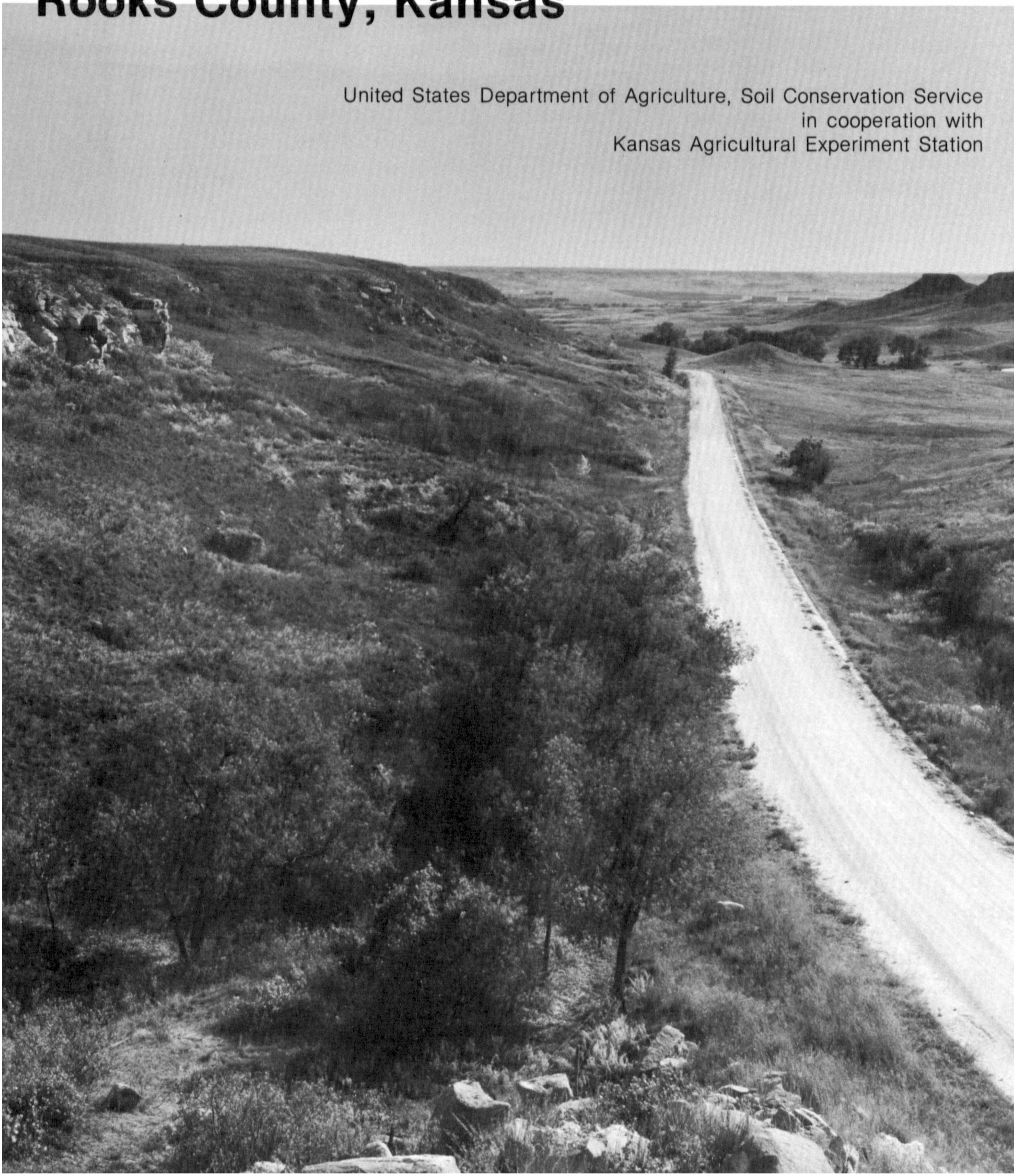
Soil Survey of

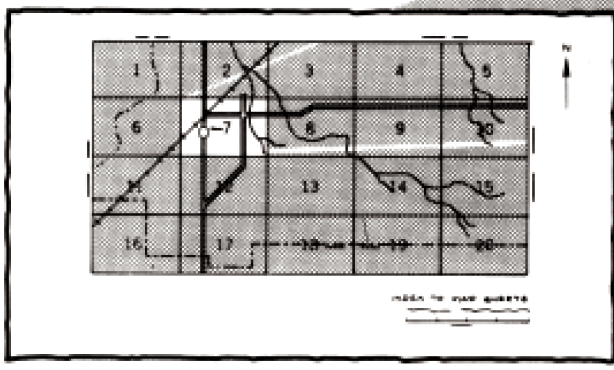
Rooks County, Kansas

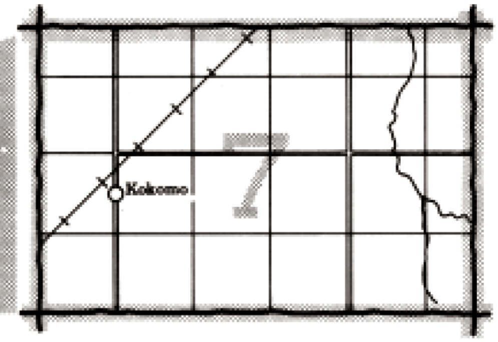


United States Department of Agriculture, Soil Conservation Service
in cooperation with
Kansas Agricultural Experiment Station

HOW TO USE

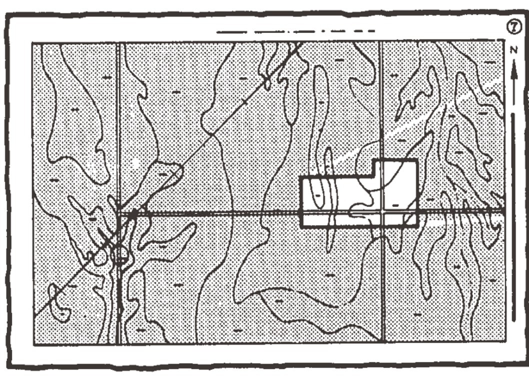
1. Locate your area of interest on the "Index to Map Sheets"

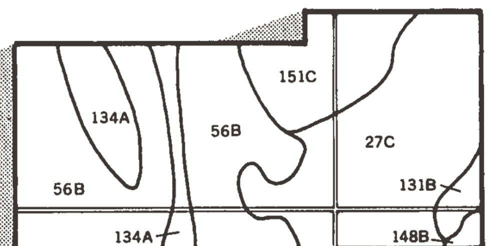




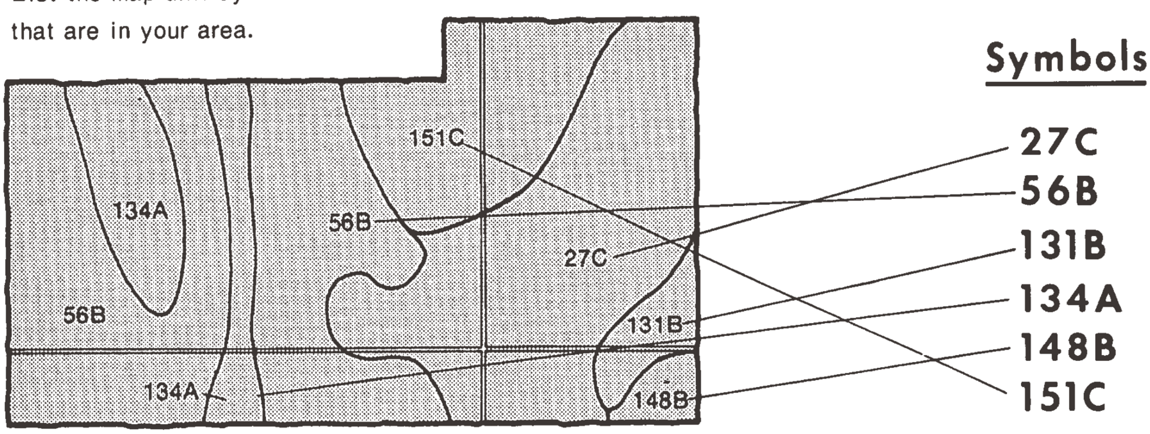
2. Note the number of the map sheet and turn to that sheet.

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



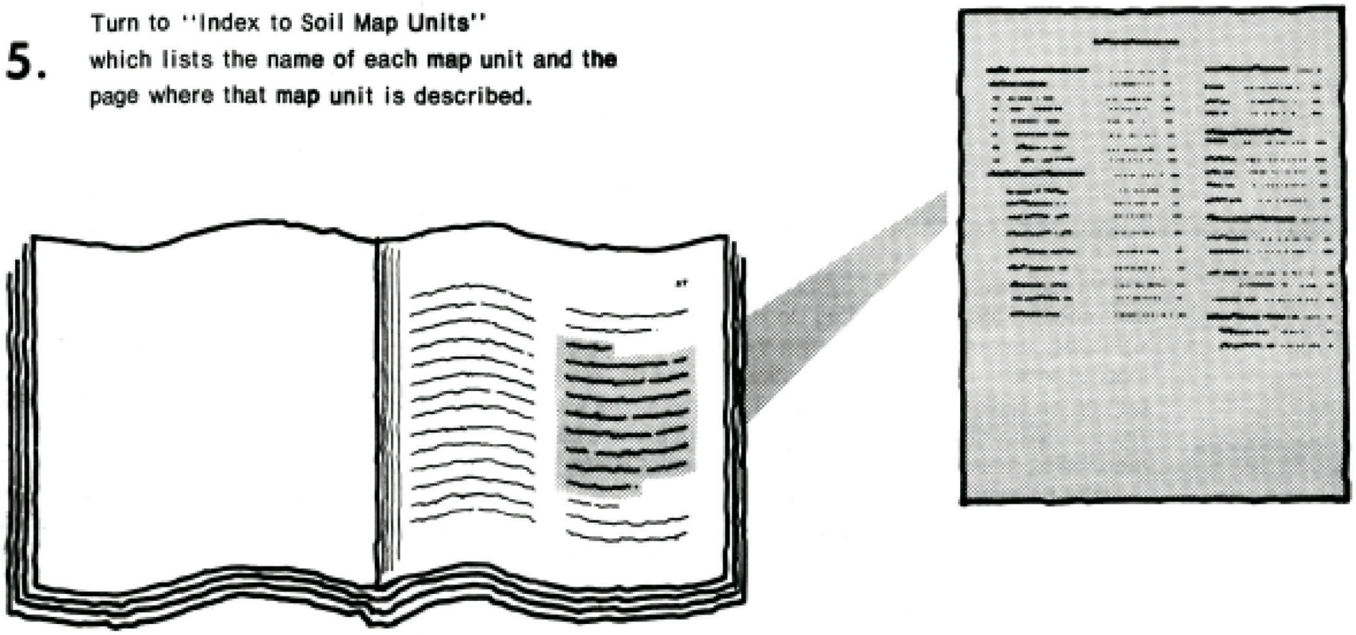


4. List the map unit symbols that are in your area.

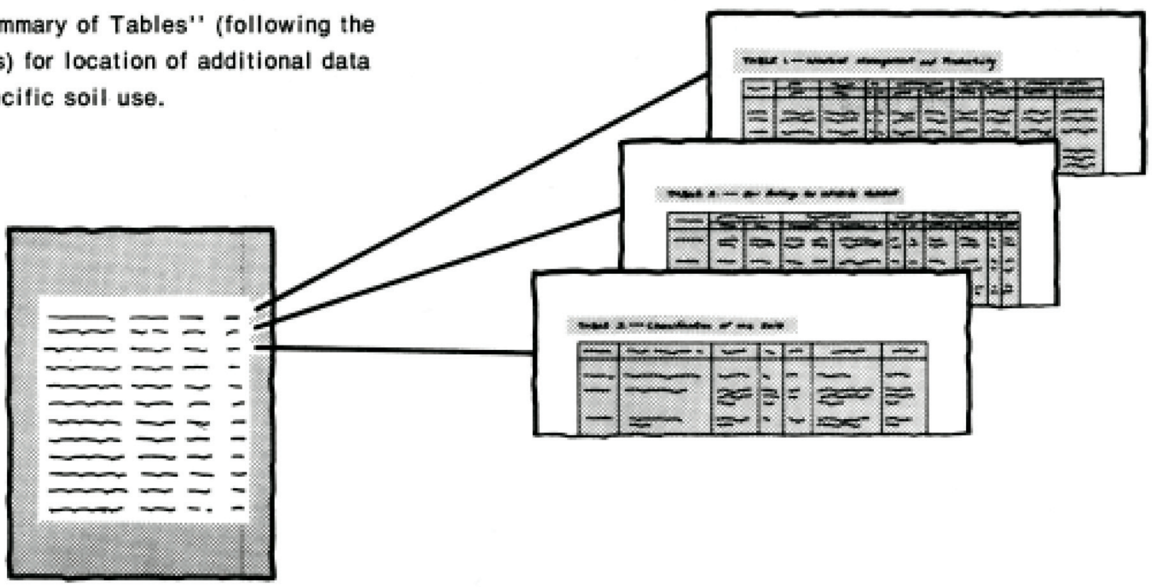


THIS SOIL SURVEY

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



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



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

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

Major fieldwork was performed in the period 1972-79. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980.

This survey was made cooperatively by the Soil Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Rooks County Conservation District.

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

Cover: Large area of Heizer and Armo soils used as native range.

contents

soil series

Issued May 1982

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summary of tables

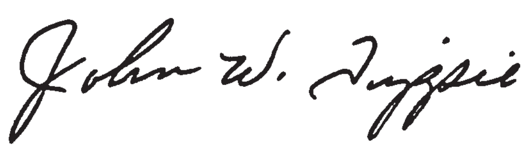
foreword

This soil survey contains information that can be used in land-planning programs in Rooks County, Kansas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, 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 insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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

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



John W. Tippie
State Conservationist
Soil Conservation Service

soil survey of
Rooks County, Kansas

By Cecil D. Palmer, Soil Conservation Service

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

ROOKS COUNTY is in the north-central part of Kansas (fig. 1). It has a total area of 571,520 acres, or 900 square miles. Stockton is the county seat. The population of the county was 7,398 in 1978. More than half of the people live in Plainville and Stockton. The county was organized in 1872.

The main enterprises are farming and ranching. Wheat and grain sorghum are the main crops.

general nature of the county

The paragraphs that follow provide general information about the county. They describe the climate; the physiography, drainage, and relief; the water supply; and the natural resources.

climate

Prepared by L. Dean Bark, climatologist, Kansas Agricultural Experiment Station, Manhattan, Kansas.

The climate of Rooks County is typical continental, as can be expected of a location in the interior of a large land mass in the middle latitudes. It is characterized by large daily and annual variations in temperature. Winter is cold because of frequent outbreaks of polar air, but it lasts only from December through February. Warm summer temperatures last for about 6 months every year. They provide a long growing season for the crops grown in the county. Spring and fall generally are short.

Rooks County generally is west of the flow of moisture-laden air from the Gulf of Mexico and east of the strong rain-shadow effects of the Rocky Mountains. As a result, the amount of annual precipitation is marginal for continuous cropping. The precipitation falls during showers and thunderstorms that are extremely heavy at times.

Severe windstorms and tornadoes accompany some of the thunderstorms, but they are infrequent and of local extent. Hail is a more severe weather hazard, but it results in less damage than the hailstorms in the counties to the west of this county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Plainville in the period 1951 to 1976. 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 31.4 degrees F, and the average daily minimum temperature is 19.6 degrees. The lowest temperature on record, which occurred at Plainville on January 11, 1918, and March 11, 1948, is -21 degrees. In summer the average temperature is 76.8 degrees, and the average daily maximum temperature is 90.0 degrees. The highest recorded temperature, which occurred at Plainville on July 24, 1936, is 116 degrees.

The total annual precipitation is 24.21 inches. Of this, 18.71 inches, or 77 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 13.32 inches. The heaviest 1-day

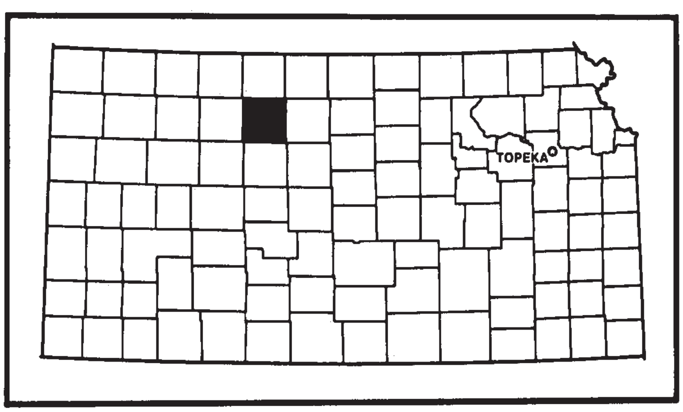


Figure 1.—Location of Rooks County in Kansas.

rainfall during the period of record was 7.02 inches at Webster Dam on August 24, 1969.

Average seasonal snowfall is 26.0 inches. The greatest snowfall, 62 inches, occurred at Stockton during the winter of 1959-60. On an average of 32 days each year, at least 1 inch of snow is on the ground.

The sun shines 76 percent of the time possible in summer and 67 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12.9 miles per hour, in spring. The somewhat high winds result in a significant amount of soil loss and crop damage in the drier years. Measures that conserve moisture and prevent excessive soil loss are needed.

physiography, drainage, and relief

Rooks County is in the Rolling Plains and Breaks land resource area (*3*). The highest elevation is about 2,300 feet above sea level, and the lowest is about 1,770 feet. The highest is near Palco, in the southwestern part of the county, and the lowest is in the eastern part, along the South Fork Solomon River. Most of the soils are gently sloping to strongly sloping, but those near Plainville, in the southern part of the county, are nearly level. The greatest relief is in areas adjacent to the major valleys, where steep upland breaks are underlain by limestone.

South Fork Solomon River and Bow Creek are the major streams. They flow to the east. The southernmost part of the county is drained by the Saline River watershed.

water supply

In many upland areas the water supply is inadequate for domestic uses and livestock. Rural water districts help to distribute water to these areas. The water supply generally is better in the valleys along the major streams. Some of the soils in these valleys are irrigated. The irrigation water is from wells and local streams or is surface water impounded by dams, such as Webster Dam.

natural resources

Soil is the most important natural resource in the county. It provides a growing medium for crops and for the grasses grazed by livestock. Other mineral resources are chalky shale and limestone, gravel, and oil. The chalky material and gravel are used for surfacing roads.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

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, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

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

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

The descriptions, names, and delineations of the soils identified on the general soil map of this county do not fully agree with those of the soils identified on the general soil maps of adjacent counties. Differences result from a better knowledge of soils, modifications in series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

soil descriptions

1. Harney-Wakeen-Uly association

Deep and moderately deep, nearly level to moderately steep, well drained soils that have a silty clay loam or silt loam subsoil; on uplands

This association is on broad ridgetops that are dissected by drainageways. A few chalky rocks crop out in the moderately steep areas. Slope ranges from 0 to 20 percent.

This association makes up about 40 percent of the county. It is about 47 percent Harney soils, 18 percent Wakeen soils, 15 percent Uly soils, and 20 percent minor soils (fig. 2).

The deep Harney soils formed in loess on the higher parts of the landscape. They are nearly level to moderately sloping. Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer also is dark grayish brown silt loam about 5 inches thick. The subsoil is silty clay loam about 27 inches thick. The upper part is grayish brown and firm, the next part is light brownish gray and firm, and the lower part is pale brown, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The moderately deep Wakeen soils formed in chalky sediments on ridges and the lower sides of drainageways. They are gently sloping to moderately steep. Typically, the surface layer is dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is grayish brown, calcareous silt loam about 7 inches thick. The subsoil is very pale brown, friable, calcareous silty clay loam about 25 inches thick. White chalky limestone is at a depth of about 37 inches.

The deep Uly soils formed in loess on the upper sides of drainageways. They are moderately sloping and strongly sloping. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 14 inches thick. The upper part is brown, friable silty clay loam, and the lower part is pale brown, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Minor in this association are Campus, Mento, Penden, and Roxbury soils. The moderately deep Campus soils are on ridgetops and the upper side slopes. The deep Mento soils are on ridgetops. The calcareous Penden soils are on side slopes. The deep Roxbury soils are on flood plains along drainageways.

This association is used mainly for cultivated crops, but some moderately sloping to moderately steep areas support native grasses and are used for grazing. Wheat, grain sorghum, and alfalfa are the main crops. Water erosion is a hazard in the gently sloping to strongly sloping areas. Measures that control water erosion, conserve moisture, and maintain fertility and tilth are the main management needs in the cultivated areas. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing are needed in the areas used as range.

2. Roxbury-Munjor-McCook association

Deep, nearly level, well drained soils that have a silt loam or sandy loam subsoil; on stream terraces or flood plains

This association is on terraces and flood plains along the major streams. Slopes generally are less than 1 percent but are steeper along the stream channels.

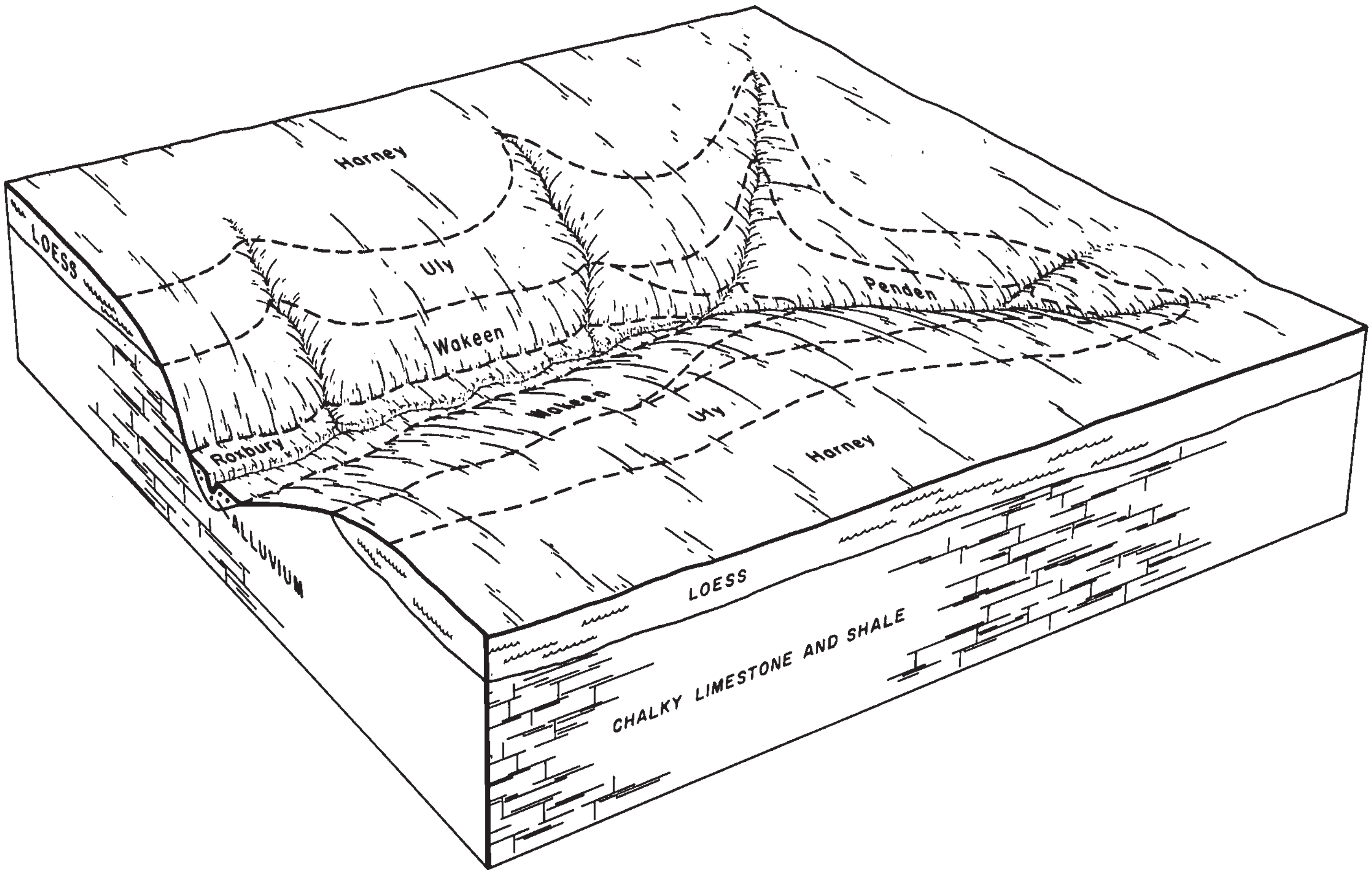


Figure 2.—Pattern of soils and parent material in the Harney-Wakeen-Uly association.

This association makes up about 8 percent of the county. It is about 30 percent Roxbury soils, 25 percent Munjor soils, 15 percent McCook soils, and 30 percent minor soils.

The Roxbury soils formed in loamy alluvium on stream terraces and flood plains. Typically, the surface layer is dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable, calcareous silt loam about 24 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 11 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam.

The Munjor soils formed in loamy alluvium on flood plains. Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The next 7 inches is light brownish gray, very friable sandy loam. The upper 28 inches of the substratum is light brownish gray fine sandy loam. The lower part to a depth of about 60 inches is pale brown sand.

The McCook soils formed in silty alluvium on stream terraces. Typically, the surface layer is dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is grayish brown, calcareous silt loam about 6 inches thick. The next 8 inches is grayish brown, friable, calcareous silt loam. The upper 21 inches of the substratum is light brownish gray, calcareous silt loam. The lower part to a depth of about 60 inches is very pale brown, calcareous fine sandy loam.

Minor in this association are Armo, Eltree, Hord, and Inavale soils. The calcareous Armo and deep Eltree soils are on the adjacent uplands. The sandy Inavale soils are on flood plains. The deep Hord soils are on the higher terraces.

This association is used mainly for cultivated crops, but some small areas are used for range. Wheat, grain sorghum, alfalfa, and corn are the main crops. Some areas of the more sandy soils are irrigated by sprinklers. Most of the areas along stream channels support cottonwood and other deciduous trees. They are used as wildlife habitat and as range. A large area adjacent to and west of Webster Lake is used for recreation.

Controlling flooding and maintaining fertility and tilth are the main concerns in managing these soils. Also, soil blowing is a hazard on the soils that have a sandy loam surface layer.

3. Uly-Wakeen-Penden association

Deep and moderately deep, moderately sloping to moderately steep, well drained soils that have a silty clay loam, silt loam, or loam subsoil; on uplands

This association is on ridgetops and side slopes that are dissected by drainageways and creeks. Slope ranges from 3 to 20 percent.

This association makes up about 12 percent of the county. It is about 30 percent Uly soils, 25 percent Wakeen soils, 15 percent Penden soils, and 30 percent minor soils (fig. 3).

The deep Uly soils formed in loess on narrow ridges and the upper sides of drainageways. They are moderately sloping to moderately steep. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 14 inches thick. The upper part is brown, friable silty clay loam, and the lower part is pale brown, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The moderately deep Wakeen soils formed in chalky sediments on side slopes. They are moderately sloping to moderately steep. Typically, the surface layer is dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is grayish brown, calcareous silt loam about 7 inches thick. The subsoil is very pale brown, friable, calcareous silty clay loam about 25 inches thick. White chalky limestone is at a depth of about 37 inches.

