.5Y and value of 5 or 6.

Carlow Series

The Carlow series consists of very deep, poorly drained, very slowly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Carlow silty clay, occasionally flooded, 1,300 feet west and 1,400 feet north of the southeast corner of sec. 29, T. 52 N., R. 2 E.

Ap—0 to 6 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; neutral; clear smooth boundary.

A—6 to 9 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; moderate medium angular blocky structure; firm; common very fine roots; moderately acid; gradual smooth boundary.

Bg1—9 to 20 inches; very dark gray (10YR 3/1) silty clay; few fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium angular blocky structure; very firm; common very fine roots; moderately acid; gradual smooth boundary.

Bg2—20 to 28 inches; dark grayish brown (2.5Y 4/2) clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; very firm; common very fine roots; moderately acid; gradual smooth boundary.

Bg3—28 to 41 inches; dark grayish brown (2.5Y 4/2) clay; many fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure; very firm; common very fine roots; strongly acid; gradual smooth boundary.

Bg4—41 to 52 inches; grayish brown (2.5Y 5/2) clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; moderate very coarse prismatic structure; very firm; common very fine roots; moderately acid; gradual smooth boundary.

Bg5—52 to 60 inches; grayish brown (2.5Y 5/2) silty clay; common medium prominent dark yellowish brown (10YR 4/6) mottles; weak very coarse prismatic structure; very firm; common very fine roots; moderately acid.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 1 or 2.

Cedargap Series

The Cedargap series consists of very deep, well drained, moderately permeable soils on flood plains along small streams. These soils formed in cherty alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Cedargap silt loam, in an area of Dameron-Cedargap complex, 0 to 3 percent slopes, 1,120 feet north and 1,150 feet west of the southeast corner of sec. 36, T. 53 N., R. 2 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine roots; about 5 percent cherty pebbles; neutral; clear wavy boundary.

A—7 to 24 inches; dark brown (10YR 3/3) extremely gravelly silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many fine roots; about 60 percent cherty pebbles, 5 percent cherty cobbles, and 5 percent limestone flagstones; neutral; clear wavy boundary.

C—24 to 60 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) extremely gravelly silt loam; massive; friable; common fine roots; about 70 percent cherty pebbles, 5 percent cherty cobbles, and 5 percent limestone flagstones; neutral.

The thickness of the mollic epipedon ranges from 24 to 36 inches. The A horizon has chroma of 2 or 3. The C horizon has value of 3 or 4 and chroma of 2 or 3.

Chequest Series

The Chequest series consists of very deep, poorly drained, moderately slowly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Chequest silty clay loam, frequently flooded, 2,000 feet north and 2,000 feet east of the southwest corner of sec. 20, T. 52 N., R. 2 E.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak fine granular structure; friable; few fine roots; moderately acid; clear smooth boundary.

A—7 to 18 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; few fine prominent light olive brown (2.5Y 5/4) mottles; weak fine subangular blocky structure; friable; few fine roots; few distinct organic coatings on faces of peds; few fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Btg1—18 to 25 inches; dark gray (10YR 4/1) silty clay loam; few fine prominent light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; few medium accumulations of iron and manganese oxide; moderately acid; few sand grains; clear smooth boundary.

Btg2—25 to 40 inches; dark gray (5Y 4/1) silty clay; few fine prominent light olive brown (2.5Y 5/4) mottles; weak fine prismatic structure; firm; few fine roots; few distinct clay films on faces of peds; few medium accumulations of iron and manganese oxide; moderately acid; few sand grains; clear smooth boundary.

Btg3—40 to 60 inches; gray (5Y 4/1) silty clay; common medium prominent yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure; firm; few fine roots; common distinct clay films on faces of peds; common medium accumulations of iron and manganese oxide; moderately acid; few sand grains.

The content of sand ranges from 10 to 15 percent in the solum. The Ap horizon has value of 2 or 3. The Btg horizon has hue of 10YR to 5Y and value of 4 or 5.

Crider Series

The Crider series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying material weathered from limestone. Slopes range from 3 to 14 percent.

Typical pedon of Crider silt loam, karst, undulating, eroded, 2,485 feet east and 650 feet south of the northwest corner of sec. 36, T. 55 N., R. 4 W.

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; common fine pores; slightly acid; abrupt smooth boundary.

Bt1—7 to 13 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt2—13 to 21 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure; friable; few fine roots; few distinct silt coatings and common distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt3—21 to 30 inches; brown (7.5YR 5/4) silty clay loam; moderate fine subangular blocky structure; friable; few fine roots; many distinct silt coatings and few distinct clay films on faces of peds; neutral; clear smooth boundary.

2Bt4—30 to 40 inches; reddish brown (5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few very fine roots; few distinct silt coatings and few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; moderately acid; clear smooth boundary.

2Bt5—40 to 60 inches; yellowish red (5YR 4/6) silty clay; few fine faint yellowish red (5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; few distinct clay films in pores; few fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; moderately acid.

The Ap horizon has chroma of 2 or 3. The upper part of the Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The lower part of the Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 5YR or 2.5YR, value of 3 to 5, and chroma of 4 to 8. It is silty clay, silty clay loam, or clay.

Dameron Series

The Dameron series consists of very deep, well drained, moderately permeable soils on flood plains along small streams. These soils formed in silty alluvium that is underlain by cherty alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Dameron silt loam, in an area of Dameron-Cedargap complex, 0 to 3 percent slopes, 2,300 feet north and 1,000 feet east of the southwest corner of sec. 20, T. 53 N., R. 2 W.

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

A1—7 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

A2—16 to 25 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate fine granular structure; friable; common fine roots; slightly acid; clear wavy boundary.

2C1—25 to 34 inches; dark brown (10YR 3/3) gravelly loam; massive; firm; common fine roots; about 15 percent cherty pebbles; slightly acid; clear wavy boundary.

2C2—34 to 49 inches; brown (10YR 4/3) gravelly sandy clay loam; massive; firm; few very fine roots; about 30 percent cherty pebbles; slightly acid; clear wavy boundary.

2C3—49 to 60 inches; brown (10YR 4/3) very gravelly sandy clay loam; massive; firm; about 40 percent cherty pebbles; slightly acid.

The A horizon has value of 2 or 3. The 2C horizon has value of 3 or 4 and chroma of 2 or 3.

Dockery Series

The Dockery series consists of very deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Dockery silt loam, frequently flooded, 1,575 feet east and 2,000 feet north of the southwest corner of sec. 34, T. 55 N., R. 2 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; few fine prominent brown (7.5YR 4/4) mottles; weak fine granular structure; very friable; common very fine roots; few fine accumulations of iron and manganese oxide; moderately acid; abrupt smooth boundary.

ACg—8 to 15 inches; stratified dark grayish brown (10YR 4/2) and light brownish gray (10YR 6/2) silt loam; few fine faint brown (10YR 4/3) mottles; weak fine granular structure; very friable; few very fine roots; few fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Cg1—15 to 25 inches; stratified dark gray (10YR 4/1) and light brownish gray (10YR 6/2) silt loam and silty clay loam; few fine distinct brown (10YR 4/3) mottles; massive; friable; common very fine roots; few fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Cg2—25 to 32 inches; stratified dark gray (10YR 4/1) and light brownish gray (10YR 6/2) silty clay loam; common fine prominent strong brown (7.5YR 4/6) mottles; massive; friable; few very fine roots; common fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Cg3—32 to 60 inches; light brownish gray (10YR 6/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles; massive; friable; few fine accumulations of iron and manganese oxide; moderately acid.

The A horizon has value of 4 to 6 and chroma of 2 or 3. Some pedons have a buried horizon below a depth of 40 inches.

Dupo Series

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

Typical pedon of Dupo silt loam, occasionally flooded, 2,300 feet east and 2,100 feet north of the southwest corner of sec. 33, T. 52 N., R. 2 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many very fine roots; moderately acid; abrupt smooth boundary.

A—7 to 14 inches; stratified dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam; very weak fine granular structure; friable; common fine roots; slightly acid; clear smooth boundary.

C1—14 to 25 inches; dark grayish brown (10YR 4/2) silt loam; few fine prominent dark yellowish brown (10YR 4/6) mottles; massive; friable; few very fine roots; slightly acid; clear smooth boundary.

C2—25 to 34 inches; stratified grayish brown (10YR 5/2) and very dark grayish brown (10YR 3/2) silt loam; common fine and medium prominent dark yellowish brown (10YR 4/6) mottles; massive; friable; few very fine roots; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

2Ab1—34 to 42 inches; very dark gray (10YR 3/1) silty clay; few fine prominent dark yellowish brown (10YR 4/6) mottles; weak fine prismatic structure parting to moderate fine angular blocky; firm; few very fine roots; few fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

2Ab2—42 to 60 inches; black (10YR 2/1) silty clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak medium and coarse prismatic structure; firm; few fine roots; few distinct clay films on pressure faces; few fine accumulations of iron and manganese oxide; neutral.

Depth to the buried soil ranges from 20 to 40 inches. The Ap horizon has value of 4 or 5 and chroma of 1 to 3. The C horizon has value of 3 to 6 and chroma of 1 to 3. The Ab horizon has value of 2 to 4 and chroma of 1 or 2.

Gorin Series

The Gorin series consists of very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in loess and glacial till. Slopes range from 2 to 9 percent.

Typical pedon of Gorin silt loam, 2 to 5 percent slopes, 2,100 feet west and 500 feet south of the northeast corner of sec. 7, T. 51 N., R. 3 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

E—5 to 12 inches; brown (10YR 5/3) silt loam; weak thin platy structure; friable; many fine roots; moderately acid; clear smooth boundary.

Bt1—12 to 16 inches; dark brown (10YR 4/3) silty clay loam; few fine distinct brown (7.5YR 4/2) mottles; very weak fine subangular blocky structure; friable; many medium roots; common distinct silt coatings and few distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—16 to 28 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct grayish brown (10YR 5/2) and few fine faint brown (10YR 5/3) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt3—28 to 36 inches; brown (10YR 5/3) silty clay loam; common fine and medium faint grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; firm; few very fine roots; few clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

2Bt4—36 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; common fine and medium distinct grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; common fine accumulations of iron and manganese oxide; common sand grains; slightly acid; clear smooth boundary.

3Btb—48 to 60 inches; yellowish brown (10YR 5/4) clay; common medium prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; firm; common distinct clay films on faces of peds; common fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; slightly acid.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. The E horizon, if it occurs, has value of 4 or 5 and chroma of 2 or 3. The upper part of the Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or silty clay. The lower part of the Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam or silty clay. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam or clay loam. The 3Bt horizon has colors similar to those of the 2Bt horizon. It is clay or clay loam.

Goss Series

The Goss series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from cherty limestone. Slopes range from 9 to 50 percent.

Typical pedon of Goss gravelly silt loam, 9 to 14 percent slopes, eroded, 2,500 feet south and 300 feet east of the northwest corner of sec. 23, T. 54 N., R. 3 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) gravelly silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many very fine and fine roots; about 20 percent cherty pebbles; slightly acid; clear smooth boundary.

BE—6 to 11 inches; brown (7.5YR 4/4) extremely gravelly silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct silt coatings on faces of peds; about 50 percent cherty pebbles and 20 percent cherty cobbles; moderately acid; clear wavy boundary.

Bt1—11 to 26 inches; yellowish red (5YR 4/6) extremely gravelly silty clay; weak fine angular blocky structure; firm; few very fine roots; common distinct silt coatings and few faint clay films on faces of peds; about 65 percent cherty pebbles and 5 percent cherty cobbles; moderately acid; clear wavy boundary.

Bt2—26 to 32 inches; red (2.5YR 4/6) gravelly clay; moderate fine and medium subangular blocky structure; firm; few very fine roots; many distinct clay films on faces of peds; about 30 percent cherty pebbles; few fine accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt3—32 to 41 inches; red (2.5YR 4/6) gravelly clay; weak medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; about 25 percent cherty pebbles; few fine accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt4—41 to 60 inches; red (2.5YR 4/6) gravelly clay; few fine prominent brown (10YR 5/3) mottles; weak coarse subangular blocky structure; firm; about 15 percent cherty pebbles; few fine accumulations of iron and manganese oxide; strongly acid.

The Ap horizon has chroma of 2 to 4. The content of chert in this horizon ranges from about 15 to 50 percent. The E horizon, if it occurs, has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. The Bt horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 4 to 8. The content of chert in this horizon ranges from about 35 to 80 percent.

Haymond Series

The Haymond series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Haymond silt loam, occasionally flooded, 0 to 3 percent slopes, 1,700 feet north and 2,000 feet east of the southwest corner of sec. 1, T. 52 N., R. 1 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable; common very fine roots; moderately acid; abrupt smooth boundary.

Bw1—8 to 16 inches; dark brown (10YR 4/3) silt loam; weak fine subangular blocky structure; very friable; common very fine roots; neutral; clear smooth boundary.

Bw2—16 to 26 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure; very friable; few fine roots; neutral; clear smooth boundary.

Bw3—26 to 36 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; very friable; few very fine roots; neutral; clear smooth boundary.

C—36 to 60 inches; dark brown (10YR 4/3) silt loam; massive; very friable; few fine accumulations of iron and manganese oxide; neutral.

The Ap horizon has chroma of 2 or 3. The Bw horizon has chroma of 3 or 4. The C horizon has value of 4 or 5 and chroma of 3 or 4.

Healing Series

The Healing series consists of very deep, well drained, moderately permeable soils on foot slopes. These soils formed in alluvium. Slopes range from 1 to 3 percent.

Typical pedon of Healing silt loam, rarely flooded, 1 to 3 percent slopes, 2,100 feet east and 475 feet south of the northwest corner of sec. 1, T. 54 N., R. 4 W.

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; few fine roots; neutral; abrupt smooth boundary.

