Issued December 1968

SOIL SURVEY

Scotts Bluff County Nebraska

NOTICE – Potential Update
Soils information in this manuscript is current as of the publication date. Situations like erosion, floods, or updated mapping may have changed some content slightly on a few acres. The most current soils information is available on-line at the Nebraska NRCS web site home page, in the e-FOTG (electronic Field Office Technical Guide). The website is www.ne.nrcs.usda.gov, then click on e-FOTG. This data is also available at the NRCS Field Office serving this county.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF NEBRASKA
Conservation and Survey Division

Major fieldwork for this soil survey was done in the period 1958–62. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1962. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska Conservation and Survey Division; it is part of the technical assistance furnished to the Scotts Bluff Soil Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Scotts Bluff County contains information that can be applied in managing farms, ranches, and woodlands; selecting sites for roads, ponds, buildings, or other structures; and in judging the value of tracts of land for agriculture, industry, or recreation.

Locating Soils

All of the soils of Scotts Bluff County are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit, windbreak suitability group, range site, or any other group in which the soil has been placed.

Interpretations not included in the text can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils in the soil descriptions and in the discussions of the capability units, range sites, and windbreak suitability groups.

Game managers, sportsmen, and others concerned with wildlife will find information about soils and wildlife in the section "Use of Soils for Wildlife and Recreation."

Ranchers and others interested in range can find, under "Use of Soils for Range," groupings of the soils according to their suitability for range, and also the plants that grow on each range site.

Community planners and others concerned with suburban development can read about the soil properties that affect the choice of homesites, industrial sites, schools, and parks in the section "Use of Soils for Homesites."

Engineers and builders will find under "Engineering Uses of Soils" tables that give estimates of engineering properties of the soils in the county and that name soil features that affect engineering practices and structures.

Scientists and others can read about how the soils were formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Scotts Bluff County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information.

Cover picture: **Area of Mitchell silt loam in the Gering Valley. This soil is commonly stripcropped and irrigated.**

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SOIL SURVEY OF SCOTTS BLUFF COUNTY, NEBRASKA

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UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE UNIVERSITY OF NEBRASKA,
CONSERVATION AND SURVEY DIVISION

SCOTTS BLUFF COUNTY is on the western edge of Nebraska bordering Wyoming (fig. 1). It is made up of 464,640 acres of land and 12,160 acres of water. The county is approximately 35 miles long and 21 miles wide. Gering is the county seat, and Scottsbluff is the largest town.

The county is in the central part of the High Plains section of the Great Plains physiographic province. The North Platte River enters the county near the northwest corner and leaves near the southeast corner. The valley of North Platte River is 20 to 25 miles wide and consists of bottom lands, well-formed terraces, and adjacent foot slopes. The uplands are formed mainly from sandstone and are on each side of the valley.

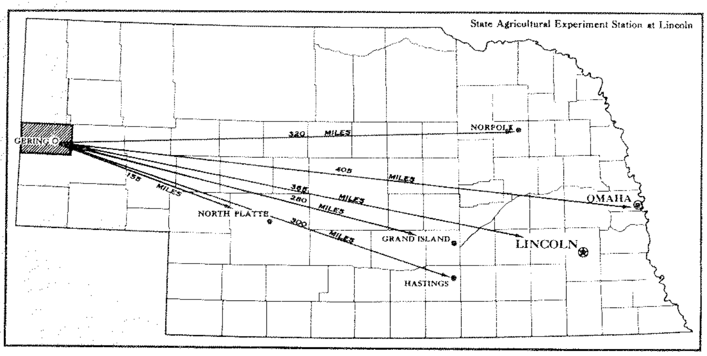

Figure 1.—Location of Scotts Bluff County in Nebraska.

The soils of Scotts Bluff County formed from a wide variety of materials. The residual soils on uplands were derived from material that weathered from Arikaree sandstone, Brule siltstone, the Chadron formation, and the Lance formation. Other soils on uplands formed in eolian, or windblown, silt and sand. The soils on terraces formed in old alluvium, and those on bottom lands formed in recent alluvium. On foot slopes the soils formed in colluvium-alluvium, or material moved into place by gravity and running water. Because these soils were derived from many kinds of material, their texture varies widely. In most places the texture of the surface layer is loam or coarser, but in some places it is silty and clayey.

Poorly drained and very poorly drained soils make up about 2 percent of the county. In these areas the water table is at or near the surface much of the year. Somewhat poorly drained soils make up 11 percent. These soils have a water table at a depth of 3 to 6 feet. The well-drained soils make up 43 percent. These soils have a medium-textured subsoil and are not affected by a high water table. The somewhat excessively drained soils occupy 28 percent of the county and excessively drained soils 16 percent. These soils have a sandy subsoil, are very shallow, or are sloping to steep.

In most places calcium occurs in the upper 36 inches. Most of the soils on bottom lands, eroded foot slopes, and loessal uplands are calcareous in the surface layer. Some soils are noncalcareous, but none are acid. Strongly to very strongly saline or saline-alkali soils are scattered on bottom lands. Where soils are calcareous, they are not affected by sodium and are mildly to moderately alkaline. In general, the content of carbonates is high in the soils of Scotts Bluff County because rainfall is light.

The climate of Scotts Bluff County is semiarid, and the average annual precipitation is 14.4 inches. The winters are not so cold and the summers are not so hot as they are in the central and eastern parts of Nebraska. The relative humidity is low.

Since about the year 1900, irrigation has had an important influence on the agriculture of the county. Now, more than 75 percent of the cropland is irrigated. Corn, field beans, sugar beets, and alfalfa are the main crops irrigated, but a substantial acreage of oats and potatoes are also irrigated. Winter wheat is the main dryfarmed crop, but some barley is grown. About 58 percent of the total acreage of the county is in native grasses and about 38 percent is in harvested crops. Except in a narrow belt along the North Platte River and in some of the canyons in the Wildcat Hills, few trees grow naturally in the county.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Scotts Bluff County, where they are located, and how they can be used. They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose 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 that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. For successful use of this survey, it is necessary to know the kinds of groupings most used in a local classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Keith and Mitchell, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural landscape. Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Mitchell fine sandy loam and Mitchell silt loam are two soil types in the Mitchell series. The difference in texture of their surface layers is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Mitchell fine sandy loam, 3 to 5 percent slopes, is one of several phases of Mitchell fine sandy loam, a soil type that ranges from nearly level to moderately steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing soil boundaries accurately. The soil map in the back of this survey was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Minatare-Janise soils.

The soil scientist may also show as one mapping unit two or more soils if the differences between them are so small that they do not justify separation for the purpose of the survey. Such a mapping unit is called an undifferentiated soil group; for example, Valentine and Dwyer fine sands.

Most surveys include areas where the soil material is so rocky, so shallow, or so frequently worked by wind and water that it cannot be classified by soil series. These areas are shown on the map like other mapping units, but are given descriptive names, such as Gravelly land or Barren badlands, and are called land types.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey. On the basis of the yield and practice tables and other data, the soil scientists set up trial groups, and then test them by further study and by consultation with farmers, agronomists, engineers, and others. The scientists adjust these groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the nine soil associations in Scotts Bluff County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The general soil map of Scotts Bluff County shows nine soil associations in four general kinds of landscape. Three are in the uplands, two are on foot slopes below the higher lying areas, two are on high benches along the

North Platte River, and two are on bottom lands. These associations are discussed on the following pages.

1. Tassel-Anselmo-Rock Outcrop Association

Shallow and deep, sandy soils and outcrops of rock on uplands

This association is on the Wildcat Hills, on "66" Mountain, and on the rocky uplands in the northeastern part of the county. The Scotts Bluff National Monument is in an isolated part of this association south of Scottsbluff. This association is mainly steep and rocky. In much of it grayish sandstone bedrock crops out. Buff-colored siltstone is beneath the sandstone and crops out along the lower parts of the bluffs. Along the borders of this association, steep canyonlike areas are common, but away from the borders the soils are undulating to rolling. In some of the less sloping areas, the soils are deep. Figure 2 shows a typical area. This association covers about 12 percent of the county.

The Tassel soils make up 65 percent of this association; Anselmo soils, 20 percent; Rock outcrop, 10 percent; and minor soils, 5 percent.

The Tassel soils are 10 to 20 inches thick over sandstone. These soils have a light-colored, limy surface layer and a lighter colored, limy, moderately coarse textured underlying layer. In some places they occur closely with the deep Anselmo soils and with Rock outcrop. Slopes range from 20 to 50 percent.

The Anselmo soils are deep and have a thick, dark surface layer that is free of lime. Their subsoil is moderately coarse textured.

Rock outcrop consists of areas of bare rock and areas where the soil is very thin over rock.

Of minor extent in this association are the Rosebud, Creighton, and Duroc soils and Barren badlands. The Rosebud and Creighton soils are on uplands, and the Duroc in low swales.

This association is mostly range on which many large herds of cows and calves, mainly Hereford, are grazed. Grazing is available throughout the year and is especially good in the Wildcat Hills, where mid and tall grasses are dominant. Less grazing is available in the northeastern part of the county, where the grasses are short.

Roads in this association are few. Most of them extend across the county and do not follow section lines. Houses are also few and are mainly the ranch headquarters for the owner or foreman.

Most of this association is too steep or too rocky for cultivation. Only about 5 percent is cultivated, and the main crop is winter wheat. Because soil blowing is a high hazard in cultivated areas, protection from soil blowing is needed. Dryfarming is possible on the deeper soils, but most of the association is better suited to grazing. Ground water is sufficient to supply the needs of ranches, but not enough is available for large-scale irrigation.

2. Bayard-Bridgeport Association

Deep, sandy and loamy soils on foot slopes

This association occurs mainly in a narrow belt bordering the Wildcat Hills and in a broader belt bordering the uplands in the northeastern part of the county (fig. 3). A few scattered areas occur elsewhere. Areas adjacent to soil association 1 are in steep canyons and on the steep sides of gullies. Areas farther from the hills are mainly gently sloping, but some are moderately steep. A few areas have slopes of only 2 percent. Many intermittent streams and gullies cut this association. They carry water from the higher lying areas into drainage ditches or into the North Platte River. This association covers about 15 percent of the county.

***Figure 2.*—Typical area of soil association 1 in the Wildcat Hills. Rock outcrop is in the steeper areas, and Tassel soils are in the less sloping areas.**

The Bayard soils make up 60 percent of this association; Bridgeport soils, 30 percent; and minor soils, 10 percent.

The soils in this association formed mainly from colluvial-alluvial materials that were moved to their present location by the combined action of gravity and running water. The original materials were most commonly adjacent to higher lying formations of siltstone and sandstone.

In uneroded areas Bayard soils have a moderately dark, limy surface layer and a lighter colored, moderately coarse textured, limy subsoil. Their surface layer is slightly lighter colored in eroded areas. The Bridgeport soils are similar to the Bayard soils but have a medium-textured subsoil.

The minor soils in this association are the Otero, Mitchell, Dunday, and Valentine. A large area of the Dunday soils in this association is east of Lake Minatare. Also, there are small areas of Sandy alluvial land on the bottom lands in this association.

About 75 percent of the acreage of this association is in permanent pasture. Most areas are so steep, so sandy, or so gullied that they cannot be farmed successfully. Some areas that could be cultivated adjoin good rangeland, and the owner prefers to graze these rather than to cultivate them. About 15 percent of this association is irrigated. The irrigated part is mainly south of Little Lake Alice and southeast of Lake Minatare. About 10 percent, mainly southwest of Melbeta, is dryfarmed to winter wheat.

Except in the cultivated parts of this association, farmsteads are widely separated. In most places the grasslands are parts of large ranches. Gully control and pasture management are the main concerns of range management.

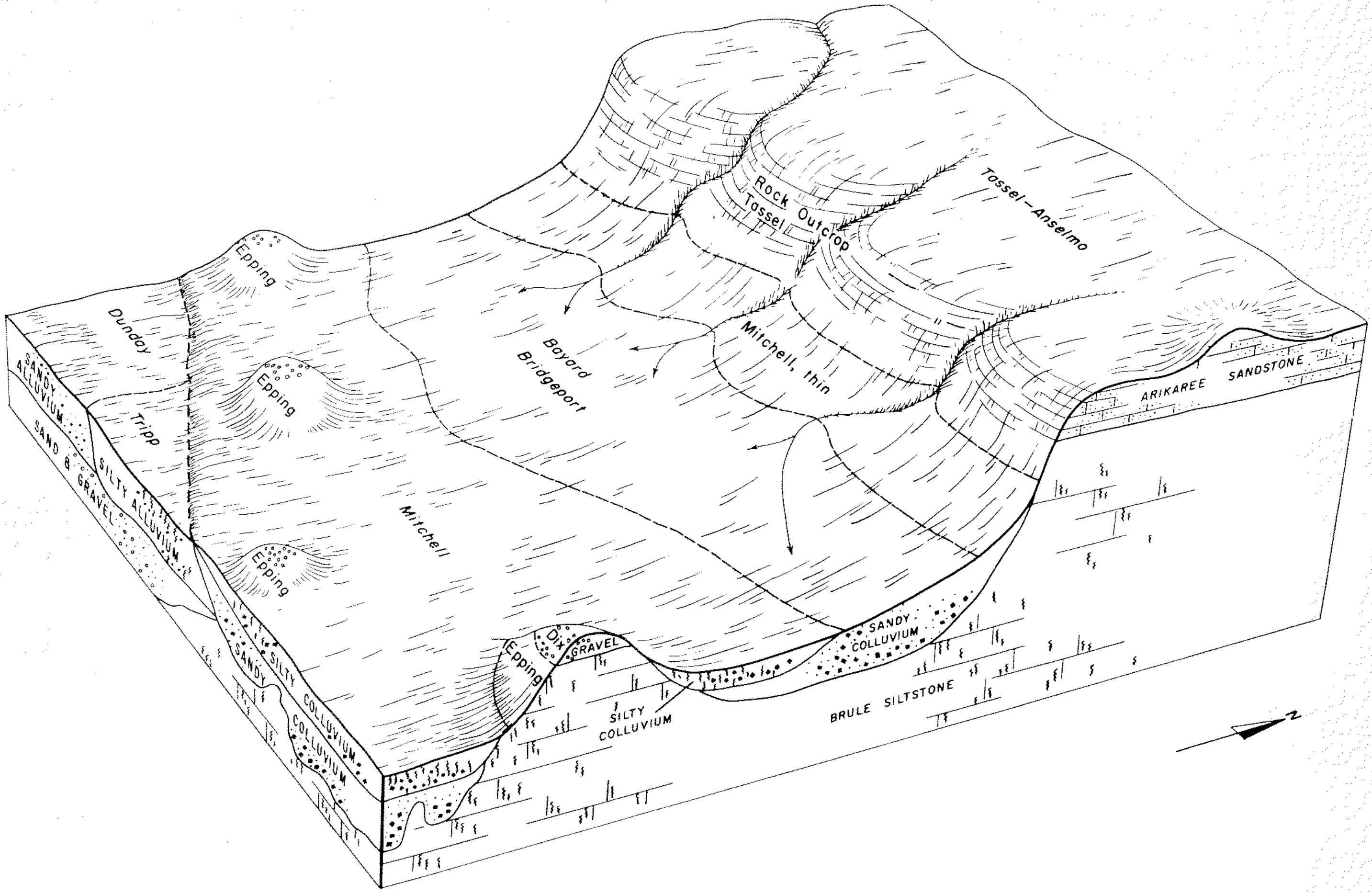

***Figure 3.*—Major and some of the minor soils and underlying material in soil association 2.**

Where the soils are irrigated, water erosion and maintenance of fertility are the principal concerns. Soil blowing and moisture conservation are the main concerns in managing dryfarmed areas.

3. Mitchell-Keith-Epping Association

Deep and shallow, loamy and sandy soils on uplands

Areas of this association are distributed throughout the county, but one large area is in the southwestern part (fig. 4). A narrow area borders the Mitchell Bottom and Gering Valley, a fairly large area is south of Lake Alice, and a smaller area is southeast of Lake Minatare. The association covers about 18 percent of the county.

The soils in this association are mainly medium textured, but some are moderately coarse textured. They are generally very gently sloping to sloping but are steep in places.

Mitchell soils occupy 55 percent of this association. These soils are deep and medium textured to moderately coarse textured. They formed in material that weathered from Brule siltstone and was then transported for only short distances. The surface layer is light colored or moderately dark colored and slightly limy. The subsoil is lighter colored than the surface layer and is rich in lime and weakly developed.

The Keith soils occupy 25 percent of this association. These soils formed in silty, wind-deposited material. They have a moderately dark, nonlimy surface layer and a brownish, nonlimy upper subsoil that is moderately well developed. The lower subsoil contains a layer that is enriched with calcium carbonate.

Epping soils occupy 15 percent of the association. These soils are 10 to 20 inches deep to Brule siltstone.

The minor soils that make up the remaining 5 percent of this association are the Duroc, in small swales; the Keota, on uplands; and the Mitchell, on foot slopes and broad fans. The Keota soils formed in material weathered from Brule siltstone, and the Duroc soils formed mainly in loess.

About 50 percent of this association is above the Fort Laramie Canal and is dryfarmed, mainly to winter wheat. Nearly all of this area is stripcropped so as to help control soil blowing. About 40 percent of the association is below irrigation canals and is irrigated. Corn, sugar beets, alfalfa, field beans, and oats are the main crops. The remaining 10 percent is used for native pasture.

The farming units are considerably larger in dryfarmed areas than in irrigated areas. Farmsteads are not far apart, and the roads are adequate.

The dryland farmer is concerned with soil blowing, water erosion, and water conservation. Farmers of ir-

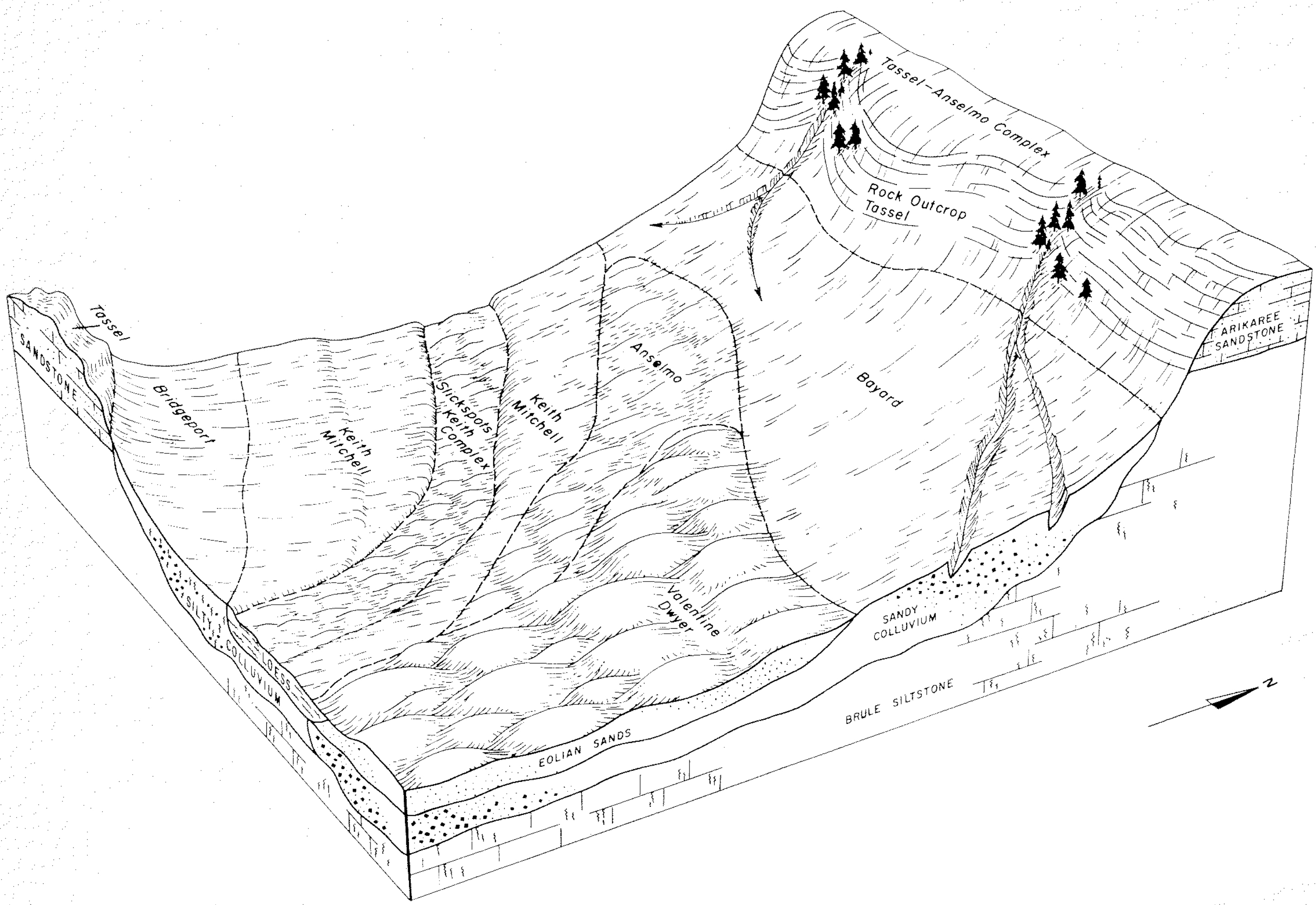

Figure 4.—**A part of soil association 3 and its underlying material in the extreme southwestern part of the county.**

rigated land are concerned with water erosion and maintenance of fertility.

4. Mitchell-Otero-Buffington Association

Deep, silty, sandy, and clayey soils on valley floors

This association consists of Mitchell Bottom, Gering Valley, Lyman Plain, a small area extending south from Melbeta, and other small areas. Almost all of it is nearly level, but in a few places slopes range from 2 to 4 percent. The association is cut by a network of irrigation canals, laterals, and drainage ditches. It covers about 12 percent of the county.

The Mitchell soils make up 70 percent of this association; Otero, 20 percent; Buffington, 5 percent; and minor soils, 5 percent.

The Mitchell are the most extensive soils in this association. These deep soils have a light-colored to moderately dark colored, limy surface layer. The subsoil is light colored, medium textured, and rich in lime.

The Otero soils have a thin, light-colored, limy surface layer. Their subsoil is moderately coarse textured.

The Buffington soils occur mainly near Lyman. These soils have a moderately dark, moderately fine textured, limy surface layer and a moderately fine textured subsoil. The surface layer and subsoil are sticky when wet.

Minor soils in this association are the Epping, on knolls and side slopes; the Keota, on uplands; and the Bayard, on foot slopes and broad basinlike fans.

Nearly all of the farmland in this association is irrigated and used for crops. The main crops are corn, sugar beets, alfalfa, field beans, potatoes, and oats. Yields are generally favorable. Some areas of this association are flooded occasionally by local spring rains. Although the water drains away rapidly, it damages crops that are planted early.

This association has many roads and farmsteads. The chief concern of farmers is managing irrigation water so that soil erosion is controlled. Because most of the soil only weakly resist moving water, safe disposal of excess irrigation water is important. Constant attention to the maintenance of fertility is needed because large amounts of plant material are removed annually in harvested crops.

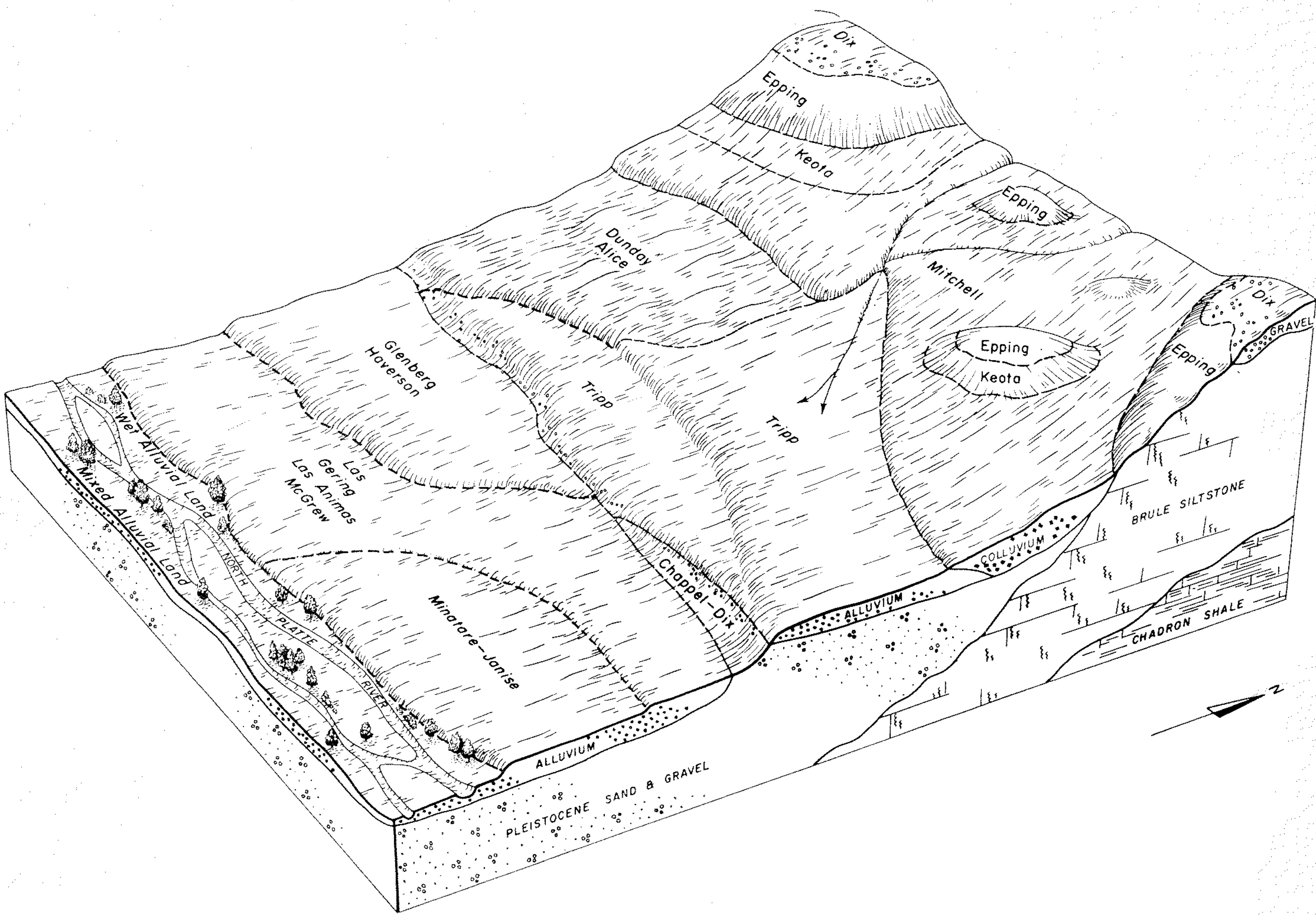

Figure 5.—**Major and some of the minor soils and underlying material in soil association 5.**

5. Tripp-Alice-Dunday Association

Deep, loamy and sandy soils on high benches and terraces

This association occupies the higher terraces and benches north of the North Platte River (fig. 5). Most areas have slopes of less than 2 percent, but in places near the University of Nebraska Experiment Station and along the breaks from terraces slopes range from 3 to 9 percent. This association covers about 15 percent of the county.

The Tripp soils make up 60 percent of this association; Alice soils, 20 percent; Dunday soils, 15 percent; and minor soils, 5 percent.

The Tripp are the most extensive soils in this association. These soils have a thick, dark, nonlimy surface layer. The upper subsoil is lighter colored than the surface layer and is medium textured and nonlimy. A silty layer of accumulated calcium carbonate occurs in the lower subsoil. In most places Tripp soils are underlain at a depth of 3 to 6 feet by mixed sand and gravel. These soils are among the best in western Nebraska for farming.

The Alice soils have a moderately coarse textured or coarse textured, nonlimy surface layer and a moderately coarse textured subsoil. A layer of accumulated calcium carbonate also occurs in the subsoil.

The Dunday are the sandiest of the major soils in this association. These soils have a loamy fine sand surface layer and subsoil. They occur mainly north of Morrill but are also on the lower terrace breaks to bottom lands along the North Platte River north and east of Mitchell.

Minor soils in this association are in the Dix, Bayard, and Chappell series. These soils occur in areas where the underlying gravel is near the surface.

About 95 percent of this association is irrigated cropland. The most commonly grown crops are corn, sugar beets, field beans, alfalfa, and potatoes. Yields are generally favorable. Soils on the steeper terrace breaks and those that are too sandy for cultivated crops are used for permanent pasture. In this association many beef cattle are fattened in feedlots.

Many farmsteads are in this association, and gravel or asphalt roads run along nearly every section line.

Water erosion and maintenance of fertility are the main concerns in managing these soils. Soil blowing must be controlled during a dry spring or after crops are harvested in fall. On slopes of 2 to 8 percent, managing irrigation water so as to control erosion is important.

6. Valentine-Dwyer Association

Deep, sandy soils on uplands

This association occurs in several areas scattered through all the county except the central part. A fairly large area is in the southeastern corner of the county, and another is in the southwestern part about 7 miles south of Stegall (fig. 6). Several smaller areas are in the northwestern part of the county. Most of this association is hummocky. In some places it is almost dunelike, but in other places the hummocks are low and have slopes of only 4 to 6 percent. This association covers about 8 percent of the county.

The Valentine soils make up 65 percent of this association; Dwyer soils, 25 percent; and minor soils, 10 percent.

The Valentine are the most extensive soils in this association. These soils have a thin, coarse-textured, nonlimy surface layer. The subsoil is also coarse textured and nonlimy, but it is lighter colored than the surface layer.

The Dwyer soils are similar to the Valentine soils but are limy above a depth of 40 inches. Both Valentine and Dwyer soils are subject to soil blowing when they are cultivated.

The Bayard and Anselmo soils, minor soils in this association, generally are at the edges of the sandhills. About 95 percent of this association is in permanent pasture. In general, the soils are too sandy, too erodible, and too steep for successful cultivation. A few small areas of the less sandy soils are cultivated.

Most areas of this association produce fair to good stands of native grasses. Herds of Hereford and Angus cows and calves graze these soils throughout the year. Supplemental feed must be supplied in extended periods of drought, or it may be necessary to sell the cattle before they are ready.

Larger farms and ranches are in this association than are in any other in the county except soil association 1. Farmsteads are few, and most of them are the headquarters for combined ranching and farming. Gravel roads run along about one-fourth of the section lines. Water for livestock and for domestic use is sufficient in most areas.

Blowouts occur in areas where cattle tramp out the grasses, and these areas tend to become enlarged during dry spells. In places gullies form in the cattle trails.

7. Las-Alluvial Land-McCook Association

Loamy, sandy, and gravelly soils on bottom lands

This association occurs mainly on bottom lands along the North Platte River. It also occurs in the valleys of Sheep, Spottedtail, Winter, and Ninemile Creeks. About 80 percent of the acreage is north of the North Platte River. This association consists of areas adjacent to the river channels; of low bottom lands, or first bottoms; and of high bottom lands, or low terraces. It is nearly level, except for some areas of breaks from one level to another and a few low ridges and swales. It covers about 11 percent of the county.

The Las soils make up 40 percent of this association; Alluvial land, 35 percent; McCook soils, 15 percent; and minor soils, 10 percent.

Las soils have a water table at a depth of 3 to 6 feet. Their loam surface layer is limy. The subsoil is medium textured, but in many areas clayey layers are below a depth of 2 feet. In places Las soils are moderately alkali.

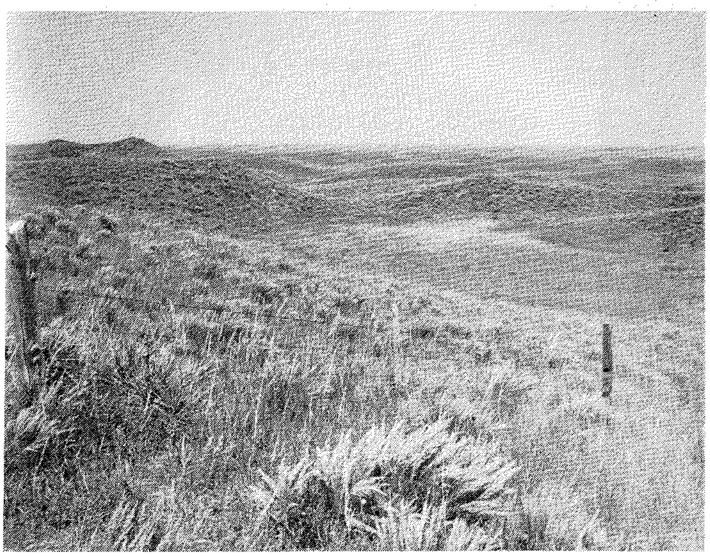

Figure 6.—**Typical area of soil association 6 in the sandhills.**

The well-drained McCook soils are deep, medium textured, and limy. These soils are underlain by mixed sand and gravel at a depth of 3 to 6 feet.

Mixed alluvial land and Wet alluvial land are in this association. These lands are adjacent to the channel of the North Platte River. They are shallow to mixed sand and gravel. The water table in Mixed alluvial land is at a depth of 2 to 4 feet; it is near the surface in Wet alluvial land.

Minor soils in this association are the Las Animas, Glenberg, Bankard, and Platte. All of these are on bottom lands.

About 70 percent of this association is irrigated cropland. Corn, alfalfa, and sugar beets are the main crops. Field beans and potatoes are grown, but on a smaller acreage than on soil association 5. Nearly all the acreage of Alluvial land is used for pasture. Where it is very shallow, Alluvial land is suited only to pasture. This land is kept too wet for crops by a high water table, or it is too droughty because it is very shallow. Also, many areas along the North Platte River are moderately affected by alkali and are used for pasture or hay.

The farms in this association are of about average size for the county. Except in areas of Alluvial land, gravel or asphalt roads are on nearly all section lines. The first irrigation of soils in the county was in this association.

On irrigated soils the maintenance of fertility and the control of soil blowing are the principal concerns of management. Some soils have a moderately high water table that fluctuates seasonally, but subirrigation is not dependable. In some places the soils are too wet or too saline for specified crops, particularly field beans.