The deep Penden soils formed in calcareous, loamy sediments on slopes between the Wakeen and Uly soils. They are moderately sloping to moderately steep. Typically, the surface layer is grayish brown, calcareous loam about 9 inches thick. The subsoil is pale brown, friable, calcareous loam about 13 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous loam.

Minor in this association are Anselmo, Campus, Harney, Holdrege, Munjor, and Roxbury soils. Anselmo soils are on ridgetops and the upper side slopes. They

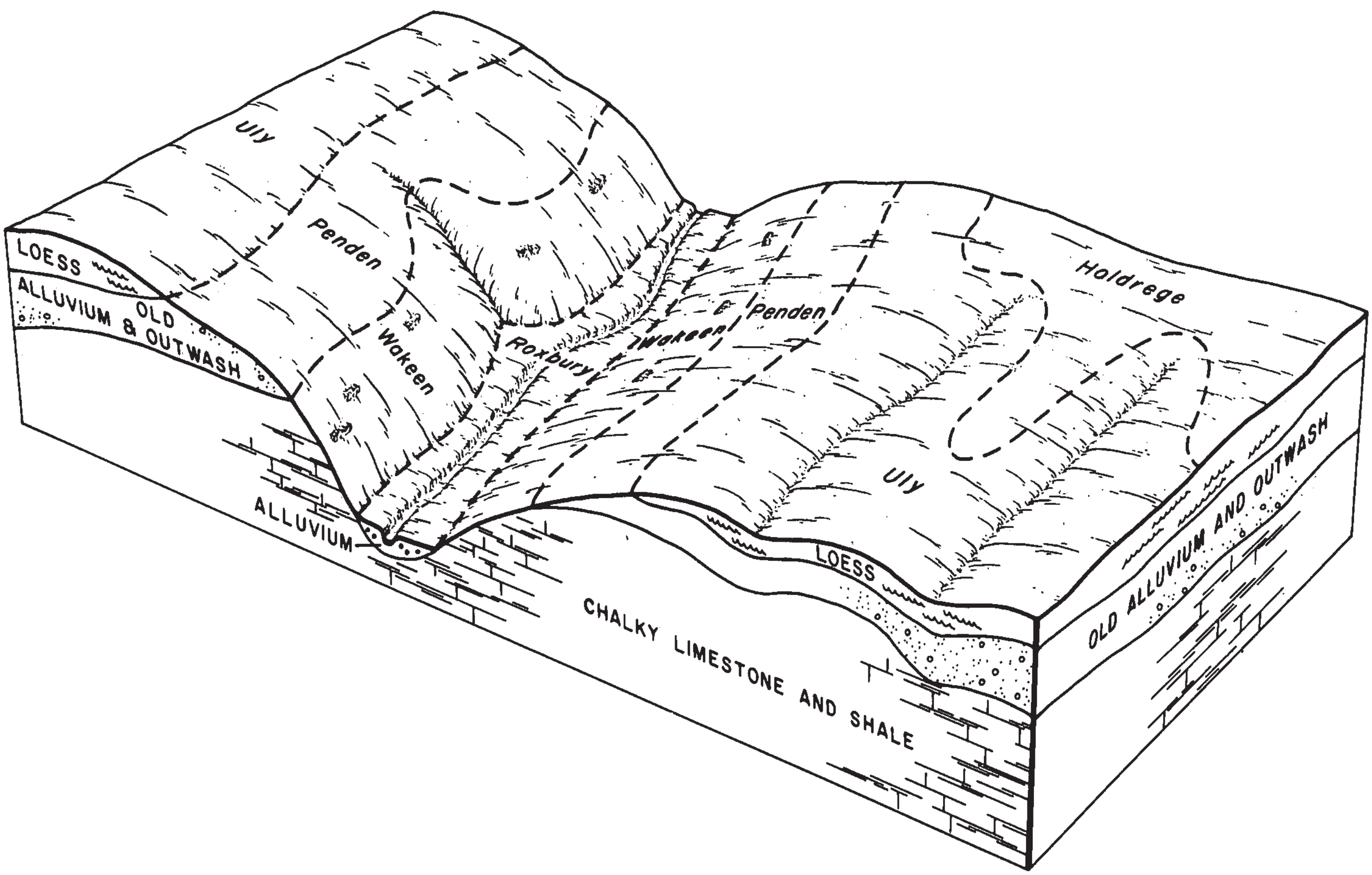


Figure 3.—Pattern of soils and parent material in the Uly-Wakeen-Penden association.

are more sandy than the major soils. The moderately deep Campus soils are on side slopes. The deep Harney and Holdrege soils are on narrow, loess-covered ridgetops. The loamy Munjor and calcareous Roxbury soils are on flood plains along drainageways.

Most of this association is used for range. Some areas are used for cultivated crops. In the areas used as range, the soils are well suited to the native grasses commonly grown in the county. In many of the areas used as cropland, they are poorly suited to cultivated crops because erosion is a severe hazard. The main management needs in the areas used as range are proper stocking rates and measures that maintain a vigorous stand of native grass. Controlling erosion and maintaining fertility are the main concerns in managing the cultivated areas.

4. Heizer-Armo-Harney association

Shallow and deep, gently sloping to steep, somewhat excessively drained and well drained soils that have a loam or silty clay loam subsoil; on uplands

This association is on narrow ridgetops deeply dissected by drainageways. Slope ranges from 1 to 30 percent.

This association makes up about 16 percent of the county. It is about 28 percent Heizer soils, 20 percent Armo soils, 20 percent Harney soils, and 32 percent minor soils (fig. 4).

The shallow, somewhat excessively drained Heizer soils formed in residuum of limestone on side slopes. They are moderately sloping to steep. Typically, the surface layer is dark gray gravelly loam about 6 inches thick. The next 3 inches is gray, friable channery loam. The substratum is light brownish gray channery loam about 5 inches thick. White chalky limestone is at a depth of about 14 inches.

The deep, well drained Armo soils formed in colluvium on foot slopes. They are gently sloping to moderately steep. Typically, the surface layer is dark grayish brown, calcareous loam about 7 inches thick. The subsurface layer is grayish brown, calcareous loam about 5 inches thick. The subsoil is pale brown, friable, calcareous loam

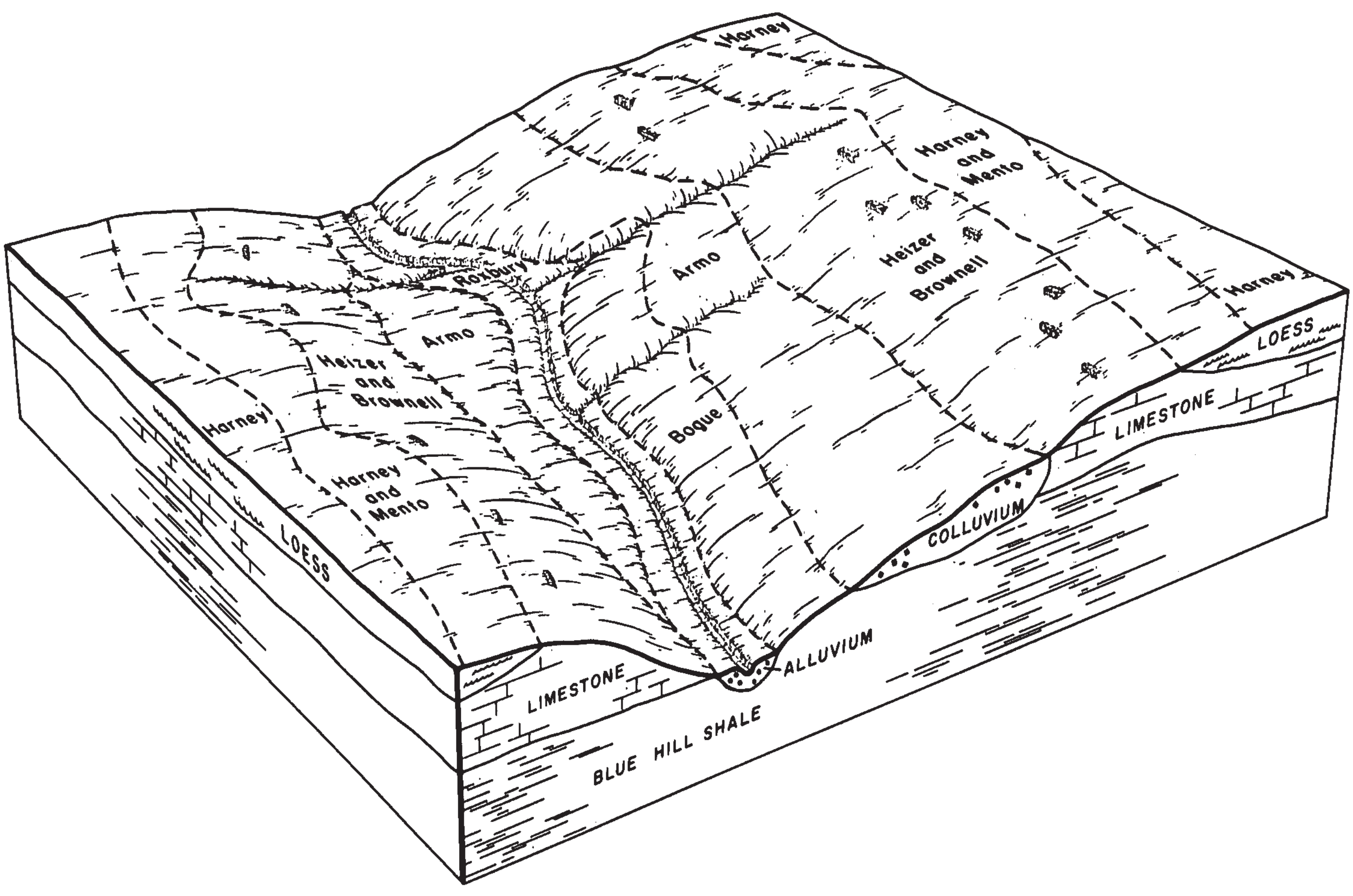


Figure 4.—Pattern of soils and parent material in the Heizer-Armo-Harney association.

about 18 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam.

The deep, well drained Harney soils formed in loess on the higher parts of the landscape. They are gently sloping or moderately sloping. Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is silty clay loam about 27 inches thick. The upper part is grayish brown and firm, the next part is light brownish gray and firm, and the lower part is pale brown, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Minor in this association are Bogue, Brownell, Mento, Roxbury, and Uly soils. The moderately deep, clayey Bogue soils are on foot slopes below the Heizer soils. The moderately deep Brownell soils are in the less sloping areas above the Heizer soils. The deep Mento and Uly soils are on ridgetops. The calcareous Roxbury soils are on flood plains along drainageways.

Most of this association supports native grasses and is used for grazing. Some small areas are used for cultivated crops, such as wheat and grain sorghum. Proper stocking rates and control of water erosion are the main concerns in managing the areas used as range.

5. Holdrege-Uly association

Deep, nearly level to moderately steep, well drained soils that have a silty clay loam or silt loam subsoil; on uplands

This association is on broad ridgetops that are dissected by narrow drainageways. Slope ranges from 0 to 15 percent.

This association makes up about 24 percent of the county. It is about 50 percent Holdrege soils, 20 percent Uly soils, and 30 percent minor soils (fig. 5).

The Holdrege soils formed in loess on broad ridgetops. They are nearly level to moderately sloping. Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 23 inches thick. The upper part is grayish brown, friable silty clay loam; the next part is pale brown, firm silty clay loam; and the lower part is pale brown, friable silt loam. The substratum to a depth

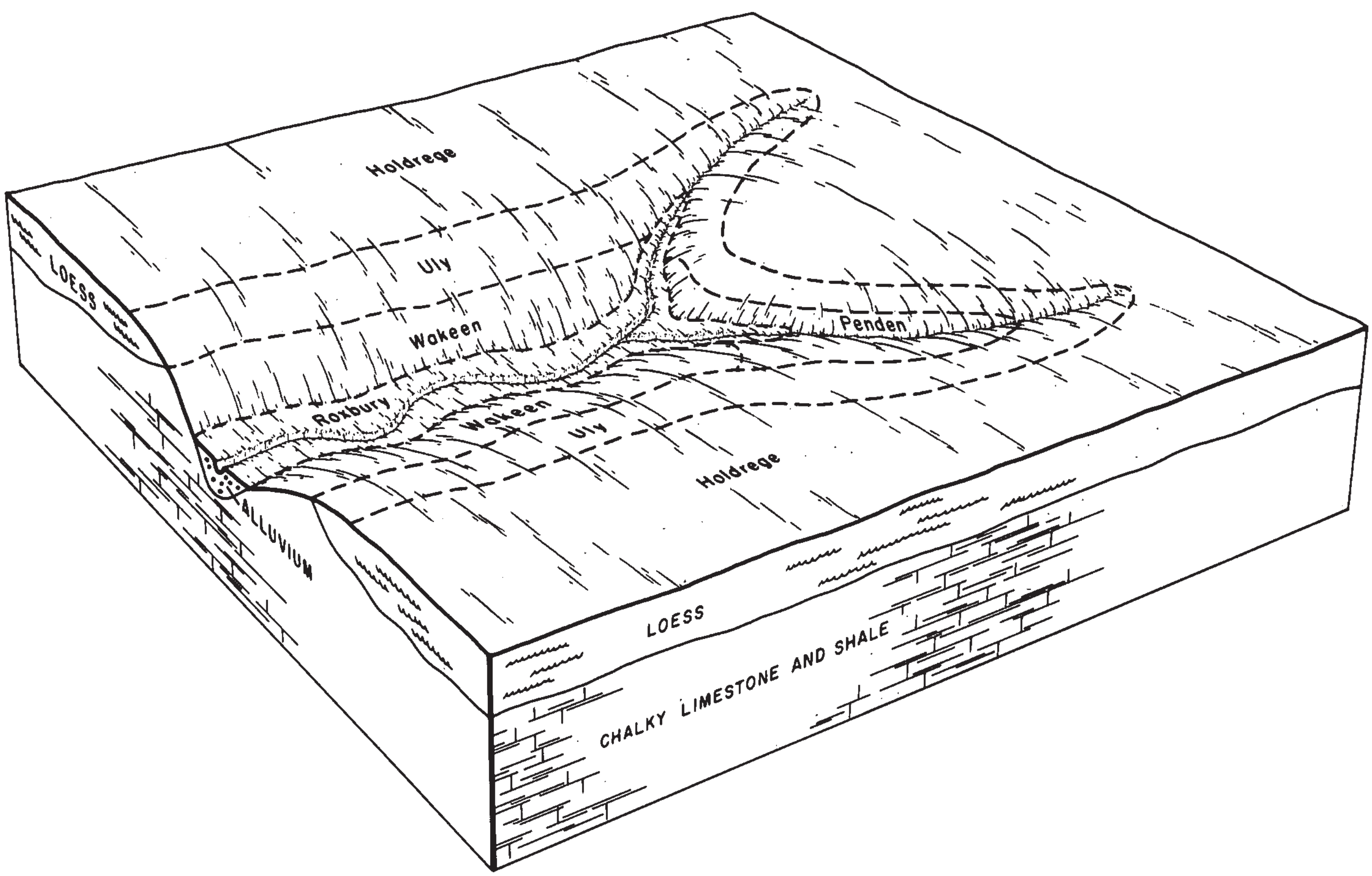


Figure 5.—Pattern of soils and parent material in the Holdrege-Uly association.

of about 60 inches is very pale brown, calcareous silt loam.

The Uly soils formed in loess on the upper sides of drainageways. They are moderately sloping to moderately steep. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 14 inches thick. The upper part is brown, friable silty clay loam, and the lower part is pale brown, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Minor in this association are Anselmo, Campus, Harney, Penden, Roxbury, and Wakeen soils. Anselmo soils are on ridgetops or foot slopes. They are more sandy than the major soils. The moderately deep Campus soils are on ridgetops and the upper side slopes. The deep Harney soils are on ridgetops. The calcareous Penden soils are on side slopes. The calcareous Roxbury soils are on flood plains along drainageways. The moderately deep Wakeen soils are on the lower side slopes.

Most of this association is cultivated, but some moderately sloping to moderately steep areas along the entrenched drainageways are used as range. Grain sorghum, wheat, and alfalfa are the main crops.

This association is well suited to all of the crops and grasses commonly grown in the county. The main management needs in the cultivated areas are measures that control water erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing are needed in the areas used as range.

detailed soil map units

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and identifies 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, Harney silt loam, 0 to 1 percent slopes, is one of several phases in the Harney 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 that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Armo-Bogue complex, 7 to 15 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. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

The descriptions, names, and delineations of the soils identified on the detailed maps of this county do not fully agree with those of the soils identified on the maps of adjacent counties. Differences result from a better knowledge of soils, modifications in series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

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

Ad—Anselmo fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on ridgetops and terraces. Individual areas are irregular in shape and range from 40 to more than 200 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 12 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 15 inches thick. The substratum to a depth of about 60 inches is pale brown fine sandy loam. In some areas lime is in the surface layer and subsoil.

Included with this soil in mapping are small areas of Holdrege soils on the higher ridgetops. These soils are more silty than the Anselmo soil. They make up about 10 percent of the map unit.

Permeability is moderately rapid in the Anselmo soil, and surface runoff is slow. Available water capacity is moderate. Natural fertility is medium, and organic matter content is moderately low. The surface layer is very friable and can be easily tilled. It is neutral or mildly alkaline.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Water erosion and soil blowing are hazards, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to maintain the organic matter content and control soil blowing and erosion.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses.

Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

The potential for frost action is a moderate limitation if this soil is used as a site for local roads and streets. Replacing the base material, however, helps to prevent the damage caused by frost action. The soil is suitable as a site for dwellings and septic tank absorption fields. Seepage is a severe limitation on sites for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability subclass is IIIe.

Af—Anselmo fine sandy loam, 3 to 8 percent slopes. This deep, moderately sloping, well drained soil is on ridgetops and terraces. Individual areas are irregular in shape and range from 50 to more than 600 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 12 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 12 inches thick. The substratum to a depth of about 60 inches is pale brown fine sandy loam. In some areas the surface layer, subsoil, and substratum are loam or silt loam. In other areas lime is in the surface layer and subsoil.

Included with this soil in mapping are small areas of the moderately deep Campus soils on the lower side slopes. These soils make up about 10 percent of the map unit.

Permeability is moderately rapid in the Anselmo soil, and surface runoff is medium. Available water capacity is moderate. Natural fertility is medium, and organic matter content is moderately low. The surface layer is very friable and can be easily tilled. The surface layer and subsoil are neutral or mildly alkaline.

Most areas are used for range. Some small areas are used for cultivated crops. This soil is moderately well suited to wheat and grain sorghum. If cultivated crops are grown, water erosion and soil blowing are hazards. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to maintain the organic matter content and control soil blowing and erosion.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition and prevent excessive erosion and soil blowing.

The potential for frost action is a moderate limitation if this soil is used as a site for local roads and streets. Replacing the base material, however, helps to prevent the damage caused by frost action. The soil is suitable as a site for dwellings and septic tank absorption fields. Seepage and slope are severe limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. The less sloping areas of this soil should be selected as sites for lagoons.

The capability subclass is IVe.

Ar—Armo loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on foot slopes. Individual areas are long and narrow and range from 10 to 300 acres in size.

Typically, the surface layer is dark grayish brown, calcareous loam about 7 inches thick. The subsurface layer is grayish brown, calcareous loam about 6 inches thick. The subsoil is pale brown, friable, calcareous loam about 22 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam. In some areas the surface layer and subsoil are fine sandy loam.

Included with this soil in mapping are small areas of the shallow Heizer and moderately deep Wakeen soils on side slopes. These soils make up about 10 percent of the map unit.

Permeability is moderate in the Armo soil, and surface runoff is medium. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is mildly alkaline or moderately alkaline.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to prevent excessive soil loss and maintain fertility.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The soil is suitable as a site for dwellings and septic tank absorption fields. It has moderate limitations as a site for sewage lagoons because of seepage and slope. Sealing the lagoon helps to control seepage. The less sloping areas of this soil should be selected as sites for lagoons.

The capability subclass is IIe.

As—Armo loam, 3 to 7 percent slopes. This deep, moderately sloping, well drained soil is on the lower side slopes and on foot slopes. Individual areas are long and narrow and range from 20 to 300 acres in size.

Typically, the surface layer is dark grayish brown, calcareous loam about 7 inches thick. The subsurface layer is grayish brown, calcareous loam about 5 inches thick. The subsoil is pale brown, friable, calcareous loam about 18 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam. In some areas the surface soil is pale brown because it has been mixed with the upper part of the subsoil by plowing. In other areas the surface soil and subsoil are fine sandy loam.

Included with this soil in mapping are small areas of the shallow Heizer soils on the upper side slopes. These soils make up about 5 percent of the map unit.

Permeability is moderate in the Armo soil, and surface runoff is medium. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. The soil is mildly alkaline or moderately alkaline throughout.

Most areas are used for cultivated crops. This soil is suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terraces, grassed waterways (fig. 6), contour farming, and minimum tillage help to prevent excessive soil loss. Returning crop residue to the soil improves fertility and increases the rate of water infiltration.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The soil is suitable as a site for dwellings and septic tank absorption fields. It has moderate limitations as a site for sewage lagoons because of seepage and slope. Sealing the lagoon helps to control seepage. The less sloping areas of this soil are the better sites for lagoons.

The capability subclass is IIIe.

Au—Armo-Bogue complex, 7 to 15 percent slopes. These strongly sloping and moderately steep soils are on uplands dissected by deeply entrenched drainageways. The deep, well drained Armo soil is on

Figure 6.—Grassed waterway in an area of Armo loam, 3 to 7 percent slopes.

side slopes. The moderately deep, moderately well drained Bogue soil is on the lower side slopes and on foot slopes. Individual areas are irregular in shape and range from 20 to several hundred acres in size. They are about 50 percent Armo soil and 30 percent Bogue soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Armo soil has a surface layer of dark grayish brown, calcareous loam about 10 inches thick. The subsoil is pale brown, friable, calcareous loam about 18 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam.

Typically, the Bogue soil has a surface layer of gray clay about 7 inches thick. The subsoil is gray, extremely firm clay about 14 inches thick. The substratum is gray clay about 15 inches thick. Shale bedrock is at a depth of about 36 inches.

Included with these soils in mapping are small areas of Brownell, Heizer, and Roxbury soils. The moderately deep Brownell and shallow Heizer soils are near limestone outcrops in the steeper areas. The deep Roxbury soils are on flood plains along narrow drainageways. Included soils make up about 20 percent of the map unit.

Permeability is moderate in the Armo soil and very slow in the Bogue soil. Available water capacity is high in the Armo soil and low in the Bogue soil. Surface runoff is rapid on both soils. Natural fertility is medium and organic matter content moderate in the Armo soil. Natural fertility is low and organic matter content moderately low in the Bogue soil. The root zone is restricted by the shale bedrock at a depth of about 36 inches in the Bogue soil. The shrink-swell potential is high in this soil.

Most areas are used for range. These soils generally are unsuitable for cultivation because of a severe hazard of erosion. They are best suited to range. The major concerns in managing range are the hazard of erosion on both soils and the low available water capacity of the Bogue soil. Overgrazing reduces the vigor and retards the growth of the grasses. An adequate plant cover and ground mulch reduce the runoff rate, help prevent excessive soil loss, and increase the moisture supply. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

The low strength of both soils and the shrink-swell potential of the Bogue soil are severe limitations if these soils are used as sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome these limitations. The slope is a moderate limitation on sites for dwellings, but the less sloping areas of the Armo soil are suitable sites. The shrink-swell potential of the Bogue soil is a severe limitation. As a result, the Armo soil or the less clayey included soils are better sites for dwellings.

The Bogue soil generally is unsuitable as a septic tank absorption field because the depth to bedrock is a severe limitation. It has severe limitations as a site for sewage lagoons because of the depth to bedrock and the slope. The slope of the Armo soil is a moderate limitation on sites for septic tank absorption fields and a severe limitation on sites for sewage lagoons. The less sloping included soils are suitable sites for septic tank absorption fields. The deeper, less sloping areas of these soils on the lower foot slopes are suitable sites for lagoons.

The capability subclass is VIe.

Ca—Campus loam, 2 to 6 percent slopes. This moderately deep, moderately sloping, well drained soil is on side slopes and narrow ridgetops in the uplands. Individual areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, calcareous loam about 8 inches thick. The subsoil is grayish brown, friable, calcareous loam about 9 inches thick. The substratum is very pale brown, calcareous loam about 12 inches thick. White caliche is at a depth of about 29 inches.

Included with this soil in mapping are some areas of the deep Anselmo and Uly soils. Anselmo soils are more sandy than the Campus soil. They are on the lower slopes. Uly soils are on the upper slopes and on ridgetops. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Campus soil, and surface runoff is medium. Available water capacity is low. Natural fertility is medium, and organic matter content is moderately low. The surface layer and subsoil are mildly alkaline or moderately alkaline. The root zone is restricted by the caliche at a depth of about 29 inches.

Most areas are used for range. Some small areas are used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, and alfalfa. If cultivated crops are grown, water erosion is a hazard. Terraces, grassed waterways, and contour farming help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to control soil blowing and conserve moisture.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. An adequate plant cover reduces the runoff rate and helps to prevent excessive soil loss. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

Low strength is a moderate limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The depth to bedrock is a moderate limitation on sites for local roads and streets and for dwellings without basements, and it is a severe limitation on sites for dwellings with basements and on sites for septic tank absorption fields and sewage lagoons. The deeper included soils are better sites.

The capability subclass is IVe.

Cc—Campus-Anselmo complex, 5 to 15 percent slopes. These moderately sloping to moderately steep, well drained soils are on side slopes and narrow ridgetops that generally are dissected by deeply entrenched drainageways. The Campus soil is moderately deep and the Anselmo soil deep. Individual areas are irregular in shape and range from 40 to several hundred acres in size. They are about 55 percent Campus soil and 35 percent Anselmo soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Campus soil has a surface layer of dark grayish brown, calcareous loam about 8 inches thick. The subsoil is grayish brown, friable, calcareous loam about 9 inches thick. The substratum is very pale brown, calcareous loam about 12 inches thick. White caliche bedrock is at a depth of about 29 inches. In some areas the bedrock is within a depth of 20 inches. In other areas it is at a depth of more than 40 inches.

Typically, the Anselmo soil has a surface layer of dark grayish brown fine sandy loam about 12 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 12 inches thick. The substratum to a depth of about 60 inches is pale brown fine sandy loam.

Included with these soils in mapping are small areas of the silty Uly soils on the ridgetops. These included soils make up about 10 percent of the map unit.

Permeability is moderate in the Campus soil and moderately rapid in the Anselmo soil. Surface runoff is medium on the Campus soil and rapid on the Anselmo soil. Available water capacity is low in the Campus soil and moderate in the Anselmo soil. Natural fertility is medium in both soils, and organic matter content is moderately low. The surface layer and subsoil of the Campus soil are mildly alkaline or moderately alkaline. Those of the Anselmo soil are neutral or mildly alkaline. The root zone is restricted by the caliche at a depth of about 29 inches in the Campus soil.