A—9 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; few fine roots; neutral; clear smooth boundary.

Bt1—15 to 35 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; few fine roots; common distinct organic coatings on faces of peds; neutral; gradual smooth boundary.

Bt2—35 to 45 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common distinct organic coatings on faces of peds; neutral; clear smooth boundary.

Bt3—45 to 48 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; few distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt4—48 to 60 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; few distinct clay films on faces of peds; neutral.

The Ap horizon has chroma of 2 or 3. The Bw horizon has chroma of 3 or 4. The middle part of the series control section averages less than 27 percent clay.

Keswick Series

The Keswick series consists of very deep, moderately well drained, slowly permeable soils on uplands. These soils formed in a thin layer of pedisediments and in the underlying weathered glacial till. Slopes range from 5 to 14 percent.

Typical pedon of Keswick loam, 5 to 9 percent slopes, eroded, 2,270 feet west and 250 feet south of the northeast corner of sec. 29, T. 52 N., R. 4 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

2Bt1—7 to 12 inches; brown (7.5YR 5/4) clay loam; few fine prominent yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; friable; many fine roots; about 1 percent rounded pebbles; strongly acid; clear smooth boundary.

2Bt2—12 to 22 inches; brown (7.5YR 5/4) clay loam; common fine prominent red (2.5YR 5/6) and few fine prominent dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; firm; common fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; strongly acid; clear smooth boundary.

2Bt3—22 to 29 inches; brown (7.5YR 5/4) clay; common fine and medium prominent yellowish red (5YR 5/6) and few fine prominent grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 1 percent rounded pebbles; moderately acid; clear smooth boundary.

2Bt4—29 to 40 inches; yellowish brown (10YR 5/4) clay; few fine distinct yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very firm; common very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; common pebbles; moderately acid; clear smooth boundary.

2Bt5—40 to 60 inches; grayish brown (10YR 5/2) clay; few fine and medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very firm; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; common pebbles; moderately acid.

Some pedons have an E horizon, which has value of 4 or 5 and chroma of 2 or 3. The upper part of the 2Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The lower part of the 2Bt horizon has value of 4 or 5 and chroma of 1 to 6. It is clay loam or clay.

Klum Series

The Klum series consists of very deep, moderately well drained, moderately rapidly permeable soils on flood plains. These soils formed in stratified silty and loamy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Klum loam, sandy substratum, occasionally flooded, 1,800 feet east and 500 feet north of the southwest corner of sec. 11, T. 55 N., R. 3 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; few very fine roots; slightly acid; abrupt smooth boundary.

C1—8 to 20 inches; stratified dark brown (10YR 4/3) and yellowish brown (10YR 5/4) fine sandy loam; massive; very friable; slightly acid; clear smooth boundary.

C2—20 to 29 inches; stratified very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/4) loam and sandy loam; massive; very friable; slightly acid; clear smooth boundary.

C3—29 to 45 inches; stratified dark brown (10YR 4/3), yellowish brown (10YR 5/4), and very dark grayish brown (10YR 3/2) fine sandy loam; very friable; massive; slightly acid; clear smooth boundary.

C4—45 to 60 inches; stratified dark brown (10YR 4/3) and yellowish brown (10YR 5/4) loamy fine sand and loamy sand; few fine prominent strong brown (7.5YR 5/8) mottles; single grain; loose; few fine accumulations of iron and manganese oxide; slightly acid.

The Ap horizon has value and chroma of 2 or 3. The C horizon is silt loam, loam, loamy fine sand, loamy sand, fine sandy loam, or sand.

Leonard Series

The Leonard series consists of very deep, poorly drained, slowly permeable soils on uplands. These soils formed in loess and the underlying pedisediments. Slopes range from 3 to 7 percent.

Typical pedon of Leonard silty clay loam, 3 to 7 percent slopes, eroded, 300 feet south and 900 feet east of the northwest corner of sec. 7, T. 51 N., R. 4 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; very weak fine subangular blocky structure parting to weak fine granular; friable; few very fine roots; neutral; abrupt smooth boundary.

Btg1—7 to 14 inches; dark gray (10YR 4/1) silty clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; firm; few fine roots; common distinct clay films on pressure faces; few fine concretions of iron and manganese oxide; moderately acid; clear smooth boundary.

Btg2—14 to 20 inches; dark gray (10YR 4/1) silty clay; few fine distinct dark yellowish brown (10YR 3/4) mottles; very weak fine subangular blocky structure; very firm; few very fine roots; many distinct clay films on pressure faces; few fine concretions of iron and manganese oxide; moderately acid; clear smooth boundary.

2Btg3—20 to 32 inches; dark gray (10YR 4/1) silty clay; common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate very fine subangular blocky and angular blocky structure; very firm; few very fine roots; many distinct clay films on pressure faces; few fine concretions of iron and manganese oxide; few sand grains; moderately acid; clear smooth boundary.

2Btg4—32 to 45 inches; gray (10YR 5/1) silty clay; common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky and angular blocky structure; very firm; few very fine roots; many distinct clay films on pressure faces; few fine concretions of iron and manganese oxide; common sand grains; slightly acid; clear smooth boundary.

2Btg5—45 to 60 inches; gray (10YR 5/1) silty clay loam; many medium prominent dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky and moderate very fine angular blocky structure; firm; many distinct clay films on pressure faces; common medium concretions of iron and manganese oxide; common sand grains; neutral.

The Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2.

Menfro Series

The Menfro series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in a thick layer of loess. Slopes range from 2 to 50 percent.

Typical pedon of Menfro silt loam, 9 to 14 percent slopes, eroded, 6,200 feet west and 2,800 feet north of the junction of Highway 79 and County Road 202 at Kissinger, Missouri, in the southeastern part of Spanish survey 1709, T. 52 N., R. 1 E., UTM coordinates 4351915m N. and 682854m E., zone 15:

Ap—0 to 4 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many very fine roots; neutral; clear smooth boundary.

Bt1—4 to 9 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; many very fine roots; few distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—9 to 28 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; common very fine roots; common distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Bt3—28 to 39 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine faint pale brown (10YR 6/3) mottles; weak fine subangular blocky structure; friable; common very fine roots; few faint clay films on faces of peds; slightly acid; clear smooth boundary.

C—39 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; common fine faint pale brown (10YR 6/3) mottles; massive; friable; few very fine roots; few fine concretions of iron and manganese oxide; moderately acid.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an E horizon, which has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR and chroma of 3 or 4. It is dominantly silty clay loam, but the range includes silt loam.

Mexico Series

The Mexico series consists of very deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in loess and the underlying pedisediments. Slopes range from 1 to 5 percent.

Typical pedon of Mexico silt loam, 1 to 5 percent slopes, 2,400 feet west and 875 feet north of the southeast corner of sec. 27, T. 53 N., R. 3 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

E—9 to 13 inches; grayish brown (10YR 5/2) silt loam; weak thin platy structure; friable; few fine roots; few fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Bt/E—13 to 17 inches; brown (10YR 5/3) and strong brown (7.5YR 5/6) silty clay loam (Bt); weak fine subangular blocky structure; friable; light brownish gray (10YR 6/2) silt loam (E) occurring as common thick silt coatings on faces of peds and as fillings in vertical cracks; friable; common fine prominent red (2.5YR 4/6) mottles; few fine roots; few fine distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt1—17 to 24 inches; grayish brown (10YR 5/2) silty clay; many medium prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt2—24 to 30 inches; grayish brown (10YR 5/2) silty clay; many medium prominent brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt3—30 to 39 inches; gray (10YR 5/1) silty clay; few fine prominent dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

2C—39 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; few fine faint brown (10YR 4/3) mottles; massive; firm; few fine accumulations of iron and manganese oxide; few sand grains; moderately acid.

The Ap horizon has chroma of 2 or 3. It is silt loam or silty clay loam. The Bt horizon has value of 4 or 5 and chroma of 1 to 4. It is silty clay or silty clay loam.

Minnith Series

The Minnith series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in loamy material weathered from sandstone. Slopes range from 5 to 9 percent.

Typical pedon of Minnith silt loam, 5 to 9 percent slopes, eroded, 4,500 feet east and 700 feet north of the junction of Highway D and Highway WW in the southeastern part of Spanish survey number 1762, T. 52 N., R. 1 W., UTM coordinate 4350549m N. and 674396m E., zone 15:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

BE—7 to 12 inches; brown (10YR 4/3) silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable; common fine and medium roots; neutral; clear smooth boundary.

Bt1—12 to 18 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; common fine and medium roots; few distinct clay films and common distinct silt coatings on faces of peds; moderately acid; clear smooth boundary.

Bt2—18 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine angular blocky and moderate fine subangular blocky structure; friable; few fine roots; few distinct clay films and common distinct silt coatings on faces of peds; few fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Bt3—26 to 31 inches; strong brown (7.5YR 4/6) silty clay loam; weak fine angular blocky and moderate fine subangular blocky structure; friable; few fine roots; few distinct silt coatings on faces of peds; common medium accumulations of iron and manganese oxide; few fine sand grains; moderately acid; clear smooth boundary.

Bt4—31 to 60 inches; strong brown (7.5YR 4/6) silty clay loam; weak medium subangular blocky structure; friable; common fine accumulations of iron and manganese oxide; common sand grains; strongly acid.

The Ap horizon has chroma of 2 or 3. The E horizon, if it occurs, has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

Moniteau Series

The Moniteau series consists of very deep, poorly drained, moderately slowly permeable soils on high flood plains. These soils formed in alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Moniteau silt loam, occasionally flooded, 0 to 3 percent slopes, 3,500 feet west and 6,000 feet north of the junction of Highway H and Highway 79 at Annada, Missouri, T. 52 N., R. 1 E., UTM coordinates 4349763m N. and 686366m E., zone 15:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

E1—8 to 15 inches; grayish brown (10YR 5/2) silt loam; few fine faint brown (10YR 5/3) mottles; weak thin platy structure; friable; common fine roots; few fine distinct organic films on faces of peds; few fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

E2—15 to 20 inches; light brownish gray (10YR 6/2) silt loam, white (10YR 8/2) dry; common fine distinct light yellowish brown (10YR 6/4) mottles; moderate thin platy structure; friable; few very fine roots; few fine distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; moderately acid; clear smooth boundary.

Btg1—20 to 24 inches; grayish brown (10YR 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few very fine roots; few fine distinct silt coatings on faces of peds; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg2—24 to 32 inches; grayish brown (10YR 5/2) silty clay loam; common fine and medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few very fine roots; few fine distinct silt coatings and common fine distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg3—32 to 43 inches; gray (10YR 5/1) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; friable; few very fine roots; few fine distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg4—43 to 60 inches; gray (10YR 5/1) silty clay loam; common fine distinct dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; friable; few fine distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; moderately acid.

The Ap horizon has chroma of 1 or 2. The E horizon has value of 5 to 7. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silt loam.

Okaw Series

The Okaw series consists of very deep, poorly drained, very slowly permeable soils on high terraces. These soils formed in a thin mantle of loess over alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Okaw silt loam, rarely flooded, 0 to 3 percent slopes, 1,800 feet west and 290 feet north of the southeast corner of sec. 7, T. 51 N., R. 3 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

E—8 to 15 inches; grayish brown (10YR 5/2) silt loam, light gray (2.5Y 7/2) dry; weak thin platy structure; friable; few fine roots; common fine and medium concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Btg1—15 to 22 inches; grayish brown (10YR 5/2) silty clay; common fine prominent dark yellowish brown (10YR 4/6) and few fine prominent yellowish brown (10YR 5/6) mottles; weak fine prismatic structure; firm; few fine roots; common distinct silt coatings and common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg2—22 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; friable; few very fine roots; common distinct clay films on faces of peds; common fine and medium accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Btg3—32 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common coarse prominent dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; friable; few very fine roots; common distinct clay films on faces of peds; common medium accumulations of iron and manganese oxide; moderately acid.

The Ap horizon has chroma of 1 or 2. The E horizon has value of 5 or 6. The Btg horizon has value of 4 or 5.

Putnam Series

The Putnam series consists of very deep, poorly drained, very slowly permeable soils on uplands. These soils formed in loess. Slopes are 0 to 1 percent.

Typical pedon of Putnam silt loam, 1,900 feet west and 100 feet south of the northeast corner of sec. 25, T. 53 N., R. 4 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common very fine roots; slightly acid; clear smooth boundary.

E—9 to 17 inches; grayish brown (10YR 5/2) silt loam; common fine prominent reddish brown (5YR 5/4) mottles; moderate thin platy structure; friable; few very fine roots; moderately acid; clear smooth boundary.

Btg1—17 to 23 inches; dark grayish brown (10YR 4/2) clay; common fine and medium prominent reddish brown (5YR 5/4) and few fine and medium prominent yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg2—23 to 29 inches; dark grayish brown (10YR 4/2) silty clay; common fine and medium prominent reddish brown (5YR 5/4) mottles; moderate fine and medium subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg3—29 to 35 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silty clay; few fine prominent yellowish brown (10YR 5/6) and common fine prominent brown (7.5YR 5/4) mottles; weak fine subangular blocky structure; firm; few very fine roots; common distinct clay films on faces of peds; common fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Btg4—35 to 41 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; common medium accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Cg—41 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent brown (7.5YR 5/4) mottles; massive; friable; common medium accumulations of iron and manganese oxide; moderately acid.

The E horizon has value of 5 or 6 and chroma of 1 or 2. The Btg horizon has chroma of 1 or 2. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Ranacker Series

The Ranacker series consists of shallow, well drained, moderately slowly permeable soils on uplands. These soils formed in material weathered from limestone. Slopes range from 9 to 14 percent.