8. Minatare-Janise Association

Strongly saline-alkali soils on bottom lands

This association occurs mainly on bottom lands along the North Platte River. Several other areas are east and south of Lyman, one is in the southwest corner of the county, and some are in the valleys of Sheep, Dry Spotted-

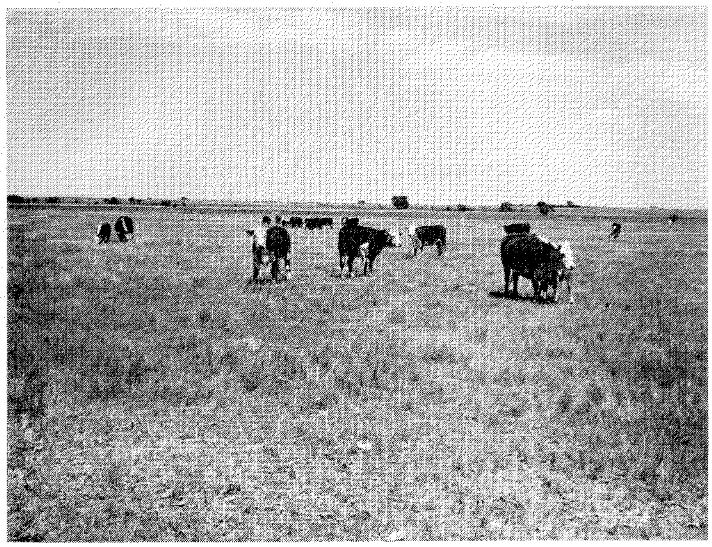

Figure 7.—**Cows and calves grazing in an area of strongly saline-alkali soils of the Minatare-Janise soil association.**

tail, Spottedtail, Tub Springs, and Winter Creeks. This association occupies about 7 percent of the county.

The Minatare soils make up 45 percent of this association; Janise soils, 45 percent; and minor soils, 10 percent.

The major soils of this association are nearly level, somewhat poorly drained, and strongly saline-alkali. Minatare soils are strongly affected by salts and alkali and have a water table at a depth of 3 to 5 feet. These soils have a thin surface layer and a well-developed, clayey subsoil that is very sticky when wet. Their substratum is of mixed sand and gravel.

Janise soils are similar to Minatare soils, but their subsoil is not so clayey. Their substratum is silt loam or mixed sand and gravel.

Also in this association are the Orella soils and Slickspots, Wet alluvial land, and Marsh.

Nearly all of this association is in permanent pasture (fig. 7). A few small areas of saline-alkali soils are cultivated, but yields are mostly unsatisfactory. Some areas southeast of Minatare are irrigated by flooding and have increased yields of forage. More than 90 percent of the vegetation on this association is tolerant of salt and alkali. The Wet alluvial land and Marsh in this association are too wet for cultivated crops. A better use is for pasture or wildlife habitat.

Because most areas of this association are fairly small, few farms are completely within the association.

A strongly saline-alkali condition is the main limitation to the use of soils in this association. Correcting this condition is difficult because the water table is high.

9. Gravelly Land-Dix-Chappell Association

Shallow to deep, gravelly soils on breaks of terraces

All of this association is north of the North Platte River. It occurs as long, narrow, steep, gravelly breaks from high terraces to low terraces or to bottom land. In many places this association is underlain by Brule siltstone at depths ranging from 1 to 10 feet or more. This association covers about 2 percent of the county.

In this association slopes range from 5 to 20 percent. Many springs occur along the lower terrace breaks and produce water throughout the year. Gravel pits are common.

Gravelly land occupies about 60 percent of this association. This land consists of very shallow soil material underlain by gravel and areas of exposed gravel. This darkened layer of soil material is in the upper 2 to 6 inches. Beneath this layer is mixed sand and gravel.

The Dix soils occupy 20 percent of this association. They consist of 10 to 20 inches of soil material overlying mixed sand and gravel.

Chappell soils occupy 15 percent of this association. They occur in gently sloping areas that are downslope from Gravelly land. These soils have a thick, dark-colored surface layer overlying a lighter colored, moderately coarse textured subsoil. Mixed sand and gravel occurs at a depth of 20 to 40 inches.

The Bayard are minor soils in this association and occupy 5 percent of it. They occur in some areas downslope from Gravelly land. As the distance from Gravelly land increases, the soil material becomes thicker, but even in areas where the soil is fairly thick, many pebbles of variable size are scattered throughout the profile.

About 80 percent of this association is used for pasture. In these pastures, the stand of desirable grasses is poor and the soils are extremely droughty. The yield of herbage is low. Soils are irrigated on the lower slopes of this association along the terrace breaks southeast of Scottsbluff. Crop yields are fair to good and depend on how well the soils are managed.

No farms are completely within this association, because it is small and narrow. In many places an area is only a small part of a farming unit in the adjacent soil association.

Because the soils in this association are porous and rapidly permeable, they are extremely droughty. In places medium and large pebbles cover the surface, and there is practically no fine soil material in the surface layer. These areas are not suited to cultivated crops, but downslope from them the soils in colluvial material can be cultivated. Even these soils are droughty and have gravel at the surface in places. Irrigation water must be carefully applied. Most areas in this association are better suited to pasture than to crops.

Descriptions of the Soils

This section describes the soil series, which are groups of similar soils, and the single soils, or mapping units, of Scotts Bluff County. The acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is first to describe the soil series and then the mapping units in that series. Thus to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gravelly land and Barren badlands, for example, are miscellaneous land types and do not belong to a soil series; nevertheless, they are listed in alphabetic order along with the series.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Alice fine sandy loam, 0 to 3 percent slopes	14, 805	3. 2
Alice fine sandy loam, 3 to 5 percent slopes	3, 776	. 8
Alice loamy fine sand, 0 to 3 percent slopes	2, 515	. 5
Anselmo fine sandy loam, 1 to 3 percent slopes	2, 792	. 6
Anselmo fine sandy loam, 3 to 5 percent slopes	5, 148	1. 1
Anselmo fine sandy loam, 5 to 9 percent slopes	5, 434	1. 2
Anselmo fine sandy loam, 9 to 20 percent slopes	3, 612	. 8
Anselmo fine sandy loam, alkali variant, 0 to 3 percent slopes	488	. 1
Bankard loamy fine sand, 0 to 3 percent slopes	272	. 1
Bankard loamy fine sand, alkali, wet variant	899	. 2
Bankard loamy fine sand, wet variant	837	. 2
Barren badlands	1, 857	. 4
Bayard fine sandy loam, 0 to 3 percent slopes	951	. 2
Bayard fine sandy loam, 3 to 5 percent slopes	7, 514	1. 6
Bayard fine sandy loam, 5 to 9 percent slopes	6, 156	1. 3
Bayard fine sandy loam, 9 to 20 percent slopes	3, 159	. 7
Bridgeport very fine sandy loam, 1 to 3 percent slopes	4, 868	1. 0
Bridgeport very fine sandy loam, 3 to 5 percent slopes	5, 720	1. 2
Bridgeport very fine sandy loam, 5 to 9 percent slopes	3, 658	. 8
Bridgeport very fine sandy loam, 9 to 20 percent slopes	2, 133	. 5
Broken alluvial land	626	. 1
Buffington silty clay loam, 0 to 1 percent slopes	1, 155	. 2
Buffington silty clay loam, 1 to 3 percent slopes	272	. 1
Buffington silty clay loam, alkali, 0 to 1 percent slopes	546	. 1
Chappell-Dix complex, 1 to 3 percent slopes	381	. 1
Chappell-Dix complex, 3 to 5 percent slopes	1, 750	. 4
Clayey alkali land	366	. 1
Creighton very fine sandy loam, 3 to 5 percent slopes	1, 133	. 2
Creighton very fine sandy loam, 5 to 9 percent slopes	1, 559	. 3
Dix-Bayard complex, 5 to 20 percent slopes	3, 865	. 8
Dix complex, 5 to 30 percent slopes	1, 768	. 4
Dunday and Valentine loamy fine sands, 0 to 3 percent slopes	9, 697	2. 1
Dunday and Valentine loamy fine sands, 3 to 5 percent slopes	11, 514	2. 6
Duroc loam, 1 to 5 percent slopes	1, 419	. 3
Epping silt loam, 1 to 3 percent slopes	875	. 2
Epping silt loam, 3 to 30 percent slopes	6, 192	1. 3
Gering loam	1, 185	. 3
Gering loam, alkali	1, 373	. 3
Glenberg fine sandy loam, 0 to 3 percent slopes	4, 395	. 9
Gravelly land	3, 714	. 8
Gullied land	2, 305	. 5
Haverson fine sandy loam, 0 to 1 percent slopes	2, 888	. 6
Janise soils	8, 099	1. 7
Keith loam, 0 to 1 percent slopes	2, 841	. 6
Keith loam, 1 to 3 percent slopes	10, 907	2. 4
Keith loam, 3 to 5 percent slopes	533	. 1
Keith loam, alkali substratum variant, 0 to 3 percent slopes	748	. 2
Keith-Ulysses loams, 3 to 5 percent slopes, eroded	1, 976	. 4
Keith-Ulysses loams, 5 to 9 percent slopes	1, 550	. 3
Keota silt loam, 1 to 3 percent slopes	811	. 2
Keota silt loam, 3 to 5 percent slopes	1, 374	. 3
Keota-Epping silt loams, 5 to 9 percent slopes	1, 503	. 3
Las loam	3, 923	. 8
Las loam, alkali	6, 296	1. 4
Las fine sandy loam, alkali	496	. 1
Las Animas fine sandy loam	3, 278	. 7
Las Animas fine sandy loam, alkali	2, 457	. 5
Las Animas loam	652	. 1
Las Animas loam, alkali	1, 067	. 2
Loamy alluvial land	493	. 1
Marsh	328	. 1
McCook loam, 0 to 1 percent slopes	8, 327	1. 8
McCook silty clay loam, gravel substratum variant, 0 to 1 percent slopes	262	. 1
McGrew loam	1, 174	. 3
McGrew fine sandy loam	618	. 1
McGrew loam, alkali	2, 640	. 6
Minatare-Janise soils	7, 832	1. 7
Mitchell fine sandy loam, 0 to 3 percent slopes	2, 896	. 6
Mitchell fine sandy loam, 3 to 5 percent slopes	1, 031	. 2
Mitchell fine sandy loam, 5 to 9 percent slopes	639	. 1
Mitchell silt loam, 0 to 1 percent slopes	34, 801	7. 5
Mitchell silt loam, 1 to 3 percent slopes	29, 060	6. 3
Mitchell silt loam, 3 to 5 percent slopes	16, 642	3. 6
Mitchell silt loam, 5 to 9 percent slopes	12, 739	2. 7
Mitchell silt loam, thin, 1 to 5 percent slopes	2, 205	. 5
Mitchell silt loam, thin, 5 to 9 percent slopes	4, 487	1. 0
Mitchell silt loam, thin, 9 to 20 percent slopes	4, 329	. 9
Mitchell silt loam, wet variant, 0 to 1 percent slopes	1, 940	. 4
Mitchell and Buffington soils, alkali, 0 to 5 percent slopes	3, 110	. 7
Mixed alluvial land	7, 142	1. 5
Orella clay, 0 to 3 percent slopes	806	. 2
Otero fine sandy loam, 1 to 5 percent slopes	4, 745	1. 0
Otero fine sandy loam, 5 to 12 percent slopes	2, 139	. 5
Otero loamy fine sand, 0 to 5 percent slopes	813	. 2
Otero-Bayard fine sandy loams, 0 to 3 percent slopes	17, 262	3. 7
Otero-Bayard fine sandy loams, 3 to 5 percent slopes	4, 267	. 9
Otero-Bayard fine sandy loams, 5 to 9 percent slopes	2, 546	. 5
Otero-Bayard very fine sandy loams, 0 to 1 percent slopes	1, 232	. 3
Platte soils	1, 740	. 4
Rock outcrop-Epping complex	2, 672	. 6
Rock outcrop-Tassel complex	4, 983	1. 1
Rosebud loam, 5 to 9 percent slopes	1, 148	. 2
Sandy alluvial land	302	. 1
Satanta fine sandy loam, 1 to 3 percent slopes	428	. 1
Shingle complex, 3 to 9 percent slopes	175	(1)
Slickspots-Keith complex	931	. 2
Tassel soils, 20 to 50 percent slopes	16, 945	3. 6
Tassel-Anselmo complex, 3 to 30 percent slopes	12, 277	2. 6
Tripp fine sandy loam, 0 to 3 percent slopes	3, 764	. 8
Tripp very fine sandy loam, 0 to 1 percent slopes	23, 090	5. 0
Tripp very fine sandy loam, 1 to 3 percent slopes	5, 719	1. 2
Tripp very fine sandy loam, 3 to 5 percent slopes, eroded	2, 367	. 5
Tripp very fine sandy loam, 5 to 9 percent slopes, eroded	340	. 1
Valentine and Dwyer fine sands, rolling	10, 191	2. 2
Valentine and Dwyer loamy fine sands, rolling	9, 486	2. 0
Wet alluvial land	7, 494	1. 6
Total	464, 640	100. 0

[1] Less than 0.05 percent.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the dryland and irrigated capability units, the range site, and the windbreak suitability group in which the mapping unit has been placed. The pages on which each capability unit, range site, and windbreak suitability group are described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

For general information about the soils, the reader can refer to the section "General Soil Map," which describes the broad patterns of soils in the county. Technical information is given in the section "Formation and Classification of Soils." Many terms used in the soil descriptions and other sections are defined in the Glossary and the "Soil Survey Manual" (*11*).[1]

Alice Series

The Alice series consists of nearly level to gently sloping, moderately coarse textured soils that formed in water-laid deposits on high stream terraces north of the North Platte River. These soils are somewhat excessively drained.

In a typical profile, the surface layer is light brownish-gray and grayish-brown fine sandy loam about 13 inches thick. It has weak granular structure in the upper part and is easily worked. This layer is free of lime and mildly alkaline.

The subsoil is slightly lighter colored than the surface layer. It is fine sandy loam about 13 inches thick and has weak prismatic structure. The subsoil is noncalcareous and moderately alkaline.

The upper part of the substratum is light-gray fine sandy loam that contains accumulated lime and has weak prismatic structure. The lower part of the substratum contains much lime and is moderately alkaline. It consists of friable, light-colored fine sandy loam and very fine sandy loam that are structureless.

Soils of the Alice series have a moderately low water-holding capacity, but they release water readily to plants. The layer of accumulated lime in the upper part of the substratum slows the downward movement of water. These soils are friable and easily worked. They have medium natural fertility. Soil blowing is a serious hazard where these soils are not protected by plant cover.

In this county nearly all of the acreage of Alice soils is irrigated. These soils are suited to all crops commonly grown.

Typical profile of Alice fine sandy loam, 0 to 3 percent slopes, in an irrigated field, 0.43 mile east and 150 feet north of the southwest corner of section 17, T. 23 N., R. 55 W.:

Ap—0 to 9 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist; mildly alkaline; abrupt, smooth boundary.

A1—9 to 13 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure; soft when dry, very friable when moist; mildly alkaline; clear, smooth boundary.

B2—13 to 26 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure; soft when dry, very friable when moist; mildly alkaline; abrupt, smooth boundary.

C1ca—26 to 43 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure; soft when dry, friable when moist; moderately alkaline; violent effervescence; gradual, smooth boundary.

C2—43 to 57 inches, light-gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive (structureless); soft when dry, friable when moist; moderately alkaline; violent effervescence; gradual, smooth boundary.

C3—57 to 60 inches, light-gray (10YR 7/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist: massive (structureless); slightly hard when dry, friable when moist; moderately alkaline; strong effervescence.

The surface layer (A horizon) ranges from 8 to 16 inches in thickness and from light brownish gray to light gray in color. It ranges from very fine sandy loam to fine sandy loam or loamy fine sand in texture. Structure in the subsoil is weak, medium, prismatic or weak, coarse, subangular blocky. The Cca horizon ranges from 5 to 18 inches in thickness. In some places this horizon is silt loam and has well-defined subangular blocky structure. Depth to lime generally is 20 to 40 inches. In most places the Alice soils are underlain by mixed sand and gravel at a depth of 5 to 15 feet.

The Alice soils are lighter colored and have a coarser textured subsoil than Tripp soils. Their subsoil is not so coarse textured as that of the Dunday soils. The Alice soils are lighter colored than the Bayard soils and have a slightly more strongly developed subsoil.

Alice fine sandy loam, 0 to 3 percent slopes (AcA).—This is a nearly level to very gently sloping soil on stream terraces.

The surface layer is fine sandy loam, but a few areas of very fine sandy loam and of loamy very fine sand were included in mapping. Also included were a few areas that have been eroded by soil blowing. In these eroded areas the surface layer is light colored and is only about as thick as the plowed layer.

A silty layer occurs between a depth of 2 and 4 feet in many places. In these places, irrigation water is held longer in the root zone and fewer irrigations are needed.

Nearly all of this soil is irrigated. The main crops are corn, alfalfa, potatoes, field beans, and sugar beets, but some spring-sown small grains are also grown. Crops grow well where this soil is properly managed. Soil blowing is a hazard, and improvement and maintenance of fertility are needed. Capability units IIIe-3 (dryland) and IIe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Alice fine sandy loam, 3 to 5 percent slopes (AcB).—This gently sloping soil is on the crests and side slopes of ridges and on breaks between benches.

In most areas the surface layer of this soil is thinner than that in the profile described as typical for the Alice series. Some soil material has been removed from the surface by water erosion and soil blowing, and the surface layer is generally only as thick as the plowed layer. Included with this soil in the mapping were some small areas where subsoil material is at the surface and makes up nearly all of the plowed layer. In these areas the surface layer is lighted colored than that in less eroded areas of Alice soils. Also included were many places where the surface layer is limy.

[1] Italic numbers in parentheses refer to Literature Cited, page 118.

Nearly all of this soil is cultivated. Growth of the crops commonly irrigated is favorable where irrigation water is properly managed. Capability units IVe-3 (dryland) and IIIe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Alice loamy fine sand, 0 to 3 percent slopes (AeA).—This is a nearly level to very gently sloping soil on stream terraces.

The surface layer is light brownish-gray loamy fine sand. The subsoil is slightly lighter colored fine sandy loam. Lime occurs at a depth ranging from 24 to 40 inches. Included with this soil in the mapping were a few areas where the surface layer is lighter colored and thinner than normal because of soil blowing.

A layer of silt loam occurs at a depth of 3 to 4 feet in about one-fourth of the acreage. This layer is compact, has weak subangular blocky structure, and is rich in lime. It tends to slow the downward movement of water through the soil and to make more water available for dryfarmed crops. Also, less frequent applications of water are needed in irrigated areas.

Most of this soil is irrigated, and growth of the crops commonly planted is favorable. Soil blowing is the main hazard, and the surface layer tends to blow readily where not protected. Management is needed for improving and maintaining fertility. Capability units IVe-5 (dryland) and IIIe-5 (irrigated); Sandy range site; Sandy windbreak suitability group.

Anselmo Series

The Anselmo series consists of deep, very gently undulating to rolling soils that commonly are moderately coarse textured throughout the profile. These soils formed in wind-deposited materials on the uplands.

In a typical profile, the surface layer is grayish-brown fine sandy loam about 14 inches thick. This layer is free of lime, very friable when moist, and nearly neutral in reaction.

The subsoil is light brownish-gray fine sandy loam that has weak prismatic structure. It is mildly alkaline, noncalcareous, and about 24 inches thick.

The underlying material is strongly calcareous, light-gray fine sandy loam. This material has little structure and is very soft when dry. It is very friable when moist and is easily penetrated by roots. It is moderately alkaline.

Anselmo soils are somewhat excessively drained and have moderately low water-holding capacity. Permeability of the subsoil is moderately rapid. These soils release water readily to plants. They are moderately high in natural fertility. Where they are not protected by plant cover, these soils are susceptible to both soil blowing and water erosion.

In this county less than one-fourth of the acreage of Anselmo soils is cultivated, and the rest is dryfarmed or in pasture. Irrigation is practiced where water is available, and the main crops are corn, alfalfa, sugar beets, field beans, potatoes, and small grains. Wheat grows well in dryfarmed areas. The main native grasses are prairie sandreed, blue grama, needle-and-thread, and sand bluestem. Threadleaf sedge is also common.

Typical profile of an Anselmo fine sandy loam, in permanent pasture, about 0.37 mile south and 0.34 mile west of the northeast corner of section 2, T. 20 N., R. 57 W.:

A1—0 to 14 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that breaks to weak granular structure; soft when dry, very friable when moist; gradual, smooth boundary.

B—14 to 38 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure; soft when dry, very friable when moist; gradual, smooth boundary.

C—38 to 60 inches, light-gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive (structureless) but coherence is slight; soft when dry, very friable when moist; strong effervescence.

The surface layer is mainly fine sandy loam, but it ranges from very fine sandy loam to loamy fine sand. This layer ranges from 8 to 18 inches in thickness. In places the subsoil is brown. Structure of the subsoil ranges from coarse prismatic to weak subangular blocky. Depth to lime ranges from 20 to more than 48 inches.

Anselmo soils are darker colored than the Valentine and Dwyer soils, and their subsoil is not so coarse textured. They are more strongly developed than the Bayard soils but are not so limy. Anselmo soils are darker colored than the Alice soils but lack a horizon of accumulated lime. They have a sandier subsoil than Keith soils and are not so well developed.

Anselmo fine sandy loam, 1 to 3 percent slopes (AnA).—This is a very gently undulating soil on uplands. Runoff is slow.

The profile of this soil is similar to the one described as typical for the Anselmo series. A few areas in cropped fields were included in mapping where the surface layer is thinner and lighter colored because soil blowing has removed some of the soil material and organic matter. Also included were a few more sloping areas of Anselmo fine sandy loam, 3 to 5 percent slopes, and of Creighton very fine sandy loam, 3 to 5 percent slopes.

This soil is suitable for irrigation where water is available. Management is needed that controls soil blowing and maintains fertility. Under dryfarming, this soil should be farmed in strips of crops alternated with strips that are allowed to lie fallow so as to conserve moisture. Stubble mulching and stripcropping are effective in controlling soil blowing. Capability units IIIe-3 (dryland) and IIe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Anselmo fine sandy loam, 3 to 5 percent slopes (AnB).—This undulating soil is mainly in the southwestern and northwestern parts of the county. Runoff is slow.

In areas where this soil is in permanent grass or has not been eroded, the profile is similar to the one described as typical for the Anselmo series. The surface layer commonly is about 12 inches thick, but in cultivated areas it is thinner because of soil blowing and water erosion. Tilling has mixed some of the subsoil material into the surface layer. Included with this soil in mapping were a few areas of Dunday and Valentine loamy fine sands, 0 to 3 percent slopes. Also included, in areas that have slopes of more than 5 percent, were areas that have a loamy fine sand subsoil.

Less than one-fourth of this soil is cultivated. Most of the cultivated acreage is dryfarmed, though a few areas are irrigated. Most important in cultivated areas are controlling soil blowing, conserving moisture, and maintaining fertility. Irrigated crops respond well to added nitrogen, and crops grow well where management is good. Capability units IVe-3 (dryland) and IIIe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Anselmo fine sandy loam, 5 to 9 percent slopes (AnC).—This rolling soil occurs mainly in the Wildcat Hills. Runoff is medium.

The profile of this soil is similar to the one described as typical for the Anselmo series, but the surface layer is generally light brownish gray instead of grayish brown. In cultivated areas the surface layer is slightly thinner and lighter colored than it is in areas under grass because soil material and organic matter have been lost through soil blowing and water erosion. Included with this soil in mapping were small areas that have a loamy fine sand subsoil and a few areas of Valentine and Dwyer loamy fine sands, rolling.

About 80 percent of the acreage of this soil is in permanent grass. Most of the rest is dryfarmed, and a small acreage is in irrigated crops. In cultivated areas, management is needed that protects this soil from soil blowing and water erosion. Under dryfarming, this soil is droughty during years of average rainfall. Practices that conserve moisture are using a stubble mulch, stripcropping, and leaving the soil fallow for a year before planting. Irrigated crops grow well, and dryfarmed crops grow well during years of above-average rainfall. Irrigated crops respond well to added nitrogen. In some areas this soil has been seeded to crested wheatgrass. Capability units IVe–3 (dryland) and IVe–3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Anselmo fine sandy loam, 9 to 20 percent slopes (AnD).—This is a hilly and steep soil in the Wildcat Hills and in the northeastern part of the county. Runoff is rapid.

The surface layer of this soil is thinner than that of the soil described as typical of the Anselmo series. In places sandstone bedrock is at a depth of 3 to 5 feet.

This soil is too steep for cultivated crops. All of the acreage is in permanent pasture. It is well suited to pasture if it is not overgrazed. Capability unit VIe–3 (dryland), irrigated capability unit not assigned; Sandy range site; Sandy windbreak suitability group.

Anselmo fine sandy loam, alkali variant, 0 to 3 percent slopes (2An).—This very gently undulating soil occurs in two areas of the county. About half of the acreage is east of Lyman, and the rest is in the southwestern corner of the county. Runoff is slow.

The surface layer and upper part of the subsoil are similar to those in the profile described as typical for the Anselmo series. At a depth ranging from 18 to 36 inches, however, the subsoil is very strongly alkaline. No mottling occurs, but a former high water table is believed to have caused the accumulation of the alkali. Except near Lyman where silt loam or very fine sandy loam occurs at a depth of 28 inches, this soil is moderately coarse textured throughout the profile.

Permeability is moderately rapid in the subsoil, but water moves slowly through this soil in some areas where the underlying material is silty. Available water capacity is moderately low. The water table is not close enough to the surface to influence the use of this soil.

Most areas of this soil near Lyman are irrigated. Shallow-rooted crops grow well, but alfalfa and other deep-rooted crops grow poorly, especially in the latter part of the growing season, because their roots extend to the alkali substratum. In the southwestern part of the county, all of this soil is in permanent pasture. Grasses grow well. More inland saltgrass and alkali sacaton grow in these areas than in areas of Anselmo soils that lack an alkali substratum.

In cultivated areas soil blowing is a serious hazard. The alkali substratum limits the growth of most crops. In leveling this soil for irrigation, cuts should not be closer than 8 inches to the alkali layer, and 12 inches is preferable. Pasture grasses grow well if management is good. Capability units IVs–1 (dryland) and IIIs–1 (irrigated); Sandy range site; Moderately Saline or Alkali windbreak suitability group.

Bankard Series

The Bankard series consists of deep, coarse-textured soils that are excessively drained and calcareous. These soils are on bottom lands of the North Platte River. They are nearly level or very gently undulating.

In a typical profile, the surface layer is grayish-brown loamy fine sand about 3 inches thick. It has weak granular structure. This layer is soft when dry and very friable when moist. It contains much lime.

The surface layer is underlain by brown loamy sand that extends to a depth of 11 inches and, in turn, is underlain by pale-brown loamy sand that extends to a depth of 23 inches. Between depths of 23 and 55 inches is a layer of very pale-brown stratified loamy sand and fine sand that is structureless and loose. This layer is distinctly mottled. It is underlain by gray loam.

The Bankard soils have low water-holding capacity. Permeability of the underlying material is rapid. These soils are low in natural fertility and content of organic matter. They blow readily.

In this county most of the acreage of Bankard soils is in permanent pasture. The main native grasses are prairie sandreed, sand dropseed, western wheatgrass, and some sand bluestem.

Typical profile of a Bankard loamy fine sand in a pastured area that was cultivated, 0.6 mile south and 100 feet east of the northwest corner of section 23, T. 23 N., R. 57 W.:

Ap—0 to 3 inches, grayish-brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist; strong effervescence; abrupt, smooth boundary.

AC—3 to 11 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure; soft when dry, very friable when moist; strong effervescence; clear, smooth boundary.

C1—11 to 23 inches, pale-brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure; soft when dry, very friable when moist; strong effervescence; clear, smooth boundary.

C2—23 to 43 inches, very pale brown (10YR 8/3) stratified loamy sand and fine sand, pale brown (10YR 6/3) when moist; single grain (structureless); loose, violent effervescence; abrupt, smooth boundary.

C3—43 to 55 inches, color, texture, structure, and consistence same as in C2 horizon; few, fine, distinct mottles; violent effervescence; abrupt, smooth boundary.

IIAb—55 to 62 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; massive (structureless); hard when dry, friable when moist; violent effervescence.

The surface layer ranges from 2 to 10 inches in thickness and from grayish brown to light brownish gray in color. In places the rest of the profile consist of layers that are moderately coarse textured and medium textured. In some areas the profile contains dark layers of stream deposits and, at a depth of 3 to 10 feet, layers of mixed sand and gravel.

The Bankard soils have a thinner surface layer than the Glenberg soils. This layer is underlain by material that is coarser textured than the substratum of Glenberg soils. The material is similar to the substratum of the Dwyer soils, but Bankard soils are more highly stratified throughout their profile than those soils.

Bankard loamy fine sand, 0 to 3 percent slopes (Bc).—In most places this soil has an irregular surface that has been reworked and roughened by wind. Some areas have been leveled for irrigation, and other areas are nearly level or only very gently sloping. This soil occurs on bottom lands along the North Platte River.

The profile of this soil is the one described for the Bankard series. The surface layer is loamy fine sand, but some small areas of fine sandy loam were included in the mapping. Also included were areas where the finer soil particles were blown away and the surface layer is fine sand. In fields where large amounts of manure and other kinds of organic matter has been added, the surface layer is darker and thicker than that described in the profile typical of the Bankard series.

Susceptibility to soil blowing and to droughtiness are hazards that severely limit the use of this soil. Growth of dryfarmed crops is generally poor. If this soil is irrigated, large quantities of water are needed at frequent intervals. Effective ways to protect this soil are returning all crop residue to the soil and keeping a plant cover on it for as much of the time as possible. Adding barnyard manure also helps. Soil blowing is controlled by keeping this soil in close-growing crops most of the time. Alfalfa and an alfalfa-grass mixture grow well where they are irrigated. Small grains, sorghums, or corn can be grown for 1 or 2 years between perennial crops. Capability units IVe–5 (dryland) and IVe–5 (irrigated); Sandy Lowland range site; Sandy windbreak suitability group.

Bankard loamy fine sand, alkali, wet variant (0 to 2 percent slopes) (2Bc).—This coarse-textured, nearly level to very gently undulating soil occurs on moderately wet bottom land. In a few areas very sandy material has been blown onto this soil from adjacent higher benches and sandhills. The water table is at a depth of 3 to 6 feet.

Below a depth of about 18 to 24 inches, this soil is strongly to very strongly alkaline. Included with this soil in mapping were some areas where the surface layer is slightly to moderately saline. These saline areas are slightly wetter than are alkaline areas. The saline soil was not mapped separately because its capabilities, uses, and management are about the same as the alkaline soil.

Both soil blowing and the saline-alkali condition restrict the use of this soil. Drainage is needed in some areas where the water table is high. This drainage reduces both wetness and the content of alkali.

Sugar beets and alfalfa grow better on this soil than other crops, but corn can be grown where the alkali is not too strong nor too near the surface. Field beans and potatoes do not grow well. This soil blows easily where it is dryfarmed and not protected by plant cover. Capability units IVs–1 (dryland) and IVs–1 (irrigated); Subirrigated range site; Moderately Saline or Alkali windbreak suitability group.

Bankard loamy fine sand, wet variant (0 to 1 percent slopes) (5Bc).—Except that it is slightly darker colored, this soil has a profile similar to the one described as typical for the Bankard series. The water table is at a depth of 3 to 5 feet. This high water table subirrigates the soil and provides moisture for growing crops. The brownish mottles or splotches at a depth ranging from 15 to 36 inches indicate that the water table fluctuates. Above the water table internal drainage is rapid. Water-holding capacity is low. In a few areas a thin crust of white salt is on the surface early in spring.

About 30 percent of this soil is used for irrigated crops; the rest is in permanent pasture. The most common crops are corn, alfalfa, and sugar beets. Growth of these crops is fair to good. Soil blowing and maintenance of fertility are serious concerns of management. Practices that help to control soil blowing are keeping close-growing crops on the soil, using crop residue, and planting cover crops. Nonlegume crops respond to added nitrogen. Capability units IVw–5 (dryland) and IVw–5 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

Barren Badlands

Barren badlands (9 to 100 percent slopes) (BB) is a land type that consists of steep and very steep areas of buff-colored Brule siltstone. The largest area in the county is near the Scotts Bluff National Monument. This siltstone is soft, and erosion of weathered material is more rapid than the formation of soil. This land is not suitable for any kind of farming.

Some yucca and broomsedge grow in places, and a few grasses and weeds grow in some of the lower areas. Not enough vegetation is produced to support grazing of livestock. These areas, however, provide some natural protection for wildlife, and they can be used as recreational areas. Capability unit VIIIs–3 (dryland), irrigated capability unit not assigned; range site and windbreak suitability group not assigned.

Bayard Series

The Bayard series consists of deep soils that, in most places, are moderately coarse textured from the surface to a depth of 60 inches. These soils formed on foot slopes and broad basinlike fans in transported material that weathered mainly from sandstone. The Bayard soils that are below terrace breaks formed in colluvium. The soils of this series occur in nearly all parts of the county.

In a typical profile, the surface layer is grayish-brown fine sandy loam about 10 inches thick. It has weak granular structure and is soft when dry and very fribale when moist. Except for weak prismatic structure and a thickness of about 4 inches, the subsurface layer is similar to the surface layer.

The upper part of the underlying material is light brownish-gray fine sandy loam. It has weak, coarse, prismatic structure and is very friable when moist. This part contains a small amount of lime. At a depth of about 40 inches is light brownish-gray fine sandy loam that is structureless. It is soft when dry and very friable when moist. This material is rich in lime. The Bayard soils have a moderately low water-holding capacity. These soils are somewhat excessively drained. They take in water rapidly and release it readily to plants. Permeability of the underlying material is moderately rapid. Where used for irrigated crops, these soils are susceptible to soil blowing.

Where slopes are less than 9 percent, these soils can be irrigated or dryfarmed. In steeper areas they are suited to pasture. Dryfarmed areas are droughty. Many areas of Bayard soils remain in permanent pasture and are used as range because they are adjacent to other soils that are less desirable for farming. The main native plants are prairie sandreed, blue grama, needle-and-thread, western wheatgrass, and threadleaf sedge.

The following profile of a Bayard soil is a loamy very fine sand, No. S61 Nebr. 79-4-1 to 4-6, that was sampled in a permanent pasture 0.33 mile south and 0.04 mile west of the northeast corner of section 10, T. 20 N., R. 57 W. on a single, concave slope of 4 percent. In texture this soil approaches the fine sandy loam described as typical for the series.

A—0 to 10 inches, grayish-brown (10YR 5/2) loamy very fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, granular structure; soft when dry, very friable when moist; noncalcareous; clear, smooth boundary.

AC—10 to 18 inches, color and texture same as above horizon; weak, coarse, prismatic structure; soft when dry, very friable when moist; noncalcareous; abrupt, smooth boundary.