Most areas are used for range. These soils generally are unsuitable for cultivation because of a severe hazard of erosion. They are best suited to range. The major concerns in managing range are the hazard of erosion on both soils and the low available water capacity of the Campus soil. Overgrazing reduces the vigor and retards the growth of the grasses and increases the runoff rate. An adequate plant cover reduces the runoff rate, helps prevent excessive soil loss, and increases the moisture supply. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

The slope is a moderate limitation if these soils are used as sites for local roads and streets. The depth to bedrock and low strength of the Campus soil and the potential for frost action in the Anselmo soil also are moderate limitations. The roads and streets should be built in the deeper, less sloping areas of this unit. Strengthening or replacing the base material helps to prevent the damage resulting from low strength and frost action.

The slope is a moderate limitation if these soils are used as sites for dwellings. Also, the depth to bedrock in the Campus soil is a moderate limitation on sites for dwellings without basements and a severe limitation on sites for dwellings with basements. The dwellings should be built in the deeper, less sloping areas of this unit.

The Campus soil is unsuitable as a site for septic tank absorption fields and sewage lagoons because the depth to bedrock is a severe limitation. The slope of the Anselmo soil is a moderate limitation on sites for septic tank absorption fields and a severe limitation on sites for sewage lagoons. Also, seepage is a severe limitation on sites for sewage lagoons. The sanitary facilities should be installed in the less sloping areas of this unit. Seepage can be controlled by sealing the lagoon.

The capability subclass is VIe.

Cr—Carlson silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on broad upland ridgetops. Individual areas are irregular in shape and range from 20 to 200 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is grayish brown, friable silty clay loam; the next part is pale brown, firm silty clay loam; and the lower part is pale brown, friable, calcareous clay loam. The substratum to a depth of about 60 inches is very pale brown, calcareous loam. In some areas the surface layer is calcareous.

Permeability is moderately slow, and surface runoff is medium. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is neutral or mildly alkaline. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to prevent excessive soil loss and maintain the organic matter content and good tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

The moderately slow permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the field, however, helps to overcome the slow absorption of liquid waste. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. The less sloping areas of this soil should be selected as sites for lagoons.

The capability subclass is IIe.

Ef—Eltree silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on foot slopes. Individual areas are irregular in shape and range from 10 to 130 acres in size.

Typically, the surface layer is grayish brown silt loam about 6 inches thick. The subsurface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is friable, calcareous silty clay loam about 18 inches thick. The upper part is grayish brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the surface layer, subsoil, and substratum are loam.

Permeability is moderate, and surface runoff is slow. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is mildly alkaline.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to prevent excessive soil loss and maintain the organic matter content and good tilth. The soil is suitable for irrigation if an adequate water supply is available. Land leveling and water management help to control erosion and improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength and the potential for frost action are moderate limitations if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to prevent the damage resulting from low strength and frost action. The soil is suitable as a site for dwellings and septic tank absorption fields. It has moderate limitations as a site for sewage lagoons because of seepage and slope. Sealing the lagoon helps to control seepage. The less sloping areas of this soil should be selected as sites for lagoons.

The capability subclass is IIe.

Ha—Harney silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on broad upland ridgetops. Individual areas are irregular in shape and range from 30 to more than 1,000 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer also is dark grayish brown silt loam about 5 inches thick. The subsoil is silty clay loam about 27 inches thick. The upper part is grayish brown and firm, the next part is light brownish gray and firm, and the lower part is pale brown, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the surface soil is silty clay loam because it has been mixed with the upper part of the subsoil by plowing. In other areas the subsoil is less clayey.

Included with this soil in mapping are some areas of somewhat poorly drained, clayey soils in small depressions. These soils make up about 2 percent of the map unit.

Permeability is moderately slow in the Harney soil, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is slightly acid or neutral. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Drought is a hazard, however, in years when the amount of rainfall is limited. Also, soil blowing is a hazard during dry periods or periods when the soil does not have sufficient plant cover. Returning crop residue to the soil and minimizing tillage help to control soil blowing and conserve moisture. The soil is suitable for irrigation if an adequate supply of water is available. Land leveling and water management improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent damage caused by shrinking and swelling.

The moderately slow permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the field, however, helps to overcome the slow absorption of liquid waste. Seepage is a moderate limitation on sites for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability subclass is IIc.

Hb—Harney silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on broad upland ridgetops that are dissected by drainageways. Most areas are 50 to 600 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is silty clay loam about 27 inches thick. The upper part is grayish brown and firm, the next part is light brownish gray and firm, and the lower part is pale brown, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas on ridges and hilltops, the surface soil is pale brown silty clay loam because it has been mixed with the upper part of the subsoil by plowing. In places the subsoil is less clayey.

Included with this soil in mapping are small areas of the moderately deep Wakeen soils on the top of the higher ridges. These soils make up about 10 percent of the map unit. Also included are small areas of somewhat poorly drained, clayey soils in depressions. These soils make up about 2 percent of the map unit.

Permeability is moderately slow in the Harney soil, and surface runoff is medium. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is slightly acid or neutral. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing (fig. 7), establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage reduce the runoff rate, help to control erosion, and maintain the organic matter content and good tilth. The soil is suitable for irrigation if an adequate water supply is available. Land leveling and water management reduce the runoff rate and improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

The moderately slow permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the field, however, helps to overcome the slow absorption of liquid waste. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the sewage lagoon helps to control seepage. The less sloping areas of this soil should be selected as sites for lagoons.

The capability subclass is IIe.

Hd—Harney-Mento silt loams, 1 to 3 percent slopes. These deep, gently sloping, well drained soils are on upland ridges that generally are dissected by sloping drainageways. The Harney soil is in the less sloping areas where the loess mantle is thicker. The Mento soil is in areas where the loess mantle is thinner and chalky limestone is within a depth of 6 feet. It commonly is adjacent to small depressions. Individual areas range from 20 to several hundred acres in size. They are about 50 percent Harney soil and 35 percent Mento soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Harney soil has a surface layer of grayish brown silt loam about 5 inches thick. The subsurface layer is grayish brown silt loam about 4 inches thick. The subsoil is silty clay loam about 25 inches thick. The upper part is grayish brown and firm, the next part is light brownish gray and firm, and the lower part is pale brown, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the surface soil is pale brown silty clay loam because it has been mixed with part of the subsoil by plowing.

Typically, the Mento soil has a surface layer of dark grayish brown silt loam about 5 inches thick. The subsoil is silty clay loam about 19 inches thick. The upper part is grayish brown and firm, the next part is pale brown, firm, and calcareous, and the lower part is very pale brown, friable, and calcareous. The substratum is calcareous silt loam about 36 inches thick. The upper part is very pale brown, and the lower part is white. Chalky limestone bedrock is at a depth of about 60 inches. In some areas the subsoil is affected by sodium.

Included with these soils in mapping are small areas of the moderately deep Wakeen soils on side slopes. Also included are some areas of soils that have chalk fragments in the surface layer. Included soils make up about 15 percent of the map unit.

Permeability is moderately slow in the Harney soil and slow in the Mento soil. Surface runoff is medium on both soils. Available water capacity is high in the Harney soil and moderate in the Mento soil. Natural fertility is high in the Harney soil and medium in the Mento soil. Organic matter content is moderate in both soils. The surface

Figure 7.—A terraced area of Harney silt loam, 1 to 3 percent slopes. The terrace is holding back water after a 4-inch rain.

layer is slightly acid or neutral. It generally is friable and can be easily tilled. In some areas, however, it is firm and tilth is poor. The shrink-swell potential is moderate.

Most areas are used for cultivated crops. These soils are well suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to prevent excessive soil loss, maintain the organic matter content, and improve tilth.

These soils are well suited to range. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if these soils are used as sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

If these soils are used as septic tank absorption fields, the slow permeability of the Mento soil is a severe limitation and the moderately slow permeability of the Harney soil a moderate limitation. Increasing the size of the field, however, helps to overcome the slow absorption of liquid waste. The slope of both soils and seepage in the Harney soil are moderate limitations on sites for sewage lagoons. Sealing the sewage lagoon helps to control seepage. The less sloping areas of this unit should be selected as sites for lagoons.

The capability subclass is IIe.

He—Harney-Mento silt loams, 3 to 7 percent slopes. These deep, moderately sloping, well drained soils are on ridges and along drainageways in the uplands. The Harney soil is in the higher areas where the loess mantle is thicker. The Mento soil is in areas where the loess mantle is thinner and chalky limestone is within a depth of 6 feet. It commonly is adjacent to small depressions. Individual areas range from 30 to several hundred acres in size. They are about 45 percent Harney soil and 40 percent Mento soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Harney soil has a surface layer of grayish brown silt loam about 8 inches thick. The subsoil is silty clay loam about 24 inches thick. The upper part is grayish brown and firm, the next part is light brownish gray and firm, and the lower part is pale brown, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the surface layer is pale brown silty clay loam because it has been mixed with part of the subsoil by plowing. In many of these areas, the depth to lime is only about 15 inches.

Typically, the Mento soil has a surface layer of dark grayish brown silt loam about 5 inches thick. The subsoil is silty clay loam about 19 inches thick. The upper part is grayish brown and firm, the next part is pale brown, firm, and calcareous, and the lower part is very pale brown, friable, and calcareous. The substratum is calcareous silt loam about 36 inches thick. The upper part is very pale brown, and the lower part is white. Chalky limestone bedrock is at a depth of about 60 inches. In some areas the subsoil is affected by sodium.

Included with these soils in mapping are small areas of Brownell and Wakeen soils on the lower side slopes. These included soils are 20 to 40 inches deep over bedrock. They make up about 15 percent of the unit.

Permeability is moderately slow in the Harney soil and slow in the Mento soil. Surface runoff is medium on both soils. Available water capacity is high in the Harney soil and moderate in the Mento soil. Natural fertility is high in the Harney soil and medium in the Mento soil. Organic matter content is moderate in both soils. The surface layer is slightly acid or neutral. It generally is friable and can be easily tilled. In some areas, however, it is firm and tilth is poor. The shrink-swell potential is moderate.

About half of the acreage is used for cultivated crops. The rest is mainly range. These soils are suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to control erosion, maintain the organic matter content, and improve tilth.

These soils are well suited to range. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if these soils are used as sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

If these soils are used as septic tank absorption fields, the slow permeability of the Mento soil is a severe limitation and the moderately slow permeability of the Harney soil a moderate limitation. Increasing the size of the field, however, helps to overcome the slow absorption of liquid waste. The slope of both soils and seepage in the Harney soil are moderate limitations on sites for sewage lagoons. Sealing the sewage lagoon helps to control seepage. The less sloping areas of these soils are the better sites for lagoons.

Hm—Heizer-Brownell gravelly loams, 5 to 30 percent slopes. These moderately sloping to steep soils are on the sides and narrow tops of upland ridges that are dissected by deeply entrenched drainageways. The shallow, somewhat excessively drained Heizer soil is on the steeper slopes. The moderately deep, well drained Brownell soil is higher on the landscape than the Heizer soil and is less sloping. Individual areas are irregular in shape and range from 30 to several hundred acres in size. They are about 55 percent Heizer soil and 25 percent Brownell soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Heizer soil has a surface layer of dark gray gravelly loam about 6 inches thick. The next 3 inches is gray, friable channery loam. The substratum is light brownish gray channery loam about 5 inches thick. Chalky limestone bedrock is at a depth of about 14 inches. In many areas the limestone crops out.

Typically, the Brownell soil has a surface layer of grayish brown gravelly loam about 11 inches thick. The subsoil is pale brown, friable gravelly loam about 7 inches thick. The substratum is pale brown channery loam about 6 inches thick. Limestone bedrock is at a depth of about 24 inches.

Included with these soils in mapping are small areas of the deep Armo, Mento, and Roxbury soils. Also included are areas of soils that have a light colored surface layer but otherwise are similar to Armo soils. Armo soils and the soils that are similar to Armo soils are on the steeper side slopes or foot slopes. Mento soils are on the upper side slopes. Roxbury soils are on flood plains along drainageways. Included soils make up about 20 percent of the map unit.

Permeability is moderate in the Brownell and Heizer soils, and surface runoff is rapid. Available water capacity is low in the Brownell soil and very low in the Heizer soil. Natural fertility is low in both soils, and organic matter content is moderately low. The root zone is restricted by the limestone bedrock at a depth of about 14 inches in the Heizer soil and at a depth of about 24 inches in the Brownell soil. Both soils are mildly alkaline or moderately alkaline throughout.

Most areas support native grasses (fig. 8). These soils are best suited to range. The major concerns of management are the hazard of erosion and the low and very low available water capacity. Overgrazing reduces the vigor and retards the growth of the grasses and increases the runoff rate. An adequate plant cover reduces the runoff rate, helps to prevent excessive soil loss, and conserves moisture. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

These soils generally are unsuitable as sites for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because of the depth to bedrock and the slope. The deep included soils on the lower side slopes and on foot slopes are better sites for these uses.

The capability subclass is VIIs.

Ho—Holdrege silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on broad upland ridgetops and in a few areas on high terraces along

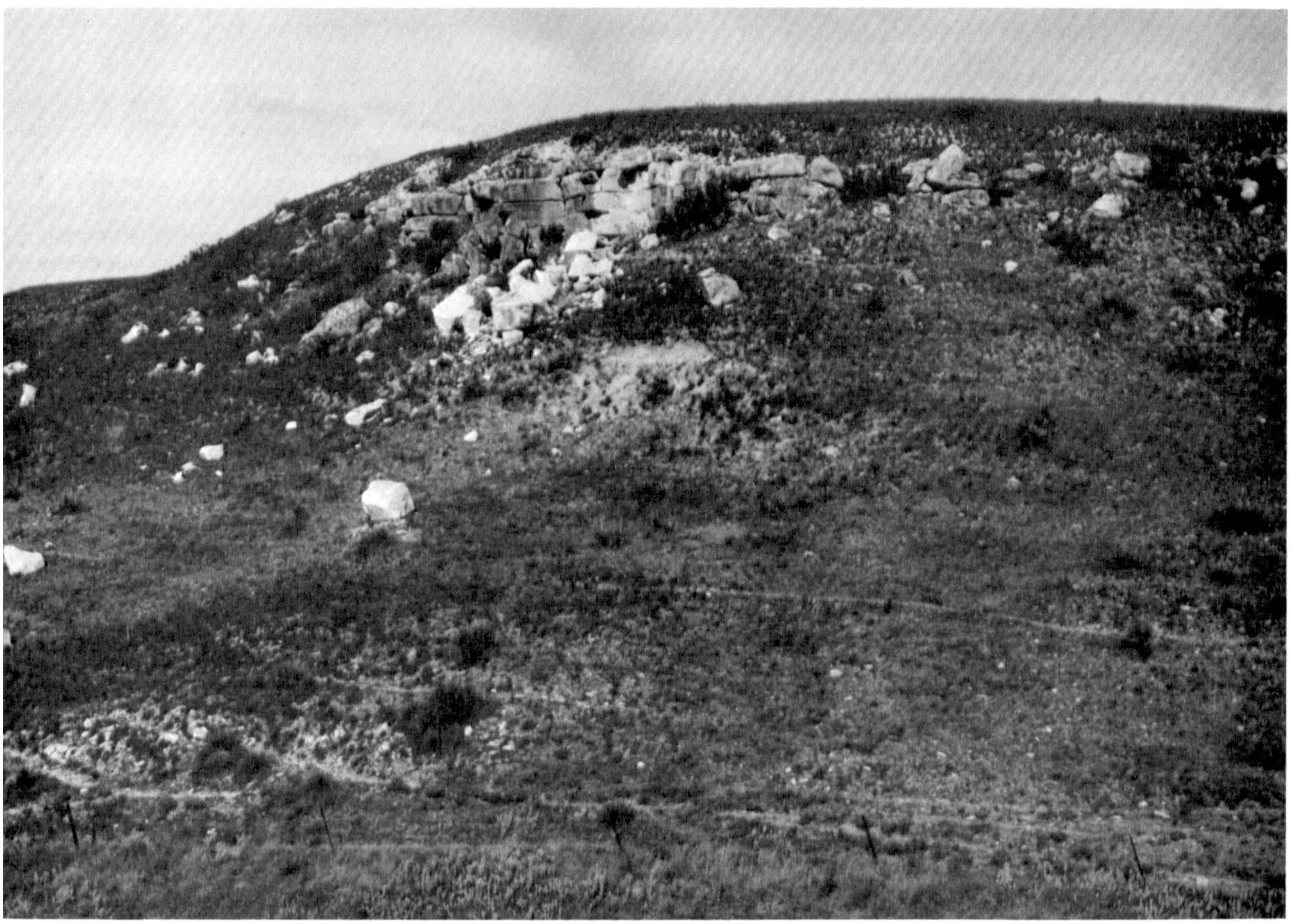


Figure 8.—An area of Heizer-Brownell gravelly loams, 5 to 30 percent slopes, used as native range. Fort Hays limestone crops out near the top of the ridge.

streams. Individual areas are irregular in shape and range from 50 to 700 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 23 inches thick. The upper part is grayish brown, friable silty clay loam; the next part is pale brown, firm silty clay loam; and the lower part is pale brown, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the upper part of the subsoil is slightly more clayey.

Included with this soil in mapping are some areas of clayey soils in small depressions or swales. These soils make up about 2 percent of the map unit.

Permeability is moderate in the Holdrege soil, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is very friable and can be easily tilled. It is slightly acid or neutral. The shrink-swell potential is moderate.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Drought is a hazard, however, in years when the amount of rainfall is limited. Also, soil blowing is a hazard during dry periods or periods when the soil does not have a sufficient plant cover. Returning crop residue to the soil and minimizing tillage help to control soil blowing and conserve moisture. The soil is suitable for irrigation if an adequate supply of water is available. Land leveling and water management improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

This soil is suitable as a septic tank absorption field. Seepage is a moderate limitation on sites for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability subclass is IIc.

Hr—Holdrege silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on broad upland ridgetops that are dissected by drainageways. Most areas are 50 to 700 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 23 inches thick. The upper part is grayish brown, friable silty clay loam; the next part is pale brown, firm silty clay loam; and the lower part is pale brown, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the upper part of the subsoil is more clayey. In other areas the surface soil is pale brown silty clay loam because it has been mixed with part of the subsoil by plowing.

Included with this soil in mapping are some areas of clayey soils in small depressions. These soils make up less than 5 percent of the map unit.

Permeability is moderate in the Holdrege soil, and surface runoff is medium. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is very friable and can be easily tilled. It is slightly acid or neutral. The shrink-swell potential is moderate.

Most areas are used for cultivated crops. This soil is well suited to wheat (fig. 9), grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to prevent excessive soil loss and maintain the organic matter content and good tilth. The soil is suitable for irrigation if an adequate supply of water is available. Land leveling and water management reduce the runoff rate and improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

This soil is suitable as a septic tank absorption field. It has moderate limitations as a site for sewage lagoons because of seepage and slope. Sealing the sewage lagoon helps to control seepage. The less sloping areas of this soil should be selected as sites for lagoons.

The capability subclass is IIe.

Hs—Holdrege silt loam, 3 to 6 percent slopes. This deep, moderately sloping, well drained soil is on the narrow tops of ridges in the uplands. Individual areas are long and narrow and range from 10 to 300 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 21 inches thick. The upper part is grayish

Figure 9.—Harvesting wheat on Holdrege silt loam, 1 to 3 percent slopes.

brown, friable silty clay loam; the next part is pale brown, firm silty clay loam; and the lower part is pale brown, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the surface layer is pale brown because it has been mixed with part of the subsoil by plowing. Lime is within a depth of 20 inches in these areas.

Included with this soil in mapping are small areas of Anselmo soils on the lower side slopes. These soils are more sandy than the Holdrege soil. They make up about 5 percent of the map unit.

Permeability is moderate in the Holdrege soil, and surface runoff is medium. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is slightly acid or neutral. The shrink-swell potential is moderate.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to control erosion and maintain the organic matter content and good tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

This soil is suitable as a septic tank absorption field. It has moderate limitations as a site for sewage lagoons because of seepage and slope. Sealing the sewage lagoon helps to control seepage. The less sloping areas of this soil are the better sites for lagoons.

The capability subclass is IIIe.

Hw—Hord silt loam. This deep, nearly level, well drained soil is in areas on stream terraces that are parallel to and higher than the flood plains along the larger streams. Individual areas range from 50 to more than 700 acres in size.

Typically, the surface layer is grayish brown silt loam about 6 inches thick (fig. 10). The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is friable silty clay loam about 23 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is pale brown and very pale brown silt loam.

Included with this soil in mapping are some areas of the calcareous Armo soils on foot slopes. Also included are some areas of soils on terrace escarpments or short, steep slopes between the stream terraces and the flood plains. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Hord soil, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is slightly acid or neutral.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. If irrigated, it also is well suited to corn. Drought and soil blowing are hazards during dry periods. Returning crop residue to the soil and minimizing tillage conserve moisture and help to control soil blowing. The soil is suitable for irrigation if an adequate supply of water is available. Land leveling and water management improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The soil is suitable as a site for dwellings and septic tank absorption fields. Seepage is a moderate limitation on sites for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability class is I.

Ic—Inavale fine sand, channeled. This deep, undulating, somewhat excessively drained soil is on flood plains along the major stream valleys in the county. It is occasionally flooded. Sand bars and channels are common. Individual areas are long and narrow and range from 50 to 700 acres in size.

Typically, the surface layer is grayish brown fine sand about 8 inches thick. The substratum to a depth of about 60 inches is very pale brown sand. In some areas the surface layer and substratum are coarse sand or loamy coarse sand.

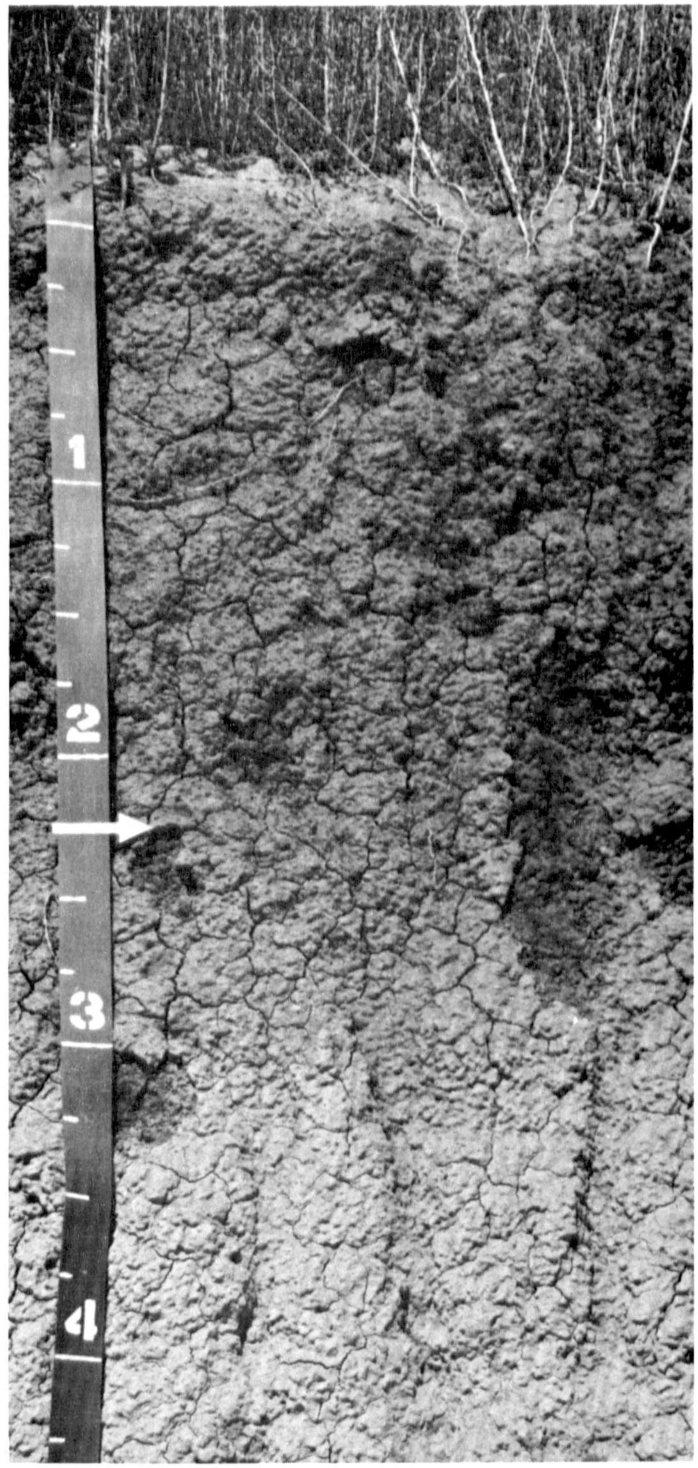


Figure 10.—Profile of Hord silt loam. This soil is dark to a depth of 20 to 40 inches. Depth is marked in feet.

Included with this soil in mapping are some areas of somewhat poorly drained, sandy soils near stream channels. These soils have a seasonal high water table at a depth of 3 to 4 feet. They make up about 10 percent of the map unit.

Permeability is rapid in the Inavale soil, and surface runoff is slow. Available water capacity is low. Natural fertility and organic matter content also are low. The soil is neutral to moderately alkaline throughout.

Most areas are used for range. This soil is poorly suited to cultivated crops because flooding, drought, and soil blowing are severe hazards. A cover of range plants is effective in controlling soil blowing and conserving moisture. Proper stocking rates, timely deferment of grazing, and control of unwanted vegetation help to maintain or increase forage production.

This soil is moderately well suited to habitat for woodland wildlife. Cottonwoods are common in most areas.

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is VIw.

Ih—Inavale fine sand, hummocky. This deep, moderately sloping, somewhat excessively drained soil is along the major stream valleys in the county. It is subject to rare flooding. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is grayish brown fine sand about 8 inches thick. The substratum to a depth of about 60 inches is very pale brown fine sand. In some areas the surface layer is fine sand or sand. In other areas the substratum has strata of fine sandy loam or loam.

Permeability is rapid, and surface runoff is slow. Available water capacity is low. Natural fertility and organic matter content also are low. The surface layer is loose. The soil is neutral to moderately alkaline throughout.

Most areas are used for range or wildlife habitat. This soil is poorly suited to cultivated crops. It is highly susceptible to soil blowing if the plant cover is removed. Also, drought is a hazard. Overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Under these conditions, the desirable grasses are replaced by less productive grasses and by weeds. A good plant cover and ground mulch help to control soil blowing and conserve moisture. Timely deferment of grazing, rotation grazing, well distributed watering facilities, and proper stocking rates help to maintain a desirable stand of native grasses.

The flooding is a moderate hazard if this soil is used as a site for local roads and streets and a severe hazard if the soil is used as a site for dwellings. Also, the slope is a moderate limitation on sites for local roads and streets. It can be overcome, however, by land shaping. Overcoming the flooding is difficult without major flood control measures.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of shallow ground water. The soil is unsuitable as a site for sewage lagoons, mainly because of seepage. Many areas are good sources of sand for building material.

The capability subclass is VIe.