Typical pedon of Ranacker flaggy silty clay loam, 9 to 14 percent slopes, 5,780 feet north and 650 feet east of the junction of Highway OO and County Road 186, west of Eolia, Missouri, in the northwestern part of Spanish survey 1727, T. 52 N., R. 2 W., UTM coordinates 43445649m N. and 665628m E., zone 15:

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) flaggy silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; firm; common fine roots; about 15 percent limestone flagstones; neutral; clear smooth boundary.

A—4 to 9 inches; very dark grayish brown (10YR 3/2) flaggy silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; common fine roots; about 20 percent limestone flagstones; neutral; clear wavy boundary.

Bt—9 to 18 inches; reddish brown (5YR 4/4) very flaggy silty clay; moderate fine subangular blocky structure; firm; few very fine roots; many distinct clay films on faces of peds; about 30 percent limestone flagstones and 25 percent cherty pebbles; neutral; clear wavy boundary.

R—18 inches; limestone bedrock.

The depth to bedrock ranges from 10 to 20 inches. The Ap and A horizons have value of 2 or 3 and chroma of 1 to 3. The Bt horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 or 4. It is the very flaggy analogs of silty clay loam or silty clay.

Tice Series

The Tice series consists of very deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Tice silt loam, occasionally flooded, 5,280 feet west and 300 feet north of the junction of Highway H and Highway 79 at Annada, Missouri, T. 52 N., R. 1 E., UTM coordinates 4347854m N. and 685763m E., zone 15:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; very friable; few fine roots; neutral; clear smooth boundary.

A—9 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine roots; neutral; clear smooth boundary.

Bw1—15 to 26 inches; brown (10YR 4/3) silt loam; common fine faint dark grayish brown (10YR 4/2) and few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; neutral; clear smooth boundary.

Bw2—26 to 40 inches; brown (10YR 4/3) silt loam; common medium faint dark grayish brown (10YR 4/2) and few fine faint dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; few fine roots; neutral; few sand grains; clear smooth boundary.

Bg—40 to 60 inches; dark grayish brown (10YR 4/2) silt loam; common fine distinct dark yellowish brown (10YR 4/4) and few fine faint dark gray (10YR 4/1) mottles; weak medium subangular blocky structure; friable; few sand grains; neutral.

The thickness of the mollic epipedon ranges from 10 to 24 inches. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has value of 4 or 5 and chroma of 2 or 3.

Twomile Series

The Twomile series consists of very deep, poorly drained, slowly permeable soils on high flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Twomile silt loam, occasionally flooded, 2,200 feet east and 500 feet south of the northwest corner of sec. 31, T. 51 N., R. 4 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common very fine roots; moderately acid; clear smooth boundary.

Eg1—10 to 15 inches; grayish brown (10YR 5/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate thin platy structure; friable; common very fine roots; moderately acid; clear smooth boundary.

Eg2—15 to 20 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate thin platy structure; friable; common very fine roots; moderately acid; clear smooth boundary.

Egx—20 to 25 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate thin platy structure parting to weak very fine subangular blocky; firm; weakly brittle; few very fine roots; few fine accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

Btg1—25 to 28 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; friable; few very fine roots; common distinct silt coatings and few distinct clay films on faces of peds; common fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Btg2—28 to 32 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate fine angular blocky structure parting to weak very fine subangular blocky; friable; few distinct silt coatings and common distinct clay films on faces of peds; common fine concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Btg3—32 to 38 inches; grayish brown (10YR 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; common distinct clay films on faces of peds; common fine and medium concretions of iron and manganese oxide; very strongly acid; clear smooth boundary.

Btg4—38 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; common fine faint light gray (10YR 7/1) and few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; few distinct clay films on faces of peds; common fine and medium concretions of iron and manganese oxide; very strongly acid.

The E horizon has value of 4 to 6 and chroma of 1 or 2. The Btg horizon has value of 4 to 6.

Vanmeter Series

The Vanmeter series consists of moderately deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in calcareous material weathered from shale. Slopes range from 14 to 35 percent.

Typical pedon of Vanmeter silty clay loam, 14 to 35 percent slopes, eroded, 3,200 feet east and 1,400 feet north of the southwest corner of sec. 6, T. 54 N., R. 2 W.

Ap—0 to 4 inches; mixed dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silty clay loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few fine roots; neutral; clear smooth boundary.

Bw1—4 to 14 inches; brown (7.5YR 4/4) and light olive gray (5Y 6/2) silty clay; moderate fine subangular blocky structure; firm; few fine roots; neutral; clear smooth boundary.

2Bw2—14 to 25 inches; olive (2.5Y 5/3) silty clay; few fine prominent brown (7.5YR 4/4) and common fine distinct gray (5Y 5/1) mottles; weak fine prismatic structure; firm; few fine roots; neutral; clear smooth boundary.

2Bw3—25 to 31 inches; gray (2.5Y 5/1) silty clay; few fine prominent light olive brown (2.5Y 5/4) mottles; weak thin platy structure; firm; few fine roots; slight effervescence; slightly alkaline; about 30 percent soft shale fragments; clear smooth boundary.

Cr—31 to 60 inches; shale bedrock.

The Bw horizon has hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is silty clay or silty clay loam.

Wakenda Series

The Wakenda series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 9 percent.

Typical pedon of Wakenda silt loam, 2 to 5 percent slopes, 900 feet north and 700 feet east of the southwest corner of sec. 31, T. 53 N., R. 1 E.

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

A—7 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to very weak fine granular; many fine roots; friable; moderately acid; clear smooth boundary.

AB—14 to 21 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bt1—21 to 31 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—31 to 41 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt3—41 to 47 inches; yellowish brown (10YR 5/4) silt loam; common fine and medium distinct grayish brown (10YR 5/2) mottles; very weak medium subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

C—47 to 60 inches; yellowish brown (10YR 5/4) silt loam; common fine and medium faint brown (10YR 5/3) mottles; massive; friable; few fine accumulations of iron and manganese oxide; moderately acid.

The thickness of the mollic epipedon ranges from 16 to 21 inches. The Bt horizon has value of 4 or 5 and chroma of 2 to 4.

Weller Series

The Weller series consists of very deep, moderately well drained, slowly permeable soils on uplands. These soils formed in loess. Slopes range from 1 to 5 percent.

Typical pedon of Weller silt loam, 1 to 5 percent slopes, 2,500 feet north and 2,000 feet west of the southeast corner of sec. 26, T. 54 N., R. 3 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

E—4 to 8 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak thin platy structure; friable; common very fine roots; few fine accumulations of iron and manganese oxide; slightly acid; abrupt smooth boundary.

Bt1—8 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films and common distinct silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt2—15 to 24 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common distinct clay films and common distinct silt coatings on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt3—24 to 34 inches; brown (10YR 5/3) silty clay; few fine faint grayish brown (10YR 5/2) and common fine distinct dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; common fine accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Bt4—34 to 46 inches; light brownish gray (10YR 6/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; many fine and medium accumulations of iron and manganese oxide; moderately acid; clear smooth boundary.

Bt5—46 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; common fine and medium prominent dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; many fine accumulations of iron and manganese oxide; moderately acid.

The A horizon has value of 4 or 5 and chroma of 1 to 3. The E horizon has value of 4 or 5 and chroma of 2 or 3. The upper part of the Bt horizon commonly has value of 4 or 5. The lower part of the Bt horizon commonly has value of 4 to 6 and chroma of 2 to 6.

Winfield Series

The Winfield series consists of very deep, moderately well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 14 percent.

Typical pedon of Winfield silt loam, 5 to 9 percent slopes, eroded, 1,200 feet west and 500 feet north of the southeast corner of sec. 17, T. 53 N., R. 1 W.

Ap—0 to 7 inches; mixed dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/4) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; common fine roots; moderately acid; abrupt smooth boundary.

Bt1—7 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; common fine roots; moderately acid; clear smooth boundary.

Bt2—13 to 23 inches; dark brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; few very fine roots; common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt3—23 to 31 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; few very fine roots; common distinct clay films on faces of peds; few fine accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

BC—31 to 46 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few very fine roots; few distinct clay films on faces of peds; common fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Cg—46 to 60 inches; light brownish gray (10YR 6/2) silt loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; massive; friable; common fine accumulations of iron and manganese oxide; moderately acid.

The Ap horizon has chroma of 2 or 3. Some pedons have an E horizon, which has value of 4 to 6 and chroma of 2 to 4. The Bt horizon has value of 4 to 6 and chroma of 2 to 6. It is silty clay loam or silt loam. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4.

Formation of the Soils

Soils are continually changing. The characteristics of a soil at any given point are determined by the physical and mineralogical composition of the parent material; the living organisms on and in the soil; the climate under which the soil material accumulated and has existed since accumulation; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Parent material is the unconsolidated mass in which a soil forms. Weathering and biological processes influence formation of the soil. The parent material largely determines the composition of the soil profile, particularly in terms of texture and natural fertility. Biological processes are the actions of plants and animals, which range from micro-organisms to human beings. They affect the content of organic matter, which in turn affects the structure and porosity of the soil. Climate influences the amount and types of biological activity and determines moisture and temperature, which affect the rate of soil development. Relief modifies the effects of other soil-forming processes. For example, soil development tends to be greater on level ground than on a slope. Time influences the degree of development of a soil profile. Horizon differentiation is generally a very slow process, and the appearance of the soil profile is affected by how long the parent material has been in place.

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

Four main kinds of parent material influence the soils in the county. They are loess, or material deposited by wind; alluvium, or material deposited by water; glacial till, or material deposited by glaciers; and residuum, or material derived from bedrock *(18)*.

The loess, which consists of silt and clay, was carried by wind from the flood plains along the major rivers after the retreat of continental glaciers. The last glacial retreat was about 12,000 years ago. In some of the uplands that are within 10 miles of the Mississippi River, the loess is more than 20 feet thick *(5, 8, 9)*. Winfield and Menfro soils developed in this parent material. They have a high content of silt.

Generally, the layer of loess is thinner and the particles of loess are finer textured in areas that are at a greater distance from the river *(8, 9)*. Many soils formed in a thin layer of loess and in the underlying material. Mexico, Calwoods, and Gorin soils, which are in the uplands, have a layer of fine textured loess that is 20 to 35 inches thick. This loess was probably derived from areas along the Missouri River and was deposited by the prevailing winds.

The alluvium near streams is often a mixture of stones and finer particles *(9, 18)*. Dameron and Cedargap soils formed in chert, sand, silt, or clay that was eroded and transported by water from areas in the adjacent uplands. The stratification of the parent material in Belknap and Klum soils indicates that sedimentation from periodic flooding currently is faster than the other soil-forming processes. Other soils on bottom land formed in similar landscape positions, but the parent material of these soils has had more opportunity to undergo weathering and structural development. Examples of these soils are the Tice and Healing soils.

The soils on terraces adjacent to the flood plains also formed in alluvium. These remnants of previous flood plains were carved by the meandering of streams and rivers as they developed newer flood plains at the lower elevations. Bremer and Okaw soils are on terraces.

The very silty Dockery and Belknap soils are the dominant soils on the natural levees next to the Mississippi and Salt Rivers. The sandy Klum soils are also on the levees. When the water level is high, sand and silt precipitate quickly. When the water recedes, they accumulate near the edge of the river. Clay remains in suspension longer and precipitates more slowly. It settles in sloughs and other depressional areas. The clayey Carlow and Chequest soils formed in these areas.

Glacial till is a mixture of separates ranging in size from stones to clay. It generally is in the central and western parts of Pike County. It was deposited by glaciers after being transported from nearby areas and from areas as far away as Minnesota and Canada during the pre-Illinoian ice age. This ice age ended about half a million years ago. Subsequent glaciations did not cover the county. Minerals in the till include quartzite, basalt, diorite, and granite, none of which originated locally *(8, 9)*. Armstrong and Keswick soils formed mainly in glacial till.

The source of the residuum in the county is a succession of horizontal beds of alternating shale and limestone. These strata were exposed by the cutting action of streams that are mainly in the eastern part of the county and that flow toward the Mississippi River. The process possibly began about 1 million years ago *(18, 24)*. The knobs in the southeastern part of the county are remnants of uplands that have been mostly washed away. Bucklick soils formed in a thin layer of loess and in the underlying clayey material or limestone and shale residuum. Goss and Ranacker soils formed in chert and limestone residuum. Vanmeter soils formed in shale residuum.

In a few areas on uplands, limestone bedrock has been dissolved in irregular patterns by weathering, resulting in the formation of sinkholes *(9)*. Crider soils are in these areas. Their development was affected by this weathering process.

Living Organisms

Soil structure is altered by the growth of plant roots, which break up aggregates within the soil profile. Microflora (bacteria, fungi, and actinomycetes) are the primary agents of decomposition of plant roots and surface residue, such as fallen leaves, dead plants and animals, and animal waste. This decomposition involves the breakdown and conversion of raw organic matter to complex organic compounds and the production of humus *(3)*.

Humus is resistant to further microbial change. It significantly influences many soil properties. Humus-rich soils have a dark brown or black color, a strong granular structure, and enhanced natural fertility. Humus retains plant nutrients, such as nitrogen, phosphorus, and sulfur, and has a high available water capacity *(3)*.

Other organisms involved in soil formation include microfauna, such as nematodes and protozoa, and macrofauna, such as centipedes, earthworms, insects, and, to a lesser degree, rodents. Microfauna feed on microflora and plants. As a result, they affect the degree and complexity of vegetative decomposition. Macrofauna contribute to organic matter conversions in many ways. They physically break up plant residue into smaller components, thereby accelerating the production of humus *(3)*.

Earthworms are particularly important in the process of soil formation. They mix the soils and produce tunnels, which enhance soil aeration and percolation *(3, 5)*.

Soil profile development varies considerably with the type of vegetation that is growing on the soil. Soils formed under forest cover and soils formed under grasses contrast in the county.