C1—18 to 31 inches, light brownish-gray (10YR 6/2) loamy very fine sand, dark grayish brown (10YR 4/2) when moist; massive (structureless); soft when dry, very friable when moist; strong effervescence; gradual, smooth boundary.

C2—31 to 40 inches; this is an arbitrary separation based on the unusual thickness of the C1 horizon; clear, smooth boundary.

C3—40 to 54 inches, light-gray (10YR 7/2) loamy very fine sand, grayish brown (10YR 5/2) when moist; massive (structureless); soft when dry, very friable when moist; strong effervescence; gradual, smooth boundary.

C4—54 to 66 inches +, color and texture same as above horizon; single grain (structureless); loose when dry, very friable when moist; violent effervescence.

A few fragments of gray sandstone occur throughout the profile.

The surface layer ranges from 8 to 20 inches in thickness and from very fine sandy loam to fine sandy loam or loamy very fine sand in texture. The soil described is a loamy very fine sand but approaches a fine sandy loam in texture. In color, the surface layer and subsurface layer range from grayish brown to dark grayish brown, and the substratum ranges from light brownish gray to light gray. The depth to lime ranges from 0 to more than 18 inches, but in pastured areas it commonly ranges from 10 to 18 inches.

Bayard soils have a coarser textured substratum than the Bridgeport soils, though these two kinds of soils are in similar positions. Bayard soils are darker colored than the Alice soils. In addition, they are not so well developed as Alice soils and lack an accumulation of lime. The material underlying the surface layer of the Bayard soils is slightly less well developed than that of the Anselmo soils. The Bayard soils formed in colluvium that weathered from sandstone, whereas Anselmo soils formed in material deposited by wind.

Bayard fine sandy loam, 0 to 3 percent slopes (BfA).—This is a nearly level to very gently sloping soil. It occurs in many parts of the county. Runoff is slow.

The profile of this soil is similar to the one described as typical for the Bayard series. In places, however, the lime is leached to a depth of more than 18 inches. Included with this soil in mapping were small areas of Bayard fine sandy loam, 3 to 5 percent slopes, of Bridgeport very fine sandy loam, 1 to 3 percent slopes, and of Otero fine sandy loam, 1 to 5 percent slopes.

Most of this soil is in permanent pasture. A few areas are dryfarmed, mainly to wheat, and a few are irrigated. Soil blowing is a hazard in irrigated areas when crops and crop residues are removed. Alternating crops with fallow, wind stripcropping, and using a stubble mulch are practices that help to control soil blowing. Crops grow well if nitrogen is applied and other good management is practiced. Capability units IIIe-3 (dryland) and IIe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Bayard fine sandy loam, 3 to 5 percent slopes (BfB).—The profile of this soil is the one described as typical for the Bayard series. Where this gently sloping soil is cultivated, runoff is medium.

Included with this soil in mapping were a few small areas of Anselmo fine sandy loam, 1 to 3 percent slopes, and of Bridgeport very fine sandy loam, 3 to 5 percent slopes.

Most of this soil is in permanent pasture, and only a few areas are irrigated. Good practices of range management are needed to keep the pasture productive. Where this soil is cultivated, soil blowing is a serious hazard. Blowing can be controlled by using a stubble mulch, wind stripcropping, and alternating crops with fallow. Growth of plants is generally good. This soil is only slightly eroded, but a cover of plants is needed all the time. Capability units IVe-3 (dryland) and IIIe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Bayard fine sandy loam, 5 to 9 percent slopes (BfC).—This sloping soil occurs in colluvial areas. Runoff is medium.

The profile of this soil is similar to the one described as typical for the Bayard series. Included in mapping were a few areas of Bayard fine sandy loam, 3 to 5 percent slopes, and of Bridgeport very fine sandy loam, 5 to 9 percent slopes.

This soil is suited to cultivation, but nearly all of it is in permanent pasture because it is adjacent to areas of much steeper soils. Wheat is the main cultivated crop. Some gullies and shallow drains cross areas of this soil. Good practices of pasture management are needed to keep the pasture productive. Where this soil is dryfarmed, the hazards of soil blowing and water erosion are high. Alternating crops with fallow, using a stubble mulch, and wind stripcropping are ways of conserving moisture and controlling erosion. Capability units IVe-3 (dryland) and IVe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Bayard fine sandy loam, 9 to 20 percent slopes (BfD).—This moderately steep soil occupies foot slopes that generally are adjacent to areas of steeper soils. It occurs in areas near the Wildcat Hills and also in areas near the sandstone breaks in the northeastern part of the county. Runoff is rapid.

The surface layer is not so thick as that described in the profile typical for the Bayard series. Unweathered sandstone chips and other fragments are more numerous in this soil, and a few stones and small boulders are on the surface.

All of this soil is used for pasture. Pasture probably is the best use for this steep soil, but good practices of management are needed. Capability unit VIe-3 (dryland), irrigated capability unit not assigned; Sandy range site; Sandy windbreak suitability group.

Bridgeport Series

The Bridgeport series consists of deep, medium-textured soils on foot slopes below bluffs. Nearly all areas of these soils are south of the North Platte River. A few areas are north of the North Platte River in the northeastern part of the county. Slopes range from 1 to 20 percent.

In a typical profile, the surface layer is grayish-brown very fine sandy loam about 14 inches thick. This layer is very friable when moist, neutral in reaction, and nonlimy. Soil structure in the upper part is weak granular; in the lower part it is weak prismatic.

Underlying the surface layer is slightly lighter colored very fine sandy loam about 10 inches thick. It has weak, coarse, prismatic structure. This layer is soft when dry and very friable when moist. It is limy and mildly alkaline.

At a depth of 24 inches is light-gray, massive, very friable very fine sandy loam that contains much lime and is moderately alkaline. Small fragments of sandstone and of siltstone are common throughout this material.

Soils of the Bridgeport series are naturally well drained. Their water-holding capacity is medium. These soils are high in natural fertility. They are susceptible to water erosion and soil blowing. Large and small gullies are common in places.

In areas where the slopes are less than 5 percent, these soils are mostly dryfarmed, mainly to wheat. Only a small acreage is irrigated. Areas that have slopes of more than 5 percent are mostly in native pasture. The main native grasses are blue grama, western wheatgrass, needle-and-thread, threadleaf sedge, and little bluestem. A small amount of prairie sandreed occurs in places.

Typical profile of a Bridgeport very fine sandy loam, in a native pasture, about 0.3 mile south and 100 feet east of the northwest corner of section 22, T. 21 N., R. 56 W.:

Ap—0 to 4 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, very friable when moist; abrupt, smooth boundary.

A1—4 to 14 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure; slightly hard when dry, very friable when moist; clear, smooth boundary.

C1—14 to 24 inches, light-gray (10YR 7/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure that breaks to massive; soft when dry, very friable when moist; slight effervescence; clear, smooth boundary.

C2—24 to 60 inches, light-gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) when moist; massive (structureless); soft when dry, very friable when moist; strong effervescence.

The A horizon ranges from 10 to 20 inches in thickness. It is very fine sandy loam in most places, though in a few small areas it is loam or loamy very fine sand. This layer ranges from grayish brown to dark grayish brown. Where Bridgeport soils are in native grass, lime has been leached to a depth of 8 to 20 inches. In cultivated areas erosion and tillage has caused some of the underlying limy material to be mixed into the surface layer. The substratum is light-gray or light brownish-gray very fine sandy loam 6 to 34 inches thick.

Bridgeport soils are not so coarse textured as the Bayard soils. They have a thicker, darker colored surface layer than the Mitchell soils and are not so silty. The surface layer of Bridgeport soils is not so thick as that of the Duroc soils. The substratum of Bridgeport soils is more weakly developed than the subsoil of Tripp soils. Lime is higher in the profile in Bridgeport soil than in Tripp.

Bridgeport very fine sandy loam, 1 to 3 percent slopes (BvA).—This very gently sloping soil occurs on colluvial fans in valleys. Runoff is slow.

The profile of this soil is similar to the one described as typical of the Bridgeport series, but in cultivated areas the surface layer is slightly limy in places. Also, the surface layer in eroded areas is thinner and not quite so light colored as that described as typical.

About half of the acreage is dryfarmed, mainly to wheat; about one-fourth is irrigated; and the rest is in permanent pasture. Corn, field beans, sugar beets, alfalfa, and potatoes are the main irrigated crops. Soil blowing and water erosion are the main concerns of management. Ordinarily, erosion can be controlled by alternating crops with fallow, using a stubble mulch, and wind stripcropping. Growth of crops is good to excellent where this soil is well managed. Nitrogen is needed for most crops. This soil tends to blow where it is not adequately protected by a growing crop, crop residue, or a roughened surface. Capability units IIIe-1 (dryland) and IIe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Bridgeport very fine sandy loam, 3 to 5 percent slopes (BvB).—This is a gently sloping soil on foot slopes. Runoff is medium.

In cultivated areas part of the surface layer has blown or washed away, and this layer is thinner than that of the less sloping Bridgeport soil. These eroded areas are slightly lighter colored than uneroded areas in permanent grass. In uneroded areas this soil is similar to the one described as typical for the Bridgeport series.

Nearly half of the acreage is dryfarmed, mainly to wheat. Only a few areas are irrigated. Soil blowing and water erosion are serious hazards. These hazards can be controlled by alternating crops with fallow, using a stubble mulch, and wind stripcropping. These practices also help to conserve moisture. Maintaining fertility and managing water are the main concerns in irrigated areas. Mid and short grasses dominate in permanent pasture. Good practices of range management are needed. Capability units IIIe-1 (dryland) and IIIe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Bridgeport very fine sandy loam, 5 to 9 percent slopes (BvC).—This is a sloping soil on foot slopes. Runoff is medium to rapid.

The profile of this soil is similar to the one described as typical for the Bridgeport series, but the surface layer is slightly thinner in the more strongly sloping areas. Commonly included in mapping were small areas of Bayard fine sandy loam, 5 to 9 percent slopes.

Almost all of this soil is in permanent pasture. Good practices of management are needed. Only a few areas are cultivated, and these are in dryfarmed wheat. In these dryfarmed areas, soil blowing and water erosion have thinned the surface layer and it is lighter colored than the surface layer in areas of permanent pasture. Using a stubble mulch and stripcropping help to control erosion in dryfarmed areas. A small amount of nitrogen added in spring is generally beneficial to wheat. Capability units IVe-1 (dryland) and IVe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Bridgeport very fine sandy loam, 9 to 20 percent slopes (BvD).—This is a moderately steep to steep soil on foot slopes. Runoff is rapid.

This soil has a profile somewhat similar to the one described as typical for the Bridgeport series, but the surface layer is slightly thinner and more fragments of unweathered sandstone are in the substratum. In a few places, rocks and boulders are on the surface. Commonly included in mapping were small areas of Bayard fine sandy loam, 9 to 20 percent slopes.

All of this soil is used for pasture. In most areas there is a good stand of short, mid, and tall native grasses. The tall grasses are more common on this soil than on the less sloping Bridgeport soils. A good stand of grass can be maintained on this soil by using deferred grazing, rotation grazing, and other good practices of management. Capability unit VIe–1 (dryland), irrigated capability unit not assigned; Silty range site; Silty to Clayey windbreak suitability group.

Broken Alluvial Land

Broken alluvial land (9 to 30 percent slopes) (Sy) is a land type that occurs on the sides of wide gullied and intermittent drainageways. It consists of deep alluvial and colluvial material. Areas of this land cross the foot slopes adjacent to the Wildcat Hills where there are areas of the Mitchell and Bridgeport soils and a few areas of Bayard soils. Areas of Broken alluvial land range from 100 to 200 feet in width and are several miles long in some places. Erosion is active in many of these areas, both on the side slopes and in the drainageways.

Included with this unit in mapping were small areas of Loamy alluvial land that are frequently flooded and a few areas that are wet by seepage from natural springs. Also included are outcrops of siltstone along the slopes or in the bottom of the drainageways.

Broken alluvial land has little profile development, though under grass some darkening has occurred in the uppermost 6 to 12 inches. The surface layer is generally light-colored, massive loam, silt loam, or very fine sandy loam. About 85 percent of the soil material weathered from Brule siltstone; the rest weathered from Arikaree sandstone.

Broken alluvial land is generally in pasture or is idle. The usefulness of much of this land can be improved by land smoothing, and a few areas have been smoothed and seeded to tame grass. Before smoothing this land, however, each area should be investigated because the native plants in a few areas are adequate for grazing. Capability unit VIe–9 (dryland), irrigated capability unit not assigned; Limy Upland range site; Silty to Clayey windbreak suitability group.

Buffington Series

The Buffington series consists of deep, moderately well drained, moderately fine textured soils. These soils are in a general area east and south of Lyman. They formed in alluvial material that weathered from soft grayish shale. These nearly level to very gently sloping soils are limy.

In a typical profile, the surface layer is gray silty clay loam about 13 inches thick. It is hard when dry, firm when moist, and sticky when wet. In the upper part the structure is moderate and granular, but in the lower part it is blocky. This layer is limy and moderately alkaline.

The underlying material is silty clay loam that is light brownish gray in the upper part and lighter colored in the lower part. The upper part contains more lime than the surface layer. Both parts have subangular blocky structure. This layer is hard when dry, and firm when moist, and it is compact.

At a depth of about 38 inches is a layer of stratified alluvium. This layer is commonly loam, silty clay loam, or fine sandy loam. It is limy and mildly alkaline in reaction. This layer is more easily penetrated by roots than the finer textured horizons above.

Because Buffington soils consist of sticky, clayey material, they shrink as they dry and swell as they become wet. The amount of available water held per foot of soil depth is large. Permeability of both the surface layer and underlying layer is moderately slow. The water table in these moderately well drained soils is deep.

Nearly all the acreage of Buffington soils is irrigated. The main crops are corn, sugar beets, field beans, and alfalfa.

Typical profile of a Buffington silty clay loam, in an irrigated field of beans, 0.42 mile east and 100 feet south of the northwest corner of section 11, T. 22 N., R. 58 W.:

Ap–0 to 10 inches, gray (10YR 5/1) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; hard when dry, firm when moist; slight effervescence; abrupt, smooth boundary.

A1—10 to 13 inches, color, texture, and consistency same as in Ap horizon; moderate, coarse, blocky structure; slight effervescence; clear, smooth boundary.

C1—13 to 20 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate, fine, subangular blocky structure; hard when dry, very firm when moist; strong effervescence; gradual, smooth boundary.

C2—20 to 38 inches, light-gray (10YR 7/2) silty clay loam grayish brown (10YR 5/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard when dry, very firm when moist; strong effervescence; clear, smooth boundary.

C3—38 to 50 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; soft when dry, friable when moist; violent effervescence; thin lenses of fine sandy loam; clear, smooth boundary.

C4—50 to 60 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry; firm when moist; violent effervescence.

The A horizon ranges from 6 to 14 inches in thickness and from gray to grayish brown in color. In many areas the underlying material of Buffington soils is not lighter in color than the surface layer.

The Buffington soils formed in finer textured material than the Mitchell soils. Buffington soils formed from weathered shale, whereas Mitchell soils formed from weathered siltstone. The Buffington soils are deeper than the Orella soils, are not so fine textured, and are less alkaline.

Buffington silty clay loam, 0 to 1 percent slopes (Bg).—This nearly level soil is sticky when wet and tends to warm slowly in spring. Runoff is slow.

The profile of this soil is the one described as typical for the Buffington series. Included with this soil in mapping were small areas that have a loam surface layer. More common were inclusions of Mitchell silt loam, 0 to 1 percent slopes. In a few areas the underlying material is strongly alkaline.

Nearly all of the acreage of this soil is irrigated. Corn, field beans, sugar beets, and alfalfa are the crops commonly grown. Potatoes are not well suited, because the soil is firm and sticky. Crops grow well when management is good. Low fertility and moderately good drainage are the main concerns of management. Nitrogen is needed for good growth of crops. Capability units IIIs-2 (dryland) and I-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Buffington silty clay loam, 1 to 3 percent slopes (BgA).—This is a gently sloping soil. It has a profile similar to the one described as typical of the series, but in areas leveled for irrigation, the surface layer is thinner in the cuts and is thicker in the fills. In areas where deep cuts were made, material from the substratum is at the surface. Runoff is medium and the rate of water intake is slow. Included in mapping were a few small areas of Mitchell soils.

Nearly all of this soil is irrigated. Except for potatoes, crops commonly grown in the county are suited. The tubers of potatoes do not grow well in this compact soil. Management is needed to maintain and increase fertility and to improve drainage. Erosion may be a problem if water management is poor. Capability units IIIe-2 (dryland) and IIe-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Buffington silty clay loam, alkali, 0 to 1 percent slopes (2Bg).—This soil is nearly level. Runoff and the rate of water intake are slow.

The profile of this soil is somewhat similar to the one described as typical of the Buffington series, but at a depth of 24 to 36 inches the effect of alkali is moderate to strong and the effect of soluble salts is slight. In most areas leveled for irrigation, this soil is affected by alkali at a depth of only 16 to 24 inches, but in deep cuts alkali is at the surface. All areas of this soil do not have an alkali substratum, but it is common enough to influence the kinds of crops grown, the cropping practices used, and the capability class of the soil.

Alfalfa and sugar beets are somewhat tolerant of alkali and are better suited to this soil than most other crops commonly grown in the county. Corn is moderately well suited. Field beans grow well except where alkali is at or near the surface, but potatoes are not well suited. Where the alkali is at or near the surface, this soil is difficult to till and crops grow poorly. Adding manure increases friability and the intake of water. Adding sulfur or gypsum hastens reclamation by helping to neutralize the alkali. Capability units IVs-1 (dryland) and IIIs-1 (irrigated); Limy Upland range site; Moderately Saline or Alkali windbreak suitability group.

Chappell Series

The Chappell series consists of weekly developed soils that are 20 to 40 inches deep over mixed sand and gravel. These soils are on foot slopes below the breaks of gravelly terraces. They are moderately coarse textured above the sand and gravel. Pebbles are scattered throughout the profile (fig. 8).

In a typical profile, the surface layer is grayish-brown sandy loam about 8 inches thick. It has weak granular structure. This layer is soft when dry and very friable when moist.

The subsoil is light brownish-gray coarse sandy loam about 8 inches thick. It is soft when dry and very friable when moist. The subsoil is underlain by slightly lighter colored gravelly sandy loam that is slightly limy. It is loose when dry but slightly coherent when moist. At a depth of 28 inches is brownish, loose, mixed sand and gravel.

Figure 8.—**Profile of a Chappell sandy loam showing many scattered pebbles. A layer of clean mixed sand and gravel is at a depth of 24 inches.**

The Chappell soils are low in water-holding capacity. They have moderately rapid permeability in the subsoil. Water is released readily to plants. The depth that roots penetrate is limited by the mixed sand and gravel. Where they are not adequately protected, these soils are susceptible to soil blowing and water erosion. They are droughty where dryfarmed, but most areas are irrigated. Growth of crops is fair to good where management is good. Natural fertility is low.

Native grasses on Chappell soils are mixed tall, mid, and short. The most common are blue grama, needle-and-thread, western wheatgrass, and prairie sandreed. Yucca and sand sagebrush are also common. In Scotts Bluff County, Chappell soils are mapped only in a complex with the Dix soils.

Typical profile of a Chappell sandy loam, in an irrigated field, about 0.2 mile north and 100 feet east of the southwest corner of section 20, T. 21 N., R. 52 W.:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist; abrupt, smooth boundary.

B—8 to 16 inches, light brownish-gray (10YR 6/2) coarse sandy loam, grayish brown (10YR 4/2) when moist; weak, medium, blocky structure; soft when dry, very friable when moist; clear, smooth boundary.

C1—16 to 28 inches, light-gray (10YR 7/2) gravelly sandy loam, grayish brown (10YR 5/2) when moist; single grain (structureless); loose when dry, very friable when moist; slightly calcareous; clear, smooth boundary.

IIC2—28 to 60 inches, brownish mixed sand and gravel; single grain (structureless).

The surface layer ranges from 7 to 12 inches in thickness. In some places the surface layer is gravelly sandy loam. The subsoil ranges from 6 to 18 inches in thickness. Lime has not accumulated in the lower part of the subsoil in all areas. At a depth of 20 to 40 inches is mixed sand and gravel.

The Chappell soils are deeper to sand and gravel than the Dix soils. Chappell soils are not so deep as the Bayard soils.

Chappell-Dix complex, 1 to 3 percent slopes (CZA).—The soils of this complex are very gently sloping. About 55 to 80 percent of the complex is moderately deep Chappell soils; 15 to 30 percent, shallow Dix soils; and about 5 to 15 percent, deep Bayard soils. A profile typical of the Chappell, Dix, and Bayard soils is described under the respective series.

The shallowest soils in this complex are in the very gently sloping, convex areas, the deepest are in the concave areas, or swales.

Nearly all of the acreage is irrigated. Irrigation runs must be short because the soils are porous. Crops common in the county grow well where irrigation water is applied at frequent intervals and large quantities of fertilizer, especially nitrogen, are added. The limitations of this complex to farming are severe, and a high level of management is required. Corn, field beans, sugar beets, and potatoes are well suited. Alfalfa, a deep-rooted crop, requires a large amount of water. Capability units IVe-3 (dryland) and IIIe-3 (irrigated); Sandy and Shallow to Gravel range sites; Sandy windbreak suitability group.

Chappell-Dix complex, 3 to 5 percent slopes (CZB).—The soils of this complex are gently sloping. They have a sandy loam and loamy sand surface layer. About 45 to 65 percent of this complex is moderately deep Chappell soils; 25 to 35 percent, shallow Dix soils; 10 to 15 percent, deep Bayard soils; and less than 5 percent, exposed gravel. A profile typical of the Chappell, Dix, and Bayard soils is described under the respective series. In some moderately eroded areas, the surface layer of each kind of soil is thinner and lighter colored than that in the respective profiles.

Because the soils in this complex are porous, large amounts of irrigation water are needed in frequent applications and in short runs. The low water-holding capacity, rapid permeability, and low fertility are the main concerns of management.

About three-fourths of the acreage is irrigated. All crops commonly irrigated are suited, but they do not grow so well as crops on deeper soils that have similar slopes. Crops respond well where large amounts of nitrogen are needed.

Only a small area of this complex is dryfarmed. Growth of crops is unfavorable because the soils are droughty. Management is needed that retains all rainwater and prevents as much evaporation as possible. Areas of this complex in native grass should be protected from overgrazing. Capability units IVe-3 (dryland) and IVe-3 (irrigated); Sandy and Shallow to Gravel range sites; Sandy windbreak suitability group.

Clayey Alkali Land

Clayey alkali land (0 to 1 percent slopes) (2Cx) consists of deep, fine-textured outwash from nearby areas of shale. This land occurs in several areas south of Lyman. The subsoil is moderately to strongly affected by alkali and is slightly affected by soluble salts.

The surface layer is light-gray to gray silty clay about 4 inches thick. It has moderate granular structure. It is very hard when dry, very firm when moist, and very sticky when wet. This layer is rich in lime and moderately alkaline.

The subsoil is light-gray clay that has strong prismatic structure that breaks to strong, medium, angular blocky structure. This layer is very hard when dry and very sticky when wet. It is rich in lime and strongly alkaline. In the lower subsoil are white flecks of accumulated salts in a concentration of about 0.3 percent.

The substratum is light-colored silty clay loam that has weak subangular blocky structure. It is rich in lime and strongly alkaline.

The surface layer ranges from 2 to 6 inches in thickness. In places it is ashy, platy silty clay loam. The subsoil ranges from 10 to 15 inches in thickness. The saline zone in the lower part of the subsoil ranges from 5 to 12 inches in thickness. Where this soil is in low positions, water seeps in from higher lying irrigated land. A few small areas of this soil are not affected by alkali.

Clayey alkali land has slow to very slow permeability in the surface layer and subsoil. The rate of water intake is very slow. This land has a high water-holding capacity, but it releases water slowly to plants. It swells when it is wet, and shrinks and cracks badly as it dries. Because of the clay texture and large amount of alkali, this land is poor for farming.

This land is not well suited to cultivated crops, but small grains are grown on a small acreage. Preparing a seedbed and establishing a stand are difficult. Nearly all of the acreage is in pasture. Native grasses are short and mid. Western wheatgrass, Gardner saltbush, and inland saltgrass are the most common plants. Capability units VIIs-1 (dryland) and VIs-1 (irrigated); Saline Upland range site; windbreak suitability group not assigned.

Creighton Series

The Creighton series consists of deep, undulating to rolling, medium-textured soils in the Wildcat Hills. These soils formed in material that weathered from sandstone. They have a weakly developed subsoil.

In a typical profile, the surface layer is grayish-brown very fine sandy loam about 19 inches thick. The upper part has weak granular structure; the lower part has weak prismatic structure. This layer is slightly hard when dry and friable when moist. It is nonlimy.

The subsoil is light brownish-gray very fine sandy loam that has weak prismatic structure. It is friable and nonlimy.

The substratum, or underlying material, is very pale brown very fine sandy loam that has many fragments of unweathered sandstone. This material is massive. It is soft when dry and very friable when moist. It is rich in lime.

The Creighton soils have a medium water-holding capacity. They readily release water to plants. Permeability is medium. Except in areas where they have been affected by soil blowing, these soils are fairly high in organic-matter content. The natural fertility is high. Crops on these soils grow well when rainfall is adequate.

Nearly all the acreage of Creighton soils is in native pasture because these soils occur in the Wildcat Hills in areas where ranching is more important than farming. A few fields are dryfarmed, mainly to wheat. The most important native grasses are prairie sandreed, blue grama, needle-and-thread, western wheatgrass, and threadleaf sedge.

Typical profile of Creighton very fine sandy loam, 3 to 5 percent slopes, in a native pasture, 0.24 mile east and 0.12 mile south of the northwest corner of section 1, T. 20 N., R. 57 W.:

Ap—0 to 4 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, granular structure; slightly hard when dry, friable when moist; noncalcareous; abrupt, smooth boundary.

A1—4 to 19 inches, color, texture, and consistence same as Ap horizon; weak, coarse, prismatic structure; noncalcareous; clear, smooth boundary.

B—19 to 36 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist; noncalcareous; gradual, smooth boundary.

C—36 to 60 inches, very pale brown (10YR 8/3) very fine sandy loam, grayish brown (10YR 5/2) when moist; massive (structureless); soft when dry, very friable when moist; violent effervescence; many small fragments of sandstone.

The surface layer (A horizon) ranges from 8 to 20 inches in thickness and from silt loam to loam or very fine sandy loam in texture. The subsoil ranges from 12 to 24 inches in thickness and from grayish brown to light gray in color. The subsoil is very fine sandy loam in most places, but in some places it is silt loam. The substratum is pale brown to very pale brown. Lime is at a depth of 15 to 40 inches. It is nearest to the surface in eroded, cultivated fields. In many places sandstone bedrock is at a depth of 40 to 60 inches.

The Creighton soils are deeper to bedrock than the Rosebud soils, and their subsoil is not so well developed. They are similar to the Anselmo soils, but have a finer textured subsoil. The Creighton soils have a less clayey subsoil than Keith soils. In addition, Creighton soils formed in material that weathered from sandstone, whereas Keith soils formed in loess. Creighton soils do not have a zone of accumulated lime that is characteristic of Tripp soils, which formed in transported material.

Creighton very fine sandy loam, 3 to 5 percent slopes (CoB).—This is a gently undulating soil in the Wildcat Hills. Runoff is medium from areas that are not in native grass.

This soil has a profile similar to the one described as typical of the Creighton series. Included in mapping were small areas of Tassel soils and outcrops of sandstone. Also included were areas of Rosebud and Anselmo soils that make up about 10 percent of the mapping unit.

A few large fields are dryfarmed to wheat. Growth of crops is good where management is at a high level. This soil is readily damaged by soil blowing if it is not protected. In a few places the surface layer is thinner than that described in the typical profile. The rate of water intake is medium to rapid. This soil is easily worked.

Most of the acreage of this soil is in native grass. These grasses grow well if management is good. Capability unit IIIe-1 (dryland), irrigated capability unit not assigned; Silty range site; Silty to Clayey windbreak suitability group.

Creighton very fine sandy loam, 5 to 9 percent slopes (CoC).—This is a rolling soil in the Wildcat Hills. Runoff is medium to rapid, and the rate of water intake is medium.

Included with this soil in the mapping were small areas of Tassel soils. Rock outcrops are common in a few of the highest areas. Also included were small areas of Duroc soils at the head of drainageways and of Anselmo and Rosebud soils.

Nearly all areas of this soil are in permanent pasture. The quality and quantity of forage is good when the pasture it not overgrazed and the grasses are allowed to reseed. A few areas are dryfarmed, mainly to winter wheat. Because of soil blowing, small parts of these areas have a surface layer that is thinner than the one described in the typical profile. This soil is easily worked, but extreme care is needed so as to control soil blowing in cultivated areas. Water erosion is serious during occasional heavy rains. Using a stubble mulch and wind stripcropping are effective in controlling both soil blowing and water erosion. Capability unit IVe-1 (dryland), irrigated capability unit not assigned; Silty range site; Silty to Clayey windbreak suitability group.

Dix Series

The Dix series consists of excessively drained soils that are shallow over mixed sand and gravel. These soils occur on the breaks of stream terraces and on the colluvial foot slopes below the breaks. In Scotts Bluff County, all the Dix soils are north of the North Platte River. They formed mainly in mixed alluvium, though in places they formed in wind-deposited material. These soils range from gently sloping to steep.

The surface layer is grayish-brown material of variable texture and about 3 inches thick. It has weak granular structure. This layer is slightly hard when dry and very friable when moist. It is nonlimy and neutral in reaction.

Underlying the surface layer is light brownish-gray loamy coarse sand. The upper part of this layer is slightly darker colored than the lower part. This loose sand is nonlimy and is neutral in reaction. At a depth of about 12 inches is mixed sand and gravel.

The Dix soils have very low water-holding capacity. Permeability of the underlying layer is moderately rapid, and that of the mixed sand and gravel is very rapid.

Dix soils are too droughty for dryfarmed crops. Where they are not too steep, these soils are suited to irrigated crops. Native grasses are mid and short, mainly little bluestem, blue grama, sideoats grama, and needle-and-thread. Yucca, sand sagebrush, and broom snakeweed are common.

Typical profile of a Dix sandy loam, in native pasture, about 0.13 mile west and 0.61 mile north of the southeast corner of section 9, T. 22 N., R. 54 W.:

A—0 to 3 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, very friable when moist; neutral; abrupt, smooth boundary.

AC—3 to 7 inches, grayish-brown (10YR 5/2) loamy coarse sand, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; loose; neutral; clear, smooth boundary.

C1—7 to 12 inches, light brownish-gray (10YR 6/2) loamy coarse sand, brown (10YR 4/3) when moist; single grain (structureless); loose; neutral; clear, smooth boundary.

IIC2—12 to 24 inches +, pale-brown (10YR 6/3) mixed coarse sand and fine gravel; single grain (structureless); loose noncalcareous.

The surface layer ranges from loam to loamy sand in texture and from 3 to 7 inches in thickness. It is grayish brown or brown. The subsurface layer ranges from 7 to 13 inches in thickness and from brown to very pale brown in color. In places this layer is rich in lime and is slightly cemented. The underlying mixed sand and gravel occurs at a depth of 10 to 20 inches, and pebbles are scattered throughout the profile. Pebbles are also on the surface in cultivated areas.

The Dix soils are similar to the Chappell soils but are shallower to mixed sand and gravel. The Dix soils are deeper to mixed sand and gravel than Gravelly land.

Dix-Bayard complex, 5 to 20 percent slopes (DBD).—This complex occurs on breaks of alluvial terraces. About 45 percent is Dix soils; 40 percent, Bayard soils; 10 percent, Chappell soils; and 5 percent, areas of exposed gravel. These percentages vary somewhat from place to place. The shallower soils (Dix) occupy the higher positions in the landscape; and the deeper soils (Bayard) the lower positions, or swales. A profile typical of each kind of soil is described under the respective series.

The surface layer in cultivated areas or in tame pasture is thinner and lighter colored than it is in areas of native grasses because soil blowing and water erosion have been stronger in these areas.

Because much of this complex is shallow or very shallow, it is not suited to cultivation. It is suited to grass. Some fields are cultivated and irrigated, but controlling water is difficult and the growth of crops over a period of several years is not satisfactory. Deferred grazing, rotation grazing, and other good practices of pasture management are needed to improve grazing. Capability unit VIs-41 (dryland), irrigated capability not assigned; Shallow to Gravel and Sandy range sites; Shallow windbreak suitability group.

Dix complex, 5 to 30 percent slopes (DxD).—This complex consists mainly of Dix soils, but in some areas from 10 to 40 percent is Chappell and Bayard soils. The surface layer generally ranges from clay loam or loam to sandy loam or loamy sand, but in some areas gravel covers from 5 to 10 percent of the surface. This complex is similar to the Dix-Bayard complex, 5 to 20 percent slopes, but some slopes are steepers, the acreage of shallow soils is larger, and more coarse pebbles are on the surface.

In a few areas Brule siltstone is at a depth of 18 to 36 inches.

This complex is too gravelly and too steep for cultivated crops. It can be used for grass, but good practices of management are needed. Capability unit VIs-41 (dryland), irrigated capability unit not assigned; Shallow to Gravel range site; Shallow windbreak suitability group.

Dunday Series

The Dunday series consists of deep, nearly level to sloping soils that are coarse-textured from the surface to a depth of at least 50 inches. These soils formed on stream terraces in sandy material that has been reworked by wind and on foot slopes in material that likely was deposited by wind. They are most extensive north of the North Platte River.

In a typical profile, the surface layer is grayish-brown loamy fine sand about 10 inches thick. This layer is easily worked. It is mildy alkaline and nonlimy.

Underlying the surface layer is light brownish-gray loamy fine sand. This material has weak prismatic structure, but it is loose and structureless if crushed when dry. It is mildly alkaline and nonlimy.

At a depth of 18 inches is light-gray, structureless loamy fine sand. Except for structure, this layer is similar to the layer above. Soils of the Dunday series have low water-holding capacity. Permeability of the underlying material is rapid. These soils are low in natural fertility. They are susceptible to soil blowing.

Most areas of the less sloping Dunday soils are in irrigated crops. These soils are droughty when they are dryfarmed. Native grasses are mixed mid and tall, mainly prairie sandreed, sand dropseed, Indian ricegrass, and western wheatgrass. Some blue grama occurs in most places.