Iv—Inavale loamy fine sand. This deep, undulating, somewhat excessively drained soil is on sandy terraces that are parallel to stream valleys. It is subject to rare flooding. Most areas are 40 to 200 acres in size.

Typically, the surface layer is grayish brown loamy fine sand about 8 inches thick. The next 8 inches is light brownish gray, loose loamy fine sand. The substratum to a depth of about 60 inches is very pale brown sand. In some areas it has strata of fine sandy loam or loam. In other areas the surface layer is fine sand or sand.

Included with this soil in mapping are some areas of McCook soils. These soils are higher on the landscape than the Inavale soil. Also, they are more silty. They make up about 15 percent of the map unit.

Permeability is rapid in the Inavale soil, and surface runoff is slow. Available water capacity is low. Natural fertility and organic matter content also are low. The surface layer is loose and can be easily tilled. The soil is neutral to moderately alkaline throughout.

Most areas are used as range. Some are used for cultivated crops. Some of the areas used for alfalfa, sorghum, or corn are irrigated by sprinklers. This soil is moderately well suited to alfalfa. If cultivated crops are grown, soil blowing is a hazard. Also, the low available water capacity and low fertility are limitations. Minimizing tillage and returning crop residue to the soil help to control soil blowing, conserve moisture, increase the organic matter content, and improve fertility and tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the susceptibility to soil blowing. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

The flooding is a moderate hazard if this soil is used as a site for local roads and streets and a severe hazard if the soil is used as a site for dwellings. Overcoming the flooding is difficult without major flood control measures.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of shallow ground water. The soil is unsuitable as a site for sewage lagoons, mainly because of seepage.

The capability subclass is IVe.

Mk—McCook silt loam. This deep, nearly level, well drained soil is on terraces that are parallel to the major stream valleys. It is subject to rare flooding. Individual areas range from 30 to 600 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is grayish brown, calcareous silt loam about 6 inches thick. The next 8 inches is grayish brown, friable, calcareous silt loam. The upper 21 inches of the substratum is light brownish gray, calcareous silt loam. The lower part to a depth of about 60 inches is very pale brown, calcareous fine sandy loam. In some areas the surface soil is more than 20 inches thick. In other areas the subsoil is silty clay loam. In places faint mottles are below a depth of 30 inches.

Included with this soil in mapping are some areas of Munjor soils on flood plains along the stream channels. These soils are more sandy than the McCook soil. They make up about 10 percent of the map unit.

Permeability is moderate in the McCook soil, and surface runoff is slow. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is mildly alkaline or moderately alkaline.

Most areas are used for cultivated crops. Some of the areas used for corn are irrigated. This soil is well suited to wheat, grain sorghum, and alfalfa. The main management needs are measures that maintain fertility and tilth. Minimizing tillage and returning crop residue to the soil help to maintain good tilth, the organic matter content, and fertility, and conserve moisture. Land leveling and water management help to control water erosion and improve water distribution in the irrigated areas.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

The potential for frost action is a moderate limitation if this soil is used as a site for local roads and streets. Replacing the base material, however, helps to prevent the damage caused by frost action. The flooding is a moderate hazard on sites for local roads and streets and septic tank absorption fields and a severe hazard on sites for dwellings and sewage lagoons. The hazard is less severe in the higher lying areas that are protected from floodwater. Overcoming this hazard generally is difficult, however, without major flood control measures.

The capability class is I.

Mu—Munjor sandy loam. This deep, nearly level, well drained soil is on flood plains along the major streams in the county. It is occasionally flooded for very brief periods. Individual areas are long and narrow and range from 20 to several hundred acres in size.

Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The next 7 inches is light brownish gray, very friable sandy loam. The upper 28 inches of the substratum is light brownish gray fine sandy loam. The lower part to a depth of about 60 inches is pale brown sand. In some areas the surface layer is dark and is more than 10 inches thick.

Included with this soil in mapping are small areas of McCook and Roxbury soils. These soils make up about 10 percent of the map unit. They are less sandy than the Munjor soil and are slightly higher on the landscape. Also included are long, narrow areas of nonarable soils in entrenched stream channels that generally are bordered by deciduous trees. These soils make up about 5 percent of the map unit.

Permeability is moderately rapid in the Munjor soil, and surface runoff is slow. Available water capacity is moderate. Natural fertility and organic matter content are low. The surface layer is very friable and can be easily tilled. It is mildly alkaline or moderately alkaline.

Most areas are used for cultivated crops. Some areas are irrigated. This soil is well suited to sprinkler irrigation (fig. 11). It is moderately well suited to wheat, grain sorghum, and alfalfa. Floodwater delays planting and harvesting and damages crops in years when the amount of rainfall is above average. Soil blowing is a hazard. Also, drought is a hazard in some years. Minimizing tillage and returning crop residue to the soil conserve moisture and help to control soil blowing.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition. A good cover of grass and mulch helps to control soil blowing and conserves moisture.

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is IIIw.

Nc—New Cambria silty clay loam. This deep, nearly level, moderately well drained soil is on terraces along the major streams in the county. It is subject to rare flooding. Individual areas are irregular in shape and range from 70 to 120 acres in size.

Typically, the surface layer is gray silty clay loam about 6 inches thick. The subsurface layer is dark gray silty clay about 9 inches thick. The subsoil is firm silty clay about 27 inches thick. The upper part is dark gray, and the lower part is gray. The substratum to a depth of about 60 inches is gray and light brownish gray, calcareous silty clay loam. In some areas the surface layer is silt loam. In other areas the subsoil is less clayey.

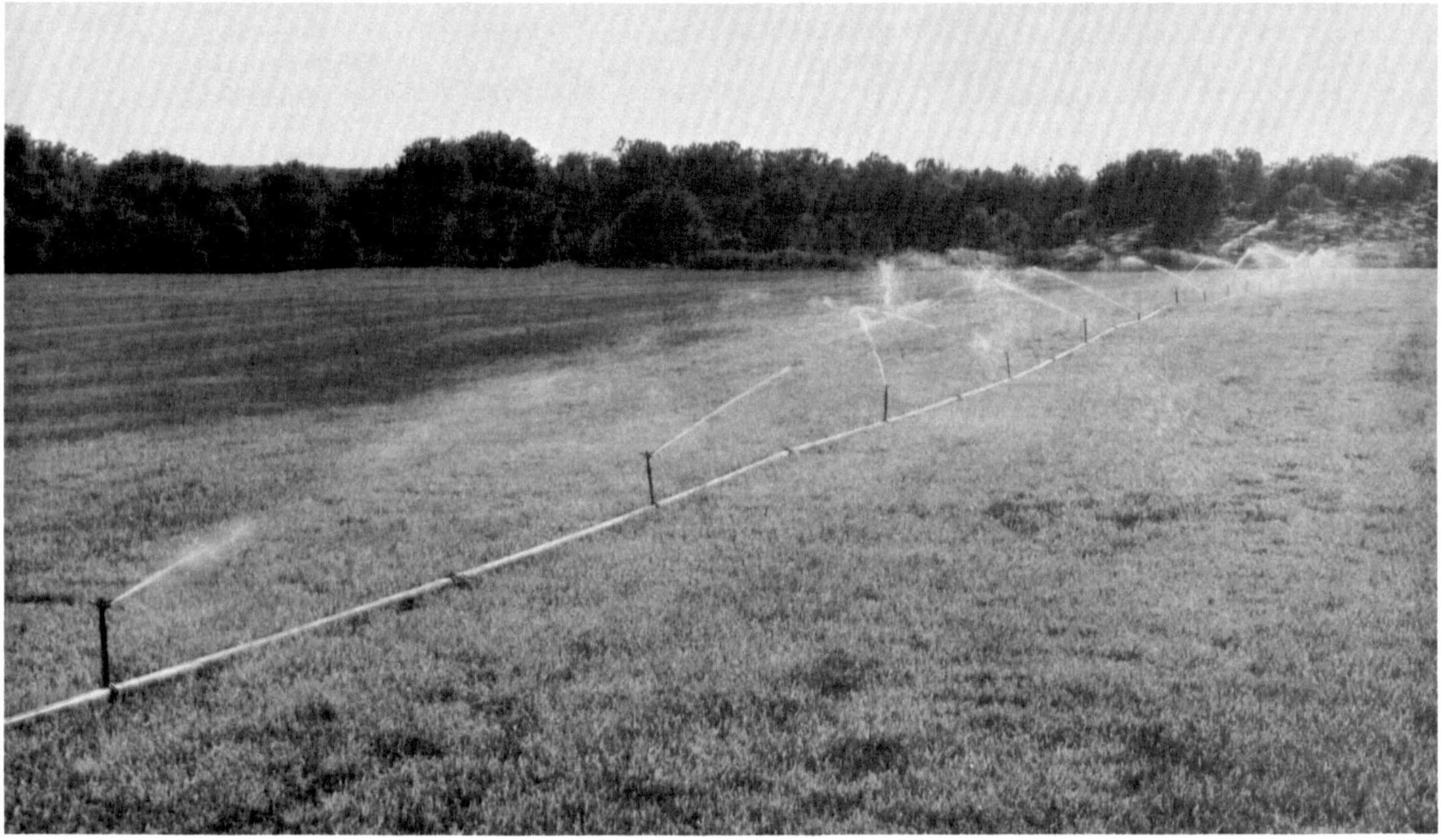


Figure 11.—Irrigating alfalfa in an area of Munjor sandy loam.

Permeability and surface runoff are slow. Available water capacity is moderate. Natural fertility is medium, and organic matter content is moderate. The surface layer is mildly alkaline or moderately alkaline. The shrink-swell potential is high.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Crops are sometimes damaged by too much moisture in periods of excessive rainfall. Establishing diversion terraces, ponds, and grassed waterways on the adjacent uplands helps to reduce the hazard of flooding on this soil. In periods when the amount of rainfall is low, the clayey subsoil restricts the movement of water into the soil and releases moisture slowly to plants. Minimizing tillage and returning crop residue to the soil increase the rate of water infiltration and conserve moisture.

This soil is well suited to range. It receives extra moisture as runoff from the uplands. Overgrazing reduces the vigor and retards the growth of the grasses and increases the extent of weeds. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

Low strength and the shrink-swell potential are severe limitations if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome these limitations. The soil generally is unsuitable as a site for dwellings because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures.

Because the slow permeability is a severe limitation, this soil generally is unsuitable as a septic tank absorption field. It is suitable, however, as a site for sewage lagoons.

The capability subclass is IIs.

Pe—Penden loam, 3 to 7 percent slopes. This deep, moderately sloping, well drained soil is on upland ridges and side slopes. Individual areas generally are long and narrow and range from 20 to 200 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 9 inches thick. The subsoil is pale brown, friable, calcareous loam about 13 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous loam. In some areas the subsoil is thinner. In other areas carbonates are leached to a depth of as much as 20 inches.

Included with this soil in mapping are some areas of Anselmo and Uly soils. Anselmo soils are on the lower slopes. They are more sandy than the Penden soil. Uly soils are on the upper slopes and on ridgetops. They are more silty than the Penden soil. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Penden soil, and surface runoff is medium. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. The surface layer and subsoil are mildly alkaline or moderately alkaline. The shrink-swell potential is moderate.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to prevent excessive soil loss and maintain the organic matter content and good tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

The moderate permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the field, however, helps to overcome the slow absorption of liquid waste. Slope and seepage are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. The less sloping areas of this soil are the better sites for lagoons.

The capability subclass is IIIe.

Ro—Roxbury silt loam. This deep, nearly level, well drained soil is on stream terraces. It is subject to rare flooding. Individual areas are long and narrow and range from 40 to more than 500 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable, calcareous silt loam about 24 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 11 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam. In some areas the surface layer and subsoil are loam. In other areas the surface layer is noncalcareous.

Included with this soil in mapping are small areas of Munjor soils on flood plains. These soils contain more sand than the Roxbury soil. They make up about 10 percent of the map unit. Also included are long, narrow areas of nonarable soils in entrenched stream channels that generally support deciduous trees. These soils make up about 5 percent of the map unit.

Permeability is moderate in the Roxbury soil, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is mildly alkaline or moderately alkaline. The shrink-swell potential is moderate.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Establishing diversion terraces and grassed waterways on the adjacent uplands reduces the hazard of flooding on this soil. Returning crop residue to the soil and minimizing tillage help to maintain the organic matter content and good tilth. The soil is suitable for irrigation if an adequate supply of water is available. Land leveling and water management improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The flooding is a severe hazard on sites for dwellings and a moderate hazard on sites for septic tank absorption fields. Overcoming this hazard is difficult without major flood control measures. Seepage is a moderate limitation on sites for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability class is I.

Rp—Roxbury silt loam, frequently flooded. This deep, nearly level, well drained soil occurs as one long and narrow, 360-acre area on the flood plain adjacent to Webster Lake. It is frequently flooded. Also, most of the area periodically is covered by water from Webster Lake.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable, calcareous silt loam about 23 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 12 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam.

Included with this soil in mapping are some areas of Munjor soils and some areas of poorly drained soils. Munjor soils contain more sand than the Roxbury soil. Also, they are higher on the landscape. The poorly drained soils are in the lower areas near Webster Lake.

They have a seasonal high water table at a depth of about 2 feet. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Roxbury soil, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is mildly alkaline or moderately alkaline. The shrink-swell potential is moderate.

Most areas are used as wildlife habitat. Because of the flooding, this soil is not used for cultivated crops in most years. The vegetation is cottonwood, willows, and smartweed.

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is Vw.

Rs—Roxbury silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains and along upland drainageways. It is occasionally flooded. In some areas the landscape is dissected by stream channels. Areas are long and narrow and range from 40 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable, calcareous silt loam about 24 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 11 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam. In some areas the surface layer and subsoil are loam.

Included with this soil in mapping are small areas of Munjor soils. These soils contain more sand than the Roxbury soil and are slightly lower on the landscape. They make up about 10 percent of the map unit. Also included are long, narrow areas of nonarable soils in entrenched stream channels that generally support deciduous trees. These soils make up about 5 percent of the map unit.

Permeability is moderate in the Roxbury soil, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic matter content is moderate. The surface layer is friable and can be easily tilled. It is mildly alkaline or moderately alkaline. The shrink-swell potential is moderate.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Yields are reduced in some years because of the flooding, but in other years they commonly are increased by the extra moisture. Minimizing tillage and returning crop residue to the soil help to maintain good tilth and increase the rate of water infiltration.

This soil is well suited to range. It receives extra moisture as runoff from the uplands. Overgrazing reduces the vigor and retards the growth of the taller grasses and increases the extent of weeds and the less productive grasses. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. Many areas are suitable sites for ponds (fig. 12).

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is IIw.

Ur—Uly silt loam, 3 to 6 percent slopes. This deep, moderately sloping, well drained soil is on the sides of upland drainageways and in some areas on the upper side slopes adjacent to steeper areas. Individual areas are long and narrow and range from 40 to 600 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 14 inches thick. The upper part is brown, friable silty clay loam, and the lower part is pale brown, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam (fig. 13). In some areas the subsoil and substratum are yellowish brown or reddish yellow. In other areas the surface layer is brown or pale brown silty clay loam because it has been mixed with part of the subsoil by plowing.

Included with this soil in mapping are some areas of Penden and Wakeen soils on the lower side slopes. Penden soils are more sandy than the Uly soil. Wakeen soils are moderately deep. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Uly soil, and surface runoff is rapid. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. The surface layer and subsoil are neutral or mildly alkaline.

Most areas are used for cultivated crops. This soil is well suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to control erosion, conserve moisture, and maintain good tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition. Well distributed watering facilities help to achieve a uniform distribution of grazing.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or

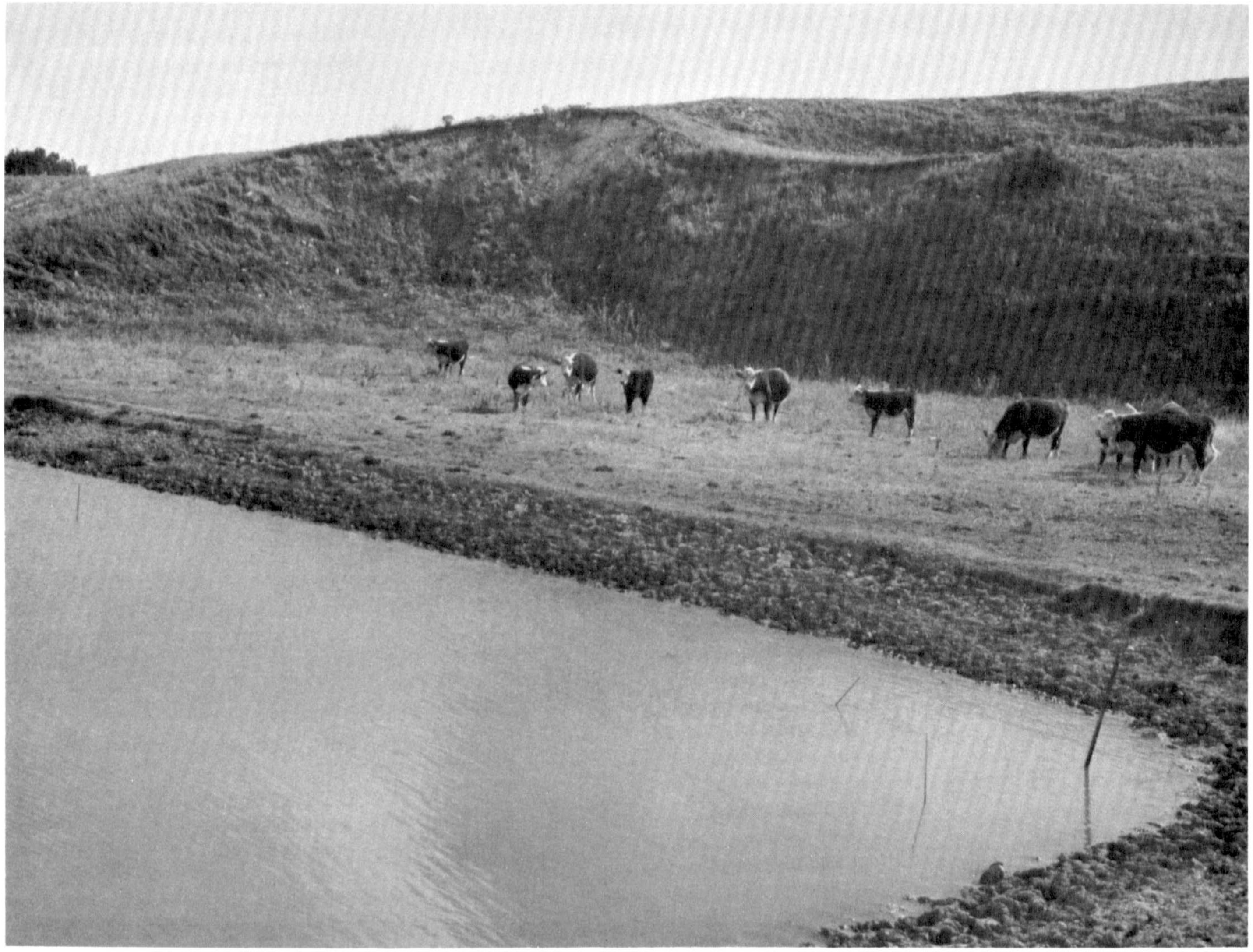


Figure 12.—Farm pond in an area of Roxbury silt loam, occasionally flooded.

replacing the base material, however, helps to overcome this limitation. The soil is suitable as a site for dwellings and septic tank absorption fields. It has moderate limitations as a site for sewage lagoons because of slope and seepage. Sealing the lagoon helps to control seepage. The less sloping areas of this soil are the better sites for lagoons.

The capability subclass is IIIe.

Us—Uly silt loam, 6 to 10 percent slopes. This deep, strongly sloping, well drained soil is on the sides of upland drainageways. Individual areas are long and narrow and range from 40 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 10 inches thick. The upper part is brown, friable silty clay loam, and the lower part is pale brown, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the subsoil and substratum are light yellowish brown or reddish yellow. In other areas the surface layer is pale brown silty clay loam because it has been mixed with part of the subsoil by plowing. In a few areas it is calcareous.

Included with this soil in mapping are some areas of Penden and Wakeen soils on the lower side slopes. Penden soils are more sandy than the Uly soil. Wakeen

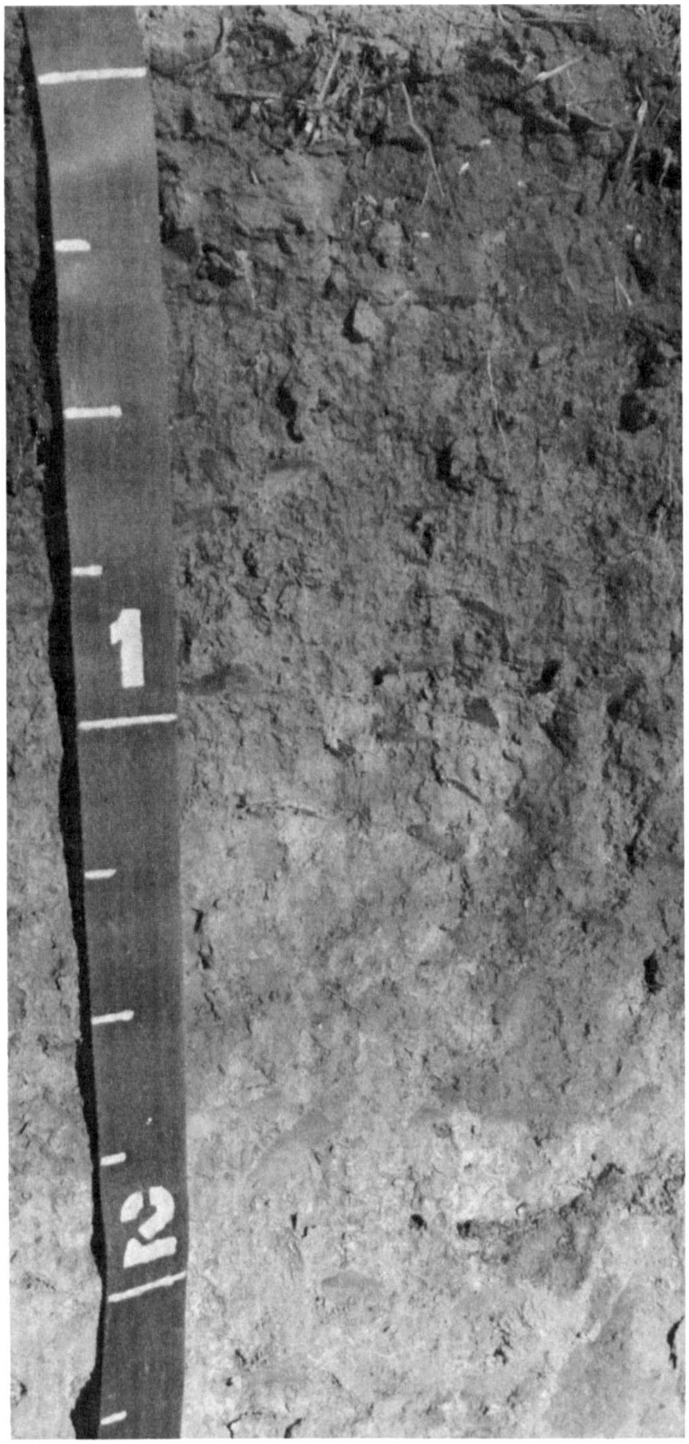


Figure 13.—Profile of Uly silt loam, 3 to 6 percent slopes. The substratum contains lime. Depth is marked in feet.

soils are moderately deep. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Uly soil, and surface runoff is rapid. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. The surface layer and subsoil are neutral or mildly alkaline.

Most areas are used for range. Some are used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, and alfalfa. If cultivated crops are grown, erosion is a hazard. Rills have formed near the base of some slopes. Terracing, establishing grassed waterways, farming on the contour, returning crop residue to the soil, and minimizing tillage help to control erosion and maintain the organic matter content and good tilth.

This soil is well suited to range. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition. Well distributed watering facilities help to achieve a uniform distribution of grazing.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The slope is a moderate limitation on sites for dwellings and septic tank absorption fields and a severe limitation on sites for sewage lagoons. The less sloping areas of this soil are the better sites for dwellings, septic tank systems, and lagoons.

The capability subclass is IVe.

Uy—Uly-Penden loams, 7 to 15 percent slopes. These deep, strongly sloping or moderately steep, well drained soils are on the sides and tops of ridges in the uplands. The Uly soil is on the upper side slopes and on narrow ridgetops. The Penden soil is on the steeper side slopes. Areas are about 45 percent Uly soil and 35 percent Penden soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Uly soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is brown, friable loam about 14 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous loam. In some areas the subsoil and substratum are light yellowish brown or reddish yellow.

Typically, the Penden soil has a surface layer of dark grayish brown loam about 9 inches thick. The subsoil is pale brown, calcareous loam about 13 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous loam. In some areas the surface layer and subsoil are silt loam.

Included with these soils in mapping are small areas of Anselmo, Roxbury, and Wakeen soils. Anselmo soils are on the lower side slopes. They are more sandy than the Uly and Penden soils. Roxbury soils are on flood plains along upland drainageways. The moderately deep

Wakeen soils are on the lower slopes. Included soils make up about 20 percent of the map unit.

Permeability is moderate in the Uly and Penden soils, and surface runoff is rapid. Available water capacity is high. Natural fertility is medium, and organic matter content is moderate. The shrink-swell potential is moderate in the Penden soil.

Most areas are used for range. These soils generally are unsuitable for cultivation because of a severe hazard of water erosion. They are best suited to range. Overgrazing reduces the vigor and retards the growth of the grasses and increases the runoff rate. An adequate plant cover reduces the runoff rate and helps to prevent excessive soil loss. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. Many areas are suitable sites for ponds.

Low strength is a severe limitation if these soils are used as sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The slope of both soils and the moderate shrink-swell potential of the Penden soil are moderate limitations on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material help to prevent the damage caused by shrinking and swelling. Less sloping areas should be selected as sites for dwellings.

The slope is a moderate limitation if these soils are used as septic tank absorption fields and a severe limitation if they are used as sites for sewage lagoons. Also, the moderate permeability in the Penden soil is a moderate limitation in septic tank absorption fields. Enlarging the field, however, helps to overcome the slow absorption of liquid waste. The less sloping included soils are better sites for sanitary facilities.

The capability subclass is VIe.

Wk—Wakeen silt loam, 3 to 7 percent slopes. This moderately deep, moderately sloping, well drained soil is on the sides and tops of ridges in the uplands. Individual areas range from 20 to more than 500 acres in size. Those on the ridgetops are irregular in shape, and those on the side slopes are long and narrow.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is grayish brown, calcareous silt loam about 5 inches thick. The subsoil is very pale brown, friable, calcareous silty clay loam about 27 inches thick. White chalky limestone is at a depth of about 37 inches. In some areas the surface layer is very pale brown, calcareous silty clay loam.

Included with this soil in mapping are small areas of Brownell, Roxbury, and Uly soils. The gravelly Brownell soils are on the steeper slopes. The deep Roxbury soils are on flood plains along upland drainageways. The deep Uly soils are in the less sloping areas. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Wakeen soil, and surface runoff is rapid. Available water capacity is moderate. Natural fertility is medium, and organic matter content is moderate. The surface layer is friable and can be easily tilled. The root zone is restricted by the limestone bedrock at a depth of about 37 inches. The shrink-swell potential is moderate.