In forested areas, most of the organic matter is concentrated at the surface, where a litter of fallen leaves and other debris is continually decomposing and being replenished. The decomposed material produces strong natural acids. When percolated downward in the soil, the acids break down minerals and organic matter. This process accelerates leaching in the subsurface layer, lowering the natural fertility in that zone. The clay tends to accumulate in an argillic horizon *(3, 5)*. Calwoods and Gorin soils formed in forested areas.

In areas of grassland, a high concentration of fibrous roots accumulates within a few feet of the surface. These roots tend to grow rapidly and then die, providing a large resource for the production of humus in that zone. Without the acid leachate of a forest litter, minerals and organic matter tend to remain within the root zone. Consequently, the topsoil is very dark, natural fertility and the water-holding capacity are high, and leaching of clay is slowed by highly mobile biological activity *(5)*. As a result, a mollic epipedon is formed. Wakenda and Healing soils have a mollic epipedon.

Most of the soils in the county formed under forest cover; however, during some periods, even before human settlement in the area, some of these same soils were also covered by prairie grasses. Examples are the Mexico and Putnam soils, which have a prominent argillic horizon and a very dark, granular topsoil.

Human activity has had an immediate and significant impact on soil characteristics in the county. Large areas of forest have been cleared for pasture or row crops. As a result, biological activity in the soil has been altered. Generally, this alteration means a reduction in organic matter content because of the effects of soil erosion and crop removal. When topsoil is removed, the remaining surface layer has poor tilth and is difficult to work, especially in areas where the surface layer is clayey.

Climate

Soil formation is greatly influenced by climate in direct and indirect ways. Temperature and moisture affect the rate of weathering of parent material and determine the amount of organic matter that can accumulate. Climate affects the types of living organisms and their population in the area. It also affects the type of parent material that is present. For example, till and loess are a product of the glacial periods. The type and extent of alluvial deposits are influenced by river flows that are in turn influenced by the climate.

In the past, the prevailing climate has been temperate. Wide variations in temperature between winter and summer were typical. Drought and times of high precipitation occurred. The native vegetation of this climate was a mosaic of prairie and forest environments that competed vigorously with each other for territory. During the early settlement period, the environment of the area shifted toward a wetter climate that produced a more forested environment *(10)*.

The climate in the area today tends toward seasonally fluctuating soil moisture, often having a dry period during the late summer and early fall and some degree of wetness during the rest of the year. As a result, silicate clays leach out of the soil and accumulate in films on the surface of aggregates in the subsoil. This clay accumulation, or argillic horizon, is found in most upland soils of the county.

Relief

Various geologic forces have influenced the landscape in Pike County. The county exhibits a broad range of landform shapes, slope, and orientation. These factors influence soil formation in several ways.

In sloping areas, water tends to run down hills rather than percolating into the soil. As a result, soil-forming processes are inhibited and erosion is accelerated, so that soils on back slopes are often more shallow and stonier than those on summits. Mexico and Putnam soils, which have a thick layer of fine textured loess, are on broad upland interfluves. Armstrong and Keswick soils are in adjacent areas on side slopes and head slopes. The layer of loess is considerably thinner in these areas. Further downslope, Goss soils are deep and very gravelly and Ranacker soils are very shallow and flaggy. Geologic erosion has differentially removed the silt and clay, leaving the gravel and flagstones behind.

Soil porosity and drainage also are affected by the shape of the landscape. Menfro and Winfield soils formed in deep loess and mainly differ in internal drainage. Menfro soils are on convex side slopes and back slopes. They are well drained. The adjacent Winfield soils are on concave side slopes. They are moderately well drained.

Time

The stage of development of a soil depends in part on when soil formation began. Initiation of a soil-forming cycle is associated with geologic events, such as glaciation, and local events leading to rapid erosion and deposition *(3)*.

Soil development is generally more efficient during times of climatic and geological stability *(7)*. Crider, Bucklick, and Goss soils are the oldest soils in the county. They formed mainly in limestone residuum. Genesis of these soils dates back at least 100,000 years to the interglacial periods, when the climate was similar to that of the present or possibly warmer *(5, 18)*. The red color and the depth of clay accumulations in these soils are indications of a high degree of mineral weathering.

Development of other soils in the county began with the retreat of the pre-Illinoian ice sheet. These soils include the Armstrong, Calwoods, Gorin, and Mexico soils. For these soils, the formation process was changed when fine textured loess was deposited *(24)*. These soils are characterized the development of a distinct argillic horizon, but they have not undergone the degree of weathering and leaching of nutrients that has taken place in the Goss and Crider soils.

Menfro and Winfield soils, which formed in the thick layer of silty loess near the Mississippi River, are less developed than the finer textured loess soils in the western part of the county. The loess in which the Menfro and Winfield soils formed was deposited during the Wisconsin Glaciation, between 12,000 and 80,000 years ago.

The youngest soils are in areas where periodic flooding leads to deposition of new parent material. For example, Belknap and Dockery soils have sedimentary planes in their profiles and have undergone very little horizon development.

The rate at which a soil develops is dependent on the other four soil-forming factors. Therefore, the appearance of the soil profile, while revealing the stage of development, is not always a good indicator of the age of the soil in terms of the number of years.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least composed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

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.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material

deposited by streams flowing from glaciers.
Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.
Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.
Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.
Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.
Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 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 the material below the water table.
Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.
Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.
Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.
Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.
Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.
Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

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.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

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, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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 drawbar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

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-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, 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.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded 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 a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-88 at Elsberry, Missouri)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	36.9	16.1	26.5	67	-15	7	1.50	0.52	2.30	4	5.5
February----	42.5	21.2	31.9	72	-9	13	1.88	.93	2.72	5	4.4
March-------	53.2	30.8	42.0	86	5	56	3.15	1.61	4.49	7	2.8
April-------	67.0	42.7	54.9	89	21	191	3.69	2.16	5.04	7	.4
May---------	76.8	51.6	64.2	92	33	446	3.94	2.12	5.54	8	.0
June--------	85.7	61.0	73.4	98	43	702	3.62	1.63	5.33	6	.0
July--------	89.8	65.0	77.4	102	48	849	3.87	1.62	5.76	6	.0
August------	87.9	62.9	75.4	102	47	787	3.51	1.27	5.36	5	.0
September---	81.0	54.9	68.0	98	35	540	3.35	1.32	5.04	5	.0
October-----	69.3	42.9	56.1	89	22	228	3.04	1.22	4.56	5	.0
November----	54.5	32.4	43.5	81	10	30	2.76	1.18	4.10	5	1.1
December----	41.8	22.5	32.2	70	-6	12	2.74	1.03	4.16	5	3.5
Yearly:											
Average---	65.5	42.0	53.8	---	---	---	---	---	---	---	---
Extreme---	---	---	---	104	-17	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,861	37.05	31.24	43.07	68	17.7

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-88 at Elsberry, Missouri)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 14	Apr. 22	May 6
2 years in 10 later than--	Apr. 9	Apr. 18	May 1
5 years in 10 later than--	Mar. 31	Apr. 10	Apr. 21
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 19	Oct. 11	Sept. 29
2 years in 10 earlier than--	Oct. 25	Oct. 16	Oct. 4
5 years in 10 earlier than--	Nov. 5	Oct. 25	Oct. 13

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-88 at Elsberry, 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	195	180	155
8 years in 10	203	186	161
5 years in 10	217	197	174
2 years in 10	232	208	187
1 year in 10	240	214	193

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
10	Bremer silty clay loam, rarely flooded	960	0.2
11	Chequest silty clay loam, occasionally flooded	8,455	1.9
12C2	Armstrong loam, 3 to 7 percent slopes, eroded	22,200	5.0
13	Tice silt loam, occasionally flooded	7,890	1.8
14	Belknap silt loam, occasionally flooded	10,810	2.5
15B	Gorin silt loam, 2 to 5 percent slopes	12,600	2.9
15C2	Gorin silt loam, 5 to 9 percent slopes, eroded	6,785	1.5
16F2	Vanmeter silty clay loam, 14 to 35 percent slopes, eroded	2,405	0.5
17D2	Goss gravelly silt loam, 9 to 14 percent slopes, eroded	13,635	3.1
17F	Goss very gravelly silt loam, 14 to 50 percent slopes, very stony	54,220	12.4
18C2	Keswick loam, 5 to 9 percent slopes, eroded	44,600	10.2
18D	Keswick loam, 9 to 14 percent slopes	9,050	2.1
20C2	Leonard silty clay loam, 3 to 7 percent slopes, eroded	2,285	0.5
23B	Menfro silt loam, 2 to 5 percent slopes	3,510	0.8
23C2	Menfro silt loam, 5 to 9 percent slopes, eroded	10,895	2.5
23D2	Menfro silt loam, 9 to 14 percent slopes, eroded	12,295	2.8
23E2	Menfro silt loam, 14 to 20 percent slopes, eroded	3,620	0.8
23F	Menfro silt loam, 20 to 50 percent slopes	3,845	0.9
24B	Mexico silt loam, 1 to 5 percent slopes	36,520	8.3
24B2	Mexico silty clay loam, 2 to 5 percent slopes, eroded	23,955	5.5
25A	Moniteau silt loam, occasionally flooded, 0 to 3 percent slopes	5,960	1.4
26	Putnam silt loam	7,880	1.8
30B	Weller silt loam, 1 to 5 percent slopes	2,505	0.6
31B	Winfield silt loam, 2 to 5 percent slopes	10,840	2.5
31C2	Winfield silt loam, 5 to 9 percent slopes, eroded	23,535	5.4
31D2	Winfield silt loam, 9 to 14 percent slopes, eroded	4,095	0.9
32	Carlow silty clay, occasionally flooded	6,000	1.4
34D	Bucklick silt loam, 9 to 14 percent slopes	2,870	0.6
35A	Okaw silt loam, rarely flooded, 0 to 3 percent slopes	5,660	1.3
36D	Ranacker flaggy silty clay loam, 9 to 14 percent slopes	1,305	0.3
38	Chequest silty clay loam, frequently flooded	2,070	0.5
41	Klum loam, sandy substratum, occasionally flooded	4,005	0.9
45C2	Minnith silt loam, 5 to 9 percent slopes, eroded	2,955	0.7
46	Pits, quarries	467	0.1
47	Twomile silt loam, occasionally flooded	7,345	1.7
48	Dockery silt loam, frequently flooded	8,515	1.9
50A	Dameron-Cedargap complex, 0 to 3 percent slopes	6,350	1.5
51A	Haymond silt loam, occasionally flooded, 0 to 3 percent slopes	1,270	0.3
55	Blackoar silt loam, occasionally flooded	5,480	1.3
74A	Healing silt loam, rarely flooded, 1 to 3 percent slopes	2,505	0.6
77B	Calwoods silt loam, 1 to 5 percent slopes	13,610	3.1
78	Dupo silt loam, occasionally flooded	2,215	0.5
86	Udorthents, sloping	920	0.2
87C2	Crider silt loam, karst, undulating, eroded	3,215	0.7
88C2	Crider silt loam, 5 to 9 percent slopes, eroded	4,125	0.9
88D2	Crider silt loam, 9 to 14 percent slopes, eroded	805	0.2
90B	Wakenda silt loam, 2 to 5 percent slopes	2,455	0.6
90C	Wakenda silt loam, 5 to 9 percent slopes	1,445	0.3
	Water areas more than 40 acres in size	6,976	1.6
	Total	437,913	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
10	Bremer silty clay loam, rarely flooded (where drained)
11	Chequest silty clay loam, occasionally flooded (where drained)
13	Tice silt loam, occasionally flooded
14	Belknap silt loam, occasionally flooded (where drained)
15B	Gorin silt loam, 2 to 5 percent slopes
20C2	Leonard silty clay loam, 3 to 7 percent slopes, eroded (where drained)
23B	Menfro silt loam, 2 to 5 percent slopes
24B	Mexico silt loam, 1 to 5 percent slopes (where drained)
24B2	Mexico silty clay loam, 2 to 5 percent slopes, eroded (where drained)
25A	Moniteau silt loam, occasionally flooded, 0 to 3 percent slopes (where drained)
26	Putnam silt loam (where drained)
30B	Weller silt loam, 1 to 5 percent slopes
31B	Winfield silt loam, 2 to 5 percent slopes
32	Carlow silty clay, occasionally flooded (where drained)
35A	Okaw silt loam, rarely flooded, 0 to 3 percent slopes (where drained)
38	Chequest silty clay loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
41	Klum loam, sandy substratum, occasionally flooded
47	Twomile silt loam, occasionally flooded (where drained)
48	Dockery silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
50A	Dameron-Cedargap complex, 0 to 3 percent slopes (where protected from flooding or not frequently flooded during the growing season)
51A	Haymond silt loam, occasionally flooded, 0 to 3 percent slopes
55	Blackoar silt loam, occasionally flooded (where drained)
74A	Healing silt loam, rarely flooded, 1 to 3 percent slopes
77B	Calwoods silt loam, 1 to 5 percent slopes (where drained)
78	Dupo silt loam, occasionally flooded
90B	Wakenda silt loam, 2 to 5 percent slopes