Typical profile of a Dunday loamy fine sand, in an irrigated field, about 0.4 mile east and 50 feet north of the southwest corner of section 3, T. 23 N., R. 57 W.:

Ap—0 to 10 inches, grayish-brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, coarse, granular structure; soft when dry, very friable when moist; mildly alkaline, abrupt, smooth boundary.

C1—10 to 18 inches, light brownish-gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure; loose when dry, very friable when moist; mildly alkaline; clear, smooth boundary.

C2—18 to 50 inches, light-gray (10YR 7/2) loamy fine sand, grayish brown (10YR 5/2) when moist; single grain (structureless); loose when dry, very friable when moist; mildly alkaline; gradual, smooth boundary.

C3—50 to 60 inches, light-gray (10YR 7/2) loamy fine sand or fine sandy loam, dark grayish brown (10YR 4/2) when moist; single grain (structureless); soft when dry, very friable when moist; mildly alkaline.

The A horizon ranges from 8 to 20 inches in thickness and from grayish brown to dark grayish brown in color. In areas where the surface soil has blown away, the material under it is lighter colored than that described. The depth to lime ranges from 12 inches to more than 60 inches and is less on foot slopes than on stream terraces.

The layer underlying the surface layer of the Dunday soils is coarser textured than that of the Bayard and Anselmo soils. Dunday soils are not so well developed as the Anselmo soils. They have a thicker surface layer than the Valentine and the Dwyer soils. Dunday soils are also not so well developed as the Alice soils, which have a layer of accumulated lime. The underlying material of Dunday soils is coarser textured than the subsoil of Alice soils.

Dunday and Valentine loamy fine sands, 0 to 3 percent slopes (DVA).—This mapping unit consists mainly of Dunday and Valentine soils. Dunday loamy fine sand makes up about 80 percent, and Valentine loamy fine sand makes up about 20 percent. Because their differences are not significant to use and management, these soils were not mapped separately. A profile of a Dunday loamy fine sand is described under the Dunday series. The profile of the Valentine soil described under the Valentine series is a fine sand that differs from the Valentine loamy fine sand in this unit mainly in texture of the surface layer. Runoff is slow. The rate of water intake and the permeability of the subsoil are rapid.

Included in this unit in the mapping were some areas that have a silty horizon below a depth of 36 inches. These areas are less droughty than the rest of this unit because moisture is held in the root zone longer. A dark-colored buried soil occurs in some areas. Also in a few areas are pockets of gravel and places where gravel is at the surface. These gravelly spots are more droughty than the surrounding soils. Lime is near the surface in a few areas.

About 80 percent of the acreage in this unit is in irrigated crops. Growth of corn, field beans, alfalfa, potatoes, and sugar beets is fair to good where management is good. These soils are not especially fertile, but plants respond well to large quantities of added fertilizer. Because these soils are coarse textured and dry out rapidly, frequent irrigations are needed. Only a few areas of this soil are dryfarmed. Unless good practices are used to control soil blowing, growth of crops is likely to be poor. Stripcropping, stubble mulching, and alternating crops with fallow are practices that conserve moisture and help to control soil blowing.

Where this soil is in native grass, the growth of grass is good. Rotation grazing, deferred grazing, and other good practices of management are needed to help keep the grasses vigorous. Capability units IVe–5 (dryland) and IVe–5 (irrigated); Sandy range site; Sandy windbreak suitability group.

Dunday and Valentine loamy fine sands, 3 to 5 percent slopes (DVB).—This mapping unit consists mainly of Dunday and Valentine soils. Dunday loamy fine sand makes up about 75 percent of the unit, and Valentine loamy fine sand makes up about 25 percent. Because their differences are not significant to use and management, these soils were not mapped separately. A profile of a Dunday loamy fine sand is described under the Dunday series. The profile of Valentine soil described under the Valentine series is a fine sand that differs from the Valentine loamy fine sand mainly in texture of the surface layer. Runoff is slow. The rate of water intake is fairly rapid, but water erosion may occur where irrigation is downslope. Permeability of the subsoil is rapid.

Included in this unit in the mapping were small lighter colored eroded areas, areas where lime is at or near the surface, small areas of Anselmo fine sandy loam, 3 to 5 percent slopes, and small areas of a rolling Valentine soil that has a fine sand surface layer. Soil blowing has severely damaged nearly one-fourth of this unit and has removed most of the organic matter. The drifting of sand is evident. A dark-colored buried soil occurs in some areas.

About 70 percent of this unit remains in native grasses, and many areas have been reseeded to grass. Unless irrigation water is available, grass is probably the best use. Because these soils are droughty and controlling soil blowing is difficult, crops nearly always grow poorly if these soils are dryfarmed.

About 20 percent of the acreage is in irrigated crops. Alfalfa and corn are the most common crops though some field beans, sugar beets, and potatoes are also grown. Growth of crops is fair where management is good. Management that protects the soils from blowing and washing is needed. Crops should be used that provide a good cover for the soils. Capability unit VIe–5 (dryland) and IVe–5 (irrigated); Sandy and Sands range sites; Very Sandy windbreak suitability group.

Duroc Series

The Duroc series consists of deep, well-drained, medium-textured soils that have a thick surface layer. These soils occur in swales and at the head of drains in the loessal uplands and in the Wildcat Hills. They formed in material that washed from higher lying soils. Slopes range from 1 to 5 percent.

In a typical profile, the surface layer is grayish-brown loam about 10 inches thick. This layer consists of material that recently washed from adjacent soils. It has weak granular structure and is easily tilled. This layer is slightly hard when dry and friable when moist. It is free of lime.

The subsurface layer is gray loam about 23 inches thick. This layer has weak prismatic structure.

At a depth of about 33 inches is the light brownish-gray loam subsoil. It has weak subangular blocky structure. The subsoil is slightly limy and is friable when moist.

The very pale brown substratum occurs at a depth of about 38 inches. It has weak blocky structure in the upper part but is massive in the lower part. The substratum is rich in lime. It is soft and feels floury when dry; it is friable when moist.

The Duroc soils have medium water-holding capacity and release water readily to plants. These soils are well drained, but they receive extra water from runoff because they are in low positions. Natural outlets for this extra water are available, however, and the water drains away slowly after rains. Crops are generally benefited by the extra water, but they are damaged by moving floodwater after heavy rains. These soils are high in natural fertility. They are susceptible to water erosion.

About two-thirds of the acreage of Duroc soils is dryfarmed, mainly to wheat. Because most areas are long and narrow, they are farmed in the same way as the adjacent soils. Where these soils are in pasture, the main grasses are blue grama, western wheatgrass, buffalograss, and needle-and-thread.

Typical profile of a Duroc loam, in a field of winter wheat, about 0.25 mile south and 50 feet west of the northeast corner of section 33, T. 21 N., R. 58 W.:

Ap—0 to 10 inches, grayish-grown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist; abrupt, smooth boundary.

A1—10 to 33 inches, gray (10YR 5/1) loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that breaks to weak, medium, blocky structure; slightly hard when dry; friable when moist; clear, smooth boundary.

B2—33 to 38 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; slight effervescence; clear, smooth boundary.

C1—38 to 45 inches, very pale brown (10YR 8/3) loam, brown (10YR 5/3) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; gradual, smooth boundary.

C2—45 to 60 inches, very pale brown (10YR 8/3) loam, brown (10YR 4/3) when moist; massive (structureless); soft when dry, friable when moist; violent effervescence.

The A horizon ranges from 20 to 40 inches in thickness. The upper part ranges from silt loam to loam or very fine sandy loam. Where the alluvium in the surface layer is recent, it consists of stratified light-colored and dark-colored material that is slightly calcareous in places. The subsoil of the Duroc soils in the Wildcat Hills is not so well developed as the subsoil of Duroc soils in the loessal uplands. Depth to lime ranges from 30 to more than 60 inches.

The Duroc soils are darker colored than Mitchell soils and have lime at a lower depth. Duroc soils are near the Keith and the Rosebud soils, but they have a thicker, darker colored surface layer, have a less well developed subsoil, and occur in lower positions.

Duroc loam, 1 to 5 percent slopes (Dr).—This soil occurs in swales on uplands. Runoff is slow to medium.

The profile of this soil is the one described as typical of the Duroc series. In places the surface layer is slightly limy. Included with this soil in mapping were a few areas of lighter colored, severely eroded soils. Also included were a few areas that have a slightly sticky, more strongly developed subsoil than that described for the Duroc series.

Because most areas of this soil are long and narrow, these areas are farmed in the same way as adjacent soils. About two-thirds of the acreage is dryfarmed, mainly to wheat. Crops grow better on this soil than on any other dryfarmed soil in the county, though small grains are damaged by lodging in places. Soil blowing and water erosion generally can be controlled by stubble mulching and wind stripcropping. Capability unit IIIe-1 (dryland), irrigated capability unit not assigned; Silty Overflow range site; Silty to Clayey windbreak suitability group.

Dwyer Series

The Dwyer series consists of excessively drained, coarse-textured soils. These soils developed in local material deposited by wind. Topography ranges from low hummocky to nearly dunelike. These soils are widely scattered throughout the county.

In a typical profile, the surface layer is light brownish-gray fine sand about 4 inches thick. It is loose when dry and only slightly coherent when moist. This layer is nonlimy and mildly alkaline.

Underlying the surface layer is light-gray fine sand about 11 inches thick. This layer is structureless. It is loose when dry, slightly limy, and moderately alkaline.

***Figure 9.*—Profile of Dwyer fine sand. Lime is at a depth of 10 inches. The sand is of uniform size throughout the profile.**

Light-gray, limy fine and medium sand occurs at a depth of 15 inches. Lime is generally at a depth of about 15 inches (fig. 9). The substratum is structureless, loose, and moderately alkaline.

Soils of the Dwyer series have low water-holding capacity. Air and water move rapidly through the underlying layer, and roots penetrate these soils readily. These soils absorb rainwater nearly as rapidly as it falls. They are droughty and are susceptible to soil blowing where not protected. Natural fertility is low.

Nearly all the acreage of Dwyer soils is in native pasture. A few areas below irrigation canals are irrigated. The main native grasses are prairie sandreed, little bluestem, sand bluestem, sand dropseed, needle-and-thread, and western wheatgrass. Indian ricegrass and blue grama are common, and sand sagebrush, yucca, and pricklypear occur in overgrazed areas.

In Scotts Bluff County, Dwyer soils are mapped only in an undifferentiated group with Valentine soils.

Typical profile of a Dwyer fine sand, in permanent pasture, about 0.25 mile east and 10 feet north of the southwest corner of section 12, T. 20 N., R. 53 W.:

A—0 to 4 inches, light brownish-gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) when moist; single grain (structureless); loose when dry, very friable when moist; mildly alkaline; abrupt, smooth boundary.

C1—4 to 15 inches, light-gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) when moist; single grain (structureless); loose when dry; moderately alkaline; gradual, smooth boundary.

C2—15 to 60 inches, light-gray (10YR 7/2) fine and medium sand, grayish brown (10YR 5/2) when moist; single grain (structureless); loose; strong effervescence; mildly alkaline; although the color designations are the same, this horizon is slightly lighter colored than the C1 horizon.

The surface layer ranges from 2 to 10 inches in thickness and from pale brown to light brownish gray in color. The texture of the surface layer and subsoil is loamy fine sand or fine sand. Typically, these soils are limy at the surface, but in places they are nonlimy to a depth of as much as 40 inches.

Except for lime in their subsoil, Dwyer soils are similar to Valentine soils. They are coarser textured and lighter colored than Anselmo soils. Dwyer soils are lighter colored than the Dunday soils and have lime nearer the surface. In addition, Dwyer soils are not so well developed as Dunday soils.

Epping Series

The Epping series consists of medium-textured, very gently sloping soils that are 10 to 20 inches thick over Brule siltstone (fig. 10). These soils are calcareous. They formed in material that weathered from Brule siltstone. Epping soils occur in most parts of Scotts Bluff County.

In a typical profile, the surface layer is light brownish-gray silt loam that is rich in lime and is about 5 inches thick. It has weak granular structure and is easily worked. It is underlain by about 5 inches of light brownish-gray loam.

Pale-brown weathered loam is at a depth of about 10 inches. It has weak subangular blocky structure and contains much lime. Roots penetrate this layer easily, but Brule siltstone is at a depth of about 15 inches. It is buff colored, is soft, and contains an abundance of lime.

Because Epping soils are shallow to bedrock, they have low water-holding capacity. These soils dry rapidly and are low in natural fertility. In cultivated areas they are susceptible to soil blowing and water erosion.

The Epping soils are used mainly for native pasture. A few areas adjacent to deeper soils are dryfarmed, and a few where slopes are not more than 2 percent are irrigated. The main native grasses are little bluestem, blue grama, western wheatgrass, needle-and-thread, and threadleaf sedge.

Typical profile of an Epping silt loam, in a dryfarmed field of wheat, about 30 feet east and 20 feet north of the southwest corner of section 34, T. 21 N., R. 58 W.:

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; strong effervescence; many fragments of siltstone on the surface and throughout the horizon; abrupt, smooth boundary.

AC—5 to 10 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; although color designations are the same, this horizon is slightly lighter colored than the Ap horizon; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; many small fragments of siltstone; clear, smooth boundary.

C—10 to 15 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; many siltstone chips; abrupt, smooth boundary.

R—15 inches +, Brule siltstone; violent effervescence.

The surface layer ranges from 4 to 12 inches in thickness and is thickest in areas where wind has deposited silt. The texture of this layer is commonly loam or silt loam. In many uneroded areas the surface layer is grayish brown, but in moderately eroded or severely eroded areas it is light brownish gray. In some undisturbed areas, the surface layer is noncalcareous. The layer underlying the surface layer ranges from 5 to 10 inches in thickness. Fragments of unweathered siltstone are common throughout the profile.

Epping soils are not so coarse textured as Tassel soils, which formed from weathered sandstone. Although they formed in the same kind of material, the Epping soils are not so deep as the Keota or the Mitchell soils.

Epping silt loam, 1 to 3 percent slopes (EpA).—This soil is on small knolls and side slopes along intermittent streams. Runoff is slow.

The profile of this soil is the one described as typical for the Epping series. Included in the mapping were small areas of the deeper Keota soils. In places this Epping soil is less than 10 inches thick, and in some cultivated fields, rock commonly crops out.

This soil is suited to irrigated crops. Frequent irrigations are needed because the soil is shallow. Growth of crops is poor unless management is good. Because water-holding capacity is low, this soil is not suited to dryfarmed crops.

Most areas of this soil are in permanent pasture of short and mid grasses. These grasses are productive if not overgrazed. Capability units VIs-42 (dryland) and IVs-4 (irrigated); Shallow Limy range site; Shallow windbreak suitability group.

Epping silt loam, 3 to 30 percent slopes (EpD).—This is a gently sloping to steep soil. Runoff is rapid.

This soil is similar to the one described for the Epping series. Included in mapping were small areas of Keota and Mitchell soils. Rock outcrops and places where the soil is less than 10 inches deep occur in nearly all areas mapped as this soil.

Figure 10.—**Profile of an Epping silt loam. Buff-colored, soft, calcareous Brule siltstone is at a depth of about 15 inches.**

Most cultivated areas of this soil are small and are farmed along with adjacent soils so that fields are economical in size and shape. The surface layer is lighter colored in cultivated areas than it is in pasture. Growth of crops is generally poor. If areas are large enough to be managed separately, grass is a better use than crops. This soil is too steep for irrigated crops, and water-holding capacity is too low for dryfarming. Nearly all of this soil is in native pasture, and grasses grow well to fairly well if management is good. Capability unit VIs-42 (dryland), irrigated capability unit not assigned; Shallow Limy range site; Shallow windbreak suitability group.

Gering Series

The Gering series consists of somewhat poorly drained soils that are 20 to 40 inches thick over mixed sand and gravel. These soils are on the bottom lands along the North Platte River. They formed in medium-textured alluvium. The water table is at a depth of 3 to 5 feet during most of the year.

In a typical profile, the surface layer is gray loam about 8 inches thick. It has weak granular structure. This layer is rich in lime and is easy to work. Except that it has weak prismatic structure, the subsurface layer is similar to the surface layer.

Underlying the subsurface layer is light-gray loam about 16 inches thick. It has weak subangular blocky structure. This layer is rich in lime and has many mottles or stains of yellowish brown. The lower part is stratified, mainly with material that has loamy textures.

At a depth of about 29 inches is mixed sand and gravel. In most places this material is stained with brownish color in the upper part. Permeability of the underlying material is moderate in these soils. In some places local flooding occurs after heavy rains but is of short duration.

About 75 percent of the acreage of Gering soils is cultivated, and most of the rest is in pasture. Most cultivated areas are irrigated. The main crops are corn, alfalfa, field beans, sugar beets, and potatoes. The main natural grasses are big bluestem, switchgrass, indiangrass, western wheatgrass, and inland saltgrass.

Typical profile of a Gering loam in an irrigated field of sugar beets, 0.1 mile west and 50 feet south of the northeast corner of section 11, T. 20 N., R. 53 W.:

Ap—0 to 8 inches, gray (10YR 5/1) loam, very dark grayish-brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist; strong effervescence; abrupt, smooth boundary.

A1—8 to 13 inches, gray (10YR 5/1) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist; strong effervescence; clear, smooth boundary.

C—13 to 29 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; many, medium, distinct mottles of yellowish brown; weak subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; stratified loam and fine sandy loam in lower part; clear, smooth boundary.

IIC2—29 to 60 inches +, brownish mixed sand and gravel; common, medium, distinct mottles of yellowish brown in upper 8 inches; noncalcareous.

The surface layer (A horizon) ranges from 8 to 20 inches in thickness and from gray to grayish brown in color. It is fine sandy loam in many places. In many areas the layer below the surface layer is stratified light-colored and dark-colored loam and very fine sandy loam and some thin lenses of sandier material. This layer is commonly light gray or light brownish gray. Mottles range from faint to distinct. In many areas the Gering soils are moderately affected by salts and alkali.

The Gering soils are similar to the McGrew soils but have a finer textured layer below the surface layer. They are not so deep over mixed sand and gravel as Las soils, but they are similar in nearly all other characteristics. Gering soils are deeper than the Platte soils. Gering soils are somewhat similar to Las Animas soils but are not so coarse textured in the layer underlying the surface layer and are not so deep over mixed sand and gravel.

Gering loam (0 to 1 percent slopes) (Gr).—This nearly level, medium-textured soil overlies mixed sand and gravel at a depth of 20 to 40 inches. Runoff is slow. The rate of water intake is medium. Permeability of the layer underlying the surface layer is moderate. Because this soil is only moderately deep, the water-holding capacity is moderately low, but a high water table subirrigates the soil and provides moisture during extended dry periods.

The profile of this soil is the one described as typical of the Gering series. Included in mapping were a few widely separated spots of saline-alkali soils. Also included were a few small areas of the shallow Platte soils and the deep Las soils. Other inclusions were small areas that have a very fine sandy loam surface layer, areas that have a sandy surface layer, and areas that have a sandy subsoil.

About half of the acreage of this soil is in irrigated crops, and the rest is in permanent pasture. The main crops are corn, alfalfa, sugar beets, and field beans. Potatoes are suited but are seldom grown. Irrigation must be more frequent on this soil than on the deeper Las soils. This soil is seldom dryfarmed, because irrigation water is available in all areas. Capability units IIw–4 (dryland) and IIw–4 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

Gering loam, alkali (0 to 1 percent slopes) (2Gr).—This nearly level, moderately wet, medium-textured soil overlies sand and gravel at a depth of 20 to 40 inches.

This soil is moderately affected by salts and alkali in spots that make up 15 to 30 percent of the acreage. In cultivated fields, these spots have a thin white crust during fall, in winter, and early in spring. They are lighter colored than the unaffected soil. Growth of crops is poor on the saline-alkali spots, but it is fair to good in the unaffected areas if management is good.

Included with this soil in mapping were small areas that have a sandy subsoil, areas shallower than 20 inches to sand and gravel, and areas deeper than 40 inches to sand and gravel.

About half of this soil is in irrigated crops; the rest is in permanent pasture or meadow. Sugar beets, alfalfa, and corn grow well if management is good. Potatoes and field beans are not suited. Where this soil is in permanent grass, the forage is of good quality. Capability units IVs–1 (dryland) and IIIs–1 (irrigated); Subirrigated range site; Moderately Saline or Alkali windbreak suitability group.

Glenberg Series

The Glenberg series consists of nearly level to very gently sloping, limy soils on high bottoms along the North Platte River and along some of the tributaries. These somewhat excessively drained soils formed in moderately coarse-textured alluvium.

In a typical profile, the surface layer is light brownish-gray fine sandy loam about 19 inches thick. It is easily tilled and is slightly limy. The upper part has weak granular structure, and the lower part has weak prismatic structure.

The substratum is slightly lighter colored fine sandy loam. It has weak prismatic structure in the upper part and is structureless in the lower part. The lower part is more stratified than the upper part. The substratum is soft when dry, is very friable when moist, and is rich in lime.

The Glenberg soils have a moderately low water-holding capacity, but they release water readily to plants. Permeability of the underlying material is moderately rapid. Soil blowing during fall and spring months is a serious hazard if plant cover is not adequate for protection. Natural fertility is medium.

Practically all of the acreage of Glenberg soils is in irrigated crops, but some is in urban or industrial developments. These soils are suited to all crops commonly grown in the county.

Typical profile of a Glenberg fine sandy loam, in an irrigated field about 0.19 mile west and 100 feet south of the northeast corner of section 8, T. 22 N., R. 55 W.:

Ap—0 to 10 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; slightly hard when dry, very friable when moist; slight effervescence; abrupt, smooth boundary.

A1—10 to 19 inches, color, texture, and consistence same as in Ap horizon; weak, coarse, prismatic structure; strong effervescence; gradual, smooth boundary.

C1—19 to 46 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; slightly lighter colored than the layers above; some thin lenses of loam; weak, coarse, prismatic structure; soft when dry, very friable when moist; strong effervescence; clear, smooth boundary.

C2—46 to 60 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; some stratification; few, fine, faint mottles; massive (structureless); soft when dry, very friable when moist; violent effervescence; clear, smooth boundary.

The A horizon ranges from 10 to 20 inches in thickness and from pale brown to light brownish gray in color. It is very fine sandy loam in many places. The material underlying the surface layer contains lenses of medium- to coarse-textured alluvium in places. In the valley of the North Platte River, these soils have a substratum of mixed sand and gravel at a depth of 3 to 8 feet.

Glenberg soils have a coarser substratum than the Haverson soils. They have a lower water table and are better drained than the Las Animas soils. Glenberg soils are similar to the Otero soils, but their subsoil is more stratified. They are lighter colored than the Bayard soils and have a more stratified substratum.

Glenberg fine sandy loam, 0 to 3 percent slopes (Gd).—This soil is nearly level in most places and very gently sloping in a few areas. It occurs in high bottoms along streams.

The profile of this soil is the one described for the Glenberg series. The Glenberg soils south of the North Platte River are slightly lighter colored than those north of the river. In some areas of this soil that have been leveled for irrigation, the surface is light colored in cuts and on fills. Included in mapping were some areas of very fine sandy loam.

When this soil is managed carefully so as to prevent damage by soil blowing, corn, alfalfa, sugar beets, potatoes, field beans, and small grains planted in spring grow well. Nonlegume crops respond to added nitrogen. Crop residue or a crop growing on this soil helps to control soil blowing. If this soil is bare, a good practice is keeping the surface rough and cloddy during periods when the soil is likely to blow. Because it occurs in areas where irrigation water is available, this soil is seldom dryfarmed. Capability units IIIe–3 (dryland) and IIe–3 (irrigated); Sandy Lowland range site; Sandy windbreak suitability group.

Gravelly Land

Gravelly land (9 to 30 percent slopes) (Gv) is on remnants of terraces and at the edge of breaks from terraces. In Scotts Bluff County all of this land is north of the North Platte River.

Gravelly land consists of variable material. Fragments are as much as 6 inches in diameter. In about 45 percent of this mapping unit gravel is exposed at the surface; in about 45 percent, gravel is at a depth of less than 10 inches: and in the remaining 10 percent, gravel is at a depth of more than 10 inches. The areas where gravel is deepest are in the lower parts of this land.

The very shallow soil material above the gravel is noncalcareous, brown to grayish-brown gravelly sandy loam or gravelly loamy sand. This material is 2 to 10 inches thick and grades abruptly to mixed sand and gravel. Included with this unit in mapping were small areas of Dix and Chappell soils.

In some low areas soil material has accumulated and grasses grow. Intermittent seeps and springs occur along the lowest edges of terraces. Where this land is on remnants of the higher terraces it overlies Brule siltstone.

The rate of water intake and permeability of this land are very rapid. Runoff is very slow because coarse gravel is at or near the surface.

Gravelly land is not suited to cultivated crops or pasture. A fair to poor stand of native grasses grows in most areas, and these areas are grazed. The main native grasses are blue grama, sand dropseed, prairie three-awn, and needle-and-thread. Other common plants are yucca, sand sagebrush, gumweed, and broom snakeweed. Good practices of pasture management are needed to keep this land producing forage. Some areas are used for feedlots for cattle because the gravelly material is generally dry. This land is a good source of gravel and sand. Capability unit VIIs–3 (dryland), irrigated capability unit not assigned; Very Shallow Gravel range site; windbreak suitability group not assigned.

Gullied Land

Gullied land (30 to 100 percent slopes) (Gl) occupies the very steep side slopes of gullies and intermittent streams that cut some of the foot slopes of the Wildcat Hills. This land consists of medium-textured material, mainly outwash from weathered siltstone in which there has been little or no soil development. In most places the material has been in place long enough for some grass and weeds to become established. In other places the land is so steep and runoff so rapid that few plants grow. After heavy rains the gullies and streams carry much water from the higher lying areas, and erosion is active on the side slopes of the gullies and in the channels of the drainageways. Most of the steep side slopes of Gullied land consist of unconsolidated material. Brule siltstone commonly crops out on the lower part of side slopes and in the bottoms of the gullies.

Included with this land in mapping were small areas of Loamy alluvial land that are frequently flooded.

About half of Gullied land has a sparse stand of vegetation and is used for grazing. This land is too steep for the use of machines in reseeding. Capability unit VIIe–9 (dryland), irrigated capability unit not assigned; Thin Loess range site; Silty to Clayey windbreak suitability group.

Haverson Series

The Haverson series consists of deep, nearly level, well-drained soils that have a moderately coarse textured surface layer over medium-textured material. These limy soils formed in stratified alluvium on high bottoms along the North Platte River.

In a typical profile, the surface layer is light brownish-gray fine sandy loam about 16 inches thick. It has weak granular structure and is friable when moist. This layer is rich in lime and mildly alkaline. The lower part is slightly darker colored than the upper part and has weak prismatic structure.

Underlying the surface layer is slightly lighter colored, friable loam. It has weak subangular blocky structure. This layer is rich in lime and mildly alkaline.

Below a depth of 36 inches is stratified alluvial material that ranges from clay loam to fine sandy loam in texture. This material is massive, light colored, and very rich in lime. It is distinctly mottled. Mixed sand and gravel occurs at a depth of about 56 inches.

The Haverson soils have medium water-holding capacity. Permeability of the underlying material is moderate. Natural fertility is high. These soils are susceptible to soil blowing if they are not protected by growing plants or crop residue.

Nearly all the acreage of Haverson soils is in irrigated crops, but some is in urban or industrial developments.

Corn, potatoes, sugar beets, field beans, and alfalfa grow well where management is good.

Typical profile of a Haverson fine sandy loam, in an irrigated field of alfalfa, about 0.49 mile east and 0.7 mile south of the northwest corner of section 30, T. 22 N., R. 54 W.:

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist; violent effervescence; mildly alkaline; abrupt, smooth boundary.

A1—8 to 16 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure; soft when dry, very friable when moist; violent effervescence; midly alkaline; clear, smooth boundary.

C1—16 to 26 inches, light-gray (10YR 7/2) loam, light brownish gray (10YR 6/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; mildly alkaline; clear, smooth boundary.

C2—26 to 36 inches, white (10YR 8/2) loam, light brownish gray (10YR 6/2) when moist; few distinct mottles; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; moderately alkaline; abrupt, smooth boundary.

C3—36 to 56 inches, light brownish-gray (10YR 6/2) fine sandy loam, grayish brown (10YR 4/2) when moist; few, fine, distinct mottles; massive (structureless); soft when dry, very friable when moist; violent effervescence; mildly alkaline; abrupt, smooth boundary.

IIC4—56 to 60 inches, brownish sand and gravel; single grain (structureless); loose.

The A horizon ranges from 8 to 20 inches in thickness and from light gray to light brownish gray in color. It is very fine sandy loam in many places. Structure of the substratum ranges from massive in the more weakly developed horizons to weak subangular blocky in the more strongly defined horizons. The substratum ranges widely in texture. Depth to sand and gravel ranges from 40 to 72 inches. Depth to the water table ranges from 6 to 8 feet.

The Haverson soils are finer textured in the C horizon and are better drained than Las Animas soils. They have a lower water table than the Las soils and are better drained. Haverson soils are similar to McCook soils but have a lighter colored surface layer.

Haverson fine sandy loam, 0 to 1 percent slopes (Hf).—This soil is nearly level. Runoff is slow, and the rate of water intake is moderately rapid.

The profile of this soil is the one described as typical of the Haverson series. Included with this soil in the mapping were a few areas where the surface layer is nonlimy. Also included were areas where buried, dark-colored soils occur and small areas of loam.

Nearly all of this soil is in irrigated crops. It is suited to all irrigated crops commonly grown. Soil blowing is serious when this soil is not protected by crop residue or a growing crop. Tillage that roughens the surface helps to control blowing. Crops generally grow well. Capability units IIIe-3 (dryland) and IIe-3 (irrigated); Sandy Lowland range site; Sandy windbreak suitability group.

Janise Series

The Janise series consist of deep, nearly level to very gently sloping, strongly saline-alkali soils that typically are medium-textured throughout the profile. In most areas these soils developed mainly in silty materials that washed from areas of weathered siltstone. In some areas these soils developed in more variable alluvial materials on bottom lands. The Janise soils are somewhat poorly drained. In most areas the water table is at a depth of 3 to 5 feet. Some areas are gullied and channeled. These soils occur on the Lyman Plain and on bottom lands along the North Platte River.

In a typical profile, the surface layer is light-gray loam about 1 inch thick. It has weak platy structure, is strongly calcareous, and is moderately alkaline.

The subsoil is gray to light-gray clay loam about 7 inches thick. It has weak prismatic structure in the upper part and weak subangular blocky structure in the lower part. This layer is rich in lime and very strongly alkaline. The lower part is slightly saline.

At a depth of about 8 inches is white silt loam that has weak subangular blocky structure. This material is slightly hard when dry and friable when moist. It is rich in lime, very strongly alkaline, and slightly to moderately saline. This layer is slightly more sandy in the lower part.

In most areas seepage keeps the Janise soils saturated below a depth of 36 inches, and capillary movement of water keeps the soil above this depth moist during most of the year. Permeability of the subsoil is slow because of the large content of salts and alkaline, which tends to stop the downward movement of water.

Janise soils are too strongly affected by alkali for cultivated crops. Nearly all the acreage is in native grass and is used for pasture. The main native grasses are inland saltgrass, alkali sacaton, and western wheatgrass. Greasewood, a woody shrub about 2 or 3 feet tall, grows on the higher Janise soils.

Typical profile of a Janise loam, in a permanent pasture, about 0.43 mile west and 200 feet south of the northeast corner of section 10, T. 22 N., R. 58 W.:

A2—0 to 1 inch, light-gray (10YR 7/1) loam, dark gray (10YR 4/1) when moist; weak, thin, platy structure; soft when dry, very friable when moist; noncalcareous; abrupt, wavy boundary.

B2t—1 to 4 inches, gray (10YR 6/1) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic to moderate, medium, blocky structure; slightly hard when dry, firm when moist; violent effervescence; clear, smooth boundary.

B3t—4 to 8 inches, light-gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) when moist; moderate, medium, subangular blocky structure; slightly hard when dry, firm when moist; violent effervescence; clear, smooth boundary.

C1—8 to 30 inches, white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; clear, smooth boundary.

C2—30 to 60 inches, white (10YR 8/2) silt loam with thin lenses of fine sandy loam and very fine sandy loam, light brownish gray (10YR 6/2) when moist; many, fine, distinct mottles; massive (structureless); slightly hard when dry, friable when moist; violent effervescence.

The surface layer ranges from 1 to 6 inches in thickness. In some places the upper part is darker colored than the lower part. This layer is nonlimy in some places, but in others it is rich in lime and very strongly alkaline. The texture generally is silt loam, loam, very fine sandy loam, and fine sandy loam. In small depressions the surface layer commonly is strongly affected by alkali. These depressions are usually barren. The subsoil ranges from silty clay loam to loam or silt loam in texture and from 4 to 12 inches in thickness. Structure is stronger in low positions, but in some places this soil is weakly developed and massive. The Janise soils mapped in one area are not affected by a high water table, but in other areas the water table is at a depth of 3 to 5 feet. The Janise soils that occur on the bottom lands along the North Platte River overlie mixed sand and gravel at a depth of 2 to 6 feet. On the Lyman Plain, the Janise soils overlie silty or slightly sandy colluvium or alluvium.

The Janise soils are not so fine textured nor so strongly developed as the Minatare soils or Slickspots. They are wetter than Slickspots because they have a higher water table and receive seepage.

Janise soils (0 to 3 percent slopes) (Jn).—These soils are nearly level to very gently sloping. A few areas are channeled. Runoff is very slow, and much water collects in depressions and slowly seeps away or evaporates.

The profile of these soils is the one described as typical for the Janise series.

Included in the mapping were small areas of Buffington and Mitchell soils. Also included, south of Morrill, was an area that has a sandy clay loam subsoil and a substratum of stratified alluvial materials.

Because their content of alkali is high, Janise soils are not suited to cultivated crops. They are suited to grasses that tolerate alkali. In farmed areas, tall wheatgrass is a suitable tame grass. Nearly all the acreage is in permanent pasture. Attempts to grow cultivated crops under irrigation are few, and results are poor. Because the choice of crops is limited and growth is poor, the time, effort, and expense needed for cultivation are not justified. Capability units VIs–1 (dryland) and VIs–1 (irrigated); Saline Subirrigated range site; windbreak suitability group not assigned.

Keith Series

The Keith series consists of deep, medium-textured soils on the uplands in the southwestern part of the county. These soils developed in loess, which is a silty wind-deposited material. Slopes range from 0 to 9 percent.

In a typical profile, the surface layer is grayish-brown loam about 10 inches thick. It has weak granular structure in the upper part and weak prismatic structure in the lower. This layer is easily tilled. It is free of lime and neutral in reaction.