Most areas are used for range. Some are used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, and alfalfa. If cultivated crops are grown, water erosion is a severe hazard. Terraces, grassed waterways, contour farming, and minimum tillage help to prevent excessive soil loss and reduce the runoff rate. Returning crop residue to the soil helps to maintain the organic matter content and increases the rate of water infiltration.

This soil is well suited to range. Many areas that formerly were cultivated have been seeded back to grass. Range seeding is needed to restore productivity on abandoned cropland. Overgrazing reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling. The depth to bedrock is a moderate limitation on sites for dwellings with basements. The deeper included soils are better sites.

This soil generally is unsuitable as a site for sewage lagoons and septic tank absorption fields because the depth to bedrock is a severe limitation. The deeper included soils are better sites for sanitary facilities.

The capability subclass is IVe.

Wx—Wakeen silt loam, 7 to 20 percent slopes. This moderately deep, strongly sloping or moderately steep, well drained soil is on the sides and narrow tops of ridges in the uplands. The landscape is dissected by deeply entrenched drainageways. Individual areas are long and narrow and range from 40 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 8 inches thick. The subsoil is very pale brown, friable, calcareous silty clay loam about 14 inches thick. White chalky limestone is at a depth of about 22 inches. In some areas it is within a depth of 20 inches. In other areas the surface layer is loam.

Included with these soils in mapping are small areas of Brownell, Roxbury, and Uly soils and areas where chalky rock crops out. The gravelly Brownell soils and the areas where chalky rock crops out are on the steeper slopes. The deep Roxbury soils are on flood plains along drainageways. The deep Uly soils are on the lower slopes and in the less steep areas. Included areas make up about 15 percent of the map unit.

Permeability is moderate in the Wakeen soil, and surface runoff is rapid. Available water capacity is moderate. Natural fertility is medium, and organic matter content is moderate. The root zone is restricted by the limestone bedrock at a depth of about 22 inches. The shrink-swell potential is moderate.

Most areas support native grasses. This soil is best suited to range. The major concerns of management are the hazards of erosion and drought. Overgrazing reduces the vigor and retards the growth of the grasses and increases the runoff rate. An adequate plant cover reduces the runoff rate, helps to prevent excessive soil loss, and conserves moisture. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. Many areas are suitable sites for ponds.

Low strength is a severe limitation if this soil is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling. The depth to bedrock is a moderate limitation on sites for dwellings with basements. The deeper included soils are better sites.

This soil generally is unsuitable as a site for sewage lagoons and septic tank absorption fields because the depth to bedrock is a severe limitation. The deeper included soils are better sites for sanitary facilities.

Road surfacing material is quarried from some areas of this soil.

The capability subclass is VIe.

Wy—Wakeen-Harney silt loams, 1 to 3 percent slopes. These gently sloping, well drained soils are in broad areas on uplands. The moderately deep Wakeen soil is on convex ridgetops and in the more sloping areas. The deep Harney soil is in the less sloping areas and on the broader ridgetops. Individual areas are irregular in shape and range from 40 to more than 300 acres in size. They are about 50 percent Wakeen soil and 40 percent Harney soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Wakeen soil has a surface layer of dark grayish brown, calcareous silt loam about 5 inches thick. The subsurface layer is grayish brown, calcareous silt loam about 7 inches thick. The subsoil is very pale brown, friable, calcareous silty clay loam about 25 inches thick. White chalky limestone is at a depth of about 37 inches.

Typically, the Harney soil has a surface layer of dark grayish brown silt loam about 5 inches thick. The subsurface layer also is dark grayish brown silt loam about 5 inches thick. The subsoil is silty clay loam about 27 inches thick. The upper part is grayish brown and firm, the next part is light brownish gray and firm, and the lower part is pale brown, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the surface soil is pale brown silty clay loam because it has been mixed with part of the subsoil by plowing.

Included with these soils in mapping are small areas of Mento soils on the lower side slopes and on ridgetops. These included soils are 40 to 72 inches deep over chalky limestone. They make up about 10 percent of the map unit.

Permeability is moderate in the Wakeen soil and moderately slow in the Harney soil. Available water capacity is moderate in the Wakeen soil and high in the Harney soil. Surface runoff is medium on both soils. Organic matter content is moderate. Natural fertility is medium in the Wakeen soil and high in the Harney soil. The root zone is restricted by the limestone bedrock at a depth of about 37 inches in the Wakeen soil. The shrink-swell potential is moderate in both soils.

Most areas are used for cultivated crops. These soils are suited to wheat, grain sorghum, and alfalfa. Water erosion is a hazard, however, if cultivated crops are grown. Terraces, grassed waterways, contour farming, incorporation of crop residue into the soil, and stubble mulch tillage help to control erosion and maintain the organic matter content and good tilth.

These soils are well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

Low strength is a severe limitation if these soils are used as sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The shrink-swell potential is a moderate limitation on sites for dwellings. Properly designing and reinforcing foundations and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling. The depth to bedrock in the Wakeen soil is a moderate limitation on sites for dwellings with basements. The deep Harney soil is a better site.

If the Wakeen soil is used as a site for septic tank absorption fields or sewage lagoons, the depth to bedrock is a severe limitation. Areas where the depth to bedrock is not critically limited are better sites. The moderately slow permeability in the Harney soil is a moderate limitation in septic tank absorption fields. Increasing the size of the field, however, helps to overcome the slow absorption of liquid waste. Seepage and slope are moderate limitations if the Harney soil is used as a site for sewage lagoons. Sealing the lagoon helps to control seepage. The less sloping areas of this soil should be selected as sites for lagoons.

The capability subclass is IIIe.

prime farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. 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 cropland, 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 or is available for those uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil economically to produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

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

In Rooks County the soils that meet the requirements for prime farmland generally are deep soils that have a slope of less than 7 percent and do not contain limestone fragments. They make up about 348,400 acres, or 61 percent of the total acreage in the county. They occur as scattered areas throughout the county but are mainly along the stream valleys and on gently sloping divides on the upland ridges that are not excessively dissected. Most of the prime farmland is cropland, a few acres of which are irrigated. The main crops are wheat, grain sorghum, alfalfa, and corn.

The map units in Rooks County that are considered prime farmland are listed in this section. 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."

The map units that meet the requirements for prime farmland are:

Ad—Anselmo fine sandy loam, 1 to 3 percent slopes
Ar—Armo loam, 1 to 3 percent slopes
As—Armo loam, 3 to 7 percent slopes
Cr—Carlson silt loam, 1 to 3 percent slopes
Ef—Eltree silt loam, 1 to 3 percent slopes
Ha—Harney silt loam, 0 to 1 percent slopes
Hb—Harney silt loam, 1 to 3 percent slopes
Hd—Harney-Mento silt loams, 1 to 3 percent slopes
Ho—Holdrege silt loam, 0 to 1 percent slopes
Hr—Holdrege silt loam, 1 to 3 percent slopes
Hs—Holdrege silt loam, 3 to 6 percent slopes
Hw—Hord silt loam
Mk—McCook silt loam
Mu—Munjor sandy loam
Nc—New Cambria silty clay loam
Pe—Penden loam, 3 to 7 percent slopes
Ro—Roxbury silt loam
Rs—Roxbury silt loam, occasionally flooded
Ur—Uly silt loam, 3 to 6 percent slopes
Wy—Wakeen-Harney silt loams, 1 to 3 percent slopes

use and management of the soils

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

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

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

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

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

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

crops and pasture

Earl J. Bondy, conservation agronomist, Soil Conservation Service, helped prepare this section.

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

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

Crops were harvested on about 87 percent of the cropland in Rooks County during the period 1968 to 1977 (*5*). Wheat was grown on 44 percent of the cropland and sorghum on 12 percent. About 38 percent was summer fallowed. Minor acreages were used for alfalfa, corn, oats, barley, and rye. The acreage planted to alfalfa increased during this period, and the acreage used for all other crops decreased.

The soils and climate are suited to most of the crops that are commonly grown in the county and to some that are not, for example, soybeans. The paragraphs that follow describe the main concerns in managing the soils for crops and pasture.

Water erosion is the major hazard on about 75 percent of the cropland in the county. It reduces the productivity of the soils. If the surface layer is lost through erosion, many of the available plant nutrients and much of the organic matter, which has positive effects on soil structure, water infiltration, available water capacity, and tilth, also are lost. Measures that help to control erosion are especially needed on soils that have a clayey subsoil, such as Harney and Mento soils. Preparing a good seedbed and tilling are difficult in the clayey spots that remain after the original friable surface layer has eroded away. Soil erosion on farmland commonly results in the pollution of streams by sediment, nutrients, and pesticides. Controlling erosion minimizes this pollution and improves the quality of the water.

Measures that control erosion provide a protective plant cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the soil for extended periods reduces the susceptibility to erosion and preserves the productive capacity of the soils.

Minimum tillage, terraces, diversions, contour farming, and a cropping system that includes close growing crops help to control erosion. In areas used for grain sorghum and other row crops, minimum tillage is more extensive than it was in the past. It is effective in reducing the susceptibility of the more sloping soils to erosion and is effective on most of the soils in the survey area.

Terraces and diversions reduce the length of slopes and thereby reduce the runoff rate and the susceptibility to erosion. They are most practical on deep, well drained soils that have uniform, regular slopes. Most of the soils in the county have those characteristics. An exception is Wakeen soils, which have short, irregular slopes and have bedrock within a depth of 40 inches. On these soils a cropping system that provides an abundant plant cover helps to control erosion. Returning crop residue to the soil, either through minimum tillage or stubble mulching, increases the rate of water infiltration and reduces the runoff rate and the susceptibility to erosion. The extra cover is needed to help prevent excessive erosion during seeding periods and during periods of early crop growth.

Soil blowing is a hazard on the sandy Anselmo, Inavale, and Munjor soils. It can be controlled by a plant cover, by surface mulch, or by methods of tillage that make the surface rough.

Information about the measures that control erosion on each kind of soil is available at the local office of the Soil Conservation Service.

On most of the arable soils in the county, crops respond well to applications of nitrogen and phosphate fertilizer. On all soils the amount of fertilizer applied should be based on the needs of the crop, on the expected level of yields, on the results of soil tests, and on past experience. The Cooperative Extension Service can help to determine the kinds and amounts of fertilizer needed.

Organic matter provides nitrogen to crops. It also increases the rate of water intake, helps to prevent surface crusting, reduces the amount of soil lost through erosion, and improves tilth. Most of the soils in the survey area that are used for crops have a surface layer of silt loam or loam. Intense rainfall causes surface crusting. The crusted surface is hard when dry and is nearly impervious to water. Because of the hard surface, the runoff rate increases. Regularly adding organic material improves soil structure and helps to prevent surface crusting. Leaving crop residue on the surface also helps to prevent crusting.

Smooth bromegrass is the chief tame grass grown in the county. The main management needs on the soils seeded to tame grasses are measures that maintain or improve the quality and quantity of forage, protect the surface, and reduce water loss. Examples are proper stocking rates, rotation grazing, well distributed watering and salting facilities, applications of fertilizer, and control of unwanted vegetation.

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 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

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

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

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 slight 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 limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Loren J. Pearson, range conservationist, Soil Conservation Service, helped prepare this section.

About 40 percent of the acreage in Rooks County can be classified as rangeland. The larger areas of rangeland are on uplands adjacent to the major valleys. In these areas the soils generally are too shallow or too steep for cultivated crops (fig. 14). The main type of livestock program is the cow-calf enterprise. Also, some dairy cows graze the areas used as rangeland.

Much of the rangeland is grazed only during the summer, but some is grazed throughout the year. During the winter the cattle typically forage in areas of grain sorghum and small grain stubble and in some areas of new wheat. After these are used up, the cattle are fed dry feed and alfalfa. A cool-season grass, such as smooth bromegrass, commonly is used in the fall and spring.

The potential native vegetation is strongly influenced by the soils in the county. Short and mid grasses grow on the Clay Upland range site. The soils on this range site do not absorb water easily or readily release moisture to plants. Tall and mid grasses grow on the Limy, Lowland, and Terrace range sites. Runoff from adjacent uplands provides additional moisture to the taller grasses on alluvial soils.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for many soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. An explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Figure 14.—An area of Campus-Anselmo complex, 5 to 15 percent slopes, used as native range.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Plant vigor is a major management concern on the rangeland in Rooks County. Healthy, vigorous plants result if about 50 percent of the seasonal growth remains at the end of the grazing season. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing (fig. 15) increase the vigor of key forage plants because they provide a rest period, during the growth cycle of the plants.

Range seeding is needed on abandoned cropland and on badly depleted rangeland. Livestock production is increased if eroded and depleted areas are reseeded to suitable species.

windbreaks and environmental plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

Eastern cottonwood, green ash, common hackberry, and black willow are common in wooded areas along the streams and drainageways in the county. Other common trees and shrubs are honeylocust, Russian mulberry, boxelder, slippery elm, American elm, black locust, American plum, and skunkbush sumac. Also, black walnut and bur oak grow in some areas. Many of the trees could be used for wood products and firewood, but they are too widely scattered to be of commercial value.

On most of the farmsteads and ranch headquarters, landowners have planted windbreaks at various times. Eastern redcedar and Siberian elm are the most common trees in these windbreaks. Other trees and shrubs are honeylocust, common hackberry, Russian-olive, and lilac (fig. 16). Tree planting around farmsteads or ranch headquarters is a continual need because old trees deteriorate after they pass maturity, because some trees die as a result of insects or disease, and because new windbreaks are needed in areas where farming or ranching is expanding.

Only a few field windbreaks or shelterbelts have been planted in the county. They generally are 10 rows of trees and shrubs, including Russian-olive, eastern redcedar, Russian mulberry, green ash, ponderosa pine, black locust, honeylocust, Siberian elm, osageorange, Kentucky coffeetree, and tamarisk.

In order for windbreaks and environmental plantings to fulfill their intended purpose, the trees or shrubs selected for planting should be suited to the soils on the site. Selecting suitable species helps to ensure survival and a maximum rate of growth. Permeability, available water capacity, and fertility greatly affect the growth rate.

A limited amount of precipitation adversely affects the survival of trees in Rooks County. Therefore, proper site preparation prior to planting and control of weeds or other competing plants after planting are the major concerns in establishing and managing a windbreak. Drip irrigation or any other method of irrigation helps to overcome the moisture deficiency.

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.

Figure 15.—Cattle in an area of Roxbury soils. The windmill provides water. Well distributed watering facilities help to achieve a uniform distribution of grazing.

Figure 16.—Farmstead windbreak in an area of Harney silt loam, 1 to 3 percent slopes. The trees are eastern redcedar and honeylocust.

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, keep snow from blowing off the fields, and provide food and cover for wildlife.

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

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

Rooks County has several areas of scenic, geologic, and historic interest. Farm ponds and the Solomon River provide opportunities for water sports. Plainville

Township Lake, Webster Reservoir, and Rooks State Fishing Lake provide opportunities for public camping, picnicking, fishing, boating, hunting, and sightseeing. The potential for further recreational development is fair.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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

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

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

Paths and trails for hiking, horseback riding, and bicycling 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.

wildlife habitat

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

The primary game species in Rooks County are pheasant, mourning dove, and cottontail rabbit. Bobwhite quail and deer are hunted along the wooded streams and valleys. Several species of waterfowl are hunted during the migratory season. Wild turkey have been stocked and are hunted on a limited basis.

Nongame species are numerous because of the diverse habitat types in the county. Cropland, woodland, and grassland are interspersed throughout the county. Each of these types provides a habitat for a particular group of species (fig. 17).

Furbearers are sparse to common along the Solomon River and its tributaries. They are trapped on a limited basis.

Webster Reservoir, stock water ponds, lakes, and streams provide good to excellent fishing. The species commonly caught are bass, bluegill, walleye, crappie, channel catfish, and bullhead

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 9, 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*

Figure 17.—Mature shelterbelt used as habitat for wildlife in an area of Harney silt loam, 0 to 1 percent slopes.

indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

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

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, indiangrass, switchgrass, western wheatgrass, grama, goldenrod, ragweed, sunflowers, and native legumes.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are cottonwood, hackberry, elm, boxelder, green ash, willow, mulberry, and osageorange. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, American plum, and fragrant sumac.

Coniferous plants furnish browse, seeds, and cones. 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 redcedar, pine, and spruce.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are gooseberry, dogwood, buckbrush, sumac, prairie rose, and chokecherry.

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, cattails, saltgrass, prairie cordgrass, rushes, sedges, and reeds.

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

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

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

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, owls, thrushes, woodpeckers, squirrels, oppossum, raccoon, and deer.

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, mule deer, meadowlark, killdeer, hawks, prairie dogs, badgers, and jackrabbits.

Technical assistance in planning wildlife areas and in determining vegetation suitable for planting can be obtained from the local office of the Soil Conservation Service. Additional information and assistance can be obtained from local offices of the Kansas Fish and Game Commission and the Cooperative Extension Service.

engineering

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

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

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

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

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

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

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

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

building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

sanitary facilities

Table 11 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 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 40 inches 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 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

construction materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

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

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

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

water management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

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

Irrigation is the controlled application of water to supplement rainfall and support plant growth (fig. 18).

Figure 18.—Irrigating corn in an area of Hord silt loam.

Figure 19.—Building terraces in an area of Wakeen-Harney silt loams, 1 to 3 percent slopes.

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

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff (fig. 19). Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

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

soil properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

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

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

engineering index properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 or 20 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

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

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

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 17.

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

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

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

physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

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

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

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

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

The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

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

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

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

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

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

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

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

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

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

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

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

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months;

November-May, for example, means that flooding can occur during the period November through May.

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. The depth to the seasonal high water table is indicated in table 16.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations generally 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 excavations.

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

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

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

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

engineering index test data

Table 17 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series. The soil samples were tested by the Kansas Department of Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 66 (AASHTO); Unified classification—D 2487 66T (ASTM); Mechanical analysis—T 88 72 (AASHTO); Liquid limit—T 89 68 (AASHTO); Plasticity index—T 90 70 (AASHTO); and Moisture density, Method A—T 99 74 (AASHTO).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*7*). 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. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning argillic horizon, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

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

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

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

soil series and their morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*6*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*7*). Unless otherwise stated, matrix colors in the descriptions are for dry 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."

Anselmo series

The Anselmo series consists of deep, well drained soils on uplands and terraces. Permeability is moderately rapid. These soils formed in loamy eolian material. Slope ranges from 1 to 15 percent.

Anselmo soils commonly are adjacent to Campus, Holdrege, and Uly soils. Campus soils are on the lower slopes. They are 20 to 40 inches deep over highly calcareous bedrock. Holdrege and Uly soils contain less sand than the Anselmo soils. They are on uplands.

Typical pedon of Anselmo fine sandy loam, 3 to 8 percent slopes, 1,600 feet north and 200 feet east of the southwest corner of sec. 4, T. 6 S., R. 20 W.

A1—0 to 12 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fibrous roots; neutral; clear smooth boundary.

B2—12 to 24 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; neutral; gradual smooth boundary.

C—24 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, very friable; few fine roots; common strata of loam and silt loam in the lower part; neutral.

The thickness of the solum ranges from 12 to 40 inches. The depth to lime ranges from 30 to more than 60 inches. The mollic epipedon ranges from 7 to 20 inches in thickness.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly fine sandy loam but in some pedons is loam, sandy loam, or loamy fine sand. It is neutral or mildly alkaline. The B2 horizon has hue of 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is fine sandy loam or loam. It is neutral or mildly alkaline. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. In many pedons it has strata of loam, silt loam, sand, or loamy fine sand below a depth of 40 inches.

Armo series

The Armo series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy sediments weathered from chalky limestone. Slope ranges from 1 to 15 percent.

Armo soils are similar to Eltree soils and commonly are adjacent to Bogue, Eltree, Heizer, Hord, and Roxbury soils. Eltree, Hord, and Roxbury soils have a mollic epipedon that is more than 20 inches thick and have a lower content of fine chalk fragments than the Armo soils. Also, they are more nearly level and are lower on the landscape. Bogue soils contain more clay than the Armo soils. Also, they are lower on the landscape. Heizer soils are shallow over limestone bedrock and have a higher content of coarse fragments than the Armo soils. Also, they generally are steeper and are higher on the landscape.

Typical pedon of Armo loam, 3 to 7 percent slopes, 2,320 feet west and 800 feet north of the southeast corner of sec. 36, T. 7 S., R. 18 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; few fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

A3—7 to 12 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; about 5 percent fine chalk fragments; strong effervescence; mildly alkaline; gradual smooth boundary.

B2—12 to 30 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate fine subangular blocky structure; hard, friable; about 5 percent chalk fragments 2 to 20 millimeters in diameter; violent effervescence; moderately alkaline; gradual smooth boundary.

C1ca—30 to 42 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; about 10 percent chalk fragments and pebbles 2 to 20 millimeters in diameter; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—42 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; about 10 percent chalk fragments and pebbles 2 to 20 millimeters in diameter; violent effervescence; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. It is mildly alkaline or moderately alkaline. The soils contain lime throughout. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is dominantly loam, but the range includes silt loam and silty clay loam. The B2 horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam or silty clay loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is dominantly silt loam or clay loam, but some pedons have strata of loamy sand below a depth of 40 inches.

Bogue series

The Bogue series consists of moderately deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in residuum of acid shale. Slope ranges from 7 to 15 percent.

Bogue soils commonly are adjacent to Armo, New Cambria, and Roxbury soils. Armo soils have a loamy subsoil. They are on side slopes above the Bogue soils. New Cambria and Roxbury soils are more than 40 inches deep over bedrock. They are on terraces or flood plains.

Typical pedon of Bogue clay, in an area of Armo-Bogue complex, 7 to 15 percent slopes, 2,065 feet north and 1,750 feet east of the southwest corner of sec. 26, T. 7 S., R. 17 W.

A1—0 to 7 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; moderate fine and medium granular structure; hard, firm; many fine roots; mildly alkaline; gradual smooth boundary.

B1—7 to 11 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; moderate fine subangular blocky structure; extremely hard, extremely firm; common fine roots; common brownish yellow (10YR 6/6) streaks or mottles; few fragments of calcite or chalk; mildly alkaline; gradual wavy boundary.

B2—11 to 21 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak coarse blocky structure; extremely hard, extremely firm; few fine distinct brownish yellow (10YR 6/6) mottles; common slickensides; common small fragments of calcite or chalk; neutral; gradual wavy boundary.

C—21 to 36 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; moderate thin platy structure; extremely hard, extremely firm; common thin brownish yellow (10YR 6/6) horizontal strata; strongly acid; gradual smooth boundary.

Cr—36 inches; dark gray (5Y 4/1) clayey shale that has brownish yellow (10YR 6/6) streaks.

The solum ranges from 12 to 23 inches in thickness. It ranges from neutral to moderately alkaline. The depth to shale ranges from 20 to 40 inches. The depth to lime varies. The lime occurs as chalk or calcite fragments along old cracks.

The A horizon has hue of 10YR to 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or less. It is dominantly clay, but the range includes silty clay. The B horizon has hue of 2.5Y or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or less. The C horizon has hue of 2.5Y or 5Y, value of 3 to 6 (2 to 4 moist), and chroma of 1 to 3. It is medium acid to very strongly acid.

Brownell series

The Brownell series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from thick, massive limestone. Slope ranges from 5 to 15 percent.

Brownell soils are similar to Heizer soils and commonly are adjacent to Heizer, Mento, and Wakeen soils. Heizer soils are less than 20 inches deep over limestone. They are on the steeper, lower side slopes. Mento and Wakeen soils contain few or no limestone fragments in the solum. They are higher on the landscape than the Brownell soils.

Typical pedon of Brownell gravelly loam, in an area of Heizer-Brownell gravelly loams, 5 to 30 percent slopes, 1,840 feet west and 1,520 feet north of the southeast corner of sec. 26, T. 7 S., R. 18 W.

A1—0 to 11 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; about 15 percent coarse limestone fragments; violent effervescence; moderately alkaline; gradual smooth boundary.

B2—11 to 18 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable; common fine roots; about 20 percent coarse limestone fragments; violent effervescence; moderately alkaline; clear smooth boundary.

C1—18 to 24 inches; pale brown (10YR 6/3) channery loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable; about 65 percent limestone fragments 3 to 6 inches in diameter; violent effervescence; moderately alkaline; clear smooth boundary.

R—24 inches; limestone.

The thickness of the solum is 10 to 20 inches. The depth to chalky limestone bedrock is 20 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. All horizons are mildly alkaline or moderately alkaline.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly gravelly loam, but the range includes loam. The B2 horizon has hue of 10YR, value of 3 to 6 (2 to 4 moist), and chroma of 1 to 3. It is gravelly loam, very gravelly loam, or channery loam. The C horizon has hue of 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 1 to 4. It is channery loam or very gravelly loam.

Campus series

The Campus series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous, loamy sediments underlain by beds of lime-cemented old alluvium, or caliche (fig. 20). Slope ranges from 2 to 15 percent.

Campus soils are similar to Penden soils and commonly are adjacent to Anselmo, Carlson, Holdrege, and Uly soils. All of the similar or adjacent soils are more than 40 inches deep over bedrock. Anselmo soils are higher on the landscape than the Campus soils. Also, they contain less clay in the subsoil. Carlson soils are on ridgetops. They contain more clay in the subsoil than the Campus soils. Holdrege and Uly soils contain less sand in the subsoil than the Campus soils. They are on ridgetops or the upper slopes.

Typical pedon of Campus loam, in an area of Campus-Anselmo complex, 5 to 15 percent slopes, 2,000 feet south and 1,100 feet east of the northwest corner of sec. 18, T. 6 S., R. 20 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

Figure 20.—Profile of Campus loam. This soil is 20 to 40 inches deep over caliche. Depth is marked in feet.

B2—8 to 17 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

Cca—17 to 29 inches; very pale brown (10YR 8/3) loam, very pale brown (10YR 7/3) moist; massive; hard, friable; about 30 percent accumulations of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

R—29 inches; white (10YR 8/2) caliche.

The solum is 12 to 20 inches thick. It is mildly alkaline or moderately alkaline. The depth to caliche ranges from 20 to 40 inches. The mollic epipedon ranges from 7 to 18 inches in thickness.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam and silty clay loam. The B2 horizon has hue of 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. It is loam or clay loam. The C horizon has hue of 10YR, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4. It is loam or clay loam.

Carlson series

The Carlson series consists of deep, well drained soils on uplands. Permeability is moderately slow. These soils formed in loess underlain by calcareous old alluvium. Slope ranges from 1 to 3 percent.

Carlson soils are similar to Harney and Mento soils and commonly are adjacent to Harney and Campus soils. Harney soils are not underlain by calcareous old alluvium. Their position on the landscape is similar to that of the Carlson soils. Mento soils have an abrupt boundary between the A and B horizons. Campus soils are 20 to 40 inches deep over bedrock. They are steeper than the Carlson soils and are lower on the landscape.

Typical pedon of Carlson silt loam, 1 to 3 percent slopes, 1,800 feet west and 400 feet south of the northeast corner of sec. 29, T. 10 S., R. 19 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; common fine roots; neutral; abrupt smooth boundary.