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-alfalfa hay	Orchardgrass-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
10-------------- Bremer	IIw	127	42	100	51	3.0	4.4	8.5
11-------------- Chequest	IIw	117	37	88	45	3.0	3.9	7.5
12C2------------ Armstrong	IIIe	90	30	71	36	3.0	3.2	6.0
13-------------- Tice	IIw	135	45	106	54	4.5	4.6	9.0
14-------------- Belknap	IIw	127	42	100	51	4.3	4.4	8.5
15B------------- Gorin	IIe	89	33	79	37	3.0	3.3	6.6
15C2------------ Gorin	IIIe	82	27	65	33	2.8	2.9	5.5
16F2------------ Vanmeter	VIIe	---	---	---	---	---	---	3.0
17D2------------ Goss	VIe	---	---	---	---	---	---	3.8
17F------------- Goss	VIIe	---	---	---	---	---	---	3.0
18C2------------ Keswick	IIIe	92	30	71	36	3.5	3.6	6.0
18D------------- Keswick	IVe	82	27	65	33	2.5	2.7	5.5
20C2------------ Leonard	IIIe	80	26	64	32	2.3	3.0	5.3
23B------------- Menfro	IIe	120	40	94	48	4.0	4.4	8.0
23C2------------ Menfro	IIIe	105	35	83	42	3.5	3.6	7.0
23D2------------ Menfro	IIIe	90	30	72	36	3.2	3.3	6.0
23E2------------ Menfro	IVe	82	27	65	33	2.8	2.9	5.6
23F------------- Menfro	VIIe	---	---	---	---	---	---	2.9
24B------------- Mexico	IIe	105	35	85	43	3.5	3.6	7.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-alfalfa hay	Orchardgrass-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
24B2----------- Mexico	IIIe	97	33	80	40	3.0	3.0	6.0
25A------------ Moniteau	IIIw	112	37	88	45	---	3.7	7.4
26------------- Putnam	IIw	107	25	65	30	---	---	6.5
30B------------ Weller	IIIe	109	35	83	42	3.3	3.5	7.0
31B------------ Winfield	IIe	127	42	101	51	4.1	4.3	8.5
31C2----------- Winfield	IIIe	112	37	89	43	3.7	3.8	7.5
31D2----------- Winfield	IIIe	97	32	77	45	3.7	3.8	6.5
32------------- Carlow	IIIw	96	31	76	39	---	3.2	---
34D------------ Bucklick	IVe	75	25	59	30	2.5	2.7	5.4
35A------------ Okaw	IIIw	84	28	62	41	---	---	---
36D------------ Ranacker	VIs	---	---	---	---	---	---	3.0
38------------- Chequest	Vw	---	---	---	---	---	---	---
41------------- Klum	IIs	103	35	80	36	3.0	3.0	4.5
45C2----------- Minnith	IIIe	105	36	83	42	3.5	3.5	7.0
46**. Pits								
47------------- Twomile	IIIw	90	30	71	36	---	3.0	6.0
48------------- Dockery	IVw	---	22	37	---	---	---	---
50A:								
Dameron---------	IIw	80	30	70	40	2.8	3.2	7.0
Cedargap--------	IIIw	72	25	58	30	---	2.7	6.5
51A------------ Haymond	IIw	110	39	86	42	3.7	3.9	8.0
55------------- Blackoar	IIw	135	45	106	54	3.0	4.4	8.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchard-grass-alfalfa hay	Orchardgrass-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	Tons	AUM*
74A------------- Healing	IIe	85	30	90	42	4.3	4.3	8.5
77B------------- Calwoods	IIe	90	34	80	37	3.5	3.5	7.0
78-------------- Dupo	IIIw	92	30	82	39	2.8	3.6	7.1
86**------------ Udorthents	VIe	---	---	---	---	---	---	3.8
87C2------------ Crider	IIIe	105	35	66	42	3.0	3.2	6.5
88C2------------ Crider	IIIe	95	30	71	36	3.0	3.1	6.2
88D2------------ Crider	IVe	92	28	69	34	2.8	2.9	6.0
90B------------- Wakenda	IIe	140	45	110	57	4.8	4.9	9.5
90C------------- Wakenda	IIIe	130	42	105	51	4.1	4.2	8.3

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
10 Bremer	2W	Slight	Severe	Moderate	Moderate	Silver maple	80	34	American sycamore, eastern cottonwood, green ash.
						Eastern cottonwood	90	103	
11 Chequest	2W	Slight	Severe	Moderate	Moderate	Silver maple	80	34	Eastern cottonwood, American sycamore, green ash, northern whitecedar.
						Eastern cottonwood	90	103	
12C2 Armstrong	3C	Slight	Slight	Moderate	Severe	White oak	55	38	White oak, northern red oak.
						Northern red oak	55	38	
13 Tice	5A	Slight	Slight	Slight	Slight	Pin oak	96	78	Yellow-poplar, eastern cottonwood, American sycamore, green ash, red maple, cherrybark oak.
						Sweetgum	86	95	
						Yellow-poplar	90	90	
						Virginia pine	90	150	
						Eastern cottonwood	---	---	
						White ash	---	---	
14 Belknap	5A	Slight	Slight	Slight	Slight	Pin oak	90	72	Eastern cottonwood, American sycamore, pin oak, baldcypress.
						Eastern cottonwood	100	128	
						American sycamore	---	---	
15B, 15C2 Gorin	3C	Slight	Slight	Moderate	Severe	White oak	53	38	White oak, northern red oak, black oak.
						Black oak	61	44	
						Northern red oak	62	45	
16F2 Vanmeter	2R	Severe	Severe	Severe	Severe	White oak	45	30	Eastern redcedar, black oak.
17D2 Goss	3A	Slight	Slight	Slight	Slight	White oak	60	43	White oak, black oak.
						Post oak	---	---	
						Black oak	---	---	
17F Goss	3R	Moderate	Moderate	Slight	Slight	White oak	60	43	White oak, black oak.
						Post oak	---	---	
						Black oak	---	---	
18C2, 18D Keswick	3C	Slight	Slight	Moderate	Severe	White oak	55	38	White oak, northern red oak.
						Northern red oak	55	38	

See footnotes 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	Volume*	
23B, 23C2, 23D2-- Menfro	4A	Slight	Slight	Slight	Slight	Northern red oak----	81	63	White oak, northern red oak, black walnut.
						Black oak-----------	73	55	
						White ash-----------	70	66	
						Sugar maple---------	68	42	
						White oak-----------	59	42	
23E2------------ Menfro	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	81	63	White oak, northern red oak, black walnut.
						Black oak-----------	73	55	
						White ash-----------	70	66	
						Sugar maple---------	68	42	
						White oak-----------	59	42	
23F------------- Menfro	4R	Severe	Severe	Slight	Slight	Northern red oak----	81	63	White oak, northern red oak, black walnut.
						Black oak-----------	73	55	
						White ash-----------	70	66	
						Sugar maple---------	68	42	
						White oak-----------	59	42	
25A------------- Moniteau	4W	Slight	Severe	Moderate	Moderate	Pin oak-------------	70	52	Pin oak, green ash, eastern cottonwood.
30B------------- Weller	3C	Slight	Slight	Severe	Severe	White oak-----------	55	38	White oak, black walnut.
31B, 31C2, 31D2- Winfield	3A	Slight	Slight	Slight	Slight	White oak-----------	65	48	Northern red oak, black oak, white oak.
						Northern red oak----	60	48	
						Black oak-----------	65	48	
32-------------- Carlow	4W	Slight	Severe	Severe	Moderate	Pin oak-------------	75	57	Eastern cottonwood, pin oak, pecan, green ash.
						Eastern cottonwood--	85	91	
34D------------- Bucklick	3A	Slight	Slight	Slight	Slight	White oak-----------	61	44	White oak, black oak.
						Northern red oak----	---	---	
						Black oak-----------	---	---	
35A------------- Okaw	4W	Slight	Severe	Severe	Severe	Pin oak-------------	70	52	Pin oak, green ash, swamp white oak.
						Black oak-----------	60	38	
						White oak-----------	55	---	
36D------------- Ranacker	2D	Slight	Moderate	Moderate	Severe	Eastern redcedar----	30	32	Eastern redcedar.
						Blackjack oak-------	---	---	
38-------------- Chequest	2W	Slight	Severe	Moderate	Moderate	Silver maple--------	80	34	Silver maple, eastern cottonwood, American sycamore, green ash.
						Eastern cottonwood--	90	102	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
41--------------- **Klum**	8A	Slight	Slight	Slight	Slight	Eastern cottonwood--	**95**	**116**	Eastern cottonwood, green ash, silver maple, black walnut.
45C2------------ Minnith	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	52	Northern red oak, white oak.
47--------------- Twomile	4W	Slight	Severe	Moderate	Moderate	Pin oak-------------	80	62	Pin oak, eastern cottonwood, pecan, green ash.
48--------------- Dockery	4W	Slight	Moderate	Slight	Slight	Pin oak-------------	76	58	Pin oak, pecan, eastern cottonwood.
50A**: Dameron--------	5A	Slight	Slight	Slight	Slight	Green ash----------- Black walnut-------- American sycamore--- White oak-----------	70 72 --- ---	33 --- --- ---	Black walnut, green ash.
Cedargap-------	3W	Slight	Moderate	Slight	Slight	Black oak-----------	66	48	Black walnut, green ash.
51A------------- **Haymond**	5A	Slight	Slight	Slight	Slight	White oak----------- Black walnut--------	90 70	72 ---	Black walnut, white oak.
55--------------- Blackoar	4W	Slight	Severe	Moderate	Moderate	Pin oak------------- Eastern cottonwood-- Green ash-----------	80 95 ---	62 116 ---	Pin oak, eastern cottonwood, pecan.
74A------------- **Healing**	4A	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- American sycamore--- Eastern cottonwood--	80 70 80 90	62 52 78 103	Northern red oak, white oak, eastern cottonwood, black walnut.
77B------------- Calwoods	3C	Slight	Slight	Moderate	Severe	White oak-----------	55	38	White oak, pin oak, black oak.
87C2, 88C2, 88D2----------- Crider	3A	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Black oak-----------	66 70 ---	48 52 ---	Black walnut, white ash, white oak.

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
10. Bremer	---	Silky dogwood, Amur privet, gray dogwood, American cranberrybush.	Norway spruce, Austrian pine, blue spruce, white fir, northern whitecedar, Washington hawthorn.	Eastern white pine	Pin oak.
11. Chequest	---	Amur privet, silky dogwood, gray dogwood, American cranberrybush.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
12C2. Armstrong	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, American cranberrybush, gray dogwood.	Austrian pine, green ash.	Eastern white pine, pin oak.	---
13. Tice	---	Silky dogwood, Amur privet, American cranberrybush, gray dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
14. Belknap	---	Silky dogwood, Amur privet, gray dogwood, American cranberrybush.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
15B, 15C2. Gorin	Fragrant sumac	Washington hawthorn, Amur maple.	Hackberry, eastern redcedar, Norway spruce.	Pin oak, Austrian pine, honeylocust.	---
16F2. Vanmeter	Siberian peashrub	Eastern redcedar, Russian-olive, Washington hawthorn.	Northern catalpa, honeylocust, green ash.	---	---
17D2, 17F. Goss	Siberian peashrub	Lilac, gray dogwood, eastern redcedar, Washington hawthorn, radiant crabapple.	Austrian pine, eastern white pine, red pine.	---	---

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
18C2, 18D: Keswick	---	Eastern redcedar, American cranberrybush, Washington hawthorn, arrowwood, Amur privet, gray dogwood.	Austrian pine, green ash.	Eastern white pine, pin oak.	---
20C2: Leonard	Fragrant sumac	Amur maple	Hackberry, eastern redcedar, Norway spruce.	Pin oak, Austrian pine, honeylocust.	---
23B, 23C2, 23D2, 23E2, 23F: Menfro	---	Silky dogwood, Amur privet, gray dogwood, American cranberrybush.	Northern whitecedar, Washington hawthorn, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
24B, 24B2: Mexico	---	Gray dogwood, American cranberrybush, arrowwood, eastern redcedar, Amur privet, Washington hawthorn.	Austrian pine, green ash.	Eastern white pine, pin oak.	---
25A: Moniteau	---	Amur privet, gray dogwood, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
26: Putnam	---	American cranberrybush, gray dogwood, Amur privet, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
30B: Weller	---	American cranberrybush, gray dogwood, arrowwood, Washington hawthorn, Amur privet, eastern redcedar.	Green ash, Austrian pine.	Eastern white pine, pin oak.	---
31B, 31C2, 31D2: Winfield	---	Gray dogwood, Amur privet, silky dogwood, American cranberrybush.	Northern whitecedar, blue spruce, white fir, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

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
32----------------- Carlow	---	Silky dogwood, Amur privet, gray dogwood, American cranberrybush.	Washington hawthorn, white fir, blue spruce, northern whitecedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
34D---------------- Bucklick	---	American cranberrybush, gray dogwood, Amur privet, silky dogwood.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
35A---------------- Okaw	---	Amur privet, gray dogwood, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
36D. Ranacker					
38----------------- Chequest	---	Amur privet, silky dogwood, gray dogwood, American cranberrybush.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
41----------------- Klum	---	Amur privet, gray dogwood, silky dogwood.	Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	---	Pin oak, eastern white pine.
45C2--------------- Minnith	---	Silky dogwood, American cranberrybush, gray dogwood, Amur privet.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
46*. Pits					
47----------------- Twomile	---	Silky dogwood, gray dogwood, American cranberrybush, Amur privet.	Washington hawthorn, white fir, blue spruce, northern whitecedar, Norway spruce, Austrian pine.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
48 Dockery	---	Silky dogwood, gray dogwood, American cranberrybush, Amur privet.	Washington hawthorn, northern whitecedar, blue spruce, white fir, Austrian pine.	Norway spruce	Eastern white pine, pin oak.
50A*: Dameron	---	American cranberrybush, silky dogwood, gray dogwood, Amur privet.	Blue spruce, Norway spruce, Washington hawthorn, Austrian pine, northern whitecedar, white fir.	---	Eastern white pine, pin oak.
Cedargap	---	Gray dogwood, lilac, Amur maple, autumn-olive.	Eastern redcedar	Hackberry, eastern white pine, Austrian pine, green ash, honeylocust, pin oak.	Eastern cottonwood.
51A Haymond	---	Amur privet, gray dogwood, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
55 Blackoar	---	Amur privet, gray dogwood, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
74A. Healing					
77B Calwoods	---	Gray dogwood, Amur privet, eastern redcedar, Washington hawthorn, arrowwood, American cranberrybush.	Austrian pine, green ash.	Pin oak, eastern white pine.	---
78 Dupo	---	Amur privet, gray dogwood, American cranberrybusy, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
86*. Udorthents					

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
87C2, 88C2, 88D2-- Crider	---	Silky dogwood, American cranberrybush, gray dogwood, Amur privet.	Washington hawthorn, blue spruce, northern whitecedar, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
90B, 90C---------- Wakenda	---	American cranberrybush, gray dogwood, Amur privet, silky dogwood.	Blue spruce, Washington hawthorn, northern whitecedar, white fir.	Austrian pine, eastern white pine, Norway spruce.	Pin oak.