The upper part of the subsoil is light brownish-gray heavy loam about 14 inches thick. It has weak but well-formed subangular blocky structure. This layer is friable when moist. It is nonlimy and mildly alkaline.

Lime has accumulated in the lower part of the subsoil. This part is light-gray silt loam about 9 inches thick. It has weak subangular blocky structure, is rich in lime, and is moderately alkaline.

The substratum is at a depth of about 35 inches. It is nearly white silt loam that is friable, rich in lime, and moderately alkaline.

Soils of the Keith series have medium water-holding capacity. The permeability of the subsoil and substratum is moderate. These soils are high in natural fertility. They are susceptible to soil blowing and water erosion where they are not protected by a plant cover.

In this county about 85 percent of the acreage of Keith soils is dryfarmed mainly to wheat. About 10 percent of the acreage is in irrigated crops, mainly corn, sugar beets, field beans, and alfalfa. The remaining acreage is in permanent pasture. The main native grasses are blue grama, little bluestem, buffalograss, needle-and-thread, and western wheatgrass.

Typical profile of a Keith loam, in fallow, about 0.3 mile east and 150 feet north of the southwest corner of section 6, T. 21 N., R. 57 W.:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist; neutral; adrupt, smooth boundary.

A1—6 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist; neutral; clear, smooth boundary.

B1—10 to 14 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; neutral; clear, smooth boundary.

B2—14 to 24 inches, light brownish-gray (10YR 6/2) heavy loam, dark grayish brown (10YR 4/2) when moist; weak but well-formed, medium, subangular blocky structure; hard when dry, friable when moist; mildly alkaline; abrupt, smooth boundary.

B3ca—24 to 35 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; moderately alkaline; clear, smooth boundary.

C—35 to 60 inches, white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) when moist; massive (structureless); soft when dry, friable when moist; violent effervescence.

The A horizon ranges from loam to silt loam, very fine sandy loam, or fine sandy loam in texture and from 6 to 13 inches in thickness. In most places structure in the subsoil is weak prismatic in the upper part but breaks to weak or moderate subangular blocky. The texture of the subsoil ranges from loam to light silty clay loam. Thickness of the subsoil ranges from 12 to 30 inches.

Keith soils have a thinner surface layer than Duroc soils. They have a more strongly developed subsoil than Mitchell or Bridgeport soils and are deeper to lime. Keith soils are similar to Rosebud soils but formed in loess, whereas Rosebud soils formed in material weathered from sandstone.

Keith loam, 0 to 1 percent slopes (Ke).—This is a nearly level soil on uplands. In places it is underlain by Brule siltstone at a depth of 4 to 5 feet.

The profile of this soil is the one described for the Keith series. The surface layer is dominantly loam in texture, but a few areas of silt loam and very fine sandy loam were included in mapping.

Nearly all of this soil is cultivated. Wheat, the main crop, grows well where management is good. Soil blowing is a hazard, but it can be controlled by planting crops in strips that are alternated with strips allowed to lie fallow under a stubble mulch. Growth of crops is favorable in irrigated areas. Capability units IIIc–1 (dryland) and I–1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Keith loam, 1 to 3 percent slopes (KeA).—This is a very gently undulating soil of the uplands. In a few areas, Brule siltstone is at a depth of 4 to 5 feet and fragments of unweathered siltstone occur below the surface layer. Runoff is slow.

Except that it is not so well developed, this soil has a profile similar to that described for the Keith series. The surface layer is mainly loam in texture, but a few areas of silt loam and very fine sandy loam were included in mapping. Also included were small areas of Ulysses soils.

Management is needed that controls soil blowing and conserves water. Effective practices are planting crops in strips alternated with strips that are allowed to lie fallow under a stubble mulch. Terraces are also effective in conserving water. Crops grow well in the few irrigated areas of this soil. Under irrigation, controlling water and maintaining fertility are problems. Capability units IIIe-1 (dryland) and IIe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Keith loam, 3 to 5 percent slopes (KeB).—This is a gently sloping soil on uplands. Small areas are underlain by Brule siltstone. Runoff is medium.

The surface layer of this soil is slightly thinner than that described in the profile typical of the Keith series, and the subsoil is not so clayey. The surface layer is mainly loam in texture, but some areas of very fine sandy loam and of silt loam were included in the mapping. Also included were a few areas of Duroc soils in swales.

This soil is subject to both soil blowing and water erosion. About three-fourths of the acreage is in permanent pasture. The rest is cultivated and used for dryfarmed and irrigated crops. Crops grow well in areas where this soil is managed so as to control soil blowing and conserve moisture. Terraces can be used to control water erosion. In dryfarmed areas, strips of crops planted on the contour should be alternated with strips allowed to lie fallow under a stubble mulch. Capability units IIIe-1 (dryland) and IIIe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Keith loam, alkali substratum variant, 0 to 3 percent slopes (2KeA).—This is a nearly level to very gently sloping soil on uplands. Runoff is slow.

This soil appears to be typical of the Keith series because the surface layer and the upper part of the subsoil are similar to those layers in the profile of the soil described as typical. Beginning at a depth of 24 inches, however, the subsoil and underlying material are very strongly alkaline and slightly to moderately saline. This alkalinity and salinity can be determined only by soil tests. These lower layers are rich in lime and are light gray or white in color.

This soil has a loam surface layer, but areas of very fine sandy loam were included in mapping. Also included were small areas of Slickspots-Keith complex. This soil is at slightly lower elevations than Keith loam, 0 to 1 percent slopes, but it is higher than soils in the Slickspots-Keith complex.

About half the acreage is dryfarmed; the rest is used for permanent pasture. Wheat is the main crop, but a considerable acreage of alfalfa is also grown. Growth of the first cutting of alfalfa is very good; for the second cutting, about half as much as the first; and for the third cutting, very poor. This soil is better suited to wheat and other shallow-rooted crops. Growth of wheat is good.

Management is needed to control soil blowing and to conserve water, particularly to prevent excessive loss of water through evaporation. Soil blowing can be controlled and water conserved by using strips of crops alternated with strips allowed to lie fallow under a stubble mulch. Where this soil is used for permanent pasture, western wheatgrass, blue grama, inland saltgrass, and alkali sacaton are the main grasses. Capability unit IVs-1 (dryland), irrigated capability unit not assigned; Silty range site; Moderately Saline or Alkali windbreak suitability group.

Keith-Ulysses loams, 3 to 5 percent slopes, eroded (KUB2).—This complex occurs on the sides and crests of low ridges. About 60 percent is Keith loam, and about 40 percent is Ulysses loam. The Ulysses loam is slightly lighter colored than the Keith loam and is on the more eroded parts of this complex. Runoff is medium.

The Keith and Ulysses soils in this complex have characteristics similar to those described for their respective series. The surface layer is mainly loam in texture, but a few areas of silt loam and very fine sandy loam were included in mapping.

In some of the more eroded spots, limy subsoil material is exposed at the surface. In much of the acreage, tillage has mixed some of the subsoil material with the remaining surface layer.

All of this complex is cultivated. Growth of crops is not so favorable as it is on Keith loam, 3 to 5 percent slopes. Farmers are concerned mainly with erosion, conservation of water, and maintenance of fertility. These soils are well suited to cultivated crops if protective measures are used. For dryfarmed areas, these measures include stubble mulching, alternating crops with fallow, and terracing. Capability units IIIe-1 (dryland) and IIIe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Keith-Ulysses loams, 5 to 9 percent slopes (KUC).—This complex occurs on the sides and crests of low ridges. About 55 percent is Keith loam, and about 45 percent is Ulysses loam. Runoff is rapid.

Profiles of Keith loam and of Ulysses loam are described for the respective series. The surface layer is mainly loam, but some areas of silt loam were included in the mapping. Also included were some eroded areas.

The Ulysses soils cover the more eroded parts of this complex. These soils are slightly lighter colored than the Keith soils. Soil blowing and water erosion have removed some soil particles and organic matter from the surface layer, and in places tillage has mixed some subsoil material with this layer. In the more eroded areas, this layer is rich in lime. Small gullies are common, but they are obliterated each year by tillage.

Most of this complex is cultivated to dryfarmed crops. A few small areas, mainly of Keith soils, are in pasture, and the growth of forage crops is generally medium where the pasture is not overgrazed. Farmers are concerned mainly with erosion and water conservation, but practices are also needed to increase the content of organic matter. Suitable practices are terracing and stripcropping in which strips of crops are alternated with strips in fallow under a stubble mulch. Capability units IVe-1 (dryland) and IVe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Keota Series

The Keota series consists of nearly level to sloping, medium-textured soils of the uplands. These soils are 20 to 40 inches thick over Brule siltstone. They are well-drained soils and occur in many parts of the county, but their total acreage is small.

In a typical profile, the plow layer is light brownish-gray silt loam about 8 inches thick. It has weak granular structure and is easily worked. This layer contains a moderate amount of lime and is mildly alkaline.

Underlying the plow layer is light-gray silt loam that has weak subangular blocky structure. It is friable, rich in lime, and moderately alkaline. The buff-colored Brule siltstone is at a depth of about 23 inches. It is soft, is rich in lime, and weathers rapidly.

The Keota soils have moderately low to medium water-holding capacity, depending on the depth to bedrock. These soils absorb water readily and are easily worked. Permeability of the underlying material is moderate. Natural fertility is medium.

Most areas of Keota soils are dryfarmed, but some areas are irrigated. Soil blowing and water erosion are the main hazards unless the soils are adequately protected. Crops grow well if management is good and rainfall is normal. The main native grasses are blue grama, western wheatgrass, and threadleaf sedge, but some needle-and-thread also occurs.

Typical profile of a Keota silt loam, in an irrigated field of sugar beets, about 0.25 mile south and 0.15 mile west of the northeast corner of section 20, T. 22 N., R. 57 W.:

Ap1—0 to 4 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; strong effervescence; mildly alkaline; clear, smooth boundary.

Ap2—4 to 8 inches, color, texture, and consistence same as Ap1 horizon; weak, coarse, blocky structure; slightly hard when dry, friable when moist; strong effervescence; mildly alkaline; abrupt, smooth boundary.

C1—8 to 16 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; moderately alkaline; clear, smooth boundary.

C2—16 to 23 inches, light-gray (10YR 7/2) heavy silt loam, light brownish gray (10YR 6/2) when moist; weak, medium, subangular block structure; hard when dry, firm when moist; violent effervescence; moderately alkaline; clear, smooth boundary.

R—23 inches +, Brule siltstone bedrock.

The surface layer (Ap horizon) ranges from 6 to 12 inches in thickness and from light gray to light brownish gray in color. Some areas have a silty clay loam or fine sandy loam surface layer. The surface layer is limy in most cultivated areas, but it is nonlimy in some pastured areas. The substratum ranges from light gray to white and from nearly massive to weak, but well-defined, subangular blocky structure. This layer is mildly or moderately alkaline. It has silty clay loam texture in many places.

Although the Keota and Epping soils formed in similar materials, the Keota soils are deeper over bedrock than the Epping soils. The Keota and Mitchell soils also formed of similar materials, but the Keota soils formed in place and the deeper Mitchell soils formed in transported materials. Keota soils are not so deep, or so well developed as Keith soils, which formed in silty wind-deposited material. This silty material probably contains some weathered Brule siltstone.

Keota silt loam, 1 to 3 percent slopes (KoA).—This is a very gently sloping soil on uplands. Runoff is slow.

About half of the acreage of this soil has been moderately eroded. In these areas the surface layer is about 6 inches thick and is slightly lighter colored than that of uneroded soils. Chips of weathered siltstone are generally scattered throughout the profile. Included with this soil in mapping were some areas of loam or silty clay loam. Also included were a few small areas of Mitchell soils, which are 40 to 60 inches deep to bedrock, and a few areas of Epping soils, which are 10 to 20 inches deep to bedrock. Other inclusions are a few areas where the subsoil is olive colored, finer textured, and strongly alkaline.

Most areas of this Keota soil are dryfarmed, though some areas below irrigation canals are irrigated. Soil blowing, water erosion, and a moderately low water-holding capacity limit the use of this soil for dryfarming. Stubble mulching, wind stripcropping, and alternating crops and fallow are practices that help conserve water and protect the soil. Maintenance of fertility is important in irrigated fields. Added nitrogen benefits nonlegume crops, and phosphate generally benefits alfalfa. Capability units IIIe-1 (dryland) and IIe-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Keota silt loam, 3 to 5 percent slopes (KoB).—This gently sloping soil is on side slopes and crests of low ridges. Runoff is medium.

This soil is similar to the soil described for the Keota series, but in about two-thirds of the areas mapped the surface layer is slightly lighter colored. This lighter color is the result of soil blowing and water erosion. In some places the subsoil material is exposed at the surface. In these eroded areas, lime is plentiful and the siltstone bedrock is closer than normal to the surface. Included with this soil in mapping were areas of the shallow Epping and the deep Mitchell soils.

Where this soil is dryfarmed, soil blowing, water erosion, and lack of moisture are the main concerns of management, but they can be offset by alternating crops and fallow under a stubble mulch and by stripcropping. In irrigated areas nonlegume crops benefit from added nitrogen. A few areas are still in native grasses. Capability units IVe-1 (dryland) and IIIe-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Keota-Epping silt loams, 5 to 9 percent slopes (KEC).—This complex of soils is made up of about 60 percent Keota silt loam and about 35 percent Epping silt loam. Areas of these soils are so intermixed that it is not practical to separate them on the soil map. This complex occurs on the sides and crests of low, sloping ridges.

A profile of Epping soil is described as typical of the Epping series. In some cultivated areas, however, the surface layer is slightly lighter colored than that in the typical profile because of water erosion and soil blowing. Tillage has mixed material from the substratum with the original surface layer.

About two-thirds of this complex is used for winter wheat. Soil blowing and water erosion are the most serious hazards in dryfarmed areas. On the small acreage that is irrigated, the maintenance of fertility is important. In most places crops respond to nitrogen and phosphate. Where this soil is in grass, good practices of management are needed. Capability units VIe-9 (dryland) and IVe-1 (irrigated); Limy Upland and Shallow Limy range sites; Silty to Clayey windbreak suitability group.

Las Series

The Las series consists of nearly level, deep, somewhat poorly drained soils on bottom lands along the North Platte River and some of its tributaries. These soils formed in medium-textured alluvium.

In a typical profile, the surface layer is grayish-brown loam about 8 inches thick. It has weak granular structure, is easily worked, and is rich in lime.

Underlying the surface layer is light brownish-gray very fine sandy loam about 9 inches thick. It has weak prismatic structure. This layer is friable when moist, slightly hard when dry, and rich in lime.

At a depth of about 17 inches is a buried soil consisting of grayish-brown and gray loam that is stained with brownish colors in the lower part. This material has prismatic structure in the upper part and is massive in the lower part. It is friable and rich in lime. Brownish mixed sand and gravel are at a depth of 41 inches. The water table is at a depth of about 48 inches.

The Las soils have medium water-holding capacity. Permeability of the underlying material is moderate. Runoff is slow. Capillary movement of water above the water table keeps these soils moist during most of the year.

About half of the acreage of Las soils is in permanent grass; the rest is in irrigated crops. These soils are well suited to crops. Soil blowing is a hazard when the surface is not protected. The main native grasses are big bluestem, indiangrass, switchgrass, western wheatgrass, tall dropseed, and inland saltgrass.

Typical profile of a Las loam, in an irrigated field about 100 feet south and 150 feet west of the northeast corner of section 4, T. 20 N., R. 53 W.:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; strong effervescence; slightly hard when dry, friable when moist; abrupt, smooth boundary.

C1—8 to 17 inches, light brownish-gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) when moist; weak, coarse, prismatic structure; slightly hard when dry, friable when moist; violent effervescence; clear, smooth boundary.

A1b—17 to 25 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure; hard when dry, friable when moist; strong effervescence; clear, smooth boundary.

C2—25 to 41 inches, gray (10YR 6/1) loam, dark grayish brown (10YR 4/2) when moist; common, medium, faint mottles; massive (structureless); hard when dry, friable when moist; strong effervescence; abrupt, smooth boundary.

IIC3—41 to 60 inches, brownish mixed sand and gravel; slightly effervescence in upper part.

The surface layer ranges from 4 to 12 inches in thickness and from grayish brown to light brownish gray in color. The texture most commonly is loam, very fine sandy loam, and fine sandy loam. Depth to mottles ranges from 10 to 40 inches, but the soils are not mottled in all places. Depth to the water table ranges from 3 to 6 feet. Underlying the surface layer are light-colored to dark-colored layers and lenses of alluvial material that has variable texture. These layers are clayey, loamy, and sandy, but when mixed, the average texture is medium. Thin layers that are greenish or bluish commonly occur just above the layer of mixed sand and gravel. Depth to coarse-textured material ranges from 40 to more than 60 inches.

Las soils have a finer textured material beneath the surface layer than the Las Animas soils. In the Las soils texture of this material is similar to that of the Haverson soils, but the water table is higher and Las soils are wetter than the Haverson. Las soils are deeper over mixed sand and gravel than the Platte or Gering soils. They are not so well drained nor so coarse textured as the Glenberg soils. Las soils are finer textured beneath the surface layer than the McGrew soils and are deeper to mixed sand and gravel.

Las loam (0 to 1 percent slopes) (Lt).—This is a deep, nearly level soil on bottom lands. Runoff is slow.

The profile of this soil is the one described as typical of the Las series. Mixed coarse sand and gravel is at a depth of 40 to 60 inches. Included with this soil in mapping were areas of silt loam and very fine sandy loam. Also included were a few small areas of moderately alkaline soils and a few areas that have a very light colored surface layer. Other inclusions were soils that have a sandy subsoil and soils that are less than 40 inches to mixed sand and gravel.

About 90 percent of this soil is in cultivated crops, mainly corn, sugar beets, and alfalfa. Potatoes and field beans can also be grown, but the acreage of these crops is small. Nonlegume crops respond to added nitrogen, and alfalfa responds well to phosphate. Soil blowing is a hazard when this soil is not adequately protected. Keeping the surface covered or roughened in the fall helps to control blowing. Where this soil is in native pasture, excellent practices of pasture management are needed. Capability units IIw–4 (dryland) and IIw–4 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

Las loam, alkali (0 to 1 percent slopes) (2Lt).—This deep, moderately wet soil is on nearly level bottom lands. It is moderately affected by alkali and soluble salts. The alkali and salts are not uniformly distributed throughout areas of this soil. More commonly they occur in small areas or spots surrounded by large unaffected areas of Las soils. The size and number of these saline-alkali spots are sufficient to affect the use and management of this soil, but not to prevent cultivation. The areas affected by salts or alkali make up from 15 to 30 percent of this soil.

Except for the effect of salts and alkali, this soil is similar to the one described for the Las series. Included with this soil in the mapping are small areas of Las Animas loam, alkali, Gering loam, alkali, and McGrew loam, alkali.

Where this soil is cultivated, the saline-alkali spots are lighter colored and crust upon drying. A thin salt crust is common during the fall, in winter, and early in spring. Crops grow poorly on these spots, and sprouts of germinating seeds have difficulty penetrating the surface. Corn, alfalfa, and sugar beets are the irrigated crops most commonly grown. Potatoes and field beans are not well suited. About 20 percent of this soil is still in native grass. Tall wheatgrass, a tame grass, is grown in places for seed and hay. Nonlegume crops respond to added nitrogen, and in most places alfalfa responds well to phosphate.

The saline-alkali condition is the main concern of management. Barnyard manure helps to make these alkali spots more friable and better suited to crops. Soil blowing may occur during times when the soil is bare. Roughening the surface in fall or leaving it covered with crop residue reduces this hazard. Capability units IVs–1 (dryland) and IIIs–1 (irrigated); Subirrigated range site; Moderately Saline or Alkali windbreak suitability group.

Las fine sandy loam, alkali (0 to 1 percent slopes) (2Ls).—This nearly level soil occurs on bottom lands. About 25 percent of it is moderately affected by alkali or soluble salts. In cultivated fields, the saline and alkali spots are lighter colored and more cloddy than the soil in adjacent areas. In pastured fields, the alkali spots have a higher percentage of saltgrass and alkali sacaton than the nonaffected soil. Most of the effect of salts and alkali is in the plow layer, though in some playas it is also in the subsoil.

Except for texture and the content of alkali, this soil has a profile similar to the one described for the Las series. Included with this soil in mapping were small areas of the shallower Gering soils. Also included were small areas of the McGrew and Las Animas soils, which have a sandier subsoil.

Sugar beets, alfalfa, corn, and pasture are the main crops grown on this soil. Field beans and potatoes are not well suited. Crops that tolerate alkali are suitable. Treating this soil with gypsum, sulfur, or other amendments is feasible, but treatment needs to be continous if long-time results are expected. Soil blowing is a hazard on this sandy soil where it is not protected by a growing crop, crop residue, or native grasses.

Where this soil is in native pasture, good practices of management are needed. Inland saltgrass or clumps of alkali sacaton generally grow on the alkali spots. Capability units IVs-1 (dryland) and IIIs-1 (irrigated); Subirrigated range site; Moderately Saline or Alkali windbreak suitability group.

Las Animas Series

The Las Animas series consists of deep, nearly level, somewhat poorly drained soils that have moderately coarse material in the layer beneath the surface layer. The water table is at a depth of 3 to 6 feet.

In a typical profile, the surface layer is light brownish-gray fine sandy loam about 8 inches thick. It has weak granular structure. This layer is very friable, rich in lime, and moderately alkaline. It is underlain by about 10 inches of light grayish-brown fine sandy loam that has blocky structure.

Fine sandy loam that is massive extends from a depth of 18 inches to 54 inches. It is light gray in the upper part, light brownish gray in the middle part, and light gray in the lower part.

At a depth of 54 inches is brownish mixed sand and gravel that is mottled in the upper part.

Soils of the Las Animas series have medium to low water-holding capacity. Permeability of the underlying material is moderately rapid. Runoff is slow. These soils are subirrigated by a high water table that provides extra moisture in the subsoil during dry seasons. When Las Animas soils are cultivated, they are susceptible to soil blowing unless they are protected by crop residue, a growing crop, or native grasses.

Few areas of Las Animas soils are dryfarmed. About three-fourths of the acreage is in irrigated crops. Growth of crops is good when management is good. The acreage not dryfarmed or irrigated is still in permanent pasture. The main native grasses are switchgrass, indiangrass, western wheatgrass, big bluestem, blue grama, and inland saltgrass.

Typical profile of a Las Animas fine sandy loam, in an irrigated field, about 0.3 mile north and 100 feet east of the southwest corner of section 3, T. 20 N., R. 53 W.:

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist; strong effervescence; moderately alkaline; abrupt, smooth boundary.

AC—8 to 18 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, blocky structure; slightly hard when dry, very friable when moist; strong effervescence; moderately alkaline; clear, smooth boundary.

C1—18 to 30 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; few, fine, faint mottles; massive (structureless); slightly hard when dry, very friable when moist; violent effervescence; moderately alkaline; clear, smooth boundary.

C2—30 to 40 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; common, medium, faint mottles; massive (structureless); soft when dry, very friable when moist; violent effervescence; moderately alkaline; gradual, smooth boundary.

C3—40 to 54 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; common, medium, distinct mottles; massive (structureless); soft when dry, very friable when moist; violent effervescence; moderately alkaline; clear, smooth boundary.

IIC4—54 to 60 inches, brownish mixed sand and gravel; many, coarse, distinct mottles in upper part; loose, noncalcareous.

The surface layer ranges from 3 to 15 inches in thickness and from grayish brown to light brownish gray in color. The texture is loam or loamy fine sand in places. The layers underlying the surface layer are commonly stratified with light-colored and dark-colored material that is widely variable in texture. When these layers are mixed, the texture on the average is sandy loam. Mottles are within 15 inches of the surface in places. Depth to mixed sand and gravel ranges from 40 to more than 60 inches.

Las Animas soils have coarser textured layers underlying the surface layer than have the Las soils, but these layers have about the same texture as those of Glenberg soils. Las Animas soils have a higher water table than the Glenberg soils and are not so well drained. They are not so coarse as the Bankard soils. Las Animas soils are similar to the McGrew soils but are deeper to mixed sand and gravel.

Las Animas fine sandy loam (0 to 1 percent slopes) (Lq).—This is a moderately wet, nearly level soil on bottom lands. Runoff is slow.

The profile of this soil is the one described as typical for the Las Animas series. This surface layer is mainly fine sandy loam, but a few small areas of loam, very fine sandy loam, and loamy fine sand were included in mapping. Other inclusions were small areas of the McGrew, Las, and Gering soils and saline-alkali spots. Where Las Animas soils occur in valleys of small tributaries of the North Platte River, or in low areas on foot slopes, they formed in very deep sandy materials.

Almost all of this soil is in irrigated crops. Corn, alfalfa, and sugar beets are the crops most commonly grown, and a smaller acreage of potatoes and field beans are grown. Soil blowing is the main hazard to use, but maintenance of fertility is also important where this soil is in irrigated crops. Some areas are still in native grasses. They grow well when not overgrazed. In places native grasses are mowed for winter hay. Capability units IIIw-6 (dryland) and IIw-6 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

Las Animas fine sandy loam, alkali (0 to 1 percent slopes) (2Lq).—This is a nearly level soil that is moderately affected by salts and alkali. Runoff is slow.

The saline-alkali condition is mostly in the surface layer, but in some places the subsoil is also affected. Areas of this soil are seldom uniformly affected. Alkali occurs mainly in small areas or spots surrounded by a large unaffected area. Salinity ranges from 0.2 to 0.5 percent in the surface layer, or upper part of the layer beneath it, and is enough to affect the choice of crops and the use and management of the soil. The alkali ranges from pH 8.5 to 9.0, which is not so high as that in some other soils of the county.

Except for the saline-alkali content, this soil has a profile similar to the one described as typical of the Las Animas series. Included with this soil in mapping were small areas of Gering, McGrew, and Las soils and some areas that have slopes of more than 1 percent. In some pastured areas, the

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alkali spots are slightly clayey in the subsoil and have weak columnar structure.

This soil is seldom dryfarmed. About half of the acreage is in irrigated crops. The saline-alkali condition and the maintenance of fertility are the main concerns of management. Growth of crops is spotty, but it is good for sugar beets and alfalfa and is fair to good for corn. Potatoes and beans are not well suited, but pasture plants grow well. Capability units IVs–1 (dryland) and IIIs–1 (irrigated); Subirrigated range site; Moderately Saline or Alkali windbreak suitability group.

Las Animas loam (0 to 1 percent slopes) (Lr).—This is a deep, moderately wet, nearly level soil. Runoff is slow.

This soil has a medium-textured, grayish-brown surface layer; otherwise, it has a profile similar to the one described as typical for the Las Animas series. Included in mapping were small areas of very fine sandy loam and fine sandy loam. Also included were small areas that are less than 40 inches deep over mixed sand and gravel. Other inclusions were a few areas of Las and Gering soils and a few small alkali spots.

Nearly all of this soil is in irrigated crops. Corn, alfalfa, and sugar beets are the main crops, though some field beans, potatoes, and small grains that are planted in spring are grown. Growth of crops is favorable where management is good. Because this soil is subirrigated, it tends to be wet during spring when the natural rainfall is above normal. Soil blowing occurs if the soil is not protected. Where this soil is in native grass, growth is favorable for forage or hay. Capability units IIw–4 (dryland) and IIw–4 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

Las Animas loam, alkali (0 to 1 percent slopes) (2Lr).—This is a deep, nearly level soil on bottom lands. Runoff is slow.

Except for a medium-textured surface layer and the saline-alkali condition, this soil has a profile similar to the one described as typical for the Las Animas series. Included with this soil in mapping were small areas of McGrew, Gering, and Las soils that are affected by alkali.

This soil is moderately affected by alkali and salts. In some places the surface layer is affected, and in others the subsoil is affected. Alkalinity ranges from pH 8.5 to 9.0, and in many areas salinity ranges from 0.2 to 0.5 percent. The saline-alkali condition is in spots in the fields and is not uniformly distributed throughout the area. In places these spots are clayey at the surface and penetration of water is very slow. The soil material becomes puddled when it is disturbed, and it is crusted and hard when dry.

This soil contains enough alkali and salts to influence the choice of crops and the use and management of the soil. About three-fourths of the acreage is in permanent pasture or hay; the rest is in irrigated crops. Corn, alfalfa, and sugar beets are suited to this soil. Spring seeded barley and oats grow fairly well, but potatoes and field beans are not well suited. In many areas the grasses are cut for hay that is used during the winter. Grasses grow well on this subirrigated soil. Large amounts of barnyard manure and additions of sulfur help to increase infiltration of water and to neutralize the alkali. Capability units IVs–1 (dryland) and IIIs–1 (irrigated); Subirrigated range site; Moderately Saline or Alkali windbreak suitability group.

Loamy Alluvial Land

Loamy alluvial land (0 to 3 percent slopes) (Lx).—This land type occurs on the bottoms of wide gullies and draws. These areas are narrow in the hills and become wider as the gullies cross the flatter bottom lands. Intermittent streams in gullies and drains that are 2 to 8 feet deep meander across these bottom lands. The gullies and drains range from 100 to 200 feet in width and have steep side slopes. Some flooding occurs each year, and more alluvium is added with each flood.

This land consists mainly of stratified, medium-textured material, but in some places it is sandy. Silt loam and very fine sandy loam are the most common textures. The surface layer differs little in texture from the material beneath it, though brownish stains or mottles are common at lower depths. This land is mainly limy, but in places some parts of the profile are nonlimy.

This land is somewhat poorly drained. Floodwaters cover the surface for only short periods, generally several hours to half a day. Permeability is moderate and the water-holding capacity is medium.

This land is not suited to cultivated crops, because of flooding. Floods occur primarily in April, May, and June when crops are small and most susceptible to damage. This land is used for native pasture, but plant cover is sparse and consists mainly of annual weeds. It can be grazed during most of the year. Structures are needed to help control gullying. Capability unit VIw–1 (dryland), irrigated capability unit not assigned; Silty Overflow range site; Moderately Wet windbreak suitability group.

Marsh

Marsh (M) consists of areas where water stands on the surface to a depth of 2 to 18 inches nearly all of the year. Areas of Marsh are generally small, are 5 to 60 acres in size, and are scattered through most of the county.

The soil material ranges from clayey to very sandy in texture. In areas along the North Platte River, this material overlies mixed sand and gravel, which is at a shallow depth. On the foot slopes and in loessal areas, Marsh overlies Brule siltstone, which is at a depth of 6 to 20 feet. In these areas, the water table is perched. In most places brownish, fibrous remains of partly decomposed plants 1 to 3 inches thick are on the surface. Soil profiles do not develop in areas of Marsh.

The vegetation consists mainly of cattails and willows. Reedgrass and tall sedges grow at the edges. Between 50 and 100 percent of the acreage is covered by plants; the rest by open water. Included in mapping were small areas of Wet alluvial land in a few places.

In some places in Marsh, saturated clayey material is forced to the surface by underground pressure and it accumulates in mounds. These areas are called bogs. Because they are dangerous to children and to farm animals, they should be fenced.

Marsh is suited to the production and protection of some kinds of wetland wildlife. It is too wet for farming, grazing, or growing trees. Capability unit VIIIw–1 (dryland), irrigated capability unit not assigned; range site and windbreak suitability group not assigned.

McCook Series

The McCook series consists of nearly level, well-drained soils on bottom lands. These soils are deep or moderately deep over mixed sand and gravel. They formed in medium-textured alluvium along the North Platte River and a few of the smaller tributaries. Runoff is slow.

In a typical profile, the surface layer is grayish-brown loam about 14 inches thick. This layer is mildly alkaline, rich in lime, and easily worked. The upper part has weak granular structure; the lower part has weak blocky structure.

Beneath the surface layer is light brownish-gray and light-gray silt loam about 24 inches thick. It has weak, medium, subangular blocky structure. This layer is friable, mildly alkaline, and rich in lime.

A layer of stratified light-colored material about 12 inches thick occurs at a depth of 38 inches. This layer is fine sandy loam in the upper part and clay loam in the lower part. It contains a small amount of lime, is massive, and is mottled. Brownish, loose, mixed sand and gravel is at a depth of about 50 inches.

Soils of the McCook series have low to medium water-holding capacity. Permeability is moderate. These soils release water readily to plants.

Most of the acreage of these soils is used for irrigated crops, but some areas are in urban developments, and a few small areas are in native pasture. Corn, alfalfa, field beans, potatoes, and sugar beets are the crops most commonly grown. McCook soils are subject to soil blowing when not protected.

Typical profile of a McCook loam, in an irrigated field, about 0.46 mile south and 100 feet east of the northwest corner of section 33, T. 22 N., R. 54 W.:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist; strong effervescence; mildly alkaline; abrupt, smooth boundary.

A1—9 to 14 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, blocky structure; slightly hard when dry, friable when moist; slight effervescence; mildly alkaline; clear, smooth boundary.

C1—14 to 26 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky; slightly hard when dry, friable when moist; violent effervescence; mildly alkaline; clear, smooth boundary.

C2—26 to 38 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; moderately alkaline; abrupt, smooth boundary.

C3—38 to 44 inches, very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) when moist; few, fine, faint mottles; massive (structureless); soft when dry, very friable when moist; slight effervescence; mildly alkaline; abrupt, smooth boundary.

C4—44 to 50 inches, light-gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) when moist; few, coarse, distinct mottles; massive (structureless); hard when dry, firm when moist; slight effervescence; clear, smooth boundary.

IIC5—50 to 60 inches, brownish mixed sand and gravel; single grain (structureless); loose.

The A horizon ranges from 10 to 20 inches in thickness and from gray to grayish brown in color. The texture is silty clay loam, silt loam, and very fine sandy loam in some places. The layers between the surface layer (A horizon) and the mixed sand and gravel range from fine sandy loam to clay loam in texture and from light gray to brownish gray in color. Sand or mixed sand and gravel is at a depth of as little as 20 inches in some places. Lime is at the surface in most places. Mottles may occur within 30 inches of the surface, and pebbles commonly are scattered throughout the profile.

The McCook soils are darker colored than the Haverson or Glenberg soils. In addition, the material beneath the surface layer is finer textured than that in Glenberg soils. McCook soils have a lower water table and are better drained than the Las and Gering soils. They are better drained than the McGrew and Las Animas soils and have finer textured material beneath the surface layer. McCook soils have more stratified sandy material in their profile than the Bridgeport soils. The McCook soils are finer textured and more stratified between the surface layer and the lower part of the substratum than the Bayard soils.

McCook loam, 0 to 1 percent slopes (Mo).—This deep, well-drained, nearly level soil is on bottom lands. Runoff is slow.