A12—5 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; common scattered wormcasts; neutral; gradual smooth boundary.

B21t—9 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; few fine roots; common scattered wormcasts; mildly alkaline; gradual smooth boundary.

B22t—13 to 23 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, firm; mildly alkaline; clear smooth boundary.

B3ca—23 to 34 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable; many concretions and soft masses of lime; violent effervescence; moderately alkaline; clear smooth boundary.

Cca—34 to 60 inches; very pale brown (10YR 8/3) loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure; hard, friable; many soft masses of lime; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 36 inches. The depth to lime ranges from 12 to 24 inches. The mollic epipedon ranges from 8 to 20 inches in thickness.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam and silty clay loam. The B2t horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. It is silty clay loam, clay loam, or silty clay. It ranges from neutral to moderately alkaline. The B3ca and Cca horizons have hue of 10YR or 7.5YR, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. They are dominantly loam or clay loam. In some pedons, however, the Cca horizon is loamy sand or sandy loam below a depth of 40 inches.

Eltree series

The Eltree series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous, silty colluvial sediments. Slope ranges from 1 to 3 percent.

Eltree soils are similar to Armo and Hord soils and commonly are adjacent to those soils. Armo soils have a mollic epipedon that is less than 20 inches thick. Their position on the landscape is similar to that of the Eltree soils. Hord soils are lower on the landscape than the Eltree soils. They do not have lime in the solum.

Typical pedon of Eltree silt loam, 1 to 3 percent slopes, 600 feet north and 1,000 feet east of the center of sec. 17, T. 7 S., R. 17 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; common fine roots; mildly alkaline; clear smooth boundary.

A12—6 to 18 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; common clusters of wormcasts; common fine roots; few fine threads of segregated lime; mildly alkaline; clear smooth boundary.

B21—18 to 23 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; strong effervescence; common threads of segregated lime; mildly alkaline; gradual smooth boundary.

B22ca—23 to 36 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; strong effervescence; many threads and coatings of segregated lime on peds; moderately alkaline; gradual smooth boundary.

C—36 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, friable; strong effervescence; common threads of segregated lime; moderately alkaline.

The thickness of the solum ranges from 35 to 60 inches. The depth to lime ranges from 0 to 15 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It is dominantly silt loam, but the range includes loam and silty clay loam. The B2 horizon has hue of 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 2 to 4. It is silty clay loam or silt loam. The C horizon has hue of 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4.

Harney series

The Harney series consists of deep, well drained soils on uplands. Permeability is moderately slow. These soils formed in loess. Slope ranges from 0 to 7 percent.

Harney soils are similar to Carlson, Holdrege, and Mento soils and commonly are adjacent to Carlson, Mento, Penden, Uly, and Wakeen soils. Carlson soils are underlain by calcareous old alluvium. Their position on the landscape is similar to that of the Harney soils. Holdrege soils contain less clay in the subsoil than the Harney soils. Mento soils are slightly lower on the landscape than the Harney soils. Also, they have a more abrupt textural change between the A and B horizons. Penden, Uly, and Wakeen soils generally are steeper than the Harney soils. They do not have an argillic horizon. Also, Wakeen soils are 20 to 40 inches deep over chalky limestone.

Typical pedon of Harney silt loam, 0 to 1 percent slopes (fig. 21), 450 feet south and 110 feet east of the northwest corner of sec. 10, T. 10 S., R. 18 W.

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

A3—5 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate

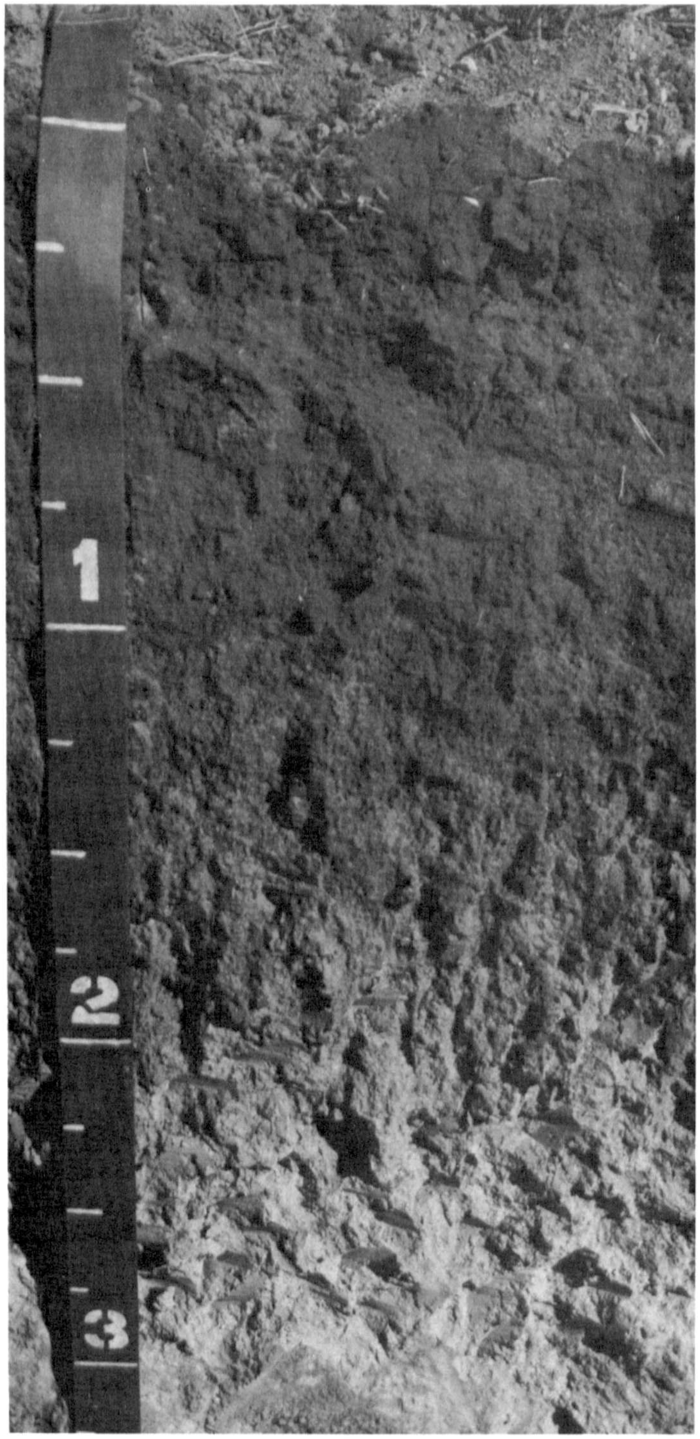


Figure 21.—Profile of Harney silt loam. The subsoil has subangular blocky structure. Depth is marked in feet.

fine and medium granular structure; hard, friable; few fine roots; few wormcasts; slightly acid; gradual smooth boundary.

B21t—10 to 14 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; neutral; clear smooth boundary.

B22t—14 to 20 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; neutral; gradual smooth boundary.

B23t—20 to 27 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; mildly alkaline; clear smooth boundary.

B3ca—27 to 37 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; strong effervescence; common soft masses and films of lime; moderately alkaline; gradual smooth boundary.

C—37 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure; slightly hard, friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 50 inches. The depth to lime ranges from 18 to 30 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is dominantly silt loam but in some pedons is silty clay loam. It is slightly acid or neutral. The B2t horizon is neutral or mildly alkaline. It has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. The darker colors are in the upper part. The C horizon has hue of 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Heizer series

The Heizer series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in residuum of thick, massive limestone. Slope ranges from 5 to 30 percent.

Heizer soils are similar to Brownell soils and commonly are adjacent to Armo and Brownell soils. Brownell soils are 20 to 40 inches deep over limestone bedrock. They are higher on the landscape than the Heizer soils. Armo soils are more than 40 inches deep over bedrock. They are lower on the landscape than the Heizer soils.

Typical pedon of Heizer gravelly loam, in an area of Heizer-Brownell gravelly loams, 5 to 30 percent slopes, 1,050 feet west and 25 feet north of the southeast corner of sec. 36, T. 7 S., R. 19 W.

A1—0 to 6 inches; dark gray (10YR 4/1) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; many fine and medium pores; strong effervescence; mildly alkaline; clear smooth boundary.
AC—6 to 9 inches; gray (10YR 5/1) channery loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; about 40 percent fragments of limestone 1 to 3 inches long; violent effervescence; moderately alkaline; clear smooth boundary.
C—9 to 14 inches; light brownish gray (10YR 6/2) channery loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, friable; few fine roots; about 65 percent fragments of limestone 1 to 5 inches long; violent effervescence; moderately alkaline; abrupt smooth boundary.
R—14 inches; white (10YR 8/2) chalky limestone.

The thickness of the solum ranges from 8 to 14 inches, and the depth to unweathered chalky limestone ranges from 10 to 20 inches. The mollic epipedon is 7 to 12 inches thick. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A1 horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly gravelly loam, but the range includes loam. The AC horizon has hue of 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 1 or 2. It is channery loam or gravelly loam. The C horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is channery loam or very gravelly loam.

Holdrege series

The Holdrege series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous, silty loess (fig. 22). Slope ranges from 0 to 6 percent.

Holdrege soils are similar to Harney and Uly soils and commonly are adjacent to Anselmo, Campus, Penden, Uly, and Wakeen soils. Harney soils contain more clay in the subsoil than the Holdrege soils. Anselmo, Campus, Penden, Uly, and Wakeen soils lack an argillic horizon. They typically are steeper than the Holdrege soils and are lower on the landscape. Campus and Penden soils contain lime in the surface layer. Campus and Wakeen soils are 20 to 40 inches deep over bedrock. Anselmo soils contain more sand than the Holdrege soils.

Typical pedon of Holdrege silt loam, 1 to 3 percent slopes, 1,600 feet west and 150 feet north of the southeast corner of sec. 19, T. 6 S., R. 17 W.
Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; common fine roots; neutral; abrupt smooth boundary.

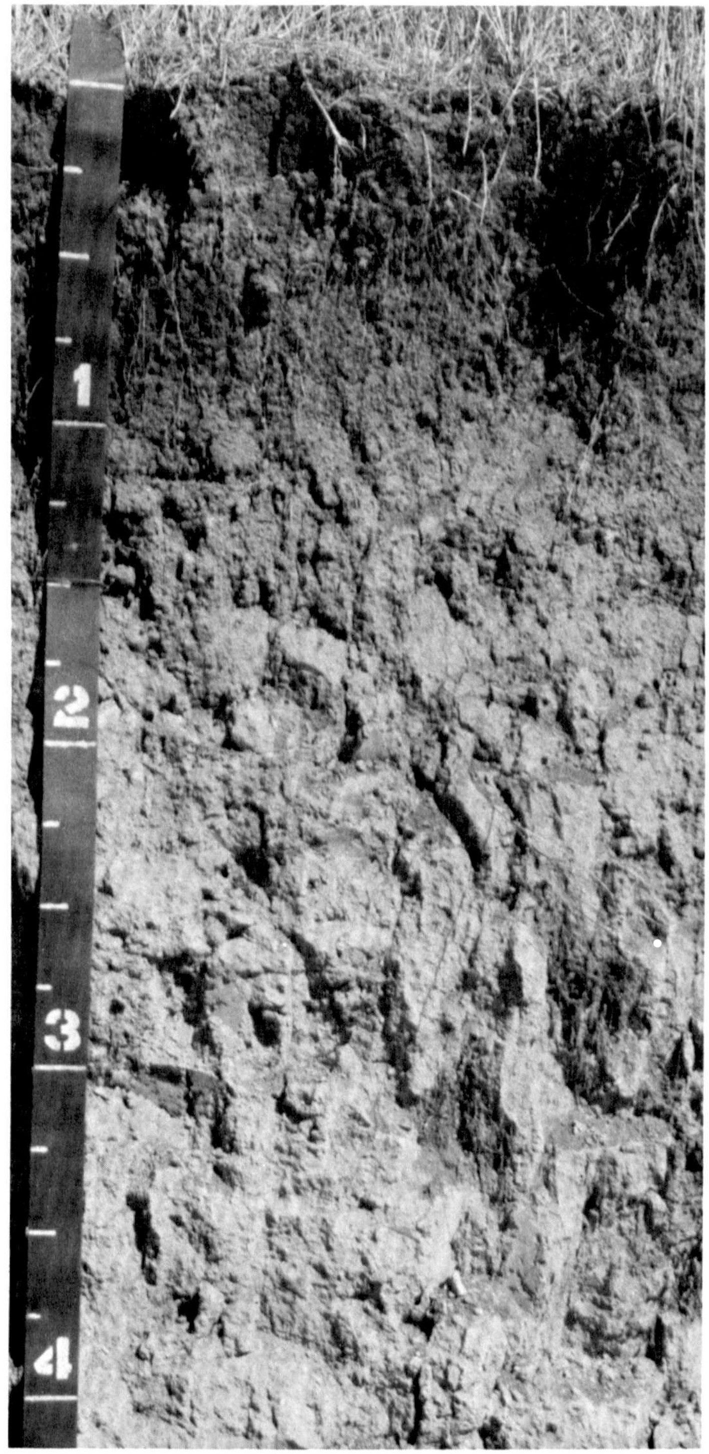


Figure 22.—Profile of Holdrege silt loam. This deep soil formed in light colored loess. Depth is marked in feet.

A12—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; common wormcasts; neutral; gradual smooth boundary.

B21t—11 to 15 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable; common fine roots; neutral; gradual smooth boundary.

B22t—15 to 25 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm; shiny faces on peds; few fine roots; neutral; gradual smooth boundary.

B3—25 to 34 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; mildly alkaline; clear smooth boundary.

C—34 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; soft, very friable; strong effervescence; few soft accumulations of lime; moderately alkaline.

The thickness of the solum and the depth to lime range from 20 to 36 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is dominantly silt loam, but the range includes very fine sandy loam and silty clay loam. The B2t horizon is neutral or mildly alkaline. It has hue of 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 2 to 4. The darker colors are in the upper part. The C horizon has hue of 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Hord series

The Hord series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in silty alluvium or a mixture of loess and alluvium. Slope is 0 to 1 percent.

Hord soils are similar to Eltree, McCook, and Roxbury soils and commonly are adjacent to those soils and to Armo and Munjor soils. All of the adjacent soils have lime within a depth of 15 inches. Munjor soils contain more sand than the Hord soils. Armo and McCook soils have a mollic epipedon that is less than 20 inches thick. Armo and Eltree soils are higher on the landscape than the Hord soils. McCook, Munjor, and Roxbury soils formed in alluvium on the lower parts of the landscape.

Typical pedon of Hord silt loam, 1,840 feet north and 150 feet east of the southwest corner of sec. 5, T. 6 S., R. 20 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; slightly hard, friable; common fine roots; neutral; abrupt smooth boundary.

A12—6 to 13 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, friable; few fine roots; slightly acid; gradual smooth boundary.

B1—13 to 23 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; few fine roots; neutral; gradual smooth boundary.

B2—23 to 36 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, friable; dark grayish brown coatings on peds in the upper part; neutral; clear smooth boundary.

C1—36 to 42 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; strong effervescence; common soft threads and films of lime; mildly alkaline; gradual smooth boundary.

C2—42 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; strong effervescence; common soft threads and films of lime; mildly alkaline.

The thickness of the solum and the depth to lime range from 30 to 50 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silt loam but in some pedons is loam or silty clay loam. It is slightly acid or neutral. The B2 horizon has hue of 10YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is neutral or mildly alkaline. It is silt loam or silty clay loam in which the content of clay ranges from 22 to 35 percent. The C horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Inavale series

The Inavale series consists of deep, somewhat excessively drained, rapidly permeable soils on flood plains and terraces. These soils formed in sand deposits that have been reworked by wind. Slope ranges from 1 to 7 percent.

Inavale soils are similar to Munjor soils and commonly are adjacent to those soils and to McCook soils. Munjor soils are coarse-loamy. They are slightly lower on the landscape than the Inavale soils or are in similar landscape positions. McCook soils are coarse-silty and have a mollic epipedon. They are on the slightly higher stream terraces.

Typical pedon of Inavale loamy fine sand, 540 feet north and 530 feet west of the southeast corner of sec. 35, T. 7 S., R. 19 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak coarse granular structure; loose; few small pebbles; common fibrous roots; slight effervescence; mildly alkaline; clear smooth boundary.

AC—8 to 16 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; single grained; loose; few fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C—16 to 60 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; single grained; loose; few fine sandy loam strata less than 1 inch thick; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 10 to 30 inches. Some pedons do not contain lime.

The A horizon has hue of 10YR, value of 4 to 6 (4 or 5 moist), and chroma of 2. It is dominantly loamy fine sand or fine sand but in some pedons is fine sandy loam, sand, or loam. It ranges from neutral to moderately alkaline. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. In some pedons it has a few faint mottles below a depth of 40 inches. It is loamy fine sand, loamy sand, fine sand, or sand and commonly has strata of fine sandy loam and coarse sand. It ranges from neutral to moderately alkaline.

McCook series

The McCook series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in calcareous, silty alluvium. Slope is 0 to 1 percent.

McCook soils are similar to Hord and Roxbury soils and commonly are adjacent to Hord, Inavale, and Munjor soils. Hord and Roxbury soils have a mollic epipedon that is more than 20 inches thick. Hord soils do not contain lime in the solum. They are slightly higher on the landscape than the McCook soils. Inavale and Munjor soils contain more sand than the McCook soils and do not have a mollic epipedon. They are on flood plains.

Typical pedon of McCook silt loam, 1,790 feet west and 450 feet north of the southeast corner of sec. 35, T. 7 S., R. 19 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

A12—5 to 11 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many wormcasts; common fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

AC—11 to 19 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, friable; many wormcasts; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—19 to 40 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; many wormcasts; strong effervescence; moderately alkaline; clear smooth boundary.

C2—40 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; loose; few small fragments of white limestone; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 17 to 30 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The depth to lime ranges from 0 to 10 inches. All horizons are mildly alkaline or moderately alkaline.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is dominantly silt loam, but the range includes very fine sandy loam and loam. The AC horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silt loam, loam, or very fine sandy loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is silt loam, very fine sandy loam, or fine sandy loam.

Mento series

The Mento series consists of deep, well drained, slowly permeable soils on uplands. These soils formed in loess 40 to 60 inches deep over chalky limestone. Slope ranges from 1 to 7 percent.

Mento soils are similar to Carlson and Harney soils and commonly are adjacent to Brownell, Harney, and Wakeen soils. Carlson and Harney soils do not have an abrupt boundary between the A and B2t horizons. Brownell soils are lower on the landscape than the Mento soils. They are 20 to 40 inches deep over bedrock. Also, the content of coarse fragments is more than 35 percent in the subsoil. Wakeen soils are on the lower side slopes. They do not have an argillic horizon and are 20 to 40 inches deep over bedrock.

Typical pedon of Mento silt loam, in an area of Harney-Mento silt loams, 3 to 7 percent slopes, 1,900 feet west and 700 feet north of the southeast corner of sec. 30, T. 8 S., R. 17 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak thin platy structure parting to weak fine granular; slightly hard, friable; many fine roots; neutral; abrupt smooth boundary.

B21t—5 to 10 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; common fine roots; mildly alkaline; clear smooth boundary.

B22t—10 to 14 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

B3ca—14 to 24 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; violent effervescence; common lime concretions; moderately alkaline; gradual smooth boundary.

C1ca—24 to 52 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, friable; few small chalk fragments; fine threads and coatings of lime on peds; strong effervescence; moderately alkaline; gradual smooth boundary.

IIC2—52 to 60 inches; white (10YR 8/2) silt loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable; increasing content of chalk fragments with increasing depth; violent effervescence; moderately alkaline; abrupt smooth boundary.

IIR—60 inches; chalky limestone.

The thickness of the solum ranges from 20 to 40 inches. The depth to chalky limestone ranges from 40 to 72 inches. The depth to lime ranges from 10 to 20 inches. The thickness of the mollic epipedon ranges from 9 to 18 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is dominantly silt loam but in some pedons is silty clay loam. It is neutral or mildly alkaline. The B2t horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. It is silty clay loam in which the content of clay ranges from 35 to 40 percent. The B3ca horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. The very pale brown Cca horizon overlies the contrasting white or very pale brown IIC horizon. These horizons are dominantly silt loam but in some pedons are loam or gravelly loam.

Munjor series

The Munjor series consists of deep, well drained soils on flood plains. Permeability is moderately rapid. These soils formed in loamy alluvium. Slope is 0 to 1 percent.

Munjor soils are similar to Inavale soils and commonly are adjacent to Hord, Inavale, and McCook soils. Inavale soils contain more sand than the Munjor soils. Also, they are more sloping. Hord and McCook soils are on terraces. They have a mollic epipedon. Also, Hord soils contain more clay than the Munjor soils and McCook soils less sand.

Typical pedon of Munjor sandy loam, 275 feet south and 400 feet east of the northwest corner of sec. 2, T. 6 S., R. 20 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; few fine roots; mildly alkaline; clear smooth boundary.

AC—5 to 12 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; few fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

C—12 to 40 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

IIC—40 to 60 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grained; loose; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 5 to 15 inches. The depth to lime is less than 10 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 3. It is dominantly sandy loam, but the range includes fine sandy loam, loam, and loamy sand. The AC horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 1 to 3. It is sandy loam, loam, fine sandy loam, or loamy sand. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is dominantly sandy loam or fine sandy loam but in some pedons has thin strata of coarser or finer material. The IIC horizon is pale brown, light gray, or very pale brown. It is loamy sand or sand.

New Cambria series

The New Cambria series consists of deep, moderately well drained, slowly permeable soils on terraces. These soils formed in calcareous, clayey alluvium. Slope ranges from 0 to 2 percent.

New Cambria soils commonly are adjacent to Bogue and Roxbury soils. Bogue soils are 20 to 40 inches deep over bedrock. They are on uplands. Roxbury soils contain less clay than the New Cambria soils. They are on terraces and flood plains.

Typical pedon of New Cambria silty clay loam, 1,250 feet north and 1,050 feet west of the southeast corner of sec. 23, T. 7 S., R. 17 W.

Ap—0 to 6 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate fine granular structure; very hard, firm; strong effervescence; mildly alkaline; abrupt smooth boundary.

A12—6 to 15 inches; dark gray (10YR 4/1) silty clay, very dark brown (10YR 2/2) moist; strong fine and medium blocky structure; very hard, firm; common fine roots and pores; strong effervescence; moderately alkaline; diffuse smooth boundary.

B2—15 to 30 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong fine and medium blocky structure; very hard, firm; common fine pores; strong effervescence; moderately alkaline; diffuse smooth boundary.

B3—30 to 42 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; strong fine and medium blocky structure; very hard, firm; common fine pores; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—42 to 55 inches; gray (10YR 5/1) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; very hard, firm; common threads and soft masses of lime in the lower part; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—55 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; many threads and soft masses of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 45 inches. The depth to lime ranges from 0 to 15 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay loam or silty clay. It is mildly alkaline or moderately alkaline. The B2 horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay or silty clay loam. The C horizon has hue of 10YR, value of 4 to 6 (4 or 5 moist), and chroma of 1 to 3.

Penden series

The Penden series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous, loamy sediments. Slope ranges from 3 to 15 percent.

Penden soils are similar to Campus soils and commonly are adjacent to Campus, Harney, Holdrege, and Uly soils. Campus soils are 20 to 40 inches deep over bedrock. Their position on the landscape is similar to that of the Penden soils. Harney and Holdrege soils are on ridgetops. They have an argillic horizon. Uly soils contain less sand in the subsoil than the Penden soils. Their position on the landscape is similar to that of the Penden soils.

Typical pedon of Penden loam, 3 to 7 percent slopes, 2,200 feet east and 1,600 feet north of the southwest corner of sec. 33, T. 7 S., R. 20 W.

A1—0 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; strong effervescence; mildly alkaline; gradual smooth boundary.

B2—9 to 22 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C1ca—22 to 40 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium prismatic structure; hard, friable; many soft accumulations and concretions of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—40 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; hard, friable; small sand lens in the upper part; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The mollic epipedon ranges from 7 to 20 inches in thickness. The soils are loam or clay loam and mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. The B2 horizon has hue of 7.5YR or 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. The C horizon has hue of 10YR or 7.5YR, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4.

Roxbury series

The Roxbury series consists of deep, well drained, moderately permeable soils on terraces and flood plains. These soils formed in calcareous, loamy alluvium. Slope is 0 to 1 percent.

Roxbury soils are similar to Hord and McCook soils and commonly are adjacent to Armo, Bogue, Hord, and Munjor soils. Hord soils are on the higher terraces. They do not contain lime in the solum. McCook and Armo soils have a mollic epipedon that is less than 20 inches thick. Armo and Bogue soils are on uplands. Bogue soils have a clayey subsoil. Munjor soils do not have a mollic epipedon and contain more sand in the subsoil than the Roxbury soils. They are on the slightly lower flood plains.

Typical pedon of Roxbury silt loam, 1,300 feet west and 100 feet south of the northeast corner of sec. 11, T. 8 S., R. 19 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

A12—5 to 29 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; common fibrous roots; strong effervescence; mildly alkaline; gradual smooth boundary.

B2—29 to 40 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, friable; strong effervescence; common films and fine threads of lime; mildly alkaline; gradual smooth boundary.

C—40 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; strong effervescence; common films and fine threads of lime; mildly alkaline.

The thickness of the solum ranges from 20 to 60 inches. The mollic epipedon is 20 to more than 50 inches thick. The depth to lime ranges from 0 to 15 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is dominantly silt loam but in some pedons is loam or silty clay loam. The B2 horizon has hue of 10YR, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is dominantly silt loam or loam. In some pedons, however, a contrasting buried soil or strata of fine sandy loam are below a depth of 40 inches.

Uly series

The Uly series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slope ranges from 3 to 15 percent.

Uly soils are similar to Holdrege soils and commonly are adjacent to Harney, Holdrege, Penden, and Wakeen soils. Holdrege and Harney soils have an argillic horizon. They are on ridgetops or the upper side slopes. Penden and Wakeen soils are on the lower side slopes. Penden soils contain more sand than the Uly soils. Wakeen soils are 20 to 40 inches deep over chalky bedrock.

Typical pedon of Uly silt loam, 3 to 6 percent slopes, 1,700 feet east and 120 feet south of the northwest corner of sec. 31, T. 6 S., R. 17 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse granular structure; slightly hard, friable; common fine roots; neutral; clear smooth boundary.

B2—8 to 15 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; neutral; clear smooth boundary.

B3—15 to 22 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable; mildly alkaline; clear smooth boundary.

C—22 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common threads and coatings of lime; strong effervescence; mildly alkaline.

The solum ranges from 12 to 36 inches in thickness. It is neutral or mildly alkaline. The depth to lime ranges from 8 to 25 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is dominantly silt loam, but the range includes loam and very fine sandy loam. The B2 horizon has hue of 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 2 or 3. It is silty clay loam or silt loam. The C horizon has hue of 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 2 or 3. It is silt loam or very fine sandy loam. It is mildly alkaline or moderately alkaline.

The Uly soil that occurs as part of the map unit Uly-Penden loams, 7 to 15 percent slopes, is a taxadjunct because it contains more fine sand in the B2 and C horizons than is defined as the range for the Uly series. This difference, however, does not significantly affect the use or behavior of the soil.