* 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
10-------------------- Bremer	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
11-------------------- Chequest	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
12C2------------------ Armstrong	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
13-------------------- Tice	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: wetness, flooding.
14-------------------- Belknap	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
15B------------------- Gorin	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
15C2------------------ Gorin	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
16F2------------------ Vanmeter	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
17D2------------------ Goss	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Severe: droughty.
17F------------------- Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty.
18C2------------------ Keswick	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
18D------------------- Keswick	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
20C2------------------ Leonard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
23B------------------- Menfro	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
23C2------------------ Menfro	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
23D2------------------ Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
23E2 Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
23F Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
24B, 24B2 Mexico	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
25A Moniteau	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
26 Putnam	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
30B Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
31B Winfield	Slight	Slight	Moderate: slope.	Slight	Slight.
31C2 Winfield	Slight	Slight	Severe: slope.	Slight	Slight.
31D2 Winfield	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
32 Carlow	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
34D Bucklick	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
35A Okaw	Severe: flooding, ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
36D Ranacker	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, slope, depth to rock.	Moderate: large stones.	Severe: large stones, depth to rock.
38 Chequest	Severe: flooding, wetness.	Moderate: flooding, wetness, percs slowly.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
41 Klum	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
45C2 Minnith	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
46*. Pits					
47 Twomile	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
48 Dockery	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
50A*:					
Dameron	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Cedargap	Severe: flooding.	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
51A Haymond	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
55 Blackoar	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
74A Healing	Severe: flooding.	Slight	Moderate: slope.	Slight	Slight.
77B Calwoods	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
78 Dupo	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, flooding, percs slowly.	Moderate: wetness.	Moderate: wetness, flooding.
86*. Udorthents					
87C2 Crider	Slight	Slight	Severe: slope.	Slight	Slight.
88C2, 88D2 Crider	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
90B Wakenda	Slight	Slight	Moderate: slope.	Slight	Slight.
90C Wakenda	Slight	Slight	Severe: slope.	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
10 Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
11 Chequest	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
12C2 Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
13 Tice	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
14 Belknap	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
15B, 15C2 Gorin	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
16F2 Vanmeter	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
17D2 Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
17F Goss	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
18C2, 18D Keswick	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
20C2 Leonard	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
23B Menfro	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
23C2, 23D2 Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
23E2 Menfro	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
23F Menfro	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
24B, 24B2 Mexico	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
25A Moniteau	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
26 Putnam	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
30B Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
31B-----Winfield	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
31C2, 31D2-----Winfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
32-----Carlow	Poor	Fair	Fair	Fair	Fair	Poor	Good	Poor	Fair	Fair.
34D-----Bucklick	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
35A-----Okaw	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
36D-----Ranacker	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.
38-----Chequest	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
41-----Klum	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
45C2-----Minnith	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
46*. Pits										
47-----Twomile	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
48-----Dockery	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
50A*:										
Dameron-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Cedargap-----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
51A-----Haymond	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
55-----Blackoar	Good	Good	Good	Fair	Fair	Good	Fair	Good	Fair	Fair.
74A-----Healing	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
77B-----Calwoods	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
78-----Dupo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
86*. Udorthents										

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
87C2, 88C2, 88D2---Crider	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
90B----------------Wakenda	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
90C----------------Wakenda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10----------------- Bremer	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
11----------------- Chequest	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: wetness, flooding.
12C2--------------- Armstrong	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
13----------------- Tice	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
14----------------- Belknap	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
15B, 15C2---------- Gorin	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
16F2--------------- Vanmeter	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
17D2--------------- Goss	Moderate: too clayey, large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Severe: droughty.
17F---------------- Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty.
18C2--------------- Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
18D---------------- Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness, slope.
20C2--------------- Leonard	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.

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
23B: Menfro	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
23C2: Menfro	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
23D2: Menfro	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
23E2, 23F: Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
24B, 24B2: Mexico	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
25A: Moniteau	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
26: Putnam	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
30B: Weller	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
31B: Winfield	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
31C2: Winfield	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
31D2: Winfield	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
32: Carlow	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
34D: Bucklick	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
35A: Okaw	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.

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
36D Ranacker	Severe: depth to rock, large stones.	Severe: shrink-swell, depth to rock, large stones.	Severe: depth to rock, shrink-swell, large stones.	Severe: shrink-swell, slope, depth to rock.	Severe: depth to rock, shrink-swell, low strength.	Severe: large stones, depth to rock.
38 Chequest	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: flooding.
41 Klum	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
45C2 Minnith	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
46*. Pits						
47 Twomile	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
48 Dockery	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
50A*:						
Dameron	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Cedargap	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
51A Haymond	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
55 Blackoar	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
74A Healing	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
77B Calwoods	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
78 Dupo	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness, shrink-swell.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
86*. Udorthents						
87C2 Crider	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Severe: low strength, frost action.	Slight.
88C2, 88D2 Crider	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
90B Wakenda	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
90C Wakenda	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.

* 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
10 Bremer	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
11 Chequest	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
12C2 Armstrong	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
13 Tice	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack.
14 Belknap	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
15B Gorin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
15C2 Gorin	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
16F2 Vanmeter	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
17D2 Goss	Moderate: percs slowly, slope, large stones.	Severe: seepage, slope.	Severe: too clayey, large stones.	Moderate: slope.	Poor: too clayey, small stones.
17F Goss	Severe: slope.	Severe: seepage, slope, large stones.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.
18C2, 18D Keswick	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
20C2 Leonard	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
23B----------------- Menfro	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
23C2---------------- Menfro	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
23D2---------------- Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
23E2, 23F----------- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
24B, 24B2----------- Mexico	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
25A----------------- Moniteau	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
26------------------ Putnam	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
30B----------------- Weller	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
31B----------------- Winfield	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
31C2---------------- Winfield	Severe: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
31D2---------------- Winfield	Severe: wetness.	Severe: slope, wetness.	Moderate: slope, wetness.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
32------------------ Carlow	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
34D----------------- Bucklick	Moderate: thin layer, seepage, percs slowly.	Severe: slope.	Severe: depth to rock, seepage.	Moderate: slope.	Poor: too clayey.
35A----------------- Okaw	Severe: ponding, percs slowly.	Slight-----------	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.

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
36D------------------ Ranacker	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, too clayey, large stones.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
38------------------ Chequest	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
41------------------ Klum	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness, thin layer.
45C2---------------- Minnith	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
46*. Pits					
47------------------ Twomile	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
48------------------ Dockery	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
50A*:					
Dameron------------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: small stones.
Cedargap-----------	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, small stones.
51A----------------- Haymond	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
55------------------ Blackoar	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
74A----------------- Healing	Moderate: flooding, percs slowly.	Moderate: seepage, slope.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
77B----------------- Calwoods	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
78------------------ Dupo	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack.
86*. Udorthents					

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
87C2: Crider	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: thin layer.
88C2, 88D2: Crider	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: thin layer.
90B: Wakenda	Moderate: wetness.	Moderate: seepage, slope, wetness.	Moderate: too clayey.	Moderate: wetness.	Fair: too clayey.
90C: Wakenda	Moderate: wetness.	Severe: slope.	Moderate: too clayey.	Moderate: wetness.	Fair: too clayey.

* 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
10 Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
11 Chequest	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
12C2 Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
13 Tice	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
14 Belknap	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
15B, 15C2 Gorin	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
16F2 Vanmeter	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
17D2 Goss	Fair: shrink-swell, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
17F Goss	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
18C2, 18D Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
20C2 Leonard	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
23B, 23C2 Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
23D2 Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
23E2 Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
23F Menfro	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
24B, 24B2 Mexico	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
25A Moniteau	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
26 Putnam	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
30B Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
31B, 31C2 Winfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
31D2 Winfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
32 Carlow	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
34D Bucklick	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
35A Okaw	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
36D Ranacker	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: depth to rock, large stones.
38 Chequest	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
41 Klum	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
45C2 Minnith	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
46*. Pits				
47 Twomile	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
48-------------------- Dockery	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
50A*:				
Dameron--------------	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Cedargap-------------	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
51A------------------ Haymond	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
55------------------- Blackoar	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
74A------------------ Healing	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, area reclaim.
77B------------------ Calwoods	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
78------------------- Dupo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
86*. Udorthents				
87C2----------------- Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
88C2, 88D2----------- Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
90B, 90C------------- Wakenda	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

* 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
10 Bremer	Slight	Severe: hard to pack, wetness.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
11 Chequest	Slight	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
12C2 Armstrong	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
13 Tice	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness	Wetness	Favorable.
14 Belknap	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
15B, 15C2 Gorin	Moderate: slope.	Moderate: thin layer, hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
16F2 Vanmeter	Severe: slope.	Slight	Deep to water	Slope, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
17D2, 17F Goss	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope.
18C2 Keswick	Moderate: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
18D Keswick	Severe: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
20C2 Leonard	Moderate: slope.	Severe: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
23B, 23C2 Menfro	Moderate: slope, seepage.	Slight	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
23D2, 23E2, 23F Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
24B, 24B2 Mexico	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
25A Moniteau	Slight	Severe: wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.

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
26---------------- Putnam	Slight---------	Severe: wetness.	Percs slowly---	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
30B--------------- Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
31B, 31C2--------- Winfield	Moderate: seepage, slope.	Moderate: thin layer, wetness.	Frost action, slope.	Slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
31D2-------------- Winfield	Severe: slope.	Moderate: thin layer, wetness.	Frost action, slope.	Slope, erodes easily.	Slope, erodes easily, wetness.	Slope, erodes easily.
32---------------- Carlow	Slight---------	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, droughty, slow intake.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, droughty.
34D--------------- Bucklick	Severe: slope.	Moderate: thin layer.	Deep to water	Slope----------	Slope----------	Slope.
35A--------------- Okaw	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
36D--------------- Ranacker	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
38---------------- Chequest	Slight---------	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
41---------------- Klum	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, flooding.	Soil blowing---	Favorable.
45C2-------------- Minnith	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
46*. Pits						
47---------------- Twomile	Moderate: seepage.	Moderate: wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
48---------------- Dockery	Moderate: seepage.	Moderate: piping, wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
50A*: Dameron----------	Moderate: seepage.	Slight---------	Deep to water	Flooding-------	Favorable------	Favorable.
Cedargap---------	Moderate: seepage.	Slight---------	Deep to water	Droughty, flooding.	Favorable------	Droughty.
51A--------------- Haymond	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
55---------------- Blackoar	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
74A--------------- Healing	Moderate: seepage.	Moderate: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
77B--------------- Calwoods	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
78---------------- Dupo	Moderate: seepage.	Severe: wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
86*. Udorthents						
87C2-------------- Crider	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
88C2, 88D2-------- Crider	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
90B, 90C---------- Wakenda	Moderate: seepage, slope.	Slight---------	Deep to water	Slope----------	Favorable------	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
10------------ Bremer	0-17	Silty clay loam.	CH, CL	A-7	0	0	100	100	100	95-100	45-60	25-40
	17-43	Silty clay loam, silty clay.	CH, MH	A-7	0	0	100	100	100	95-100	50-65	20-35
	43-60	Silty clay loam.	CH, CL	A-7	0	0	100	100	95-100	95-100	40-60	25-40
11------------ Chequest	0-18	Silty clay loam.	CL	A-7	0	0	100	100	95-100	95-100	40-50	15-25
	18-60	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-60	20-30
12C2---------- Armstrong	0-9	Loam----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	9-14	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	14-60	Clay loam-----	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
13------------ Tice	0-15	Silt loam-----	CL	A-6, A-7	0	0	100	100	90-100	80-95	30-45	10-20
	15-40	Silty clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	85-95	40-55	15-30
	40-60	Stratified silty clay loam to loam.	CL-ML, CL	A-4, A-6, A-7	0	0	100	100	60-95	55-80	25-45	5-20
14------------ Belknap	0-8	Silt loam-----	ML, CL, CL-ML	A-4	0	0	100	95-100	90-100	80-100	20-30	2-8
	8-43	Silt loam-----	ML, CL-ML, CL	A-4, A-6	0	0	100	95-100	90-100	80-100	20-35	NP-12
	43-60	Silt loam, loam, silty clay loam.	ML, CL-ML, CL	A-4, A-6	0	0	100	95-100	85-100	60-100	20-40	3-20
15B, 15C2----- Gorin	0-12	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-18
	12-16	Silty clay loam, silty clay.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-50	15-30
	16-36	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	90-100	50-65	30-40
	36-48	Silty clay loam, clay loam.	CL	A-6, A-7	0	0	100	100	80-95	70-90	30-50	12-30
	48-60	Clay, clay loam.	CH, CL	A-7	0	0	95-100	95-100	90-100	70-95	45-70	30-45
16F2---------- Vanmeter	0-4	Silty clay loam.	ML, MH	A-7	0	0-5	95-100	75-100	70-100	65-100	40-55	11-25
	4-31	Silty clay, clay.	CH, CL	A-7	0	0-5	95-100	75-100	70-100	65-100	40-65	24-40
	31-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
17D2----------- Goss	0-6	Gravelly silt loam.	ML, CL, CL-ML	A-4	0	0-10	65-85	65-75	65-75	65-75	20-30	2-10
	6-26	Extremely gravelly silty clay loam, very gravelly silty loam, gravelly silty clay loam.	GM, GC, GM-GC	A-2	0-5	5-40	40-60	35-55	30-50	25-35	20-30	2-10
	26-60	Silty clay, clay, gravelly clay.	CL, CH	A-7	0	0-10	70-100	70-100	70-95	70-95	45-65	20-35
17F----------- Goss	0-4	Very gravelly silt loam.	GM, GC, GM-GC	A-2	0-5	5-40	40-60	35-55	30-50	25-35	20-30	2-10
	4-30	Very gravelly silty clay loam, very gravelly silt loam, gravelly silty clay loam.	GM, GC, GM-GC	A-2	0-5	5-40	40-60	35-55	30-50	25-35	20-30	2-10
	30-60	Silty clay, clay, gravelly clay.	CL, CH	A-7	0	0-10	70-100	70-100	70-95	70-95	45-65	20-35
18C2----------- Keswick	0-7	Loam----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	7-60	Clay loam, clay.	CH, CL	A-7	0	0-5	90-100	80-100	70-90	55-80	40-70	20-40
18D----------- Keswick	0-11	Loam----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	11-22	Clay loam, clay.	CH, CL	A-7	0	0-5	90-100	80-100	70-90	55-80	40-70	20-40
	22-60	Clay loam-----	CL	A-6	0	0-5	90-100	80-100	70-90	55-80	30-40	15-25
20C2----------- Leonard	0-7	Silty clay loam.	CL	A-6, A-7	0	0	100	95-100	90-100	85-100	30-45	15-25
	7-20	Silty clay loam, silty clay.	CL	A-6, A-7	0	0	100	95-100	90-100	85-100	35-50	20-30
	20-45	Silty clay, clay, silty clay loam.	CH	A-7	0	0	100	95-100	85-100	80-100	55-70	30-40
	45-60	Silty clay, clay loam, silty clay loam.	CL, CH	A-7	0	0	95-100	95-100	90-100	75-90	45-60	25-35
23B----------- Menfro	0-11	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	11-16	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	25-40	11-20
	16-60	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
23C2----------- Menfro	0-9	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	9-60	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
23D2----------- Menfro	0-4	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	4-9	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	25-40	11-20
	9-39	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	39-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
23E2----------- Menfro	0-6	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	6-18	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	25-40	11-20
	18-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
23F------------ Menfro	0-9	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	9-21	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	25-40	11-20
	21-45	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	45-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
24B------------ Mexico	0-13	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-40	5-15
	13-17	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-60	25-35
	17-39	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	95-100	60-75	30-45
	39-60	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-60	25-35
24B2----------- Mexico	0-8	Silty clay loam.	CL, CH, ML, MH	A-7	0	0	100	100	95-100	90-100	40-55	15-25
	8-18	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-60	25-35
	18-36	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	95-100	60-75	30-45
	36-60	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-60	25-35
25A------------ Moniteau	0-8	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	85-100	25-35	5-15
	8-20	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	85-100	25-35	5-15
	20-60	Silty clay loam.	CL	A-6, A-7	0	0	100	100	85-100	80-95	30-45	15-25
26------------- Putnam	0-9	Silt loam-----	CL, ML	A-6, A-4	0	0	100	100	90-100	85-100	30-40	5-15
	9-17	Silt loam-----	CL, ML	A-4, A-6	0	0	100	100	90-100	85-100	30-40	5-15
	17-35	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	90-100	60-70	35-45
	35-60	Silty clay loam, silty clay.	CH	A-7	0	0	100	100	95-100	90-100	50-65	25-40