In most places the profile of this soil is the one described as typical for the McCook series. The surface layer is dominantly loam in texture, but some areas of silt loam and very fine sandy loam were included in the mapping. In an area of this soil west of Scottsbluff, the material from the bottom of the surface layer to a depth of 24 inches is darker colored than that in the profile described as typical for the McCook series. In an area near Morrill the soil is not limy in the surface layer. In a few small places mixed sand and gravel is at a depth of 24 to 40 inches.

This is one of the best soils for farming in the valley of the North Platte River. All crops commonly irrigated are suited. Crops grow well when irrigation management is good. Nonlegume crops respond to added nitrogen, and in most places alfalfa responds to phosphate. Management is needed to control soil blowing when the soil is not protected by growing crops or crop residue. Capability units IIIc-1 (dryland) and I-1 (irrigated); Silty Lowland range site; Silty to Clayey windbreak suitability group.

McCook silty clay loam, gravel substratum variant, 0 to 1 percent slopes (3Mo).—This soil occurs on high bottoms along the North Platte River between Lyman and Henry. The water table has declined and is now at a depth of 10 or 11 feet. Mottling caused by the previously high water table is evident. Mixed sand and gravel is at a depth ranging from 20 to 40 inches.

The surface layer is gray, firm silty clay loam about 12 inches thick. This layer is hard when dry, firm when moist, and sticky when wet. It is limy and moderately alkaline. Underlying the surface layer is light-gray loam that has distinct brown mottles. It is structureless, friable, and rich in lime. The lower part is sandier than the upper part. Mottles are common in the upper part of the mixed sand and gravel. Small pebbles are on the surface and scattered throughout the profile. Included with this soil in mapping were a few areas where the depth to sand and gravel is less than 20 inches. Also included are small areas that have a sandy material directly beneath the surface layer.

When moist, this soil is somewhat difficult to till because the surface layer is sticky. Because the soil is only moderately deep to mixed sand and gravel, it has low to medium water-holding capacity. The rate of water intake is slow. Permeability is moderate.

All of this soil is irrigated. When the management of irrigation water is good, alfalfa, corn, field beans, and sugar beets grow well. Potatoes are not well suited, because the surface layer is firm. If dryfarmed, this soil is droughty. Capability units IVe-1 (dryland) and IIs-5 (irrigated); range site not assigned; Silty to Clayey windbreak suitability group.

McGrew Series

The McGrew series consists of nearly level, somewhat poorly drained soils that are moderately deep over mixed sand and gravel. These soils formed in alluvium on bottom lands along the North Platte River.

In a typical profile, the surface layer is light brownish-gray loam about 10 inches thick. It has weak granular structure, is friable, and is rich in lime.

Underlying the surface layer is light-gray stratified materials about 18 inches thick. When these materials are mixed, the texture is fine sandy loam. Most of this layer is massive, but some parts have platy structure. This layer has many, medium, distinct, brownish mottles. It is very friable and contains only a small amount of lime.

Below a depth of 28 inches is brownish, mixed sand and gravel that is distinctly mottled in the upper part.

The McGrew soils have moderate to moderately low water-holding capacity. Permeability of the material between the surface layer and the mixed sand and gravel is moderately rapid. Runoff is slow. Capillary rise of water from the water table provides moisture for plants during some seasons. Soil blowing is a hazard in fall and early in spring if these soils are not adequately protected.

About half the acreage of McGrew soils is in irrigated crops. Alfalfa, corn, and sugar beets are the most common crops, but field beans and potatoes are also grown. Because irrigation water is available in most places, only a small acreage of these soils is dryfarmed. If dryfarmed, these soils are somewhat droughty for shallow-rooted crops. Native grasses grow well on these soils. In many areas the grasses are mowed, and the hay is baled or stacked for winter use.

Typical profile of a McGrew loam, in an irrigated field, 0.26 mile west and 0.24 mile north of the southeast corner of section 26, T. 21 N., R. 53 W.:

Ap—0 to 8 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist; violent effervescence; abrupt, smooth boundary.

A1—8 to 10 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist; violent effervescence; clear, smooth boundary.

C1—10 to 28 inches, light-gray (2.5Y 7/2) stratified very fine sandy loam, fine sandy loam, and loamy very fine sand; grayish brown (2.5Y 5/2) when moist; many, medium, distinct mottles of yellowish brown; generally massive but platy in some parts; soft when dry, very friable when moist; slight effervescence; clear smooth boundary.

IIC2—28 to 60 inches, brownish mixed sand and gravel; loose; noncalcareous; distinct mottles in upper part.

The surface layer (A horizon) ranges from 8 to 17 inches in thickness and from grayish brown to light brownish gray in color. The texture is mainly loam and fine sandy loam. Texture of the stratified layers between the surface layer and a depth of 28 inches ranges from loam to loamy fine sand, but when the layers are mixed the texture is fine sandy loam. These layers range from light gray to light brownish gray or pale brown in color. Mottles are faint to prominent. Depth to the mixed sand and gravel ranges from 20 to 40 inches. The water table is at a depth of 3 to 5 feet most of the year.

McGrew soils are similar to Gering soils but have coarser textured material beneath the surface layer. They are deeper than the Las Animas soils. The McGrew soils are not so well drained as the McCook, Haverson, and Glenberg soils, which have a lower water table.

McGrew loam (0 to 1 percent slopes) (Mg).—This is a nearly level, moderately wet soil on bottom lands. It is 20 to 40 inches deep to mixed sand and gravel. The water table is at a depth of 3 to 5 feet.

The profile of this soil is the one described as typical for the McGrew series. Included with this soil in the mapping were a few small areas of fine sandy loam. Also included were small areas that are less than 20 inches deep to gravel, a few spots that are saline-alkali, and small areas of Gering soils.

Most of this soil is in irrigated crops. All the crops commonly irrigated in the county are suited. Crops grow well where irrigation is frequent, runs are short, and large amounts of fertilizer are added. Nonlegume crops commonly benefit from added nitrogen; alfalfa generally benefits from phosphate. Hay and pasture grasses grow well on this soil where management is good. Capability units IIw-4 (dryland) and IIw-4 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

McGrew fine sandy loam (0 to 1 percent slopes) (Mf).—This is a nearly level moderately wet soil. It is 20 to 40 inches deep to mixed sand and gravel.

Except that it has a fine sandy loam surface layer, this soil is similar to the one described as typical for the McGrew series. Included with this soil in mapping were small areas deeper than 40 inches to mixed sand and gravel and a few areas that have medium-textured material between the surface layer and the mixed sand and gravel. Also included were a few spots that are saline-alkali. Where this soil has been leveled, its surface layer is lighter colored than that in areas not leveled.

About half of this soil is in irrigated crops commonly grown in the county. These crops grow well if management is good. Because this soil has a moderately low water-holding capacity, irrigations should be frequent, especially during periods when the water table is low. The acreage not in irrigated crops is in permanent pasture or meadow. Hay and pasture plants grow well under good management. Capability units IIIw-6 (dryland) and IIw-6 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

McGrew loam, alkali (0 to 1 percent slopes) (2Mg).—This soil is on bottom lands and is 20 to 40 inches deep to mixed sand and gravel.

This soil has many saline-alkali spots and is moderately affected by them, but not uniformly. Crusts of salts on this soil are common from late in fall to late in spring. The concentration of salt ranges from 0.2 to 0.5 percent in the surface layer. The alkalinity ranges from pH 8.5 to 9.0. This salt and alkali influence management of the soil and the choice of crops but do not prevent cultivation of many crops.

Where saline-alkali spots occur in pastures, a thin clayey layer is at a depth of about 2 to 6 inches. This layer has prismatic structure. Where these spots occur in cultivated fields, the surface is puddled and the rate of water intake is very slow. These spots are affected by both salts and alkali, but the alkali causes more damage and is harder to eliminate.

Except for the content of salts and alkali and the loam surface layer, this soil has a profile similar to the one described as typical for the McGrew series. A few areas of fine sandy loam were included in the mapping. Also included were areas of Gering and Las soils that are affected by salts and alkali.

About one-third of the acreage is in irrigated crops. Sugar beets, alfalfa, and corn are better suited than field beans or potatoes. Barnyard manure added to cultivated soils improves infiltration. Sulfur or gypsum added early in spring helps to neutralize the alkali, but seldom permanently unless the water table is lowered. Lowering the water table is difficult in most places. Treatment generally must be repeated at least every 5 years. Most of this soil is in native pasture or hay. Because this soil is subirrigated, native plants grow well. Capability units IVs-1 (dryland) and IIIs-1 (irrigated); Subirrigated range site; Moderately Saline or Alkali windbreak suitability group.

Minatare Series

The Minatare series consists of deep, strongly alkali soils that have a fine-textured subsoil. These are nearly level and somewhat poorly drained soils on bottom lands in the valley of the North Platte River. They formed in alluvium. Minatare soils occur in a general area northwest and southeast of Minatare and in another area northeast of Lyman. Small, shallow, intermittent streams are common in most areas.

In a typical profile, the upper part of the surface layer is gray loam only about 1½ inches thick. It has weak crumb structure. This part is friable, nonlimy, and mildly alkaline. The lower part is light-gray loam about 1½ inches thick. It has weak platy structure. This part is leached, nonlimy, and strongly alkaline.

The subsoil is light brownish gray and is about 17 inches thick. It is very strongly alkaline, moderately saline, and rich in lime. The upper part of the subsoil is clay loam that is hard when dry and very firm when moist. The lower part is clay loam that is hard when dry and firm when moist. Structure is prismatic, blocky, or subangular blocky.

Below the subsoil is a layer of accumulated lime about 13 inches thick. This layer is clay loam that has subangular blocky structure. It is very strongly alkaline and strongly saline. When moist, this layer is firm in the upper part and very firm in the lower part.

The substratum at a depth of 33 inches is olive-gray sandy clay loam. This layer has common, medium, distinct, reddish-brown mottles. It is firm, very strongly alkaline, and mildly saline. Mixed sand and gravel occurs at a depth of about 40 inches.

Soils of the Minatare series have a high water-holding capacity. Permeability in the subsoil is slow. When the soils are disturbed, they crack at the surface when dry and become badly puddled when wet. Puddled soils absorb water very slowly. Tillage is difficult. These soils release moisture slowly to plants. Because of the capillary rise of water from the water table, these soils are moist from the water table to the surface much of the year.

Practically all the acreage of the Minatare soils is in permanent pasture or hay. Many areas have been cultivated, but now they are too strongly affected by alkali and salts for cultivated crops. Inland saltgrass, alkali sacaton, and western wheatgrass are the most common native grasses.

Typical profile of a Minatare loam, 600 feet west and 200 feet north of the southeast corner of section 29, T. 21 N., R. 52 W.:

A1—0 to 1½ inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, crumb structure; soft when dry, friable when moist; mildly alkaline; abrupt, smooth boundary.

A2—1½ to 3 inches, light-gray (10YR 7/1) loam, gray (10YR 5/1) when moist; weak, thin, platy structure; soft when dry, friable when moist; strongly alkaline; abrupt, wavy boundary.

B2t—3 to 7 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that breaks to moderate, medium, blocky structure; hard when dry, firm when moist; very strongly alkaline, violent effervescence; clear, smooth boundary.

B3t—7 to 20 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist; very strongly alkaline; strong effervescence; clear, smooth boundary.

C1ca—20 to 26 inches, light-gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist; very strongly alkaline; strong effervescence; clear, smooth boundary.

C2ca—26 to 33 inches, light brownish-gray to light-gray (10YR 6.5/2) clay loam, grayish brown (10YR 5/2) when moist; moderate, medium, subangular blocky structure; very hard when dry, very firm when moist; very strongly alkaline; strong effervescence; abrupt, wavy boundary.

IIC3g—33 to 40 inches, light olive-gray (5Y 6/2) sandy clay loam, olive gray (5Y 4/2) when moist; common, medium, distinct mottles of reddish brown; massive (structureless); slightly hard when dry, firm when moist; very strongly alkaline; clear, wavy boundary.

IIIC4—40 to 50 inches +, brownish mixed sand and gravel; medium, distinct, yellowish-brown mottles in the upper part; single grain (structureless).

In undisturbed Minatare soils the upper part of the surface layer is 1 to 2 inches thick; the lower part is 1 to 3 inches thick. Texture of the surface layer is commonly loam, very fine sandy loam, or fine sandy loam. In some places the lower part is limy and strongly alkaline. In places the subsoil has prismatic structure that breaks to moderate angular or subangular blocky structure. The layer of accumulated lime does not occur in all places. A dark-colored, buried soil is common in these soils. Depth to mixed sand and gravel ranges from 40 to more than 60 inches. Depth to the water table ranges from 2 to 6 feet.

The Minatare soils are darker colored than Janise soils and have a finer textured, more strongly developed subsoil. They closely resemble the slickspots in the Slickspots-Keith complex, but they have a higher water table.

Minatare-Janise soils (0 to 1 percent slopes) (MJ).—This complex is about 60 percent Minatare soils and 40 percent Janise soils. In most places areas of these soils are so small and so intermingled that they cannot be separated on the soil map of the scale used. Runoff is very slow or nonexistent.

A profile of Janise soils is described under the Janise series. Areas of this complex have many small depressions in which water stands after rains. In these small depressions, the soils are more strongly saline-alkali than they are in surrounding areas. Some small areas are bare of vegetation. Thick white salt crusts cover the soils in these areas late in fall and early in spring. In an area west of Scottsbluff, the salinity is more serious than alkalinity. Included with this complex in mapping were a few areas that have a fine sandy loam surface layer and some that have a moderately fine textured subsoil. The thin, gray loam surface layer does not occur in all areas of this complex.

The strongly saline-alkali condition of this complex is the main limitation to use. Cultivated crops grow poorly, and grass is a better use. Where the owner desires to seed cultivated areas to permanent grass, tall wheatgrass is one of the better tame grasses. Without lowering the high water table in these soils, the chances for successful reclamation is poor. Before spending money, time, and effort to reclaim these soils, the owner should consult a technician. Capability units VIs–1 (dryland) and VIs–1 (irrigated); Saline Subirrigated range site; windbreak suitability group not assigned.

Mitchell Series

The Mitchell series consists of deep, well drained or moderately well drained, immature soils that have a medium-textured layer beneath the surface layer. These soils formed in material that weathered from Brule siltstone and then was transported and deposited to form short foot slopes or broad, nearly level, basinlike fans. Mitchell soils range from nearly level to steep. They are widely scattered throughout the county.

In a typical profile, the surface layer is light brownish-gray silt loam about 11 inches thick. It has weak granular structure in the upper part and in the lower part weak prismatic structure. This layer has a moderate amount of lime and is mildly alkaline to moderately alkaline.

Beneath the surface layer is about 8 inches of grayish-brown silt loam. This layer has subangular blocky structure, is rich in lime, and is mildly akaline. It is slightly hard when dry and friable when moist.

The substratum is light brownish-gray silt loam. It is rich in lime, is mildly alkaline, and extends to a depth of more than 5 feet. In the upper part, this layer has subangular blocky structure and is friable when moist. The lower part is massive, or structureless. It is soft when dry and very friable when moist.

Soils of the Mitchell series have medium water-holding capacity. Permeability of the underlying layers is moderate. These soils are susceptible to soil blowing and to water erosion when they are not adequately protected by growing crops, crop residue, or permanent vegetation.

Crops grow well on the less sloping Mitchell soils. About 70 percent of the acreage of Mitchell soils is irrigated. Many of the more sloping areas are higher than the irrigation ditches and are dryfarmed, and a few areas are in native pasture. In most of the native pastures short grasses grow, but mid grasses are on some of the sandier areas.

Typical profile of a Mitchell silt loam, 1,740 feet west and 475 feet south of the northeast corner of section 23, T. 22 N., R. 56 W.:

Ap—0 to 9 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; hard when dry, friable when moist; mildly alkaline; slight effervescence; abrupt, smooth boundary.

A1—9 to 11 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure; hard when dry, friable when moist; moderately alkaline; strong effervescence; abrupt, smooth boundary.

AC—11 to 19 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; mildly alkaline; violent effervescence; clear, smooth boundary.

C1—19 to 29 inches, white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist; mildly alkaline; violent effervescence; gradual, smooth boundary.

C2—29 to 60 inches, white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) when moist; massive (structureless); soft when dry, very friable when moist; mildly alkaline; violent effervescence.

The surface layer (A horizon) ranges from 2 to 20 inches in thickness. The texture commonly is silt loam, loam, very fine sandy loam, or fine sandy loam. Depth of lime ranges from the surface to 10 inches. The surface layer ranges from light brownish gray to light gray. In some areas where this layer is less than 5 inches thick, it is grayish brown. The layer beneath the surface layer is mainly silt loam, but in places it is loam or very fine sandy loam. Its structure ranges from massive to weak subangular blocky. Thin sandy layers are common in the substratum. Depth to Brule siltstone bedrock generally is more than 60 inches, but in places it is only 40 inches.

The Mitchell soils are lighter colored than Tripp soils. They are not so strongly developed as Tripp soils and have lime nearer the surface. Although Mitchell and Bridgeport soils are in similar positions, Mitchell soils are lighter colored and formed in material that weathered from siltstone, whereas Bridgeport soils formed in material that weathered from grayish sandstone. The Mitchell soils and the Keota and Epping soils formed in material that was derived from siltstone, but the siltstone underlying Mitchell soils is below a depth of 60 inches. Mitchell soils are less strongly developed beneath the surface layer than the Keith soils. In contrast to Mitchell soils, Keith soils formed in wind-deposited materials, are darker colored, and have lime lower in their profile. Mitchell soils are coarser textured than Buffington soils.

Mitchell fine sandy loam, 0 to 3 percent slopes (MzA).—This soil is nearly level or very gently sloping. Runoff is slow.

The fine sandy loam surface layer ranges from 10 to 20 inches in thickness. It is very friable and rich in lime. In many areas, the surface layer is made up of material that was blown from adjacent deep sandy soils.

Except for texture of the surface layer, this soil has a profile similar to the one described as typical for the Mitchell series. Included with this soil in the mapping were areas where a dark, buried soil occurs. Also included were a few areas of loamy fine sand, and many areas that have a darker colored surface layer than is typical for the series. In some areas, the dark color extends to a depth of 24 to 30 inches. Other inclusions are small areas of Keota soils, and areas near Lyman that have a silty clay loam subsoil.

Soil blowing, water erosion, and the maintenance of fertility are the main concerns of management. When the soil is not protected by a growing crop or crop residue, the surface should be roughened to prevent soil blowing. Contour farming and bench leveling are good practices on this soil. Most areas are irrigated.

Maintaining the fertility of this soil is important. Nonlegume crops respond to large amounts of nitrogen, and alfalfa generally responds to phosphate. Particularly beneficial are a cropping sequence that provides a legume, a green crop that is plowed under, and crops that leave a large amount of residue. All crops commonly irrigated in the county are suited to this soil. Growth of crops is favorable when management is good. Capability units IIIe–3 (dryland) and IIe-3 (irrigated); Limy Upland range site; Sandy windbreak suitability group.

Mitchell fine sandy loam, 3 to 5 percent slopes (MzB).—This soil occurs on crests and side slopes of low ridges. Runoff is medium. Nearly all areas are moderatey eroded.

The surface layer is light brownish gray or light gray and is about 8 inches thick. It is rich in lime. Erosion has been severe in places, and subsoil material is exposed at the surface. In eroded places tillage has mixed the original dark surface layer with subsoil material.

Except for texture of the surface layer, this soil has a profile similar to the one described as typical for the Mitchell series. Included with this soil in mapping were areas of loam and very fine sandy loam and some areas where fine sandy loam extends to a depth of 24 inches. Also included were small areas of Keota soils.

Soil blowing, water erosion, and the maintenance of fertility are the main concerns of management. The soil is low in organic-matter content. Contour farming and bench leveling are practices that help to control water erosion. Keeping the soil covered by growing crops or crop residue helps to control blowing. Nearly all areas of this soil are irrigated. Only a few areas are dryfarmed. In dryfarmed areas, alternating crops with fallow under a stubble mulch conserves moisture and helps to control soil blowing. Contour terraces also can be used. Capability units IIIe-3 (dryland) and IIIe-3 (irrigated); Limy Upland range site; Sandy windbreak suitability group.

Mitchell fine sandy loam, 5 to 9 percent slopes (MzC).—This sloping soil has medium to rapid runoff.

Except for texture of the surface layer, this soil has a profile similiar to the one described as typical for the Mitchell series. The surface layer is about 8 inches thick in cultivated fields and about 12 inches thick in pastures of native grass. This layer consists of sandy material blown from adjacent deep sandy soils. Included with this soil in mapping were areas where the sandy material extends to a depth of 24 inches. Also included were small areas of Keota soils.

About two-thirds of the acreage of this soil is dryfarmed, mainly to wheat. Cultivated fields have been eroded by soil blowing. Where erosion has been most severe, the pale-brown or light-gray material beneath the surface layer is exposed at the surface.

Soil blowing and water erosion are the main concerns of management. Contour terraces help to control water erosion and also help to reduce evaporation. The soil is droughty when it is dryfarmed, and practices for conserving moisture are needed. Tillage that roughens the surface may be needed to help reduce soil blowing during periods of high wind. Capability units IVe-3 (dryland) and IVe-3 (irrigated); Limy Upland range site; Sandy windbreak suitability group.

Mitchell silt loam, 0 to 1 percent slopes (Mt).—This is the largest single mapping unit in Scotts Bluff County. The soil is nearly level and colluvial-alluvial. It occurs in the Mitchell Valley, in the Gering Valley, and on the Lyman Plain, and in scattered areas elsewhere in the county. Runoff is slow.

The profile of this soil is the one described as typical for the Mitchell series. In the area of the Lyman Plain, this soil is slightly darker colored than it is in the Mitchell and Gering Valleys. A grayish-brown surface layer is common, and in some areas it extends to a depth of 24 inches. The dark color comes from a dark, buried soil that occurs in many places. Included with this soil in mapping were areas of loam and very fine sandy loam. Also included were small areas that are nonlimy to a depth of 24 inches. Southeast of Lyman a few areas were included where the subsoil is silty clay loam.

This is one of the better soils for irrigated crops in Scotts Bluff County. The main crops are corn, sugar beets, potatoes, field beans, and alfalfa. After field beans or sugar beets have been harvested and the soil is bare, it is susceptible to soil blowing. Tillage that brings clods to the surface is needed to help control blowing. This soil is also susceptible to water erosion. Careful management of irrigation water on fields in row crops helps to prevent gullying. Nonlegume crops respond to added nitrogen, and legume crops to phospate. Only a few scattered fields are dryfarmed. Stripcropping and leaving the soil fallow under a stubble mulch are effective practices for controlling soil blowing and conserving water. A small acreage is in pasture consisting mainly of short and mid grasses. Capability units IIIc-1 (dryland) and I-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Mitchell silt loam, 1 to 3 percent slopes (MtA).—This very gently sloping soil is extensive in the county. Runoff is slow.

The profile of this soil is similar to the one described as typical for the Mitchell series. In some moderately eroded areas the surface layer is thinner and lighter colored. In other areas the surface layer is darker colored than that described for the series. In the Gering Valley and on the Lyman Plain, a dark, buried soil occurs in some places. Included with this soil in mapping were areas of loam and very fine sandy loam and a few areas that are affected by alkali below a depth of 30 inches. Also included were small areas of Keota soils.

About two-thirds of the acreage of this soil is in irrigated crops. The rest is above irrigation ditches and is dryfarmed, mainly to wheat. Only a few acres are in grass. In the southwestern part of the county, windblown material is mixed into the surface layer in most areas.

Growth of crops is favorable in irrigated areas. Soil blowing and water erosion, the main concerns of management, can be controlled by contour farming, bench leveling, or other good practices. This soil should be kept covered by growing crops or by crop residue, or the surface should be kept rough and cloddy to control soil blowing. Additions of fertilizer are needed in irrigated areas for favorable growth of crops. Nonlegume crops respond to nitrogen, and alfalfa generally responds to phosphate. Stubble mulching on soils in fallow and stripcropping are ways to conserve moisture and control soil blowing in dryfarmed areas. Capability units IIe-1 (dryland) and IIe-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Mitchell silt loam, 3 to 5 percent slopes (MtB).—This gently sloping soil is on crest and side slopes of low ridges. Runoff is medium.

In most areas this soil has a profile similar to the one described as typical for the Mitchell series. About half the acreage is slightly to moderately eroded. In these eroded areas the surface layer is lighter colored and thinner than that in the uneroded areas. Where this soil is in lower positions, the surface layer is darker colored than is typical for the series. Included with this soil in mapping were areas of loam and very fine sandy loam and small areas of Keota soils.

About half the acreage of this soil is in irrigated crops, mainly corn, alfalfa, field beans, sugar beets, and potatoes. Contour furrows and bench leveling can be used on this soil to control water erosion. Corrugations are suitable for close-growing crops. Keeping the ground covered with growing crops or crop residue helps to control soil blowing. Tillage that brings clods to the surface is a control measure in an emergency. Added nitrogen benefits nonlegume crops, and phosphate generally benefits alfalfa.

Most of the acreage not irrigated is dryfarmed to wheat. Terraces constructed on the contour control runoff. If areas are left fallow under a stubble mulch and alternately planted to crops, moisture is conserved and evaporation and soil blowing are reduced. Some areas are still in native grasses. The grasses are mainly blue grama, western wheatgrass, threadleaf sedge, needle-and-thread, and sideoats grama. Growth is fair to good where the pasture is not overgrazed. Capability units IIIe-1 (dryland) and IIIe-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Mitchell silt loam, 5 to 9 percent slopes (MtC).—This sloping soil is on the crest and side slopes of ridges. Runoff is medium to rapid.

About half of this soil is moderately eroded. In eroded areas the surface layer is light brownish gray or light gray and is thinner than that of uneroded areas. The lighter colored areas are in higher positions. Included with this soil in mapping were some small areas that have Brule siltstone bedrock at a depth of 20 to 40 inches. Areas of this soil in the southwestern part of the county have had loess mixed into the surface layer.

About three-fourths of the acreage of this soil is cultivated. Most areas are dryfarmed, mainly to wheat. A few areas on knolls or side slopes of ridges are irrigated. Soil blowing and water erosion are the main hazards to the use of this soil. Effective practices for controlling erosion are close spacing of terraces on the contour, stripcropping, stubble mulching, and alternating crops with fallow. Roughening the surface by tillage may be needed.

The mid and short grasses dominate in pastures. Growth is only medium, but the quality of the grasses is high. Pastures can be contour furrowed or pitted to hold the water on the soil. Overgrazing of these short grasses is to be avoided. Capability units IVe-1 (dryland) and IVe-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Mitchell silt loam, thin, 1 to 5 percent slopes (2MtB).—This soil is very gently sloping to gently sloping. Runoff is medium.

About three-fourths of the acreage of this soil has been severely eroded, and little of the original dark-colored soil material remains. The other one-fourth is still in native pasture, but the surface layer is only 2 to 6 inches thick.

Included with this soil in mapping were many areas where very fine sandy loam extends from the surface to a depth of more than 5 feet. Also included were areas that have a slightly dark colored, buried soil in their profile and places where siltstone is at a depth of 2 to 5 feet.

The cultivated areas are mostly dryfarmed to wheat. Soil blowing and water erosion are the main concerns of management. Terracing, contour stripcropping, and stubble mulching are effective in controlling erosion and conserving moisture.

In areas of this soil below irrigation canals, field beans, sugar beets, corn, alfalfa, and potatoes are grown. Growth is fair to good when large amounts of fertilizer are used. Alfalfa responds to phosphate. The soil can be protected from blowing by keeping it covered with a growing crop or crop residue. After crops are harvested in fall, bare fields should be roughened with a chisel or lister to prevent blowing. Added barnyard manure increases the organic-matter content, fertility, and the rate of water intake. It also improves tilth.

Some areas of this soil are still in native pasture. The main native grasses are blue grama, threadleaf sedge, western wheatgrass, and needle-and-thread. Growth is not too good, but the quality of these short grasses is high. Capability units IVe-9 (dryland) and IIIe-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Mitchell silt loam, thin, 5 to 9 percent slopes (2MtC).—This is a well-drained, light-colored, sloping soil. Runoff is moderately rapid.

Where this soil is in permanent pasture, the surface layer ranges from 1 to 6 inches in thickness. Cultivated areas have been severely eroded, and the surface layer is light gray or very pale brown. In these areas small gullies are common.

Included with this soil in mapping are areas that have a very fine sandy loam surface layer and subsoil and a few areas that have a thin, weakly formed, buried soil at a depth of 2 to 5 feet. Also included are areas where the layer beneath the surface layer has weak prismatic structure and is 2 to 8 inches thick, and some areas that have a nonlimy, darkened surface layer.

About four-fifths of the acreage of this soil is in native pasture of short and mid grasses. Growth is only fair, but the quality of the grasses is high. Management is needed that prevents overgrazing. Pasture grooving or pitting helps to keep the water on the soil and encourages the growth of grasses.

About one-fifth of the acreage of this soil is dryfarmed, mainly to wheat. This soil is low in natural fertility. The main hazards are water erosion and soil blowing, which are severe. Some eroded areas could be reseeded to crested wheatgrass or to a mixture of adapted native grasses. Gullied areas should be filled and then protected from further erosion by constructing diversions or terraces. A few fields are irrigated, but growth of crops is only fair. Capability units VIe-9 (dryland) and IVe-1 (irrigated); Limy Upland range site; Silty to Clayey windbreak suitability group.

Mitchell silt loam, thin, 9 to 20 percent slopes (2MtD).—This moderately steep to steep soil generally is on colluvial foot slopes below steep bluffs of Brule siltstone. In some areas deep gullies extend into adjacent steeper hills and bluffs.

About 90 percent of this soil is in native grass. Where this soil is under grass, the surface layer is 2 to 6 inches thick in most places. About 10 percent is dryfarmed to wheat. The dryfarmed areas are so steep that erosion has removed nearly all of the original dark-colored surface layer. The present surface layer is very light colored, and small gullies are common.

Included with this soil in mapping were small areas of very fine sandy loam and areas of the moderately coarse textured Otero soils. Fragments of Brule siltstone are common throughout the profile, and in some areas stones and boulders of siltstone and sandstone are on the surface. In places siltstone is at a depth of 20 to 40 inches.

This land is too steep for cultivation. All cultivated areas would benefit from seeding to tame crested wheatgrass or to a mixture of adapted grasses. The low fertility, rapid runoff, and steepness make the growing of cultivated crops a poor risk.

The main native grasses are blue grama, threadleaf sedge, western wheatgrass, and needle-and-thread. The growth of grasses is only fairly good, and care is needed to prevent overgrazing. Deferred grazing, rotation grazing, and other good practices of pasture management are beneficial. Capability unit VIe–9 (dryland), irrigated capability unit not assigned; Limy Upland range site; Silty to Clayey windbreak suitability group.

Mitchell silt loam, wet variant, 0 to 1 percent slopes (5Mt).—This is a moderately wet, nearly level soil that is slightly lower than adjacent soils. The higher, adjacent soils are underlain by Brule siltstone, and when they are irrigated, a perched water table forms because some of the irrigation water seeps into this lower soil. The perched water table is at a depth of about 36 inches and keeps this soil saturated below that depth much of the year. Most areas of this soil are in Gering Valley and on the Lyman Plain, but a few are in swales of the high terraces north of Minatare.

This soil has a profile similar to the one described as typical for the Mitchell series. The surface layer is mainly silt loam, but loam and very fine sandy loam were included in mapping. In about two-thirds of the acreage, the surface layer is gray or grayish brown, which is darker than is typical for Mitchell soils. This layer is about 20 inches thick, but in a few areas it is light colored and only about 8 inches thick. In most areas the layer beneath the surface layer has faint brownish mottles above the water table. The profile is limy throughout.

This soil is wettest during summer when water is in the irrigation canals, and wetness limits the use for crops. Because the soil warms slowly in spring, preparation of the seedbed and planting may be delayed. V-ditches are commonly used to remove some of the excess water.

Nearly all areas are in irrigated crops. Corn, alfalfa, and sugar beets grow well. A small acreage of field beans is grown, but potatoes are not well suited. Nonlegume crops respond to added nitrogen, and alfalfa generally responds to phosphate. Capability units IIw–4 (dryland) and IIw–4 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

Mitchell and Buffington soils, alkali, 0 to 5 percent slopes (2MBB).—These soils could be mapped separately, but they were mapped together because their use and management are essentially the same. About 75 percent of the mapping unit is Mitchell silt loam, and about 25 percent is Buffington silty clay loam. The soils are mainly nearly level, but in a few areas slopes range from 2 to 5 percent. These soils are moderately saline-alkali as a result of their being kept moderately wet much of the time by seepage from irrigation canals.

Profiles of Mitchell silt loam and of Buffington silty clay loam are described for the respective series. In places the surface layer is moderately saline or strongly alkaline. It is rich in lime in most areas. The layer beneath the surface layer is lighter colored loam, silt loam, or silty clay loam. This layer is generally strongly alkaline or moderately saline. It is rich in lime. The substratum ranges from loam to fine sandy loam. Generally this layer is not affected by salinity or high alkalinity.

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The water-holding capacity is moderately low in the silt loam soils and high in the silty clay loam soils. Permeability of the layer beneath the surface layer ranges from moderately slow to moderately rapid, depending on the texture. The rate of water intake is medium to moderately slow. These soils are wettest in summer when water is in the irrigation canals.

These moderately saline-alkali soils are suited to some crops that tolerate salts and alkali. Crops do not grow so well on these soils as they do on similar soils that are not affected by salts and alkali.

Seepage has caused the saline-alkali condition in most areas of this group, but seepage can be stopped by lining the higher lying irrigation canals and laterals with concrete. Where lining the canals is impractical, V-ditches or tile drains can be used to carry away excess water and to lower the water table. Commonly, the only feasible treatment is use of crops that tolerate alkali and irrigation management suitable for alkali soils.

Most areas of this group are in irrigated crops. Sugar beets, alfalfa, and corn are suited, though potatoes and field beans are not so well suited. These soils are susceptible to soil blowing when not protected by a cover of growing plants. Sloping areas are also susceptible to erosion by water, and a few of the more sloping areas are eroded. Only a small acreage is dryfarmed or in native grass. Capability units IVs–1 (dryland) and IIIs–1 (irrigated); Subirrigated range site; Moderately Saline or Alkali windbreak suitability group.

Mixed Alluvial Land

Mixed alluvial land (0 to 1 percent slopes) (3Sx) consists mainly of recent alluvial deposits bordering the North Platte River. It is cut by large channels of the river and by many smaller channels of intermittent streams. Areas between the streams are nearly level or very gently undulating.