Wakeen series

The Wakeen series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in silty residuum of chalky limestone and shale. Slope ranges from 1 to 20 percent.

Wakeen soils commonly are adjacent to the Brownell, Harney, Mento, Roxbury, and Uly soils. Brownell soils are lower on the landscape than the Wakeen soils. Also, they have a higher content of coarse fragments in the solum. Harney and Mento soils have an argillic horizon and are more than 40 inches deep over bedrock. Harney soils are on ridgetops or the upper side slopes, and Mento soils are in positions on the landscape similar to those of the Wakeen soils. Roxbury soils are on terraces and flood plains. Their mollic epipedon is thicker than that of the Wakeen soils. Uly soils are on the upper side slopes. They are more than 40 inches deep over bedrock.

Typical pedon of Wakeen silt loam, in an area of Wakeen-Harney silt loams, 1 to 3 percent slopes, 1,000 feet north and 250 feet west of the southeast corner of sec. 17, T. 9 S., R. 19 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; common fine roots; mildly alkaline; clear smooth boundary.

A12—5 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; strong fine and medium granular structure; slightly hard, friable; common fine roots; violent effervescence; moderately alkaline; gradual smooth boundary.

B2—12 to 21 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; weak medium granular structure; hard, friable; about 5 percent small chalk fragments; violent effervescence; moderately alkaline; gradual smooth boundary.

B3—21 to 37 inches; very pale brown (10YR 8/3) silty clay loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; violent effervescence; moderately alkaline; gradual smooth boundary.

Cr—37 inches; chalky limestone.

The thickness of the solum, or the depth to chalky limestone, ranges from 20 to 40 inches. The solum is silt loam or silty clay loam. The mollic epipedon is 7 to 20 inches thick.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is mildly alkaline or moderately alkaline. The B2 horizon has hue of 10YR, value of 5 to 8 (3 to 6 moist), and chroma of 2 to 6. It ranges from mildly alkaline to strongly alkaline.

formation of the soils

The characteristics of a soil are determined by the interaction among five factors of soil formation—climate, plants and other living organisms, parent material, relief, and time. Each of these factors affects the formation of every soil, and each modifies the effects of the other four. The effects of the individual factors vary from place to place.

Climate and vegetation act on the parent material and gradually change it to a natural body of soil. Relief modifies the effects of climate and vegetation, mainly through its effect on runoff and temperature. The nature of the parent material also affects the kind of soil that forms. Time is needed for changing the parent material into a soil. Generally, a long period is needed for the formation of distinct horizons.

parent material

Parent material is the unconsolidated mass in which the soils form. It determines the mineralogical and chemical composition of the soil and, to a large extent, the rate at which soil forming processes take place. It affects texture, structure, color, natural fertility, and other soil properties. The soils in Rooks County formed in loess, colluvium, alluvium, loamy outwash, and residuum of chalky limestone, clayey shale, and caliche.

Loess is silty material that was transported by the wind as much as hundreds of miles from its source. Peorian Loess of the Wisconsin Glacial Stage, which was deposited during the Pleistocene Epoch, covers many areas throughout the county. In most places it is pale brown, calcareous, friable, and porous. Harney, Holdrege, Mento, and Uly soils formed in loess. In the Mento soils, chalky limestone residuum is mixed with loess below the subsoil and chalky limestone bedrock is at a depth of 4 to 6 feet.

Local colluvium derived from chalky limestone is an important parent material in the county. Armo soils formed in sediments weathered from Cretaceous chalky limestone on side slopes in many areas.

Recent alluvium is on the bottom land and terraces along the South Fork Solomon River and Bow Creek and, to a lesser extent, along some of the other streams in the county. The soils that formed in alluvium range from silt loam to loamy fine sand and show little or no evidence of soil formation. Hord, McCook, Munjor, and Roxbury soils are examples.

The loamy outwash in the county weathered mainly from the Ogallala Formation and was modified in the upper part by loess during the Pleistocene Epoch and more recent times (*4*). It is in many areas, mainly on dissected uplands in the western part of the county. It is limy and contains medium and coarse sand grains. Campus and Penden soils formed in this material.

Some of the soils in the county formed in residuum of chalky limestone, clayey shale, and caliche. Brownell, Heizer, and Wakeen soils formed in material weathered from chalky limestone. Bogue soils formed in material weathered from clayey shale.

climate

Climate is an active factor of soil formation. It directly affects soil formation by weathering the parent material. It indirectly affects soil formation through its effect on the plants and animals in or on the soil.

The continental climate of Rooks County is characterized by intermittent dry and moist periods. These periods can last for less than a year or for several years. The soil dries to varying depths during dry periods. It slowly regains moisture during wet periods and can become so saturated that excess moisture penetrates the substratum. The accumulation of soft lime in the substratum of Holdrege soils is evidence of this excess moisture. As a result of this wetting and drying, some of the basic nutrients, and even clay particles, have been leached from the upper horizons of some soils.

plant and animal life

Plants generally affect the content of nutrients and of organic matter in the soil and the color of the surface layer. Earthworms, cicadas, and burrowing animals help to keep the soil open and porous. Bacteria and fungi help to decompose the plants, thus releasing plant nutrients.

The mid and tall prairie grasses have affected soil formation in Rooks County more significantly than other forms of plant and animal life. As a result of these grasses, the upper part of a typical soil in the county is dark and generally has a high content of organic matter and available nutrients. The next part in many areas is slightly finer textured and somewhat lighter colored than the layer above. The underlying parent material generally is light in color and high in content of carbonates.

relief

Relief affects soil formation through its effect on drainage, runoff, erosion, and soil temperature. Through its effect on moisture and temperature, it also affects the kinds of plants and animals that live on and in the soil.

If other factors are equal, soil formation is less rapid in the more sloping areas because runoff is more rapid and erosion more extensive. In the more nearly level areas, the hazard of erosion is slight, the soils generally are deep, and the soil horizons are well expressed. Harney and Holdrege soils formed in loess in nearly level to moderately sloping areas. They have well expressed horizons. Uly soils also formed in loess but generally are steeper than the Harney and Holdrege soils. They show less evidence of soil formation than those soils.

time

Differences in the length of time that the parent materials have been in place commonly are reflected in the degree of profile development. Some soils form rapidly; others form slowly.

The soils in Rooks County range from immature to mature. Those on low bottom land, such as Roxbury soils, are subject to stream overflow. They receive new sediment with each flood. They have a thick, dark surface layer, but the soil structure is weak. As a result, they are considered immature. Harney soils are considered mature because they have distinct horizons.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

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.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

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.

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.

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.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

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 removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.
Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.
Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.
Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 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 (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

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 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.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

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.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

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."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-76 at Plainville, Kansas]

Month	Temperature					Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	In	In	In		In
January	40.2	16.7	28.5	70	-10	.32	.07	.52	1	4.5
February	46.3	21.6	34.0	78	-5	.77	.09	1.31	2	5.8
March	53.5	27.9	40.7	87	3	1.66	.21	2.59	3	6.7
April	66.7	39.8	53.3	92	18	1.88	1.05	2.52	4	1.2
May	76.2	50.4	63.3	98	31	3.79	1.47	5.38	7	0.1
June	86.8	60.7	73.8	108	44	4.18	1.71	6.09	6	0.0
July	92.3	66.0	79.2	108	52	3.22	1.30	4.76	5	0.0
August	90.9	64.0	77.5	107	50	2.83	1.50	3.96	4	0.0
September	80.8	54.3	67.6	104	35	2.81	.91	4.68	5	0.0
October	70.6	42.7	56.7	94	21	1.37	.20	2.41	3	0.1
November	53.8	29.1	41.5	78	4	.89	.06	1.75	1	3.2
December	43.2	20.4	31.8	70	-7	.49	.07	.73	1	4.4
Year	66.8	41.1	54.0	109	-14	24.21	16.89	28.97	42	26.0

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1931-60 at Plainville, Kansas]

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 17	April 29	May 10
2 years in 10 later than--	April 12	April 24	May 5
5 years in 10 later than--	April 3	April 14	April 25
First freezing temperature in fall:			
1 year in 10 earlier than--	October 19	October 10	October 1
2 years in 10 earlier than--	October 23	October 15	October 5
5 years in 10 earlier than--	November 2	October 24	October 15

TABLE 3.--GROWING SEASON

[Recorded in the period 1931-60 at Plainville, Kansas]

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	192	170	152
8 years in 10	199	178	159
5 years in 10	213	193	173
2 years in 10	226	208	186
1 year in 10	233	216	194

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Anselmo fine sandy loam, 1 to 3 percent slopes	3,200	0.6
Af	Anselmo fine sandy loam, 3 to 8 percent slopes	7,100	1.2
Ar	Armo loam, 1 to 3 percent slopes	1,660	0.3
As	Armo loam, 3 to 7 percent slopes	15,400	2.7
Au	Armo-Bogue complex, 7 to 15 percent slopes	6,450	1.1
Ca	Campus loam, 2 to 6 percent slopes	1,460	0.3
Cc	Campus-Anselmo complex, 5 to 15 percent slopes	7,650	1.3
Cr	Carlson silt loam, 1 to 3 percent slopes	590	0.1
Ef	Eltree silt loam, 1 to 3 percent slopes	1,820	0.3
Ha	Harney silt loam, 0 to 1 percent slopes	38,950	6.8
Hb	Harney silt loam, 1 to 3 percent slopes	77,700	13.6
Hd	Harney-Mento silt loams, 1 to 3 percent slopes	2,700	0.5
He	Harney-Mento silt loams, 3 to 7 percent slopes	37,375	6.5
Hm	Heizer-Brownell gravelly loams, 5 to 30 percent slopes	47,500	8.3
Ho	Holdrege silt loam, 0 to 1 percent slopes	9,900	1.7
Hr	Holdrege silt loam, 1 to 3 percent slopes	53,800	9.4
Hs	Holdrege silt loam, 3 to 6 percent slopes	7,675	1.3
Hw	Hord silt loam	5,590	1.0
Ic	Inavale fine sand, channeled	2,540	0.5
Ih	Inavale fine sand, hummocky	530	0.1
Iv	Inavale loamy fine sand	4,080	0.7
Mk	McCook silt loam	7,525	1.3
Mu	Munjor sandy loam	13,150	2.3
Nc	New Cambria silty clay loam	675	0.1
Pe	Penden loam, 3 to 7 percent slopes	11,110	1.9
Ro	Roxbury silt loam	13,760	2.4
Rp	Roxbury silt loam, frequently flooded	356	0.1
Rs	Roxbury silt loam, occasionally flooded	22,550	4.0
Ur	Uly silt loam, 3 to 6 percent slopes	50,600	8.9
Us	Uly silt loam, 6 to 10 percent slopes	28,200	4.9
Uy	Uly-Penden loams, 7 to 15 percent slopes	12,550	2.2
Wk	Wakeen silt loam, 3 to 7 percent slopes	31,850	5.6
Wx	Wakeen silt loam, 7 to 20 percent slopes	31,300	5.5
Wy	Wakeen-Harney silt loams, 1 to 3 percent slopes	10,000	1.8
	Water	4,224	0.7
	Total	571,520	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Only arable soils are listed. 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	Winter wheat	Grain sorghum	Alfalfa hay	Smooth bromegrass
	Bu	Bu	Ton	AUM*
Ad: Anselmo	33	50	2.0	4.0
Af: Anselmo	30	44	1.9	3.5
Ar: Armo	33	48	2.0	4.0
As: Armo	30	44	1.8	3.8
Ca: Campus	28	38	---	2.0
Cr: Carlson	36	52	2.5	4.0
Ef: Eltree	37	54	2.8	4.0
Ha: Harney	38	54	2.7	4.0
Hb: Harney	35	50	2.7	4.0
Hd: Harney-Mento	32	46	2.0	3.6
He: Harney-Mento	29	42	1.8	3.1
Ho: Holdrege	40	56	2.8	4.0
Hr: Holdrege	37	52	2.8	4.0
Hs: Holdrege	34	48	2.2	3.8
Hw: Hord	40	58	3.5	5.0
Iv: Inavale	26	46	1.8	---
Mk: McCook	38	56	3.5	5.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat	Grain sorghum	Alfalfa hay	Smooth bromegrass
	Bu	Bu	Ton	AUM*
Mu----------------------- Munjor	34	50	2.0	4.0
Nc----------------------- New Cambria	36	54	3.0	4.0
Pe----------------------- Penden	28	42	2.3	3.5
Ro----------------------- Roxbury	38	56	4.2	5.5
Rp----------------------- Roxbury	---	---	---	4.0
Rs----------------------- Roxbury	33	50	3.5	5.5
Ur----------------------- Uly	30	46	1.9	3.5
Us----------------------- Uly	27	42	1.7	2.5
Wk----------------------- Wakeen	26	38	---	2.5
Wy----------------------- Wakeen-Harney	32	48	2.3	3.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ad, Af-------------- Anselmo	Sandy-------------------------	Favorable	3,250	Little bluestem---------------	25
		Normal	2,600	Sand bluestem-----------------	15
		Unfavorable	2,000	Prairie sandreed--------------	15
				Western wheatgrass------------	15
				Blue grama--------------------	10
				Buffalograss------------------	5
Ar, As-------------- Armo	Limy Upland-------------------	Favorable	4,000	Big bluestem------------------	40
		Normal	3,000	Little bluestem---------------	20
		Unfavorable	1,000	Sideoats grama----------------	10
				Indiangrass-------------------	5
				Switchgrass-------------------	5
				Leadplant---------------------	5
				Western wheatgrass------------	5
Au*:					
Armo---------------	Limy Upland-------------------	Favorable	4,000	Big bluestem------------------	40
		Normal	3,000	Little bluestem---------------	20
		Unfavorable	1,000	Sideoats grama----------------	10
				Indiangrass-------------------	5
				Switchgrass-------------------	5
				Leadplant---------------------	5
				Western wheatgrass------------	5
Bogue--------------	Blue Shale--------------------	Favorable	3,000	Big bluestem------------------	40
		Normal	2,000	Little bluestem---------------	20
		Unfavorable	1,000	Sideoats grama----------------	15
				Leadplant---------------------	10
				Indiangrass-------------------	5
Ca------------------ Campus	Limy Upland-------------------	Favorable	3,500	Little bluestem---------------	30
		Normal	2,500	Big bluestem------------------	20
		Unfavorable	1,500	Sideoats grama----------------	20
				Switchgrass-------------------	5
				Blue grama--------------------	5
				Western wheatgrass------------	5
Cc*:					
Campus-------------	Limy Upland-------------------	Favorable	3,500	Little bluestem---------------	30
		Normal	2,500	Big bluestem------------------	20
		Unfavorable	1,500	Sideoats grama----------------	20
				Switchgrass-------------------	5
				Blue grama--------------------	5
				Western wheatgrass------------	5
Anselmo------------	Sandy-------------------------	Favorable	3,250	Little bluestem---------------	25
		Normal	2,600	Sand bluestem-----------------	15
		Unfavorable	2,000	Prairie sandreed--------------	15
				Western wheatgrass------------	15
				Blue grama--------------------	10
				Buffalograss------------------	5
Cr------------------ Carlson	Loamy Upland------------------	Favorable	4,000	Big bluestem------------------	20
		Normal	2,500	Little bluestem---------------	15
		Unfavorable	1,500	Blue grama--------------------	15
				Sideoats grama----------------	10
				Buffalograss------------------	10
				Western wheatgrass------------	10
				Western ragweed---------------	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Ef: Eltree	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,500	Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Leadplant	5
				Western wheatgrass	5
Ha, Hb: Harney	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,500	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
				Western ragweed	5
Hd*, He*:					
Harney	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,500	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
				Western ragweed	5
Mento	Clay Upland	Favorable	3,500	Blue grama	30
		Normal	2,000	Sideoats grama	15
		Unfavorable	1,000	Western wheatgrass	15
				Buffalograss	10
				Big bluestem	5
				Western ragweed	5
Hm*:					
Heizer	Shallow Limy	Favorable	3,000	Little bluestem	40
		Normal	2,000	Big bluestem	25
		Unfavorable	900	Sideoats grama	10
				Switchgrass	5
				Hairy grama	5
Brownell	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	20
				Indiangrass	5
Ho, Hr, Hs: Holdrege	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,800	Little bluestem	20
		Unfavorable	1,700	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Indiangrass	5
				Buffalograss	5
				Sand dropseed	5
Hw: Hord	Loamy Terrace	Favorable	4,500	Big bluestem	30
		Normal	3,500	Little bluestem	10
		Unfavorable	2,000	Switchgrass	10
				Indiangrass	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
				Western wheatgrass	5
				Porcupinegrass	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ic-- Inavale	Sandy Lowland	Favorable	3,500	Little bluestem	25
		Normal	3,000	Sand bluestem	20
		Unfavorable	2,000	Prairie sandreed	15
				Switchgrass	5
				Blue grama	5
				Sand dropseed	5
Ih-- Inavale	Sands	Favorable	3,500	Little bluestem	25
		Normal	3,000	Sand bluestem	20
		Unfavorable	2,500	Prairie sandreed	15
				Switchgrass	5
				Blue grama	5
				Sand dropseed	5
Iv-- Inavale	Sandy Terrace	Favorable	4,000	Sand bluestem	30
		Normal	3,500	Prairie sandreed	20
		Unfavorable	2,500	Little bluestem	15
				Switchgrass	5
				Porcupinegrass	5
				Sedge	5
Mk-- McCook	Loamy Terrace	Favorable	4,000	Big bluestem	25
		Normal	3,600	Little bluestem	15
		Unfavorable	2,800	Switchgrass	10
				Indiangrass	10
				Western wheatgrass	10
				Canada wildrye	5
				Sedge	5
				Blue grama	5
				Sideoats grama	5
Mu-- Munjor	Sandy Lowland	Favorable	4,500	Sand bluestem	35
		Normal	4,000	Switchgrass	15
		Unfavorable	3,000	Indiangrass	10
				Little bluestem	10
				Western wheatgrass	5
				Chickasaw plum	5
Nc-- New Cambria	Clay Terrace	Favorable	5,000	Big bluestem	30
		Normal	4,000	Little bluestem	15
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Western wheatgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Blue grama	5
Pe-- Penden	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Switchgrass	5
				Indiangrass	5
				Western wheatgrass	5
				Leadplant	5
Ro-- Roxbury	Loamy Terrace	Favorable	5,000	Big bluestem	35
		Normal	4,000	Sideoats grama	15
		Unfavorable	3,000	Western wheatgrass	15
				Switchgrass	10
				Little bluestem	10
				Indiangrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo- sition
			Lb/acre		Pct
Rp, Rs: Roxbury	Loamy Lowland	Favorable	6,500	Big bluestem	40
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Indiangrass	10
				Western wheatgrass	10
				Little bluestem	5
Ur, Us: Uly	Loamy Upland	Favorable	4,000	Big bluestem	30
		Normal	3,000	Little bluestem	25
		Unfavorable	2,000	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Sedge	5
Uy*:					
Uly	Loamy Upland	Favorable	4,000	Big bluestem	30
		Normal	3,000	Little bluestem	25
		Unfavorable	2,000	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Sedge	5
Penden	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Switchgrass	5
				Indiangrass	5
				Western wheatgrass	5
				Leadplant	5
Wk, Wx: Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Switchgrass	5
				Blue grama	5
Wy*:					
Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Switchgrass	5
				Blue grama	5
Harney	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,000	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
				Western ragweed	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--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 heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ad, Af: Anselmo	Lilac, American plum.	Common chokecherry	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, honeylocust, green ash, common hackberry, Russian mulberry.	Siberian elm	---
Ar, As: Armo	Fragrant sumac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, bur oak, Russian-olive, Rocky Mountain juniper.	Ponderosa pine, honeylocust, green ash, Siberian elm.	---	---
Au*:					
Armo	Fragrant sumac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, bur oak, Russian-olive, Rocky Mountain juniper.	Ponderosa pine, honeylocust, green ash, Siberian elm.	---	---
Bogue	Peking cotoneaster, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, common hackberry, Russian-olive, green ash, Rocky Mountain juniper.	Austrian pine, honeylocust, Russian mulberry.	Siberian elm	---
Ca: Campus	Fragrant sumac, silver buffaloberry, Tatarian honeysuckle, Siberian peashrub.	Rocky Mountain juniper, eastern redcedar, Russian-olive, bur oak.	Siberian elm, ponderosa pine, honeylocust, green ash.	---	---
Cc*:					
Campus	Fragrant sumac, silver buffaloberry, Tatarian honeysuckle, Siberian peashrub.	Rocky Mountain juniper, eastern redcedar, Russian-olive, bur oak.	Siberian elm, ponderosa pine, honeylocust, green ash.	---	---
Anselmo	Lilac, American plum.	Common chokecherry	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, honeylocust, green ash, common hackberry, Russian mulberry.	Siberian elm	---
Cr: Carlson	Lilac, Amur honeysuckle, fragrant sumac.	Russian mulberry	Eastern redcedar, green ash, honeylocust, Russian-olive, bur oak, Austrian pine, common hackberry.	Siberian elm	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ef: Eltree	American plum	Amur honeysuckle, lilac.	Eastern redcedar, ponderosa pine, Russian mulberry, Russian-olive, Austrian pine, green ash.	Honeylocust, common hackberry.	---
Ha, Hb: Harney	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, bur oak, honeylocust, Russian-olive, Austrian pine, green ash, common hackberry.	Siberian elm	---
Hd*, He*:					
Harney	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, bur oak, honeylocust, Russian-olive, Austrian pine, green ash, common hackberry.	Siberian elm	---
Mento	Lilac, Siberian peashrub, silver buffaloberry.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, green ash, Siberian elm.	Ponderosa pine	---	---
Hm*:					
Heizer.					
Brownell	---	---	---	---	---
Ho, Hr, Hs: Holdrege	Lilac, Amur honeysuckle, fragrant sumac.	Russian mulberry	Eastern redcedar, Austrian pine, green ash, honeylocust, common hackberry, bur oak, Russian-olive.	Siberian elm	---
Hw: Hord	Amur honeysuckle, fragrant sumac, lilac.	Russian mulberry, Russian-olive.	Eastern redcedar, Austrian pine, green ash, common hackberry, honeylocust, bur oak.	Siberian elm	---
Ic, Ih: Inavale	---	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine.	---	---
Iv: Inavale	Lilac, American plum.	Common chokecherry	Eastern redcedar, Austrian pine, Scotch pine, Russian mulberry, green ash, honeylocust, common hackberry, Russian mulberry.	Siberian elm	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Mk----------------- McCook	American plum, lilac.	Amur honeysuckle	Eastern redcedar, ponderosa pine, common hackberry, green ash, Russian-olive, Rocky Mountain juniper.	Honeylocust, Siberian elm.	Eastern cottonwood.
Mu----------------- Munjor	American plum-----	Tatarian honeysuckle, silver buffaloberry, Siberian peashrub.	Eastern redcedar, ponderosa pine, green ash, Russian mulberry, Russian-olive.	Honeylocust, Siberian elm.	Eastern cottonwood.
Nc----------------- New Cambria	---	Siberian peashrub, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Russian-olive, ponderosa pine, green ash, Russian mulberry.	Siberian elm, common hackberry, honeylocust.	Eastern cottonwood.
Pe----------------- Penden	Fragrant sumac, silver buffaloberry, Siberian peashrub.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Siberian elm, honeylocust, ponderosa pine, green ash.	---	---
Ro----------------- Roxbury	---	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry.	Russian mulberry, ponderosa pine, green ash, Russian-olive, eastern redcedar.	Common hackberry, Siberian elm, honeylocust.	Eastern cottonwood.
Rp, Rs------------- Roxbury	---	Tatarian honeysuckle, Siberian peashrub, silver buffaloberry.	Eastern redcedar, Russian-olive, ponderosa pine, green ash, Russian mulberry.	Siberian elm, common hackberry, honeylocust.	Eastern cottonwood.
Ur, Us------------- Uly	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian-olive, honeylocust, Austrian pine, common hackberry, bur oak.	Siberian elm------	---
Uy*:					
Uly----------------	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian-olive, honeylocust, Austrian pine, common hackberry, bur oak.	Siberian elm------	---
Penden------------	Fragrant sumac, silver buffaloberry, Siberian peashrub.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Siberian elm, honeylocust, ponderosa pine, green ash.	---	---
Wk, Wx------------- Wakeen	Siberian peashrub, fragrant sumac, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Wy*:					
Wakeen-----------	Siberian peashrub, fragrant sumac, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---
Harney-----------	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, bur oak, honeylocust, Russian-olive, Austrian pine, green ash, common hackberry.	Siberian elm------	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--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
Ad: Anselmo	Slight	Slight	Moderate: slope.	Slight.
Af: Anselmo	Slight	Slight	Severe: slope.	Slight.
Ar, As: Armo	Slight	Slight	Moderate: slope.	Slight.
Au*:				
Armo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Bogue	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
Ca: Campus	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Cc*:				
Campus	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Anselmo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Cr: Carlson	Slight	Slight	Moderate: slope.	Slight.
Ef: Eltree	Slight	Slight	Moderate: slope.	Slight.
Ha: Harney	Slight	Slight	Slight	Slight.
Hb: Harney	Slight	Slight	Moderate: slope.	Slight.
Hd*, He*:				
Harney	Slight	Slight	Moderate: slope.	Slight.
Mento	Slight	Slight	Moderate: slope.	Severe: erodes easily.
Hm*:				
Heizer	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.
Brownell	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight.
Ho: Holdrege	Slight	Slight	Slight	Slight.
Hr, Hs: Holdrege	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Hw: Hord	Slight	Slight	Slight	Slight.
Ic: Inavale	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Ih: Inavale	Severe: flooding, too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Iv: Inavale	Severe: flooding.	Slight	Slight	Slight.
Mk: McCook	Severe: flooding.	Slight	Slight	Slight.
Mu: Munjor	Severe: flooding.	Slight	Moderate: flooding.	Slight.
Nc: New Cambria	Severe: flooding.	Slight	Slight	Slight.
Pe: Penden	Slight	Slight	Moderate: slope.	Slight.
Ro: Roxbury	Severe: flooding.	Slight	Slight	Slight.
Rp: Roxbury	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Rs: Roxbury	Severe: flooding.	Slight	Moderate: flooding.	Slight.
Ur: Uly	Slight	Slight	Moderate: slope.	Slight.
Us: Uly	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Uy*:				
Uly	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Penden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Wk: Wakeen	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Wx: Wakeen	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Wy*:				
Wakeen	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Harney	Slight	Slight	Moderate: slope.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ad, Af------------- Anselmo	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Ar----------------- Armo	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
As----------------- Armo	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Au*:												
Armo---------------	Poor	Fair	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Bogue--------------	Poor	Fair	Poor	---	---	Poor	Very poor.	Poor	Poor	---	Very poor.	Poor.
Ca----------------- Campus	Fair	Good	Good	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Cc*:												
Campus-------------	Poor	Fair	Good	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Anselmo------------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Cr----------------- Carlson	Good	Good	Fair	---	---	Fair	Poor	Fair	Good	---	Poor	Fair.
Ef----------------- Eltree	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Ha----------------- Harney	Good	Good	Fair	---	---	Fair	Poor	Fair	Good	---	Poor	Poor.
Hb----------------- Harney	Good	Good	Fair	---	---	Fair	Poor	Fair	Good	---	Poor	Poor.
Hd*:												
Harney-------------	Good	Good	Fair	Poor	Poor	Fair	Poor	Fair	Fair	---	Poor	Poor.
Mento--------------	Fair	Good	Fair	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
He*:												
Harney-------------	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Fair	---	Poor	Poor.
Mento--------------	Fair	Good	Fair	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
Hm*:												
Heizer-------------	Very poor.	Poor	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Brownell-----------	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Ho, Hr------------- Holdrege	Good	Good	Fair	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
Hs----------------- Holdrege	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Hw----------------- Hord	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ic, Ih------------- Inavale	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Iv----------------- Inavale	Fair	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Mk----------------- McCook	Good	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Mu----------------- Munjor	Fair	Fair	Good	Fair	Fair	Good	Poor	Poor	Fair	Fair	Poor	Good.
Nc----------------- New Cambria	Good	Good	Fair	Good	Good	Good	Good	Poor	Fair	Good	Fair	Fair.
Pe----------------- Penden	Fair	Good	Fair	---	---	Poor	Very poor.	Poor	Fair	---	Very poor.	Fair.
Ro----------------- Roxbury	Good	Good	Good	Fair	Fair	Fair	Poor	Fair	Good	Fair	Poor	Fair.
Rp----------------- Roxbury	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Poor	Fair.
Rs----------------- Roxbury	Good	Good	Good	Fair	Fair	Fair	Poor	Fair	Good	Fair	Poor	Fair.
Ur, Us------------- Uly	Fair	Good	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Uy*:												
Uly---------------	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Penden------------	Poor	Fair	Fair	---	---	Poor	Very poor.	Poor	Fair	---	Very poor.	Fair.
Wk----------------- Wakeen	Fair	Good	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Wx----------------- Wakeen	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Wy*:												
Wakeen------------	Fair	Good	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Harney------------	Good	Good	Fair	Poor	Poor	Fair	Poor	Fair	Good	---	Poor	Poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ad: Anselmo	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
Af: Anselmo	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
Ar: Armo	Slight	Slight	Slight	Slight	Severe: low strength.
As: Armo	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
Au*:					
Armo	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Bogue	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Ca: Campus	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, low strength.
Cc*:					
Campus	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, low strength, slope.
Anselmo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Cr: Carlson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Ef: Eltree	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.
Ha, Hb: Harney	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Hd*:					
Harney	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Mento	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
He*:					
Harney	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Mento	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Hm*:					
Heizer	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Hm*:					
Brownell	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, large stones.
Ho, Hr Holdrege	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Hs Holdrege	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Hw Hord	Slight	Slight	Slight	Slight	Severe: low strength.
Ic Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Ih Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding, slope.	Moderate: slope, flooding.
Iv Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Mk McCook	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Mu Munjor	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Nc New Cambria	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
Pe Penden	Slight Moderate: slope.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Ro Roxbury	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Rp, Rs Roxbury	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Ur Uly	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
Us Uly	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Uy*:					
Uly	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Penden	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Wk Wakeen	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Wx----------------- Wakeen	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.
Wy*:					
Wakeen------------	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Harney------------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ad-------------------- Anselmo	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Af-------------------- Anselmo	Slight-----------	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Ar, As---------------- Armo	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Fair: too clayey, thin layer.
Au*:					
Armo----------------	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: too clayey, slope, thin layer.
Bogue---------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Ca-------------------- Campus	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Cc*:					
Campus--------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Anselmo-------------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Cr-------------------- Carlson	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Ef-------------------- Eltree	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Ha-------------------- Harney	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Hb-------------------- Harney	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Hd*, He*:					
Harney--------------	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Mento---------------	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey, small stones, thin layer.