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
30B----------- Weller	0-8	Silt loam-----	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	8-34	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	100	95-100	45-65	30-40
	34-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	0	100	100	100	95-100	30-55	10-30
31B----------- Winfield	0-10	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-40	10-20
	10-17	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-45	15-25
	17-28	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	28-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
31C2---------- Winfield	0-7	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-40	10-20
	7-13	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-45	15-25
	13-46	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	46-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
31D2---------- Winfield	0-5	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-40	10-20
	5-13	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-45	15-25
	13-22	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	22-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
32------------ Carlow	0-9	Silty clay----	CL, CH	A-7	0	0	100	100	95-100	95-100	40-65	25-40
	9-60	Silty clay, clay.	CL, CH	A-7	0	0	100	100	95-100	95-100	45-75	30-50
34D----------- Bucklick	0-8	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	80-95	25-40	5-15
	8-29	Silty clay loam, silty clay, clay loam.	CL	A-7	0	0-10	95-100	85-100	80-100	65-95	40-50	20-30
	29-47	Gravelly silty clay, gravelly silty clay loam, silty clay.	CL, SC, GC	A-7	0	0-15	70-100	65-100	35-100	35-95	40-50	20-30
	47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
35A----------- Okaw	0-15	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	90-100	25-40	5-15
	15-22	Silty clay, clay.	CH	A-7	0	0	100	95-100	95-100	85-100	50-70	30-50
	22-60	Silty clay loam, silty clay, clay.	CH, CL	A-7	0	0	100	100	95-100	80-100	45-65	20-40

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
36D----------- Ranacker	0-9	Flaggy silty clay loam.	CL	A-6, A-7	0	20-50	80-100	80-100	75-95	70-95	30-45	15-25
	9-18	Very flaggy silty clay, very flaggy silty clay loam.	CL, CH, GC	A-7	0	20-70	40-70	40-70	40-70	35-60	45-60	20-32
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
38------------ Chequest	0-18	Silty clay loam.	CL	A-7	0	0	100	100	95-100	95-100	40-50	15-25
	18-60	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-60	20-30
41------------ Klum	0-8	Loam----------	CL-ML, CL	A-4	0	0	100	100	85-95	60-75	16-25	4-9
	8-45	Fine sandy loam, loam, sandy loam.	ML, SM	A-4	0	0	100	95-100	65-95	35-85	14-20	NP-3
	45-60	Loamy fine sand, sand, loamy sand.	SM	A-2-4	0	0	100	95-100	50-90	15-35	14-20	NP-3
45C2---------- Minnith	0-12	Silt loam-----	CL, CL-ML	A-6, A-4	0	0	100	100	90-100	90-95	20-35	5-15
	12-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	100	90-100	85-90	30-50	10-20
46*. Pits												
47------------ Twomile	0-10	Silt loam-----	CL-ML, CL	A-4	0	0	100	100	95-100	90-100	20-30	4-9
	10-20	Silt loam, silt.	CL-ML, CL	A-4	0	0	100	100	95-100	90-100	20-30	4-9
	20-25	Silt loam, silt.	CL-ML, CL	A-4	0	0	100	100	95-100	90-100	20-30	4-9
	25-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	95-100	90-100	85-95	30-45	15-25
48------------ Dockery	0-8	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	85-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	100	100	90-100	85-95	25-40	8-20
50A*: Dameron------	0-7	Silt loam-----	CL	A-6	0	0-1	95-100	90-100	85-100	80-95	25-40	10-20
	7-25	Silt loam, silty clay loam.	CL	A-6	0	0-1	95-100	90-100	85-100	80-95	25-40	10-20
	25-60	Gravelly loam, gravelly sandy clay loam, very gravelly sandy clay loam.	GC, SC, CL	A-2-6	0	0-10	35-75	25-70	25-70	20-65	30-40	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
50A*:												
Cedargap-----	0-7	Silt loam-----	ML, CL, CL-ML	A-4	0	0-5	90-100	85-95	75-95	70-95	20-30	3-10
	7-60	Extremely gravelly silty clay loam, extremely gravelly silt loam.	GC, GP-GC	A-2-4, A-2-6	0	5-15	20-25	15-25	15-25	10-25	30-40	8-18
51A----------- Haymond	0-8	Silt loam-----	ML, CL, CL-ML	A-4	0	0	100	100	90-100	85-100	20-30	4-10
	8-60	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	0	100	100	90-100	80-100	20-32	4-13
55------------ Blackoar	0-14	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-18
	14-36	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-18
	36-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-20
74A----------- Healing	0-15	Silt loam-----	ML, CL-ML, CL	A-4	0	0	90-100	90-100	90-100	70-90	<30	3-10
	15-60	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	90-100	90-100	90-100	70-95	25-38	8-15
77B----------- Calwoods	0-11	Silt loam-----	CL	A-6, A-7	0	0	100	100	95-100	90-100	30-45	15-25
	11-14	Silty clay loam.	CL, CH	A-7	0	0	100	100	95-100	90-100	45-55	25-35
	14-21	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	95-100	60-75	40-50
	21-60	Silty clay loam.	CL, CH	A-7	0	0	100	100	95-100	95-100	45-55	25-35
78------------ Dupo	0-14	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	95-100	20-35	1-15
	14-34	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	100	95-100	20-35	5-15
	34-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	0	100	100	100	98-100	35-55	15-30
86*. Udorthents												
87C2---------- Crider	0-7	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	85-100	25-35	4-12
	7-40	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	0	100	95-100	90-100	85-100	25-42	4-20
	40-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	---	0-5	85-100	75-100	70-100	60-100	35-65	15-40