The surface layer is generally less than 10 inches thick. It is slightly darkened in the upper 3 to 6 inches. This layer ranges from silty clay to medium sand but is loamy or sandy in most places. It overlies mixed sand and gravel. White soluble salts crust on the surface in some places early in spring.

Mixed alluvial land has very low water-holding capacity. The water table is generally at a depth of 2 to 4 feet. In some of the lower areas it is at 12 to 18 inches during the wetter periods, but these areas are not large. Capillary rise of moisture occurs only where there is enough fine material mixed with the sand and gravel. Gravel is at the surface in 5 to 15 percent of the acreage. Many sand and gravel pits are in this mapping unit.

During seasons when the water table is high or rainfall is heavy, this land produces a fair to good growth of native grasses and other forage plants. Where gravel is at the surface, however, there is only a sparse stand of vegetation, mainly weeds and some woody plants. During the summer and fall of most years, not enough moisture from either the water table or rainfall is available to sustain forage plants. In these months grazing is available only in the lower areas along drains and streambanks.

The native vegetation consists mainly of sand dropseed, prairie three-awn, blue grama, inland saltgrass, alkali sacaton, and switchgrass. Other plants are white sweetclover, bluegrass, indiangrass, and wildrye. The principal trees are cottonwood, willow, Russian-olive, and American elm.

Mixed alluvial land is too droughty for cultivated crops and is so shallow over mixed sand and gravel that it cannot be tilled successfully. This land is suited only to grazing. Some tame grasses can be grown in areas where the water table is high and the soil material is deep enough. Growth of herbage is medium during spring and early in summer, but it decreases late in summer, as the plants dry up for lack of moisture. Capability unit VIw-4 (dryland), irrigated capability unit not assigned; Subirrigated range site; not assigned to a windbreak suitability group.

Orella Series

The Orella series consists of fine-textured soils that are 10 to 20 inches thick over the Chadron formation. These soils are calcareous at the surface and are moderately well drained. In Scotts Bluff County, most areas of these soils are moderately affected by salts and alkali. Orella soils shrink and crack badly in dry weather and swell when they become wet. Slopes range from 0 to 3 percent. These soils occur in an area south of Lyman.

In a typical profile, the surface layer is light grayish-brown clay about 3 inches thick. It has granular structure. This layer is hard when dry, firm when moist, and very sticky when wet. It is rich in lime and moderately alkaline. Beneath the surface layer is a layer of light grayish-brown clay about 10 inches thick. It has medium and fine, moderate to strong, blocky structure. This layer is very hard when dry and very firm when moist. It is rich in lime and strongly alkaline.

The substratum, about 5 inches thick, is very pale brown clay that has many fragments of shale. It has medium, moderate to strong, blocky structure, is very hard when dry, and is very firm when moist. This layer is rich in lime and strongly alkaline. Many white accumulations of salt occur throughout this layer.

Sandy clay shale bedrock occurs at a depth of about 18 inches. The shale is gray to pale olive in color, but the seams contain pinkish-gray to pale-yellow clay.

These shallow Orella soils have low water-holding capacity. Permeability of the underlying layers is very slow. These clayey soils release water slowly to plants. They are ponded in the lower areas.

Nearly all areas of Orella soils are in permanent pasture. This pasture has a sparse stand of western wheatgrass, inland saltgrass, alkali sacaton, and Gardner saltbush.

Typical profile of Orella clay in a permanent pasture, 0.15 mile north and 50 feet east of the southwest corner of section 14, T. 22 N., R. 58 W.:

A1—0 to 3 inches, light grayish-brown (10YR 6/2) clay, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; hard when dry, firm when moist; strong effervescence; abrupt, smooth boundary.

AC—3 to 13 inches, light grayish-brown (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) when moist; medium and fine, moderate to strong, blocky structure; very hard when dry, very firm when moist; strong effervescence; clear, smooth boundary.

C—13 to 18 inches, very pale brown (10YR 7/3) clay that has many shale fragments, pale brown (10YR 6/3) when moist; medium, moderate to strong, blocky structure; very hard when dry, very firm when moist; strong effervescence; gradual, smooth boundary.

R—18 to 30 inches +, gray (5Y 5/1) to pale-olive (5Y 6/3) clay and sandy clay shale with splotches and seams of pinkish gray (7.5YR 6/2) to pale yellow (5Y 7/3); blocky structure; weak effervescence.

The surface layer ranges from 2 to 6 inches in thickness. Many chert fragments are scattered on the surface. The subsoil ranges from 8 to 14 inches in thickness. The saline layer is absent in some areas, but many areas are affected by alkali. Depth to the unweathered bedrock ranges from 10 to 20 inches.

The Orella soils are finer textured and grayer than Epping soils, which developed from weathered siltstone. Orella soils are finer textured than Shingle soils. Orella soils are shallower than Clayey alkali land. Orella soils are finer textured and shallower than the Buffington soil.

Orella clay, 0 to 3 percent slopes (OrA).—This soil is nearly level to very gently sloping. Runoff is slow to medium.

The profile of this soil is the one described as typical for the Orella series. In some areas material from adjacent soils has blown onto the original Orella soil, and these areas have a thin layer of loam or very fine sandy loam on the surface. The effect of salinity and alkalinity ranges from none to strong. Included with this soil in mapping were small areas of Clayey alkali land.

Because it is difficult to till, has low water-holding capacity, and has a high content of alkali, this soil is not suited to cultivated crops. It is better suited to grass, though some areas need to be reseeded. Reseeding with a mixture of alkali sacaton, western wheatgrass, and other plants that tolerate alkali might be successful, but reclamation of this soil is difficult. Rotation grazing, deferred grazing, and other practices of pasture management allow the grasses to grow better and to produce seed. Capability unit VIIs-1 (dryland), irrigated capability unit not assigned; Saline Upland range site; Windbreak suitability group not assigned.

Otero Series

The Otero series consists of deep, somewhat excessively drained, moderately coarse textured soils on foot slopes. These soils formed in material that washed from the sandy uplands. They are mainly in the northeastern part of the county, in a narrow belt that is above the High Line Canal but below the steep bluffs of the uplands. Only a few areas are south of the North Platte River. Slopes range from 1 to 12 percent.

In a typical profile, the surface layer is light brownish-gray fine sandy loam about 4 inches thick. It has weak granular structure and is very friable. This layer is free of lime and is moderately alkaline in reaction.

Beneath the surface layer is light-gray fine sandy loam. It has weak, coarse, prismatic structure. This layer is soft when dry and very friable when moist. It is rich in lime and is moderately alkaline.

At a depth of about 20 inches is a layer of loose, structureless, light-gray loamy very fine sand. This layer is rich in lime and is mildly alkaline. Chips and fragments of sandstone and siltstone are scattered throughout this layer.

Soils of the Otero series have moderately low to low water-holding capacity. Permeability of the underlying material is moderately rapid. These soils take in water rapidly and release it readily to plants. They have low organic-matter content and natural fertility. These soils are susceptible to soil blowing and water erosion.

Many areas of Otero soils are still in permanent pasture. The main native grasses are blue grama, prairie sandreed, sand dropseed, western wheatgrass, needle-and-thread, and threadleaf sedge. Growth of these grasses is only fair to good, but their quality is high. Some areas of Otero soils are below irrigation canals and are irrigated. The main crops are corn, field beans, alfalfa, potatoes, and sugar beets. Other areas of Otero soils are dryfarmed.

Typical profile of an Otero fine sandy loam, in a permanent pasture, 0.1 mile east and 20 feet south of the northwest corner of section 9, T. 23 N., R. 54 W.:

A—0 to 4 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist; moderately alkaline; abrupt, smooth boundary.

C1—4 to 20 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; weak, coarse, prismatic structure; soft when dry, very friable when moist; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—20 to 60 inches, light-gray (10YR 7/2) loamy very fine sand; single grain (structureless); loose when dry, very friable when moist; violent effervescence; moderately alkaline.

The surface layer ranges from 1 to 8 inches in thickness and from very fine sandy loam to fine sandy loam or loamy very fine sand in texture. Depth to lime ranges from 0 to 10 inches. The substrata ranges from 8 to 18 inches in thickness and from fine sandy loam to loamy very fine sand in texture.

Otero soils have a thinner surface layer and generally a lighter colored underlying material than Bayard soils. They have coarser textured underlying material than the Bridgeport soils. In addition, they have lime nearer the surface and are lighter colored. Otero soils are similar to Mitchell soils but have coarser textured underlying material.

Otero fine sandy loam, 1 to 5 percent slopes (OtB).—This is a light-colored, very gently sloping to sloping soil. Runoff is medium.

The profile of this soil is the one described as typical of the Otero series. Included with this soil in mapping were small areas of Mitchell and Bayard soils. A moderately dark colored, buried soil commonly occurs at a depth of 1 to 3 feet.

Where this soil is below an irrigation canal, it is used for irrigated crops. Adding barnyard manure increases fertility and the organic-matter content. Most crops respond to additions of nitrogen. Because soil blowing is a hazard, this soil needs to be protected by crop residue or by a cover of growing vegetation throughout the year. Tillage to roughen the surface may be needed in fall to control blowing. Because alfalfa is a close-growing crop and adds nitrogen to the soil, it is well suited to this soil.

This soil is suited to dryfarmed crops, particularly wheat. When it is dryfarmed, however, soil blowing is particularly severe. Stubble mulching, contour stripcropping, and terracing help to control erosion. This soil is droughty because the water-holding capacity is low.

Most areas of this soil are in short, mid, and tall native grasses. Growth is medium, but the quality of the grasses is high. The grasses should not be overgrazed. Capability units IVe-3 (dryland) and IVe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Otero fine sandy loam, 5 to 12 percent slopes (OtD).—This soil is sloping and moderately steep. Runoff is moderately rapid.

This soil is similar to the one described as typical for the Otero series. Included with this soil in mapping were a few small areas of Mitchell and of Bayard soils. In some of the steeper areas, this soil is underlain by siltstone bedrock at a depth of 2 to 5 feet. A slightly darkened, buried soil occurs in places.

Because of the hazard of soil blowing and water erosion and low fertility, this soil is not suited to dryland crops. A few areas are irrigated, but limitations to use are severe because of the steep slopes and low fertility. Contour furrowing and terracing are needed. Sprinkler irrigation is suitable for some crops. Land reshaping is generally needed before irrigating. Added nitrogen benefits nonlegume crops, and phosphate generally benefits alfalfa.

Most areas of this soil are in native pasture. Growth of grasses is fair to good. Deferred grazing, rotation grazing, and other good practices of pasture management are needed. Capability units VIe-3 (dryland) and IVe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Otero loamy fine sand, 0 to 5 percent slopes (OdB).—This light-colored, nearly level to sloping soil has a limy surface layer. Runoff ranges from slow to medium, depending on the slope. The coarse-textured surface layer is a result of winnowing. In winnowing, much of the organic matter and of the clay and silt are blown away, and the coarser material is left on the surface.

Except for the coarser textured surface layer, this soil has a profile similar to the one described as typical for the Otero series. In some areas lime is leached to a depth of 20 inches, and in some places the loamy fine sand extends to a depth of 18 to 24 inches. Included with this soil in mapping were areas of Bayard fine sandy loam, 1 to 3 percent slopes, and a few areas where the substratum is silt loam.

This soil is nearly all in irrigated crops. Soil blowing and low fertility are the main concerns of management. This soil is suited to all crops commonly irrigated, but management is needed that keeps the soil covered by crop residue or growing crops throughout the year. Added nitrogen benefits all nonlegume crops. This soil is dryfarmed only in occasional years. A few areas have been seeded to tame grasses. Capability units IVe-5 (dryland) and IVe-5 (irrigated); Sandy range site; Sandy windbreak suitability group.

Otero-Bayard fine sandy loams, 0 to 3 percent slopes (OBA).—About 80 percent of this complex is Otero fine sandy loam, and about 20 percent is Bayard fine sandy loam. Areas of these soils are so intermingled that it is not practical to separate them on a soil map. Runoff is slow. Permeability of the subsoil is moderately rapid. Although these soils are deep, they have low water-holding capacity.

Profiles of Otero and Bayard soils are described for their respective series. The Bayard soils have a darker colored surface layer than the Otero soils; otherwise, they are similar. Included with these soils in mapping were a few areas of Mitchell soils, which have a medium-textured subsoil. Also included were some areas of very fine sandy loam. In some areas soil blowing has severely damaged the soils of this complex and has left the surface uneven and rough. Also, there are a few small blowouts. A darkened, buried soil commonly occurs in some areas.

Most areas of this complex are irrigated. Growth of crops is favorable when management is good. Corn, field beans, potatoes, alfalfa, and sugar beets are the crops commonly grown. Soil blowing is the most serious hazard, especially in fall after crops have been harvested and the soils are bare. Keeping the surface roughened or keeping it covered with growing crops or crop residue is effective in controlling blowing. Added nitrogen benefits nonlegume crops, and phosphate benefits alfalfa. Adding barnyard manure increases fertility.

A small acreage is dryfarmed to wheat. Stubble mulching, alternating crops and fallow, and wind stripcropping are practices that help to control soil blowing and conserve much needed moisture.

Some acreage is in native pasture. Good practices of pasture management prevent overgrazing and help keep the grasses healthy and vigorous. In severely damaged areas, these soils need to be reshaped for irrigation where feasible. Where reshaping is not feasible, the areas should be planted to a tame grass or to a mixture of suitable native grasses. Capability units IIIe-3 (dryland) and IIe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Otero-Bayard fine sandy loams, 3 to 5 percent slopes (OBB).—About 60 percent of this complex is Otero fine sandy loam, and about 40 percent is Bayard fine sandy loam. Areas of these soils are so intermingled that it is not practical to separate them on the soil map. Runoff is medium. The Otero soils occur in the highest, most exposed areas; the Bayard soils are darker colored and occupy the lower slopes and swales. Most areas of this complex are moderately eroded.

Profiles of the Otero and Bayard soils are described for their respective series. Included with this complex in mapping were some areas that have a lighter colored surface layer and places where the original surface layer has been removed and the subsoil material is now the plowed layer.

Except for a few odd areas, these soils are cultivated. Growth of all crops commonly irrigated is good if large amounts of fertilizer, particularly nitrogen, are added. These soils are susceptible to soil blowing and water erosion. Damage by soil blowing can be controlled by keeping the soil covered by a growing crop, by crop residue, or by keeping the surface roughened and cloddy by tillage.

Where these soils are dryfarmed, winter wheat is the main crop. Terracing, stripcropping, and alternating crops with fallow under a stubble mulch are the practices needed to adequately control soil blowing and water erosion. Only a few small areas are in native pasture. Capability units IVe-3 (dryland) and IIIe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Otero-Bayard fine sandy loams, 5 to 9 percent slopes (OBC).—About 60 percent of this complex is Otero fine sandy loam, and about 40 percent is Bayard fine sandy loam. Areas of these soils are so intermingled that it is not practical to separate them on the soil map. These areas are scattered throughout the county, mainly on foot slopes below sandstone outcrops but also on breaks from benches or terraces.

Profiles of Otero and Bayard soils are described for their respective series. The Otero soils are light colored and occupy the moderately eroded knolls and side slopes. The Bayard soils are dark colored and are mainly on the lower slopes and in swales. The soils of this complex are limy at or near the surface. Tillage has mixed their original surface layer with subsoil material over most of the areas, and in places the subsoil is exposed at the surface.

Included with this complex in mapping were small areas of loam and very fine sandy loam and a few places where gravel is exposed at the surface. Also included were a few areas of Dunday soils.

Except for a few small areas, these soils are cultivated, and many areas are irrigated. Nearly all the irrigated crops grow well. Good control of irrigation water is needed. Contour farming, terracing, and bench leveling can be used to prevent the formation of gullies and other erosion. Soil blowing can be controlled by keeping the surface covered by growing crops or crop residue. On bare areas, tillage that makes the surface cloddy can be used.

Maintaining or improving fertility in irrigated areas is the main concern of management. Barnyard manure increases fertility, adds organic matter, and tends to help stabilize the soils against blowing. Added nitrogen benefits nearly all the nonlegume crops.

The dryfarmed areas are mainly in winter wheat. Terracing and alternating crops with fallow under a stubble mulch adequately control soil blowing and water erosion. Only a few areas of this complex are in native pasture. Capability units IVe-3 (dryland) and IVe-3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Otero-Bayard very fine sandy loams, 0 to 1 percent slopes (OC).—About 80 percent of this complex is Otero very fine sandy loam, and about 20 percent is Bayard very fine sandy loam. These nearly level soils occur in areas so intermingled that it is not practical to separate them on the soil map. Runoff is very slow. This complex occurs mainly in the Gering Valley and southeast of Melbeta. The surface layer is limy and absorbs moisture at a medium rate. Permeability of the subsoil is moderate.

Except for the slightly finer textured surface layer, the Otero and Bayard soils in this complex have a profile that is similar to the one described for their respective series. Included with this complex in mapping were a few areas of loam and areas of Mitchell soils.

Nearly all of this complex is used for irrigated crops. Under good management, corn, sugar beets, alfalfa, field beans, and potatoes grow well. Soil blowing is a serious hazard in fall after crops that leave little residue are harvested. The surface should be kept roughened during winter and early in spring. Except in emergencies, this complex is not dryfarmed. Only a few areas around farmsteads or odd areas are in native grasses. Capability units IIIc-1 (dryland) and I-1 (irrigated); Limy Upland and Sandy range sites; Silty to Clayey windbreak suitability group.

Platte Series

The Platte series consists of somewhat poorly drained soils that are 10 to 20 inches deep to mixed sand and gravel. The water table is at a depth of 2 to 5 feet. Platte soils formed in mixed alluvium on bottom lands in the valley of the North Platte River. These soils generally are nearly level, but in some places they are channeled by small, shallow drains.

In a typical profile, the surface layer is gray loam about 6 inches thick. This layer has weak granular structure and is rich in lime. Mottles or stains are faint.

Beneath the surface layer is a layer of stratified light-gray fine sandy loam, pale-brown fine sand, and very pale brown loam about 13 inches thick. This layer is rich in lime, is friable to loose, and is mottled.

The substratum, beginning at a depth of about 20 inches, is mixed sand and gravel. Mottles are common in the upper part. This layer is not limy.

Permeability is moderately rapid in the underlying layers and is very rapid in the substratum. The Platte soils have low water-holding capacity because they are shallow. When they are not protected, they are susceptible to soil blowing.

Most of the acreage of Platte soils is in native pasture or meadow. The common grasses are western wheatgrass, blue grama, big bluestem, inland saltgrass, and switchgrass.

Typical profile of a Platte loam, in a permanent pasture, about 0.45 mile south and 50 feet east of the northwest corner of section 18, T. 21 N., R. 53 W.:

A—0 to 6 inches, gray (10YR 5/1) loam, very dark grayish brown (10YR 3/2) when moist; few, fine, faint mottles; weak, medium, granular structure; slightly hard when dry, firm when moist; strong effervescence; clear, smooth boundary.

C1—6 to 9 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; few, medium, distinct mottles; weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist; violent effervescence; clear, smooth boundary.

C2—9 to 14 inches, very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) when moist; common, coarse, prominent mottles; single grain (structureless); loose; slight effervescence; abrupt, smooth boundary.

C3—14 to 19 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; many, medium, distinct mottles; weak, coarse, blocky structure; slightly hard when dry, friable when moist; slight effervescence; abrupt, smooth boundary.

IIC4—19 inches +, brownish mixed sand and gravel; loose; noncalcareous.

The surface layer ranges from 3 to 8 inches in thickness and from clay loam to sandy loam in texture. Texture of the material between the surface layer and the layer of mixed sand and gravel is widely variable. This material contains thin layers that range from silty clay to fine or medium sand. Mottles range from faint to prominent.

Platte soils are not so deep to mixed sand and gravel as the Glenberg, McGrew, or Las Animas soils. They are better drained than the Glenberg soils, and their water table is higher in the profile.

Platte soils (0 to 1 percent slopes) (P).—This is the only unit in the Platte series mapped in Scotts Bluff County. The surface layer ranges from clay loam to sandy loam. In a few places, coarse sand or mixed sand and gravel has been exposed at the surface by land leveling. In these areas, most of the soil material exposed is light colored. Included with this unit in mapping were small areas that are moderately saline-alkali. In these areas a white salt crust is on the surface early in spring. Also included were areas of McGrew soils.

About 50 percent of the acreage is irrigated. Corn, field beans, and sugar beets are the crops most commonly grown. Because these soils are shallow and water-holding capacity is low, good management is required to produce satisfactory growth of crops. Where these soils are in permanent pasture, they are crossed by shallow, intermittent streams. In areas where the water table is fairly high, Platte soils are used to produce native hay. Capability units VIw-4 (dryland) and IVs-4 (irrigated); Subirrigated range site; Moderately Wet windbreak suitability group.

Rock Outcrop Complexes

In Scotts Bluff County, Rock outcrop is mapped in a complex with the Epping soils and with the Tassel soils. In these complexes Rock outcrop makes up about 50 percent of the unit mapped. Areas of this land type consist chiefly of outcrops of siltstone and sandstone. These areas have no value for farming and little value as a wildlife habitat or as recreational areas.

Rock outcrop-Epping complex (9 to 100 percent slopes) (RE).—About 50 percent of this complex is siltstone outcrops, about 45 percent is Epping and other very shallow soils, and about 5 percent is Keota and Mitchell soils. The steeper areas are in the low canyons. Runoff is very rapid. This complex occurs in outlying areas of the Wildcat Hills and in the northeastern part of the county. Little water is absorbed because the slopes are steep and the soils are shallow. The water-holding capacity is very low.

A profile of Epping soils is described for the Epping series. The other very shallow soils are similar to Epping soils but have siltstone at a depth of less than 10 inches. The siltstone bedrock in the northeastern part of the county is slightly sandier than it is in other parts of the county.

Areas of this complex are used for native pasture, but they produce little grazing and are easily overgrazed. The main native grasses are little bluestem, blue grama, and sand dropseed. Some other plants that commonly occur are wild sweetclover, three-awn, yucca, and broom snakeweed. This complex furnishes some protection for wildlife. Capability unit VIIs-3 (dryland), irrigated capability unit not assigned; Shallow Limy range site; windbreak suitability group not assigned.

Rock outcrop-Tassel complex (9 to 100 percent slopes) (RT).—About 50 percent of this complex is sandstone outcrops, and about 45 percent is Tassel and other very shallow soils. The remaining 5 percent consists of moderately deep and deep soils in canyons. This complex occurs in the Wildcat Hills and in the sandstone uplands that break to the valley of the North Platte River in the northeastern part of the county. Runoff is very rapid.

A profile of Tassel soils is described for the Tassel series. The other shallow soils are less than 10 inches deep. In these soils the surface layer is loam, fine sandy loam, or loamy fine sand 2 to 6 inches thick. It is very friable and rich in lime. This layer overlies similar, lighter colored material or sandstone bedrock. In some areas both the sandstone bedrock and the shallow soils are noncalcareous.

The water-holding capacity of the soils in this complex is very low.

All areas of this complex are used for permanent pasture, but they produce little grazing and are easily overgrazed. Seeding grasses is not practical. Good grazing practices help to increase the usefulness of this complex. The most common native grasses are little bluestem, blue grama, sand dropseed, and prairie sandreed. Other common plants are yucca, green sagewort, scurfpea, prairie clover, and broom snakeweed. A few scattered pines and redcedars grow in the Wildcat Hills. Capability unit VIIs–3 (dryland), irrigated capability unit not assigned; Shallow Limy range site; Shallow windbreak suitability group.

Rosebud Series

The Rosebud series consists of well-drained, medium-textured, rolling soils on uplands. These soils formed in material that weathered from sandstone. Nearly all areas of these soils are in the Wildcat Hills.

In a typical profile, the surface layer is grayish-brown loam about 7 inches thick. It has weak granular structure. This layer is easily worked and is free of lime.

The subsoil is light brownish-gray loam about 21 inches thick. The upper part has weak prismatic structure that breaks to moderate subangular blocky. This part is nonlimy. The lower part is loam or very fine sandy loam, and the structure is not so well formed. This part contains a small amount of lime.

Beneath the subsoil is a layer of accumulated lime about 8 inches thick. This layer is light-gray loam that is easily penetrated by roots. It is soft when dry and very friable when moist.

The substratum has the same color and texture as the layer above. It is massive, or structureless, friable, and rich in lime. Weathered chips and fragments of sandstone are common throughout the substratum.

Soils of the Rosebud series have medium water-holding capacity. Permeability of the subsoil and underlying layer is moderate. These soils have high natural fertility and are easily worked. Soil blowing and water erosion are serious hazards to the use of these soils for dryfarming.

The Rosebud soils developed under a cover of fixed short and mid grasses, and about 85 percent of the acreage is still in permanent pasture. Blue grama, needle-and-thread, and western wheatgrass are the main native grasses, but threadleaf sedge is common. These grasses grow well when the pasture is not overgrazed. About 15 percent is dryfarmed, mainly to wheat.

Typical profile of Rosebud loam, in a permanent pasture, about 0.1 mile east and 15 feet south of the northwest corner of section 33, T. 21 N., R. 56 W.:

A—0 to 7 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist; clear, smooth boundary.

B2—7 to 20 inches, light brownish-gray (10YR 6/2) heavy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; hard when dry, friable when moist; clear, smooth boundary.

B31—20 to 28 inches, light brownish-gray (10YR 6/2) loam or very fine sandy loam, grayish brown (10YR 5/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist; slight effervescence; gradual, smooth boundary.

B32ca—28 to 36 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; weak; coarse, subangular blocky structure; soft when dry, very friable when moist; strong effervescence; gradual, smooth boundary.

C—36 to 60 inches, color and texture same as B32ca horizon; massive (structureless); soft when dry, friable when moist; violent effervescence.

The surface layer ranges from 7 to 14 inches in thickness. Texture of the surface layer is very fine sandy loam in many places. The subsoil ranges from loam to light silty clay loam in texture and from 12 to 36 inches in thickness. It is slightly finer textured than the surface layer. Depth to the zone of accumulated lime ranges from 18 to 42 inches. In some areas, lime has accumulated in the lower subsoil. The sandstone bedrock generally is at a depth of 3 to more than 5 feet, and small outcrops of sandstone are common.

Rosebud soils are similar to Keith soils in development and texture of the subsoil, but the Keith soils formed in loess instead of material that weathered from sandstone. The Rosebud soils have a finer textured, more strongly developed subsoil than the Anselmo soils. Their surface layer is not so thick as that of Duroc soils, which formed in low swales. Rosebud soils have a more strongly developed subsoil than Tripp soils.

Rosebud loam, 5 to 9 percent slopes (RbC).—This is a well-drained, rolling soil. Runoff is medium.

The profile of this soil is the one described as typical for the Rosebud series. The surface layer is mainly loam, but many areas of very fine sandy loam were included in the mapping. Also included were Duroc soils in small swales and areas of Creighton soils. Other inclusions were some small areas that are only 20 to 40 inches deep over the sandstone and outcrops of rock in scattered places.

Only a few areas of this soil are cultivated. These areas are dryfarmed, mainly to wheat. In some of the higher positions, this soil is lighter colored because wind has blown away much of the organic matter. Growth of crops is good, however, where soil blowing and water erosion are controlled. Alternating crops with fallow under a stubble mulch, stripcropping, and terracing are effective in controlling erosion. Where this soil is in permanent pasture, the grasses grow well and are nutritious when rotation grazing, deferred grazing, and other good practices of pasture management are used. Capability unit IVe–1 (dryland), irrigated capability unit not assigned; Silty range site; Silty to Clayey windbreak suitability group.

Sandy Alluvial Land

Sandy alluvial land (0 to 3 percent slopes) (Sx) is in long, narrow strips along the sides of shallow intermittent streams. These streams flow from the sandstone uplands in the northeastern part of the county. They overflow during heavy rains. Flooding occurs about once each year, mainly in spring, but this land is dry during the rest of the year. The streambeds are 1 to 5 feet deep and 8 to 20 feet wide. At times these streambeds are used by ranchers as cattle trails because they are more easily traveled by cattle than the adjacent steeper areas. Most of the soil material in this unit was deposited by water, but some has been reworked by wind.

In about 60 percent of this land, the soil material is deep or moderately deep and moderately coarse textured; in about 20 percent, shallow or very shallow to Brule siltstone; and in about 15 percent, coarse textured. Rock outcrops, mainly of siltstone, make up the remaining 5 percent. Rocks and small boulders are commonly on the surface.

In the broad, flat streambeds soil blowing is common and vegetation is sparse. The areas along the channels produce a fair growth of grasses, mainly blue grama, needle-and-thread, Indian ricegrass, and sand dropseed. Other plants are western wheatgrass and prairie sandreed.

Ground water is not high enough to affect the use of this land. The land is not suited to cultivation, because rock outcrops and loose boulders seriously hinder the use of tillage implements. Also, flooding is serious during spring, and crops would be washed out nearly every year. These long, narrow strips of Sandy alluvial land occur near other soils that are used almost exclusively for range, and pasture is probably their best use. Capability unit VIs-43 (dryland), irrigated capability unit not assigned; Sandy Lowland range site; Shallow windbreak suitability group.

Satanta Series

The Satanta series consists of well-drained, gently sloping soils that have a subsoil that is lighter colored and finer textured than the surface layer. These soils formed in wind-deposited material on uplands. They occur in the southwestern part of the county.

In a typical profile, the surface layer is grayish-brown fine sandy loam about 9 inches thick. This layer is friable and is nonlimy. It has weak granular structure in the upper half and weak prismatic structure in the lower half.

Beneath the surface layer is a layer of heavy loam about 23 inches thick. This layer is grayish brown in the upper part and light brownish gray in the lower part. The structure is weak, coarse, prismatic in the upper part and medium subangular blocky to moderate subangular blocky in the lower part. This layer is nonlimy.

A buried soil occurs at a depth of about 32 inches. It is gray in the upper part and light brownish gray to light gray in the lower part. This layer is friable and is rich in lime. The texture of this layer is loam, and the structure ranges from weak subangular blocky to massive.

The Satanta soils give up moisture readily to plants. Permeability of the underlying material is moderate. Soil blowing is a serious hazard to use.

Most of the acreage of Satanta soils is dryfarmed to wheat. A few areas are in short and mid native grasses.

Typical profile of Satanta fine sandy loam, in wheat stubble, 0.49 mile south and 125 feet west of the northeast corner of section 14, T. 21 N., R. 58 W.:

Ap—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist; abrupt, smooth boundary.

A1—5 to 9 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure; soft when dry, friable when moist; clear, smooth boundary.

IIB1t—9 to 16 inches, grayish-brown (10YR 5/2) heavy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic and moderate, medium, subangular blocky structure; hard when dry, friable when moist; clear, smooth boundary.

IIB2t—16 to 23 inches, light brownish-gray (10YR 6/2) heavy loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist; clear, smooth boundary.

IIB3t—23 to 32 inches, loam, color and consistence same as IIB2t horizon; weak, medium, subangular blocky structure; clear, smooth boundary.

IIAb—32 to 42 inches, gray (10YR 6/1) loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure; hard when dry, friable when moist; strong effervescence; gradual, smooth boundary.

IIBb—42 to 54 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist; slight effervescence; clear, smooth boundary.

IIC—54 to 60 inches +, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; massive (structureless); soft when dry, friable when moist; violent effervescence.

The A horizon ranges from 8 to 20 inches in thickness. The subsoil ranges from dark grayish brown to pale brown in color and from heavy loam to sandy clay loam in texture. A layer of accumulated lime is generally in the lower subsoil. A buried, darkened soil is commonly below a depth of 30 inches.

Satanta soils have slightly less silt than the Keith and Ulysses soils. Their surface layer is not so thick as that of the Duroc soils, and their subsoil is more strongly developed. Satanta soils are similar to Tripp soils but have a more strongly developed subsoil. They are finer textured than the Alice soils and have a more strongly developed subsoil.

Satanta fine sandy loam, 1 to 3 percent slopes (Sa).—This is a very gently undulating soil that has a moderately coarse textured surface layer. In Scotts Bluff County, this layer consists of material that was blown from nearby areas of Anselmo soils. The subsoil is slightly finer textured than either the surface layer or the substratum. Runoff is slow. The rate of water intake is moderately rapid.

The profile of this soil is the one described as typical for the Satanta series. Included with this soil in mapping were small areas of Anselmo soils that are fine sandy loam to a depth of from 30 to more than 40 inches. Also included are areas where a buried soil is below a depth of 18 to 24 inches, and a few areas where the substratum is weathered, very pale brown Brule siltstone.

Except for a few small pastured areas, this soil is dryfarmed to wheat. Soil blowing is the most serious concern of management. Wind stripcropping, in narrow strips of crops alternated with strips of fallow, and under a stubble mulch, nearly always controls blowing. Tillage to roughen the surface is used occasionally. During dry years, millet or sorghum can be grown to keep the soil covered.

Where the soil is in pasture, the main grasses are blue grama, western wheatgrass, needle-and-thread, prairie sandreed, and threadleaf sedge. Growth of these grasses is favorable when the pasture is managed well. Capability unit IIIe-3 (dryland), irrigated capability unit not assigned; Sandy range site; Sandy windbreak suitability group.

Shingle Series

The Shingle series consists of gently sloping to sloping, medium-textured to moderately fine textured soils that are 10 to 20 inches thick over soft shale and sandstone of the Lance formation. These soils are immature and are limy at the surface. Only a few areas of this soil are in the county. One area is between Henry and Lyman, and another is about 5 miles south of Lyman.

In a typical profile, the surface layer is light brownish-gray loam about 5 inches thick. This layer has weak granular structure. It is friable, rich in lime, and moderately alkaline.

Beneath the surface layer is a layer of pale-brown silty clay loam about 7 inches thick. It has strong blocky structure. This layer is hard when dry and firm when moist. It is rich in lime and moderately alkaline.

At a depth of 12 inches is strong, blocky, soft shale. This shale is mainly gray and yellow but is purple, dull red, and brown in places. It is very hard when dry, very firm when moist, and very sticky and plastic when wet. It is rich in lime. The shale is interbedded with yellowish sandstone that is very hard and contains much lime.

Shingle soils are well drained, and their water-holding capacity is low. Permeability is moderate.

Shingle soils developed under a cover of mixed short and mid grasses, and they are used mainly as native pasture. Blue grama and buffalograss are the main grasses, and there are some western wheatgrass, threadleaf sedge, and little bluestem. Small areas that occur among deeper soils are tilled, but the growth of crops is poor.