See footnote at end of table.

TABLE 11.--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
Hm*:					
Heizer	Severe: depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Brownell	Severe: depth to rock.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, small stones.
Ho Holdrege	Slight	Moderate: seepage.	Slight	Slight	Good.
Hr, Hs Holdrege	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Hw Hord	Slight	Moderate: seepage.	Slight	Slight	Good.
Ic Inavale	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: seepage, too sandy, flooding.	Severe: seepage, flooding.	Poor: too sandy, seepage.
Ih Inavale	Severe: poor filter.	Severe: seepage, slope, flooding.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Iv Inavale	Severe: poor filter.	Severe: seepage, flooding.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Mk McCook	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
Mu Munjor	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Fair: thin layer.
Nc New Cambria	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
Pe Penden	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ro Roxbury	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Rp, Rs Roxbury	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Ur Uly	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Us Uly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Uy*:					
Uly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.

See footnote at end of table.

TABLE 11.--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
Uy*:					
Penden	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Wk Wakeen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Wx Wakeen	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Wy*:					
Wakeen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Harney	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ad, Af------ Anselmo	Good------	Probable------	Improbable: too sandy.	Fair: thin layer.
Ar, As------ Armo	Good------	Improable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Au*:				
Armo------	Good------	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Bogue------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ca------ Campus	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
Cc*:				
Campus------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
Anselmo------	Good------	Probable------	Improbable: too sandy.	Fair: thin layer, slope.
Cr------ Carlson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Ef------ Eltree	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ha, Hb------ Harney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Hd*, He*:				
Harney------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Mento------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Hm*:				
Heizer------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Brownell------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Ho, Hr, Hs------ Holdrege	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hw------ Hord	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ic, Ih, Iv------ Inavale	Good------	Probable------	Improbable: too sandy.	Poor: too sandy.
Mk------ McCook	Good------	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Mu: Munjor	Good	Probable	Improbable: too sandy.	Good.
Nc: New Cambria	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Pe: Penden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ro, Rp, Rs: Roxbury	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ur: Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Us: Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Uy*:				
Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Penden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Wk: Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Wx: Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
Wy*:				
Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Harney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ad----------------- Anselmo	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable------	Too sandy, soil blowing.	Favorable.
Af----------------- Anselmo	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope----------	Too sandy, soil blowing.	Favorable.
Ar----------------- Armo	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable------	Favorable------	Favorable.
As----------------- Armo	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope----------	Favorable------	Favorable.
Au*:						
Armo-------------	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope----------	Slope----------	Slope.
Bogue------------	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, percs slowly.	Slope, droughty, depth to rock.
Ca----------------- Campus	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
Cc*:						
Campus-----------	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Anselmo----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope----------	Slope, too sandy, soil blowing.	Slope.
Cr----------------- Carlson	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Ef----------------- Eltree	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Ha, Hb------------ Harney	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Hd*:						
Harney-----------	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Mento------------	Slight---------	Moderate: thin layer.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
He*:						
Harney-----------	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Mento------------	Moderate: slope.	Moderate: thin layer.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Hm*:						
Heizer	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Brownell	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Ho, Hr Holdrege	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Hs Holdrege	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Hw Hord	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Ic Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Ih Inavale	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Iv Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Mk McCook	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Mu Munjor	Severe: seepage.	Severe: piping.	Deep to water	Flooding	Soil blowing	Favorable.
Nc New Cambria	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Pe Penden	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Ro Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Rp, Rs Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Ur Uly	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Us Uly	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Uy*:						
Uly	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Penden	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Wk Wakeen	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.

See footnote at end of table.

TABLE 13.--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
Wx---------------- Wakeen	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Wy*:						
Wakeen-----------	Moderate: seepage, depth to rock.	Moderate: thin layer, piping.	Deep to water	Depth to rock	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Harney-----------	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable------	Erodes easily	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ad, Af----------- Anselmo	0-12	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	100	100	60-100	30-65	<20	NP-5
	12-24	Fine sandy loam, loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	90-100	35-65	<24	NP-5
	24-60	Fine sandy loam, loamy fine sand, fine sand.	SM	A-4, A-2	0	100	100	65-100	12-40	<20	NP
Ar, As----------- Armo	0-12	Loam-------------	CL	A-6, A-4	0	95-100	90-100	90-100	70-95	25-40	7-18
	12-60	Silt loam, clay loam, loam.	CL	A-6, A-4	0	95-100	85-100	70-100	65-80	25-45	7-22
Au*:											
Armo------------	0-12	Loam-------------	CL	A-6, A-4	0	95-100	90-100	90-100	70-95	25-40	7-18
	12-60	Silt loam, clay loam, loam.	CL	A-6, A-4	0	95-100	85-100	70-100	65-80	25-45	7-22
Bogue-----------	0-7	Clay-------------	CH	A-7	0	100	100	90-100	90-100	55-85	35-50
	7-21	Clay-------------	CH	A-7	0	100	100	90-100	90-100	60-90	35-50
	21-36	Clay-------------	CH	A-7	0	100	100	90-100	80-100	60-90	35-50
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ca--------------- Campus	0-8	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	55-90	20-40	3-20
	8-17	Loam, clay loam	CL, ML	A-6, A-7, A-4	0	100	100	75-95	50-80	33-45	8-20
	17-29	Loam, clay loam	CL, ML, SC, SM	A-6, A-7, A-4	0	90-100	70-100	65-85	40-80	33-45	8-20
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cc*:											
Campus----------	0-8	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	55-90	20-40	3-20
	8-17	Loam, clay loam	CL, ML	A-6, A-7, A-4	0	100	100	75-95	50-80	33-45	8-20
	17-29	Loam, clay loam	CL, ML, SC, SM	A-6, A-7, A-4	0	90-100	70-100	65-85	40-80	33-45	8-20
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Anselmo---------	0-12	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	100	100	60-100	30-65	<20	NP-5
	12-24	Fine sandy loam, loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	90-100	35-65	<24	NP-5
	24-60	Fine sandy loam, loamy fine sand, fine sand.	SM	A-4, A-2	0	100	100	65-100	12-40	<20	NP
Cr--------------- Carlson	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-40	5-20
	9-23	Silty clay loam, clay loam, silty clay.	CL, CH	A-7-6	0	100	100	90-100	85-100	40-55	20-30
	23-60	Silty clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6, A-7-6	0	100	95-100	80-100	55-100	25-45	5-20
Ef--------------- Eltree	0-18	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-40	3-15
	18-60	Silt loam, loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	95-100	90-100	65-100	25-45	7-22

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ha, Hb------------ Harney	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	10-27	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	27-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Hd*, He*: Harney-----------	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	10-27	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	27-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Mento------------	0-5	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	5-15
	5-14	Silty clay loam, silty clay.	CH	A-7	0	100	95-100	90-100	85-100	50-70	25-45
	14-60	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	100	95-100	90-100	85-100	30-50	11-25
Hm*: Heizer-----------	0-6	Gravelly loam----	GC, SC, GM-GC	A-2-4, A-2-6, A-1	0-20	50-90	40-70	30-60	20-35	20-40	5-20
	6-14	Channery loam, gravelly loam, very gravelly loam.	GC, SC, GP-GC, SP-SC	A-2-4, A-2-6, A-1	5-50	20-80	10-50	10-45	8-35	20-40	5-20
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Brownell---------	0-18	Gravelly loam----	GC, SC	A-2-4, A-2-6, A-1	0-20	50-80	40-70	30-60	20-35	20-40	5-20
	18-24	Very gravelly loam, channery loam, gravelly loam.	GC, GP-GC, SC, SP-SC	A-2-4, A-2-6, A-1	5-50	20-80	10-50	10-45	8-35	20-40	5-20
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ho, Hr, Hs-------- Holdrege	0-11	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-40	2-18
	11-25	Silty clay loam	CL	A-7, A-6	0	100	100	98-100	90-100	30-50	15-35
	25-60	Silt loam--------	CL, ML	A-4, A-6	0	100	100	95-100	90-100	30-40	5-15
Hw---------------- Hord	0-13	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	3-18
	13-36	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	98-100	85-100	25-40	8-23
	36-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	85-100	25-40	6-21
Ic, Ih------------ Inavale	0-8	Fine sand--------	SM, SP-SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	8-60	Fine sand, loamy fine sand, sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
Iv---------------- Inavale	0-8	Loamy fine sand	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	75-95	5-35	<25	NP-5
	8-60	Fine sand, loamy fine sand, sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
Mk---------------- McCook	0-11	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	95-100	60-100	20-35	2-10
	11-60	Very fine sandy loam, silt loam, fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	55-100	<20	NP-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Mu-- Munjor	0-5	Sandy loam	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	95-100	65-100	25-55	15-30	NP-7
	5-40	Fine sandy loam, loam, sandy loam.	SM, SC, ML, CL	A-4	0	100	95-100	65-100	35-65	15-30	3-10
	40-60	Loamy sand, sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	55-100	5-30	---	NP
Nc-- New Cambria	0-6	Silty clay loam	CL, CH	A-7-6	0	100	100	95-100	85-100	40-55	20-30
	6-42	Silty clay, silty clay loam, clay.	CH	A-7-6	0	100	100	95-100	85-100	50-75	25-45
	42-60	Silty clay, silty clay loam, clay.	CH, CL	A-7-6	0	100	100	95-100	85-100	40-60	20-40
Pe-- Penden	0-9	Loam	CL	A-4, A-6	0	100	100	85-100	65-95	25-40	7-20
	9-60	Clay loam, loam	CL	A-6, A-7-6	0	100	100	75-100	55-75	30-45	11-25
Ro, Rp, Rs-- Roxbury	0-29	Silt loam	CL	A-4, A-6	0	100	100	95-100	65-100	25-40	7-20
	29-40	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	95-100	80-100	30-50	8-25
	40-60	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6, A-7-6	0	100	100	95-100	65-100	30-50	7-25
Ur, Us-- Uly	0-8	Silt loam	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
	8-22	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	22-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
Uy*:											
Uly	0-60	Loam	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
Penden	0-9	Loam	CL	A-4, A-6	0	100	100	85-100	65-95	25-40	7-20
	9-60	Clay loam, loam	CL	A-6, A-7-6	0	100	100	75-100	55-75	30-45	11-25
Wk, Wx-- Wakeen	0-12	Silt loam	CL	A-4, A-6	0	100	100	95-100	75-95	25-40	7-20
	12-37	Silty clay loam, silt loam.	CL, ML	A-6, A-7-6	0	100	100	90-100	75-95	30-50	10-25
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wy*:											
Wakeen	0-12	Silt loam	CL	A-4, A-6	0	100	100	95-100	75-95	25-40	7-20
	12-37	Silty clay loam, silt loam.	CL, ML	A-6, A-7-6	0	100	100	90-100	75-95	30-50	10-25
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Harney	0-10	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	10-27	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	27-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--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	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
Ad, Af------------ Anselmo	0-12	10-18	1.30-1.60	0.6-6.0	0.13-0.18	6.1-7.8	<2	Low--------	0.20	5	3	1-2
	12-24	10-18	1.40-1.60	2.0-6.0	0.15-0.19	6.6-7.8	<2	Low--------	0.20			
	24-60	5-18	1.50-1.70	2.0-6.0	0.08-0.16	6.6-8.4	<2	Low--------	0.20			
Ar, As------------ Armo	0-12	18-27	1.25-1.40	0.6-2.0	0.21-0.24	6.6-8.4	<2	Low--------	0.28	5	4L	1-3
	12-60	18-35	1.30-1.45	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low--------	0.28			
Au*:												
Armo-------------	0-12	18-27	1.25-1.40	0.6-2.0	0.21-0.24	6.6-8.4	<2	Low--------	0.28	5	4L	1-3
	12-60	18-35	1.30-1.45	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low--------	0.28			
Bogue------------	0-7	50-75	1.10-1.30	<0.06	0.11-0.14	6.6-8.4	<2	High-------	0.28	4	4	---
	7-21	60-80	1.30-1.45	<0.06	0.09-0.11	6.6-8.4	<2	High-------	0.28			
	21-36	60-80	1.30-1.45	<0.06	0.09-0.11	4.5-6.0	<2	High-------	0.28			
	36	---	---	---	---	---	---	-----------	----			
Ca---------------- Campus	0-8	15-27	1.25-1.35	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.28	4	4L	1-2
	8-17	18-35	1.30-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.28			
	17-29	18-35	1.40-1.60	0.6-2.0	0.15-0.19	7.9-8.4	<2	Low--------	0.28			
	29	---	---	---	---	---	---	-----------	----			
Cc*:												
Campus-----------	0-8	15-27	1.25-1.35	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.28	4	4L	1-2
	8-17	18-35	1.30-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.28			
	17-29	18-35	1.40-1.60	0.6-2.0	0.15-0.19	7.9-8.4	<2	Low--------	0.28			
	29	---	---	---	---	---	---	-----------	----			
Anselmo----------	0-12	10-18	1.30-1.60	0.6-6.0	0.13-0.18	6.1-7.8	<2	Low--------	0.20	5	3	1-2
	12-24	10-18	1.40-1.60	2.0-6.0	0.15-0.19	6.6-7.8	<2	Low--------	0.20			
	24-60	5-18	1.50-1.70	2.0-6.0	0.08-0.16	6.6-8.4	<2	Low--------	0.20			
Cr---------------- Carlson	0-9	15-27	1.30-1.40	0.6-2.0	0.19-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
	9-23	35-45	1.35-1.50	0.2-0.6	0.14-0.19	6.6-8.4	<2	Moderate	0.43			
	23-60	18-35	1.35-1.50	0.6-2.0	0.16-0.20	7.9-8.4	<2	Low--------	0.43			
Ef---------------- Eltree	0-18	12-27	1.25-1.35	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.32	5	6	1-3
	18-60	18-35	1.35-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low--------	0.43			
Ha, Hb------------ Harney	0-10	22-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-7.8	<2	Low--------	0.32	5	6	2-4
	10-27	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	Moderate	0.43			
	27-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low--------	0.43			
Hd*, He*:												
Harney-----------	0-10	22-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-7.8	<2	Low--------	0.32	5	6	2-4
	10-27	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	Moderate	0.43			
	27-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low--------	0.43			
Mento------------	0-5	15-27	1.30-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low--------	0.37	4	7	1-3
	5-14	35-45	1.35-1.45	0.06-0.2	0.12-0.18	7.4-8.4	<2	High-------	0.37			
	14-60	21-35	1.30-1.40	0.2-0.6	0.18-0.20	7.9-8.4	<4	Moderate	0.37			
Hm*:												
Heizer-----------	0-6	15-27	1.30-1.45	0.6-2.0	0.10-0.16	7.4-8.4	<2	Low--------	0.24	2	8	---
	6-14	15-27	1.35-1.50	0.6-2.0	0.06-0.13	7.4-8.4	<2	Low--------	0.24			
	14	---	---	---	---	---	---	-----------	----			
Brownell---------	0-18	15-27	1.30-1.45	0.6-2.0	0.10-0.16	7.4-8.4	<2	Low--------	0.20	3	4L	---
	18-24	15-27	1.35-1.50	0.6-2.0	0.06-0.13	7.4-8.4	<2	Low--------	0.20			
	24	---	---	---	---	---	---	-----------	----			
Ho, Hr, Hs-------- Holdrege	0-11	15-25	1.40-1.60	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	1-3
	11-25	28-35	1.20-1.40	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	25-60	15-20	1.40-1.60	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.43			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
Hw---------------- Hord	0-13	17-27	1.30-1.40	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low--------	0.32	5	6	2-4
	13-36	20-35	1.35-1.45	0.6-2.0	0.17-0.22	6.6-7.8	<2	Low--------	0.32			
	36-60	18-30	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low--------	0.43			
Ic, Ih------------ Inavale	0-8	1-5	1.50-1.60	6.0-20	0.07-0.09	6.6-7.8	<2	Low--------	0.17	5	1	.5-1
	8-60	3-10	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	<2	Low--------	0.17			
Iv---------------- Inavale	0-8	7-18	1.50-1.60	6.0-20	0.10-0.12	6.6-7.8	<2	Low--------	0.17	5	2	.5-1
	8-60	3-10	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	<2	Low--------	0.17			
Mk---------------- McCook	0-11	15-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
	11-60	10-18	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low--------	0.43			
Mu---------------- Munjor	0-5	7-15	1.30-1.40	2.0-6.0	0.14-0.20	7.4-8.4	<2	Low--------	0.24	5	3	.5-1
	5-40	7-15	1.30-1.40	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low--------	0.24			
	40-60	1-5	1.40-1.50	6.0-20	0.06-0.09	7.4-8.4	<2	Low--------	0.24			
Nc---------------- New Cambria	0-6	30-40	1.30-1.40	0.06-0.2	0.21-0.23	6.6-8.4	<2	High-------	0.28	5	4	2-4
	6-42	38-60	1.35-1.45	0.06-0.2	0.13-0.18	7.9-8.4	<2	High-------	0.28			
	42-60	30-50	1.35-1.45	0.06-0.6	0.12-0.16	7.9-8.4	<2	High-------	0.28			
Pe---------------- Penden	0-9	20-27	1.30-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.28	5	4L	1-4
	9-60	24-35	1.30-1.45	0.6-2.0	0.14-0.19	7.9-8.4	<2	Moderate	0.37			
Ro---------------- Roxbury	0-29	18-27	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
	29-40	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	40-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Rp, Rs------------ Roxbury	0-29	18-27	1.30-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low--------	0.32	5	4L	2-4
	29-40	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	40-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Ur, Us------------ Uly	0-8	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
	8-22	20-32	1.20-1.30	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.43			
	22-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Uy*:												
Uly--------------	0-60	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
Penden-----------	0-9	20-27	1.30-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.28	5	4L	1-4
	9-60	24-35	1.30-1.45	0.6-2.0	0.14-0.19	7.9-8.4	<2	Moderate	0.37			
Wk, Wx------------ Wakeen	0-12	18-27	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low--------	0.32	4	4L	1-3
	12-37	18-35	1.35-1.50	0.6-2.0	0.18-0.32	7.4-9.0	<2	Moderate	0.43			
	37	---	---	---	---	---	---	-----------	----			
Wy*:												
Wakeen-----------	0-12	18-27	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low--------	0.32	4	4L	1-3
	12-37	18-35	1.35-1.50	0.6-2.0	0.18-0.32	7.4-9.0	<2	Moderate	0.43			
	37	---	---	---	---	---	---	-----------	----			
Harney-----------	0-10	22-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-7.8	<2	Low--------	0.32	5	6	2-4
	10-27	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	Moderate	0.43			
	27-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low--------	0.43			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ad, Af---------- Anselmo	A	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ar, As---------- Armo	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Au*:												
Armo------------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Bogue-----------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
Ca-------------- Campus	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	Low------	Low.
Cc*:												
Campus----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	Low------	Low.
Anselmo---------	A	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Cr-------------- Carlson	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Ef-------------- Eltree	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Ha, Hb---------- Harney	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Hd*, He*:												
Harney----------	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Mento-----------	C	None--------	---	---	>6.0	---	---	>60	Hard	Low------	High-----	Low.
Hm*:												
Heizer----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Low------	Low.
Brownell--------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	Low------	Low.
Ho, Hr, Hs------ Holdrege	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Hw-------------- Hord	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Ic-------------- Inavale	A	Occasional	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low------	Moderate	Low.
Ih, Iv---------- Inavale	A	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.

See footnote at end of table.

TABLE 16.--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				
Mk----------------- McCook	B	Rare----------	---	---	>6.0	---	---	>60	---	Moderate	Low---------	Low.
Mu----------------- Munjor	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Low---------	Moderate	Low.
Nc----------------- New Cambria	C	Rare----------	---	---	>6.0	---	---	>60	---	Low---------	High--------	Low.
Pe----------------- Penden	B	None----------	---	---	>6.0	---	---	>60	---	Low---------	Moderate	Low.
Ro----------------- Roxbury	B	Rare----------	---	---	>6.0	---	---	>60	---	Moderate	Low---------	Low.
Rp----------------- Roxbury	B	Frequent-----	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low---------	Low.
Rs----------------- Roxbury	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low---------	Low.
Ur, Us------------- Uly	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High--------	Low.
Uy*:												
Uly-----------------	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High--------	Low.
Penden--------------	B	None----------	---	---	>6.0	---	---	>60	---	Low---------	Moderate	Low.
Wk, Wx------------- Wakeen	B	None----------	---	---	>6.0	---	---	20-40	Soft	Low---------	Moderate	Low.
Wy*:												
Wakeen--------------	B	None----------	---	---	>6.0	---	---	20-40	Soft	Low---------	Moderate	Low.
Harney--------------	C	None----------	---	---	>6.0	---	---	>60	---	Low---------	High--------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, horizon, and depth in inches	Classification		Grain-size distribution*							Liquid limit	Plasticity index	Moisture density**	
			Percentage passing sieve--				Percentage smaller than--						
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Max. dry density	Optimum moisture
										Pct		Lb/ft3	Pct
Carlson silt loam:													
A1--------0 to 9	A-6(10)	CL	100	100	95	84	39	--	--	35	12	499	19
B2t------13 to 23	A-7-6(25)	CL	100	100	98	92	57	--	--	48	25	437	21
Cca------34 to 60	A-6(03)	CL	100	99	81	55	40	--	--	30	11	125	15
Inavale loamy fine sand:													
A1--------0 to 8	A-2-4(00)	SM	100	100	77	14	5	--	--	19	1	375	10
C--------16 to 60	A-3(01)	SP-SM	100	99	65	7	2	--	--	--	NP	187	10

* Grain-size distribution according to the AASHTO Designation T 88 72 with the following variations: (1) all material is crushed in a laboratory steel-jawed crusher; (2) the sample is not soaked prior to dispersion; (3) dispersing time is 5 minutes at 7 p.s.i. using an Iowa air tube; and (4) AASHTO T 133 74 is followed except for sample size to obtain SpG for the hydrometer analysis. Results by this procedure frequently differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes.

** Moisture density based on AASHTO Designation T 99 74, Method A, with the following variations: (1) all material is crushed in a laboratory steel-jawed crusher after drying, and (2) no time is allowed for dispersion of moisture after mixing with the soil material.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Anselmo	Coarse-loamy, mixed, mesic Typic Haplustolls
Armo	Fine-loamy, mixed, mesic Entic Haplustolls
Bogue	Very-fine, montmorillonitic, mesic Udorthentic Pellusterts
Brownell	Loamy-skeletal, carbonatic, mesic Entic Haplustolls
Campus	Fine-loamy, mixed, mesic Typic Calciustolls
Carlson	Fine, montmorillonitic, mesic Typic Argiustolls
Eltree	Fine-silty, mixed, mesic Pachic Haplustolls
Harney	Fine, montmorillonitic, mesic Typic Argiustolls
Heizer	Loamy-skeletal, carbonatic, mesic Lithic Haplustolls
Holdrege	Fine-silty, mixed, mesic Typic Argiustolls
Hord	Fine-silty, mixed, mesic Cumulic Haplustolls
Inavale	Sandy, mixed, mesic Typic Ustifluvents
McCook	Coarse-silty, mixed, mesic Fluventic Haplustolls
Mento	Fine, montmorillonitic, mesic Typic Argiustolls
Munjor	Coarse-loamy, mixed (calcareous), mesic Typic Ustifluvents
New Cambria	Fine, montmorillonitic, mesic Cumulic Haplustolls
Penden	Fine-loamy, mixed, mesic Typic Calciustolls
Roxbury	Fine-silty, mixed, mesic Cumulic Haplustolls
Uly	Fine-silty, mixed, mesic Typic Haplustolls
Wakeen	Fine-silty, carbonatic, mesic Entic Haplustolls

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