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
88C2----------- Crider	0-7	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	85-100	25-35	4-12
	7-26	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	0	100	95-100	90-100	85-100	25-42	4-20
	26-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	---	0-5	85-100	75-100	70-100	60-100	35-65	15-40
88D2----------- Crider	0-7	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	85-100	25-35	4-12
	7-39	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	0	100	95-100	90-100	85-100	25-42	4-20
	39-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	---	0-5	85-100	75-100	70-100	60-100	35-65	15-40
90B------------ Wakenda	0-14	Silt loam-----	CL, ML	A-6, A-4	0	0	100	100	100	90-100	30-40	5-15
	14-31	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	90-100	35-45	15-25
	31-60	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	100	90-100	30-40	11-20
90C------------ Wakenda	0-13	Silt loam-----	CL, ML	A-6, A-4	0	0	100	100	100	90-100	30-40	5-15
	13-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	90-100	35-45	15-25
	47-60	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	100	90-100	30-40	11-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
10----------------- Bremer	0-17	27-36	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	5-7
	17-43	35-42	1.30-1.40	0.2-0.6	0.15-0.17	5.6-6.5	High---------	0.43			
	43-60	32-38	1.40-1.45	0.2-0.6	0.18-0.20	5.6-6.5	High---------	0.43			
11----------------- Chequest	0-18	30-35	1.30-1.35	0.2-0.6	0.18-0.20	5.1-7.3	High---------	0.32	5	7	3-4
	18-60	35-42	1.35-1.45	0.2-0.6	0.14-0.18	5.1-6.0	High---------	0.43			
12C2--------------- Armstrong	0-9	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6	2-3
	9-14	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	14-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
13----------------- Tice	0-15	22-27	1.25-1.45	0.6-2.0	0.21-0.24	6.1-7.8	Moderate-----	0.32	5	6	2-3
	15-40	24-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.8	Moderate-----	0.32			
	40-60	15-30	1.40-1.60	0.6-2.0	0.11-0.18	5.6-7.8	Moderate-----	0.32			
14----------------- Belknap	0-8	8-18	1.35-1.55	0.2-2.0	0.21-0.25	4.5-7.3	Low----------	0.37	5	5	1-3
	8-43	8-25	1.40-1.60	0.2-2.0	0.21-0.24	4.5-6.0	Low----------	0.37			
	43-60	8-30	1.35-1.65	0.2-2.0	0.14-0.24	4.5-7.3	Low----------	0.37			
15B, 15C2---------- Gorin	0-12	12-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.43	3	6	.5-2
	12-16	27-42	1.30-1.45	0.06-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.32			
	16-36	35-60	1.30-1.40	0.06-0.2	0.11-0.16	4.5-6.0	High---------	0.32			
	36-48	27-40	1.30-1.45	0.2-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.32			
	48-60	35-60	1.30-1.40	<0.06	0.10-0.12	4.5-6.5	High---------	0.32			
16F2--------------- Vanmeter	0-4	27-35	1.30-1.40	0.2-0.6	0.14-0.16	6.1-8.4	Moderate-----	0.43	2	4L	1-2
	4-31	40-60	1.50-1.60	<0.06	0.12-0.14	6.1-8.4	High---------	0.32			
	31-60	---	---	<0.06	---	---	-------------	----			
17D2--------------- Goss	0-6	10-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.5	Low----------	0.24	2	8	.5-2
	6-26	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.10			
	26-60	50-90	1.40-1.60	0.6-2.0	0.06-0.10	4.5-7.3	Moderate-----	0.24			
17F---------------- Goss	0-4	20-27	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.5	Low----------	0.10	2	8	.5-2
	4-30	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.10			
	30-60	50-90	1.40-1.60	0.6-2.0	0.06-0.10	4.5-7.3	Moderate-----	0.24			
18C2--------------- Keswick	0-7	22-27	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.37	3	6	1-2
	7-60	35-60	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37			
18D---------------- Keswick	0-11	22-27	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.32	3	6	2-3
	11-22	35-60	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37			
	22-60	30-40	1.60-1.75	0.2-0.6	0.12-0.16	4.5-7.8	Moderate-----	0.37			
20C2--------------- Leonard	0-7	27-35	1.20-1.40	0.2-0.6	0.22-0.24	6.1-7.3	Moderate-----	0.37	3	7	.5-2
	7-20	35-45	1.30-1.45	0.06-0.2	0.11-0.13	4.5-6.5	High---------	0.37			
	20-45	35-50	1.20-1.35	0.06-0.2	0.10-0.12	4.5-6.5	High---------	0.37			
	45-60	32-50	1.25-1.40	0.06-0.2	0.11-0.14	5.1-7.8	High---------	0.37			
23B---------------- Menfro	0-11	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
	11-16	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	16-60	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
23C2--------------- Menfro	0-9	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-2
	9-60	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
23D2------------- 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
	4-9	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	9-39	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	39-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
23E2------------- 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
	6-18	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	18-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
23F-------------- Menfro	0-9	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-2
	9-21	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.37			
	21-45	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	45-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
24B-------------- Mexico	0-13	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.43	3	6	2-4
	13-17	35-50	1.25-1.45	0.2-0.6	0.12-0.16	4.5-6.0	High---------	0.32			
	17-39	50-60	1.25-1.45	<0.06	0.08-0.12	4.5-6.0	High---------	0.32			
	39-60	35-50	1.25-1.45	0.06-0.2	0.12-0.16	5.1-7.3	High---------	0.32			
24B2------------- Mexico	0-8	27-35	1.30-1.50	0.2-0.6	0.16-0.20	5.1-7.3	Moderate-----	0.43	2	7	1-3
	8-18	35-50	1.25-1.45	0.2-0.6	0.12-0.16	4.5-6.0	High---------	0.32			
	18-36	50-60	1.25-1.45	<0.06	0.08-0.12	4.5-6.0	High---------	0.32			
	36-60	35-50	1.25-1.45	0.06-0.2	0.12-0.16	5.1-7.3	High---------	0.32			
25A-------------- Moniteau	0-8	18-27	1.20-1.40	0.6-2.0	0.21-0.23	5.6-7.3	Low----------	0.43	5	6	1-2
	8-20	18-27	1.20-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.43			
	20-60	27-35	1.30-1.50	0.2-0.6	0.18-0.20	4.5-6.0	Moderate-----	0.43			
26--------------- Putnam	0-9	12-27	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	6	.5-3
	9-17	12-27	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.5	Low----------	0.43			
	17-35	48-60	1.20-1.40	<0.06	0.09-0.11	3.6-5.5	High---------	0.28			
	35-60	35-48	1.25-1.45	0.06-0.2	0.12-0.16	5.1-6.5	High---------	0.37			
30B-------------- Weller	0-8	16-27	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	3	6	2-3
	8-34	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High---------	0.43			
	34-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.5	High---------	0.43			
31B-------------- Winfield	0-10	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	.5-2
	10-17	22-30	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.37			
	17-28	24-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	28-60	20-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.37			
31C2------------- Winfield	0-7	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	.5-2
	7-13	22-30	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.37			
	13-46	24-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	46-60	20-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.37			
31D2------------- Winfield	0-5	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	.5-2
	5-13	22-30	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.37			
	13-22	24-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	22-60	20-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.37			
32--------------- Carlow	0-9	40-50	1.30-1.40	0.06-0.2	0.12-0.14	5.1-7.3	High---------	0.37	5	4	2-4
	9-60	45-60	1.25-1.35	<0.06	0.09-0.12	4.5-6.0	High---------	0.37			
34D-------------- Bucklick	0-8	15-25	1.35-1.45	0.6-2.0	0.15-0.24	4.5-7.3	Low----------	0.32	4	6	2-4
	8-29	35-45	1.25-1.35	0.6-2.0	0.10-0.18	4.5-7.3	High---------	0.32			
	29-47	35-45	1.25-1.55	0.6-2.0	0.08-0.18	5.1-7.3	High---------	0.32			
	47	---	---	0.01-0.06	---	---	-------------	----			
35A-------------- Okaw	0-15	15-27	1.20-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	6	1-3
	15-22	40-60	1.35-1.60	<0.06	0.09-0.18	4.5-6.0	High---------	0.32			
	22-60	35-60	1.45-1.70	<0.06	0.08-0.18	4.5-7.3	High---------	0.32			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
36D------------- Ranacker	0-9	27-40	1.35-1.50	0.6-2.0	0.12-0.16	5.6-7.8	Moderate-----	0.20	2	8	2-4
	9-18	35-60	1.35-1.55	0.2-0.6	0.06-0.08	5.6-7.8	High---------	0.20			
	18	---	---	0.06-0.6	---	---	-------------	----			
38-------------- Chequest	0-18	30-35	1.30-1.35	0.2-0.6	0.18-0.20	5.1-7.3	High---------	0.32	5	7	3-4
	18-60	35-42	1.35-1.45	0.2-0.6	0.14-0.18	5.1-6.0	High---------	0.43			
41-------------- Klum	0-8	10-18	1.40-1.55	2.0-6.0	0.20-0.22	6.1-7.3	Low----------	0.20	5	3	1-2
	8-45	5-12	1.40-1.55	2.0-6.0	0.16-0.20	6.1-7.3	Low----------	0.20			
	45-60	5-12	1.40-1.55	6.0-20	0.07-0.13	6.1-7.3	Low----------	0.20			
45C2------------ Minnith	0-12	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
	12-60	25-35	1.30-1.60	0.2-2.0	0.20-0.22	4.5-6.5	Moderate-----	0.37			
46*. Pits											
47-------------- Twomile	0-10	10-18	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	5	5	1-2
	10-20	10-18	1.35-1.45	0.6-2.0	0.22-0.24	4.5-6.0	Low----------	0.43			
	20-25	10-18	1.40-1.50	0.2-0.6	0.10-0.13	3.6-6.0	Low----------	0.43			
	25-60	25-35	1.30-1.40	0.06-0.2	0.08-0.10	3.6-6.5	Moderate-----	0.43			
48-------------- Dockery	0-8	15-27	1.35-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	2-4
	8-60	18-30	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.8	Moderate-----	0.37			
50A*:											
Dameron---------	0-7	20-27	1.25-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	4	6	2-4
	7-25	20-32	1.25-1.40	0.6-2.0	0.18-0.24	6.1-7.3	Moderate-----	0.32			
	25-60	18-27	1.20-1.50	0.6-2.0	0.04-0.10	5.6-7.3	Low----------	0.20			
Cedargap--------	0-7	15-25	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6	1-4
	7-60	25-35	1.30-1.50	0.6-2.0	0.06-0.10	5.6-7.3	Moderate-----	0.32			
51A------------- Haymond	0-8	10-20	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.8	Low----------	0.37	5	5	1-3
	8-60	10-22	1.30-1.50	0.6-2.0	0.20-0.22	5.6-7.8	Low----------	0.37			
55-------------- Blackoar	0-14	18-27	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	5	6	2-4
	14-36	18-27	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
	36-60	18-30	1.35-1.45	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.43			
74A------------- Healing	0-15	10-25	1.35-1.50	0.6-2.0	0.16-0.24	5.6-6.5	Low----------	0.37	5	5	2-4
	15-60	20-35	1.35-1.45	0.6-2.0	0.16-0.24	5.6-6.5	Low----------	0.37			
77B------------- Calwoods	0-11	15-27	1.40-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	3	6	1-2
	11-14	27-36	1.35-1.45	0.2-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	14-21	45-60	1.30-1.40	<0.06	0.11-0.13	4.5-5.5	High---------	0.37			
	21-60	28-39	1.35-1.45	<0.06	0.14-0.18	4.5-6.5	Moderate-----	0.37			
78-------------- Dupo	0-14	10-18	1.25-1.45	0.6-2.0	0.22-0.24	5.6-8.4	Low----------	0.37	4	5	1-2
	14-34	10-18	1.30-1.50	0.6-2.0	0.20-0.22	5.6-8.4	Low----------	0.37			
	34-60	35-45	1.35-1.60	0.06-0.2	0.08-0.19	6.6-7.8	High---------	0.37			
86*. Udorthents											
87C2------------ Crider	0-7	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low----------	0.32	5	6	2-4
	7-40	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low----------	0.28			
	40-60	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.5	Moderate-----	0.28			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
88C2-------------- Crider	0-7	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low-----------	0.32	5	6	2-4
	7-26	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low-----------	0.28			
	26-60	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.5	Moderate------	0.28			
88D2-------------- Crider	0-7	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low-----------	0.32	5	6	2-4
	7-39	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low-----------	0.28			
	39-60	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.5	Moderate------	0.28			
90B--------------- Wakenda	0-14	18-27	1.20-1.30	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	6	3-4
	14-31	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.28			
	31-60	20-30	1.20-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate------	0.43			
90C--------------- Wakenda	0-13	18-27	1.20-1.30	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	6	3-4
	13-47	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.28			
	47-60	20-30	1.20-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate------	0.43			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding," "water table," and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
10---------------- Bremer	C	Rare---------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	High-----	Moderate	Moderate.
11---------------- Chequest	C	Occasional	Brief-----	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
12C2-------------- Armstrong	C	None---------	---	---	1.0-3.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
13---------------- Tice	B	Occasional	Brief-----	Nov-May	1.5-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
14---------------- Belknap	C	Occasional	Brief-----	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	High.
15B, 15C2--------- Gorin	C	None---------	---	---	2.0-4.0	Perched	Nov-Apr	>60	---	High-----	High-----	Moderate.
16F2-------------- Vanmeter	C	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Low.
17D2, 17F--------- Goss	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
18C2, 18D--------- Keswick	C	None---------	---	---	1.0-3.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
20C2-------------- Leonard	D	None---------	---	---	0.5-2.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
23B, 23C2, 23D2, 23E2, 23F-------- Menfro	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
24B, 24B2--------- Mexico	D	None---------	---	---	1.0-2.5	Perched	Nov-May	>60	---	Moderate	High-----	Moderate.
25A--------------- Moniteau	D	Occasional	Brief-----	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	High.
26---------------- Putnam	D	None---------	---	---	0.5-1.5	Perched	Nov-May	>60	---	Moderate	High-----	High.
30B--------------- Weller	C	None---------	---	---	2.0-4.0	Perched	Nov-May	>60	---	High-----	High-----	High.

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				
31B, 31C2, 31D2--- Winfield	B	None--------	---	---	2.5-4.0	Perched	Nov-Apr	>60	---	High-----	Moderate	Moderate.
32---------------- Carlow	D	Occasional	Brief-----	Nov-May	0-1.0	Apparent	Nov-Apr	>60	---	Moderate	High-----	Moderate.
34D--------------- Bucklick	C	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Moderate.
35A--------------- Okaw	D	Rare--------	---	---	+.5-1.0	Apparent	Nov-May	>60	---	High-----	High-----	High.
36D--------------- Ranacker	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.
38---------------- Chequest	C	Frequent----	Long------	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
41---------------- Klum	B	Occasional	Brief-----	Nov-May	3.0-6.0	Apparent	Nov-May	>60	---	Moderate	Low------	Low.
45C2-------------- Minnith	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
46*. Pits												
47---------------- Twomile	D	Occasional	Brief-----	Nov-May	1.0-2.0	Perched	Nov-May	>60	---	High-----	High-----	High.
48---------------- Dockery	C	Frequent----	Long------	Nov-Apr	2.0-3.0	Apparent	Nov-Apr	>60	---	High-----	Moderate	Low.
50A*:												
Dameron-----------	B	Occasional	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low------	Low.
Cedargap----------	B	Frequent----	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low------	Low.
51A--------------- Haymond	B	Occasional	Brief-----	Nov-May	>6.0	---	---	>60	---	High-----	Low------	Low.
55---------------- Blackoar	D	Occasional	Brief-----	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
74A--------------- Healing	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
77B--------------- Calwoods	D	None---------	---	---	1.0-2.5	Perched	Nov-Apr	>60	---	High-----	High-----	High.
78---------------- Dupo	C	Occasional	Brief-----	Nov-May	1.5-3.5	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
86*. Udorthents												
87C2, 88C2, 88D2-- Crider	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
90B, 90C---------- Wakenda	B	None---------	---	---	4.0-6.0	Perched	Nov-May	>60	---	High-----	Low------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Armstrong	Fine, smectitic, mesic Aquertic Hapludalfs
Belknap	Coarse-silty, mixed, acid, mesic Aeric Fluvaquents
Blackoar	Fine-silty, mixed, mesic Fluvaquentic Endoaquolls
Bremer	Fine, smectitic, mesic Typic Argiaquolls
Bucklick	Fine, mixed, mesic Typic Hapludalfs
Calwoods	Fine, smectitic, mesic Aeric Ochraqualfs
Carlow	Fine, smectitic, mesic Vertic Endoaquolls
Cedargap	Loamy-skeletal, mixed, mesic Cumulic Hapludolls
Chequest	Fine, smectitic, mesic Typic Endoaquolls
Crider	Fine-silty, mixed, mesic Typic Paleudalfs
Dameron	Fine-loamy, mixed, mesic Cumulic Hapludolls
Dockery	Fine-silty, mixed, nonacid, mesic Aquic Udifluvents
Dupo	Coarse-silty over clayey, mixed, nonacid, mesic Aquic Udifluvents
Gorin	Fine, smectitic, mesic Aquertic Chromic Hapludalfs
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Haymond	Coarse-silty, mixed, mesic Fluventic Eutrochrepts
Healing	Fine-silty, mixed, mesic Typic Argiudolls
Keswick	Fine, smectitic, mesic Aquertic Chromic Hapludalfs
Klum	Coarse-loamy, mixed, nonacid, mesic Mollic Udifluvents
Leonard	Fine, smectitic, mesic, sloping Vertic Epiaqualfs
Menfro	Fine-silty, mixed, mesic Typic Hapludalfs
Mexico	Fine, smectitic, mesic Aeric Vertic Epiaqualfs
Minnith	Fine-silty, mixed, mesic Typic Hapludalfs
Moniteau	Fine-silty, mixed, mesic Typic Endoaqualfs
Okaw	Fine, smectitic, mesic Vertic Albaqualfs
Putnam	Fine, smectitic, mesic Vertic Albaqualfs
Ranacker	Clayey-skeletal, mixed, mesic Lithic Argiudolls
Tice	Fine-silty, mixed, mesic Fluvaquentic Hapludolls
Twomile	Fine-silty, mixed, mesic Typic Albaqualfs
Udorthents	Aquic Udorthents
Vanmeter	Fine, illitic, mesic Oxyaquic Eutrochrepts
Wakenda	Fine-silty, mixed, mesic Typic Argiudolls
Weller	Fine, smectitic, mesic Aquertic Chromic Hapludalfs
Winfield	Fine-silty, mixed, mesic Oxyaquic Hapludalfs

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