Typical profile of a Shingle loam, in a permanent pasture, about 0.3 mile south and 0.25 mile west of the northeast corner of section 34, T. 22 N., R. 58 W.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) loam, brown (10YR 5/3) when moist; weak, medium, granular structure; soft when dry, friable when moist; strong effervescence; moderately alkaline; abrupt, smooth boundary.

C—5 to 12 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; strong, medium blocky structure; hard when dry, firm when moist; strong effervescence; moderately alkaline; clear, smooth boundary.

R—12 to 32 inches +, variegated very pale brown, pale-yellow, pale-red, and grayish, soft shale; strong, coarse, blocky structure; slight effervescence; interbedded with hard yellowish layers of sandstone.

The surface layer ranges from 2 to 6 inches in thickness. The texture commonly is loam, clay loam, or silty clay loam. The material between the surface layer and the shale ranges from nearly massive to strong blocky structure. It is slightly saline in places. Sandstone commonly crops out, and most areas are rocky. Depth to soft shale averages from 10 to 20 inches.

Shingle soils are coarser textured than Orella soils, though both formed in material that was derived from shale. Shingle soils are finer textured than Tassel soils, which formed in material that weathered from sandstone, and the Epping soils, which formed in material that weathered from siltstone.

Shingle complex, 3 to 9 percent slopes (ShC).—This complex consists of Shingle soils of variable texture. The surface layer ranges from clay loam to silty clay loam, loam, or fine sandy loam in texture. In about half of the acreage the texture is loam. Runoff is medium.

The profile of Shingle loam is described as typical for the Shingle series. Included with this soil in mapping were areas where wind has deposited silty or sandy material on the surface. Also included were small areas of Mitchell and Keota soils and a few areas that are mainly of sandstone outcrops. The thinnest soil developed on the crests and upper part of the side slopes.

Rock ledges, steepness, and low water-holding capacity limit the use of these soils. A few areas that are better developed and less rocky are cultivated with larger areas of deeper soils. Growth of crops is poor. These soils are better suited to grass. Controlling runoff and erosion is difficult. Capability unit VIs-42 (dryland), irrigated capability unit not assigned; Shallow Limy range site; Shallow windbreak suitability group.

Slickspots

Slickspots is a land type in which the soil material is strongly alkaline and moderately saline, wind-deposited silt, and the substratum is thin and medium textured. This land is in the southwestern part of the county. The general topography is nearly level, but the Slickspots are small, shallow, irregularly shaped depressions that give the area a pock-marked appearance.

The surface layer is gray loam about 2 inches thick. It has thin platy structure, is friable, and is neutral in reaction. This layer is not affected by alkali or salts.

Beneath the surface layer is a layer about 16 inches thick. The upper part is darker, is finer textured, and has stronger structure than the lower part. The upper 4 inches is light brownish-gray silty clay that has moderate prismatic structure. This part is very hard when dry and very firm when moist. It is slightly limy and very strongly alkaline. The lower part is light-gray silty clay loam that has weak blocky structure. This part is friable when moist. It is rich in lime, strongly alkaline, and moderately saline.

The substratum is white or very pale brown silt loam that is massive. It feels soft and powdery when dry and is very friable when moist. This layer is rich in lime and very strongly alkaline, but it does not contain a damaging amount of salt.

Because Slickspots occupy low, nearly level areas, runoff is very slow. Permeability of the layer beneath the surface layer also is slow. Rainwater stands in some depressions until it evaporates. This land has medium to moderately high water-holding capacity. When it is disturbed, the soil material becomes puddled. It is very sticky and difficult to work.

Only a few small areas of Slickspots are cultivated. These are generally corners of fields or places where the fence does not follow the soil boundary between pastured and cultivated land. Slickspots are too strongly alkali to produce cultivated crops; they are better suited to use as pasture. The main native grasses are inland saltgrass, western wheatgrass, and alkali sacaton.

The surface layer of this land ranges from 1 to 5 inches in thickness. In places the upper part is slightly darkened by organic matter. The texture commonly is loam or very fine sandy loam. The layer beneath the surface layer ranges from 8 to 24 inches in thickness. In places the upper part is not limy. In some areas the underlying layers are very fine sandy loam and fine sandy loam in texture. The water table is at a depth of 6 to 8 feet. This land is fairly dry most of the year, and wetness above the water table is seldom within a depth of 5 feet. Some areas where alkalinity is extremely high are bare.

Slickspots are finer textured below the surface layer and are deeper to the water table than Janise soils. Texture of the subsurface layer and degree of development are about the same as those of Minatare soils, but the water table of Slickspots is lower.

Slickspots-Keith complex (0 to 1 percent slopes) (SK).—This complex is in the southwestern part of the county. About 60 percent is Slickspots, and about 40 percent is Keith loam, alkali substratum variant. These areas are so intermixed that they cannot be separated on a soil map of the scale used. Slickpots are in the lower positions, mainly in small depressions within flat basins and in places connected to form an irregular network. The surrounding soil is 6 to 18 inches higher than these areas. This higher lying soil is similar to Keith loam, alkali substratum variant, 0 to 3 percent slopes. It is very strongly alkali at a depth of about 24 inches. The water table is at a depth of 5 to 7 feet.

Included with this complex in mapping were some higher areas where 2 to 4 inches of loamy material have recently been deposited on the surface.

Because of the high percentage of strongly alkali Slickspots, this complex is not suited to cultivated crops. The Keith soil is suited to cultivation, but it is so intermixed with the Slickspots that it cannot be tilled separately.

Except for a few small areas, all of this complex is in permanent pasture. Saltgrass and western wheatgrass are the main plants that grow on Slickspots, and some areas are bare. On the higher lying soils blue grama is the main grass, but there are smaller amounts of western wheatgrass and threadleaf sedge and a sparse stand of saltgrass. Growth of grasses is fair to good, depending on management. Where this complex is dryfarmed, growth of crops is generally not favorable. Capability unit VIs–11 (dryland), irrigated capability unit not assigned; Panspots and Silty range sites; windbreak suitability group not assigned.

Tassel Series

The Tassel series consists of shallow, very gently sloping to steep, moderately coarse textured soils on uplands. These soils formed in material from weathered limy sandstone. They occur mainly in the Wildcat Hills and in the sandstone uplands in the northeastern part of the county.

In a typical profile, the surface layer is light brownish-gray fine sandy loam about 8 inches thick. It has weak granular structure. This layer is very friable, rich in lime, and moderately alkaline.

Underlying the surface layer is light-gray fine sandy loam about 7 inches thick. It has coarse subangular blocky structure. This layer has many fragments of soft sandstone. It is rich in lime, very friable, and mildy alkaline.

At a depth of about 15 inches is soft, gray, limy sandstone that contains hardened layers and many concretions.

The Tassel soils are well drained and have low water-holding capacity. Permeability of the underlying material is moderately rapid. The roots of most crops do not penetrate the bedrock to any great depth, but pine and cedar trees grow well on the steeper areas.

Because they have low water-holding capacity, are droughty, and bedrock is at or near the surface in many places, Tassel soils are not suited to cultivation. Nearly all areas are used for pasture. The main native grasses are blue grama, western wheatgrass, threadleaf sedge, little bluestem, sand dropseed, and prairie sandreed. Short pine and redcedar trees commonly grow on the steeper Tassel soils in the Wildcat Hills.

Typical profile of a Tassel fine sandy loam, in native pasture, 0.35 mile west and 0.4 mile north of the southeast corner of section 29, T. 21 N., R. 56 W.:

A1—0 to 8 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft when dry, very friable when moist; few soft fragments of sandstone; strong effervescence; gradual boundary.

C—8 to 15 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; weak, coarse, subangular blocky structure; soft when dry, very friable when moist; many fragments of soft sandstone; violent effervescence; gradual boundary.

R—15 inches +, gray, calcareous, soft sandstone.

The surface layer ranges from 2 to 10 inches in thickness. It is mainly light brownish gray or light gray in color. The texture commonly is fine sandy loam, very fine sandy loam, or loamy fine sand. The layer between the surface layer and the sandstone ranges from 7 to 11 inches in thickness and from fine sandy loam to loamy very fine sand in texture. It has weak subangular structure and is single grain. Depth to limy material ranges from 0 to 3 inches. In some places the surface layer and the layer beneath are similar in color and in texture. Depth to bedrock ranges from 10 to 20 inches.

Tassel soils have coarser textured material beneath the surface layer than the Epping, Orella, or Shingle soils. They are similar to Otero soils, but bedrock is at a depth of less than 20 inches.

Tassel soils, 20 to 50 percent slopes (Tl).—These steep and very steep Tassel soils occur on the Wildcat Hills and in the sandstone uplands that break to the valley of the North Platte River in the northeastern part of the county. These soils are on the sides of small, medium, and large canyons. The slopes are short, steep, and broken, and many ledges of sandstone crop out. This sandstone is soft in most places, but it is interbedded with hard sheets that form the ledges. In the northeastern part of the county, the canyons are not so steep nor so ledgy. The texture of the surface layer commonly is fine sandy loam and loamy very fine sand.

Tassel soils make up about 50 percent of this mapping unit. Soils that are similar to Tassel soils but less than 10 inches thick make up about 20 percent. About 25 percent is mainly deep, moderately coarse textured Bayard and Otero soils, and the remaining 5 percent is outcrops of bare rock. A few acres of Loamy alluvial land is on the floor of canyons. The shallower soils are on the steeper slopes and crests of the canyons.

These soils are suited to grazing and provide some of the better ranching areas in the county. In the Wildcat Hills, the native vegetation consists mainly of mid and tall grasses. These grasses are little bluestem, prarie sandreed, sideoats grama, sand bluestem, and needle-and-thread. Some blue grama, sand dropseed, and threadleaf sedge occur in places. In the northeastern part of the county, the tall grasses grow only in favored lower areas, and the common native grasses are blue grama, threadleaf sedge, and needle-and-thread.

Rotation grazing, deferred grazing, and other good practices of pasture management are needed. The smoother crests of ridges and floors of canyons can be reseeded to native grasses.

In the Wildcat Hills, these soils have many short pine and redcedar trees, but areas north of the North Platte River have no trees. These soils are suited as recreational areas and wildlife habitat. Much of the Nebraska State Recreational Park is on these soils. Deer, antelope, wild turkey, and other wildlife use these soils intensively for feeding, nesting, and protection. Capability unit VIIs–4 (dryland), irrigated capability unit not assigned; Shallow Limy and Sandy range sites; Shallow windbreak suitability group.

Tassel-Anselmo complex, 3 to 30 percent slopes (TA).—In this complex shallow Tassel soils are intermingled with deep Anselmo soils. About 20 to 55 percent of the complex is Tassel soils; 30 to 65 percent, Anselmo soils; 5 to 15 percent, soils less than 10 inches deep; and 5 percent, outcrops of sandstone. This complex is in the higher parts of the county and ranges from undulating to hilly. Runoff is medium to rapid, depending on the slope. In places bedrock crops out, but in some places it is below a depth of 5 feet.

Profiles for Tassel and Anselmo soils are described for their respective series. Some shallow areas are nonlimy.

This complex is not suited to crops. Many areas are shallow, have low water-holding capacity, have an uneven, rough surface, or have many rock outcrops that hinder tillage. Small patches that are adjacent to the deeper Anselmo soils are cultivated because they cannot easily be excluded. Growth of crops in these areas, however, is poor. The Tassel-Anselmo complex is better suited to pasture. The main native grasses are threadleaf sedge, little bluestem, sand bluestem, western wheatgrass, blue grama, and prairie sandreed. Other common plants are pricklypear and yucca. Growth of plants is fair to good except on rock outcrops and the very shallow soils where the stand is sparse. Good practices of range management are needed to keep these grasses vigorous. Capability unit VIs–42 (dryland), irrigated capability unit not assigned; Shallow Limy and Sandy range sites; Shallow windbreak suitability group.

Tripp Series

The Tripp series consists of deep, well-drained, nearly level to sloping soils that have a weakly developed, medium-textured subsoil. These soils formed in alluvium on the high terraces or benches in the county.

In a typical profile, the surface layer is grayish-brown very fine sandy loam about 13 inches thick. The upper part has moderate granular structure and the lower part has weak blocky structure. This layer is easily worked, free of lime, and mildly alkaline.

The subsoil is friable very fine sandy loam about 22 inches thick. The upper part is light brownish-gray and has weak prismatic structure. The lower part is light gray and has weak subangular blocky structure. This layer is free of lime and mildly alkaline.

Below the subsoil is a zone of accumulated lime. This layer is fairly compact, white very fine sandy loam about 10 inches thick. It has weak but well formed subangular structure, is rich in lime, and is moderately alkaline.

At a depth of 45 inches is a layer of very pale brown, friable loam that has weak granular structure. It is rich in lime and moderately alkaline. Mixed sand and gravel is at a depth of about 63 inches.

Tripp soils have moderate water-holding capacity. Permeability of the subsoil is moderate. These soils are easily worked. They release water readily to plants. Roots of crops penetrate the upper layers easily, but the layer of accumulated lime slows the movement of both roots and water. These soils are susceptible to soil blowing if they are not protected by a growing crop, crop residue, or a roughened surface.

Except for a few small areas, the Tripp soils of this county are in irrigated corn, alfalfa, sugar beets, field beans, and potatoes. When well managed, these soils are among the best soils for farming in western Nebraska.

Typical profile of a Tripp very fine sandy loam, in an irrigated field, 1,200 feet south and 100 feet east of northwest corner of section 19, T. 22 N., R. 53 W.:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; hard when dry, friable when moist; slightly alkaline; abrupt, smooth boundary.

A1—7 to 13 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, blocky structure; slightly hard when dry, friable when moist; slightly alkaline; clear, smooth boundary.

B21—13 to 20 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure that breaks to moderate, fine, granular; hard when dry, friable when moist; slightly alkaline; gradual, smooth boundary.

B22—20 to 30 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure that breaks to moderate, fine, subangular blocky; slightly hard when dry, friable when moist; mildly alkaline; few fine and coarse pebbles; gradual, wavy boundary.

B3—30 to 35 inches, light-gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) when moist; weak, coarse, subangular blocky structure; soft when dry, very friable when moist; slightly alkaline; clear, wavy boundary.

C1ca—35 to 45 inches, white (10YR 8/2) very fine sandy loam, light brownish gray (10YR 6/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; pores filled with carbonate accumulations; compact; moderately alkaline; violent effervescence; clear, wavy boundary.

C2—45 to 63 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; weak, very fine, granular structure; soft when dry, very friable when moist; medium alkaline; violent effervescence; abrupt, wavy boundary.

IIC3—63 inches +, mixed sand and gravel.

The A horizon ranges from 10 to 20 inches in thickness. The texture commonly is loam, very fine sandy loam, or fine sandy loam. The upper part of the subsoil ranges from 10 to 24 inches in thickness. The structure ranges from weak prismatic to moderate subangular blocky. The horizon of accumulated lime ranges from 3 to 15 inches in thickness but is absent in places. Depth to this horizon averages from 20 to 42 inches. Depth to mixed sand and gravel ranges from 40 inches to more than 6 feet. Pebbles commonly are on the surface and throughout the profile.

The Tripp soils are darker colored than the Alice soils and have a finer textured subsoil. They resemble the Keith and Ulysses soils, but they have a thicker surface layer and a less well developed subsoil. They are better developed than the Bridgeport or McCook soils, and lime is lower in their profile.

Tripp fine sandy loam, 0 to 3 percent slopes (TrA).—This is a very friable, nearly level to very gently sloping soil on high benches north of the North Platte River. Runoff is slow.

Except that the surface layer is coarser textured, this soil is similar to the one described as typical for the Tripp series. The surface layer is about 12 inches thick and is easily worked. It grades abruptly to the subsoil in most areas, but in a few places a thin, lighter colored layer of fine sandy loam is between the surface layer and an underlying, dark-colored, buried soil. Included with this soil in mapping were small areas of Alice soils.

Nearly all of this soil is in irrigated corn, field beans, sugar beets, alfalfa, potatoes, and small grains that are planted in spring. Only a few small areas are in native pasture. Fields where sugar beets and field beans have been harvested are especially susceptible to soil blowing. Tillage that brings clods to the surface helps to stop the blowing, but a better practice is keeping the soil covered with crop residue. Nitrogen is needed for growing nonlegume crops. Capability units IIIe–3 (dryland) and IIe–3 (irrigated); Sandy range site; Sandy windbreak suitability group.

Tripp very fine sandy loam, 0 to 1 percent slopes (Tv).—This is a well-drained, nearly level soil.

The profile of this soil is the one described as typical for the Tripp series. The surface layer is moderately dark colored, thick very fine sandy loam. Included with this soil in mapping were a few areas where the subsoil is slightly coarser textured.

This is one of the better soils for farming in western Nebraska, and nearly all the acreage is irrigated. The main crops are corn, potatoes, sugar beets, field beans, alfalfa, and small grains that are planted in spring. Soil blowing is a hazard to use where the soil is not protected by growing crops, crop residue, or a roughened surface. Large additions of fertilizer are needed when large amounts of crops are removed. Nitrogen is needed for all nonlegume crops. Runoff is slow. The water-holding capacity is moderate, and water is released readily to plants.

Only a few small areas are still in native pasture, and these are field corners or areas near farmsteads. Capability units IIIc-1 (dryland) and I-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Tripp very fine sandy loam, 1 to 3 percent slopes (TvA).—On about one-fourth of this soil, water erosion has thinned the surface layer, and in a few places the light-colored subsoil material is exposed at the surface. In other respects this soil has a profile similar to the one described as typical for the Tripp series. Included with this soil in mapping were some areas of loam and small areas of fine sandy loam.

Nearly all of this soil is irrigated, and all crops commonly irrigated are grown. Soil blowing and water erosion are hazards to use. Water erosion can be controlled by contour farming and bench leveling. Practices that help to control soil blowing are keeping crop residue on the soil or roughening the surface by tillage. Although this soil is high in natural fertility, addition of fertilizer is needed for good crop growth. Nitrogen is needed for nonlegume crops. Runoff is slow to medium. The soil is easily worked. Capability units IIIe-1 (dryland) and IIe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Tripp very fine sandy loam, 3 to 5 percent slopes, eroded (TvB2).—This gently sloping soil has medium runoff. Soil blowing and water erosion have removed part of the organic matter and some soil material from the original surface layer. The remaining surface layer is grayish brown or light brownish gray and is only about as thick as the depth plowed. In many places, tillage has mixed the original surface layer with subsoil material. In these places the surface layer is lighter colored than it is in uneroded areas. In a few, small, severely eroded areas the subsoil or even the underlying material is exposed at the surface.

Included with this soil in mapping were a few areas of loam and a few areas on breaks from benches or terraces that have mixed sand and gravel at a depth of 2 to 3 feet. Pebbles are commonly scattered throughout the profile and on the surface on these breaks. Also included were small areas of Alice and Otero soils.

Nearly all of this soil is in irrigated crops. Growth of crops is good. Water erosion is a serious hazard to use, and managing irrigation water is difficult. Contour farming and bench leveling are practices needed. If this soil is not protected by crop residue or growing crops, it is susceptible to soil blowing. After harvesting of field beans and sugar beets, the soil should be roughened by tillage to resist blowing.

The maintenance of fertility is an important concern of management. Barnyard manure is beneficial on spots where erosion has been severe. Nitrogen most commonly is needed. Only a few small field corners are still in native pasture. Capability units IIIe-1 (dryland) and IIIe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Tripp very fine sandy loam, 5 to 9 percent slopes, eroded (TvC2).—This sloping soil is mainly on breaks from a high terrace to a lower terrace. The areas are long and narrow and range from 10 to 60 acres in size.

The surface layer is a grayish-brown, light brownish-gray, or pale-brown very fine sandy loam. Because soil blowing and water erosion have removed some of the original soil material, the surface layer is only about as thick as the depth plowed. Tillage has mixed the original surface layer with subsoil material. In places lighter colored subsoil material is exposed at the surface. In a few, small, severely eroded areas, tillage extends into the underlying material.

Included with this soil in mapping were some areas of loam and fine sandy loam, and areas where pebbles are scattered throughout the profile and on the surface. In some small places, gravel is at the surface. Also included were small areas of Alice and Otero soils.

Nearly all of this soil is in irrigated crops. Because water is difficult to control, this soil is not so suitable for irrigation as other Tripp soils. Runoff is medium to rapid in areas where the soil is not contour farmed or terraced. Controlling water erosion and soil blowing and improving and maintaining fertility are concerns of management. Large amounts of fertilizer, particularly nitrogen, are needed for good growth of crops. Keeping the surface covered or roughened by tillage helps to control blowing. Capability units IVe-1 (dryland) and IVe-1 (irrigated); Silty range site; Silty to Clayey windbreak suitability group.

Ulysses Series

The Ulysses series consists of deep, well-drained, medium-textured soils that have lime at an average depth of about 15 inches. These soils formed in loess on uplands in the southwestern part of the county.

In a typical profile, the surface layer is gray loam about 6 inches thick. It has weak granular structure. This layer is easily worked. It is nonlimy.

The subsoil is light brownish-gray loam about 14 inches thick. Although the texture is loam, it is somewhat finer than that of the surface layer. The upper part has weak blocky structure, and the lower part has weak subangular blocky structure. This layer is friable and nonlimy. Accumulated lime is in the lower 4 inches of the subsoil. This layer is light brownish-gray loam.

Beginning at 20 inches is light-gray silt loam that extends to a depth of more than 5 feet. This layer has weak subangular blocky structure or is massive. It is rich in lime and soft when dry.

The Ulysses soils have moderate water-holding capacity. Permeability of the subsoil is moderate. Natural fertility is medium.

Nearly all the acreage of these soils is dryfarmed to winter wheat. Alternating crops with fallow under a stubble mulch and stripcropping are practices that conserve moisture and help to control erosion.

Typical profile of a Ulysses loam, in fallow, 0.3 mile west and 100 feet south of the northeast corner of section 21, T. 21 N., R. 58 W.:

Ap—0 to 6 inches, gray (10YR 6/1.5) loam, dark grayish brown (10YR 3.5/2) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; noncalcareous; abrupt, smooth boundary.

B1—6 to 13 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, blocky structure; slightly hard when dry, friable when moist; noncalcareous; clear, smooth boundary.

B2—13 to 16 inches, light brownish-gray (10YR 6.5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; noncalcareous; abrupt, wavy boundary.

B3ca—16 to 20 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; clear, smooth boundary.

C1—20 to 36 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist; violent effervescence; gradual, smooth boundary.

C2—36 to 60 inches, light-gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) when moist; massive (structureless); soft when dry, friable when moist; violent effervescence.

The surface layer is gray, grayish brown, or dark grayish brown. It is commonly loam but is silt loam or very fine sandy loam in many places. This layer ranges from 5 to 8 inches in thickness. In places lime is present in the plowed layer. The subsoil is 5 to 17 inches thick. It ranges from a loam to a light clay loam in texture.

Ulysses soils are similar to Keith soils but are shallower to the zone of accumulated lime and have a thinner surface layer and subsoil. They have a more strongly developed profile than the Mitchell soils and are more leached. The Ulysses soils formed in loess, whereas the Rosebud and Creighton soils formed in material that weathered from sandstone.

In Scotts Bluff County, the Ulysses soils are mapped only in a complex with the Keith soils.

Valentine Series

The Valentine series consists of deep, nonlimy, excessively drained soils. These soils formed in coarse-textured materials deposited by wind. The topography ranges from hummocky to nearly dunelike, and slopes range from 3 to 17 percent. Areas of Valentine soils are scattered in many parts of the county.

In a typical profile, the surface layer is grayish-brown, structureless fine sand about 4 inches thick. It is loose, nonlimy, and neutral in reaction.

Beneath the surface layer is light brownish-gray, neutral, structureless fine sand about 10 inches thick.

At a depth of 14 inches is very pale brown, structureless fine sand. This layer is loose, noncalcareous, and mildly alkaline.

Because the pores in these sandy soils are large, movement of water and air through the soils is rapid. Water-holding capacity and natural fertility are low. Rainwater enters the soils almost as rapidly as it falls, and water erosion is seldom a problem. Water is released readily to plants. Roots penetrate readily.

Nearly all the acreage of Valentine soils is in permanent pasture. A few small areas are irrigated, but the growth of crops is only fair. These soils developed under a cover of mixed mid and tall grasses. The main native grasses are prairie sandreed, little bluestem, sand bluestem, needle-and-thread, and sand dropseed. Some blue grama is in most areas. Where the pasture has been overgrazed, sand sagebrush, pricklypear, and yucca are abundant.

Typical profile of Valentine fine sand, in native pasture, about 0.2 mile east and 0.5 mile north of the southwest corner of section 29, T. 21 N., R. 57 W.:

A1—0 to 4 inches, grayish-brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) when moist; single grain (structureless); loose; neutral; clear, smooth boundary.

C1—4 to 14 inches, light brownish-gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) when moist; single grain (structureless); loose; neutral; gradual, smooth boundary.

C2—14 to 16 inches, very pale brown (10YR 7/3) fine sand, grayish brown (10YR 5/2) when moist; single grain (structureless); loose; mildly alkaline.

The surface layer ranges from grayish brown to light brownish gray in color and from 2 to 12 inches in thickness. Both the surface layer and underlying material range from fine sand to loamy fine sand in texture. Slopes range from 3 to 17 percent, but a few areas have complex slopes that are nearly 40 percent. Typically, Valentine soils are nonlimy to a depth of more than 5 feet but in places are limy within a depth of 40 inches.

The Valentine soils formed in nonlimy materials; otherwise, they are similar to the Dwyer soils. Valentine soils have coarser textured material beneath the surface layer than Anselmo soils. They have a thinner surface layer than the Dunday soils and are less coherent and are not so well developed.

Valentine and Dwyer fine sands, rolling (3 to 17 percent slopes) (VD).—This mapping unit consists of about equal acreages of Valentine fine sand and Dwyer fine sand. These soils were not separated on the soil map, because they are very similar and there is no difference in their use and management. These two soils are intermingled in some places, but each occurs separately in other places in the county. Topography ranges from hummocky to nearly dunelike. Runoff is slow.

A profile of Dwyer soil is described as typical for the Dwyer series. Included with these soils in mapping were small areas of loamy fine sand and a few areas of Dunday soils in the lower swales.

Nearly all the acreage is in permanent pasture. These soils are too coarse textured and unstable for cultivated crops, but they are very good for grass. Deferred grazing, rotation grazing, and other good practices of pasture management are needed. Capability unit VIe-5 (dryland), irrigated capability unit not assigned; Sands range site; Very Sandy windbreak suitability group.

Valentine and Dwyer loamy fine sands, rolling (5 to 17 percent slopes) (VDy).—About 35 percent of this mapping unit is Valentine loamy fine sand, and about 65 percent is Dwyer loamy fine sand. A few small areas are Anselmo or Dunday soils. These soils were mapped together because the differences in use and management do not justify mapping them separately. These soils are mainly hummocky, but a few areas below terrace breaks are sloping. Although these soils are coarse textured, runoff is medium.

A profile of Dwyer fine sand is described as typical for the Dwyer series. Except for texture of the surface layer, it is similar to Dwyer loamy fine sand. Both the surface layer and underlying material are a loamy fine sand in texture, though in a few areas the lower part of the underlying material is fine sand.

The soils in this unit are excessively drained. They have low water-holding capacity. These soils are too unstable and droughty for cultivated crops. A better use is pasture. They provide good grazing when managed well. Deferred grazing, rotation grazing, and other good practices of pasture management are needed to keep pasture plants vigorous. Blowouts need to be reseeded and protected from trampling by animals. Capability unit VIe-5 (dryland), irrigated capability unit not assigned; Sands range site; Very Sandy windbreak suitability group.

Wet Alluvial Land

Wet alluvial land (0 to 1 percent slopes) (Wx) is dark colored, is poorly drained, and has a water table at or near the surface most of the time. This land has two kinds of soil material. One kind is less than 10 inches thick over mixed sand and gravel. It makes up most of the wet, recent alluvial deposits adjacent to the North Platte River. The other kind consists of deep and moderately deep, loamy to sandy, wet alluvial deposits. It is in areas farther from the river, areas along small streams, low pockets on sandy foot slopes, and areas downslope from large irrigation canals that seep badly. A few of the areas downslope from the canals have slopes of 2 to 4 percent, but most of this land is in depressions or on flats.

The water table fluctuates from a depth of about 30 inches to the surface, and at times water stands on the surface. Depth depends on natural fluctuations of the water table, rainfall, and the irrigation of higher lying soils.

Some, but not all, areas of this land are affected by soluble salts. About 5 percent of the acreage is slightly to strongly affected. During dry periods the salts accumulate on the surface and form a white crust. The accumulation of salts is seldom below a depth of 12 inches, because ground water dissolves the salts and carries them away.

Texture of the surface layer ranges from moderately fine to medium or moderately coarse. Loam to sandy loam textures are most common. The subsoil is equally variable in texture. The surface layer is generally darker colored than the underlying material. It is mainly gray, dark gray, very dark gray, and other dull colors. The high water table prevents oxidation that is necessary to produce bright colors. In places the soil layers are olive, greenish, or bluish in color. These are gleyed layers that formed because of poor drainage. Mottles commonly occur in the upper layers.

In many places an inch or more of organic matter is on the surface. Small patches of Marsh were included in the mapping. Also included were some areas of the somewhat poorly drained Platte and McGrew soils.

Wet alluvial land has poor natural drainage. In some areas runoff is very slow or nonexistent. Some of the acreage has been drained and the water table lowered by using V-ditches.

Without drainage this land is not suited to cultivated crops. Nearly all the acreage is used for pasture. This land produces more forage per acre than any other areas in the county, but the quality of this forage is not so good as that of forage grown in other areas.

The principal kinds of native vegetation on this land are tall sedges, prairie cordgrass, and reedgrass. Willow, rush, and reedgrass grow in the lower areas; inland saltgrass, alkali sacaton, and western wheatgrass grow in higher areas. Capability unit Vw-1 (dryland), irrigated capability unit not assigned; Wet Land range site; Wet windbreak suitability group.

Use and Management of the Soils

This section discusses management of soils used for dryland and irrigated crops, for range, for woodland and windbreaks, and for wildlife habitat. Use of soils in engineering and for homesites is also discussed.

Managing Soils for Crops and Pasture

This subsection consists of four main parts. The first explains the capability grouping used by the Soil Conservation Service. In the second part the soils are placed in dryland capability units, and their use and management is described. In the third part the soils are placed in irrigated capability units, and use and management are described for this kind of farming. The fourth part provides a table that shows predicted yields of principal crops under two levels of management.

Capability groups of soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on the limitations of the soils, the risk of damage when they are used for the ordinary field crops or sown pastures, and the way they respond to treatment. The classification does not apply to most horticultural crops, or to rice and other crops that have special requirements for production. The soils are classified according to degree and kind of permanent limitations, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible major reclamation.

In the capability system, all soils are grouped at three levels, the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groupings, are designated by Roman numerals I through VIII. The larger the numeral, the greater the limitations and the narrower the choices for practical use. The classes are defined as follows:

Class I. Soils have few limitations that restrict their use.

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

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

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

Class V. Soil subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plant production without major reclamation, and that restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

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*, is used in those areas where climate is the chief limitation to the production of common cultivated crops.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitations, and the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph. The Arabic numeral specifically identifies the capability unit within each subclass. Because the capability classification of soils in Scotts Bluff County is part of a statewide system, all the capability units in the system do not occur in this county. Consequently, capability unit numbers in this survey are not consecutive.

Management by dryland capability units

The amount of rainfall is important in managing dryfarmed soils. The average annual precipitation at Scottsbluff is less than 15 inches and varies widely from year to year. Nearly all dryfarmed crops are grown on soils that are left fallow the preceding year. The common procedure is to leave the stubble from the last crop on the soil during the winter; then, the soil is tilled in spring so that it is kept free of weeds and loose enough to absorb rainwater during summer. A soil left fallow for one year stores enough water to produce a crop the next year. To increase the amount of moisture stored by soils left fallow, many farmers leave a stubble mulch on the soil. By using specially designed machinery, the stubble and straw are anchored to the surface to prevent them from blowing away.

Controlling erosion and conserving moisture are the main concerns of management. Soil blowing can be controlled by wind stripcropping on the nearly level soils. On the sloping soils, contour stripcropping is effective against soil blowing and water erosion. Terraces and contour cultivation are used to control water erosion and to conserve moisture. A stubble mulch helps to control soil blowing and to conserve moisture. Tillage that roughens the surface is used on bare soils to prevent blowing, or quick-growing crops are planted for cover.

The main crop grown on dryfarmed soils is winter wheat. If plenty of moisture is available, the wheat is grazed in spring. Safflower is grown for oil that is extracted from the seed. A small acreage of grain sorghum and forage sorghum is grown, and a few fields are sown in spring to millet. Oats and barley are planted in spring in fields where wheat has been blown out. Alfalfa is grown mainly on subirrigated bottom lands. Crested wheatgrass and intermediate wheatgrass are the main tame grasses grown.

On the following pages, the capability units, or groups of soils similar in management requirements for dryfarming, are described; some limitations are given; and suitable management is discussed. The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series appear in the unit. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT IIw-4 (DRYLAND)

This unit consists of deep and moderately deep, nearly level soils that have a medium-textured surface layer. Their subsoil is medium textured to moderately coarse textured. Texture of the substratum varies from place to place. These soils are kept moderately wet mainly by a water table that is at a depth of 3 to 5 or 6 feet. In places, however, wetness is caused by seepage of irrigation water from higher lying soils. The soils in this unit are in the Gering, Las Animas, Las, McGrew, and Mitchell series.

During dry years crops can obtain some water from the water table, but these soils tend to be droughty late in summer. They absorb water well and release it readily to plants. Water erosion is not a hazard, but soil blowing occurs if the soils are not protected.

When dryfarmed, the soils of this unit are suited to wheat and other small grains and to sorghum, safflower, millet, alfalfa, and grass. Some areas are in native meadow, and yields of hay are favorable.

On these soils, wetness is the main concern of management. In most places V-ditches are helpful. A legume or a grass-legume mixture in the cropping sequence increases the organic-matter content, improves tilth, and helps maintain the fertility of the soils. Row crops should be limited to not more than 3 consecutive years. Where it can be practiced, stripcropping is desirable. A catch crop of sudangrass helps to protect the soils and can be planted when moisture is available.

The soils of this unit are high in lime. Alfalfa ordinarily produces increased yields after phosphate is added, and small applications of nitrogen benefit nonlegume crops.

CAPABILITY UNIT IIIc-1 (DRYLAND)

This unit consists of deep, nearly level soils that have a medium-textured surface layer. Texture of the subsoil is medium to moderately coarse, and that of the substratum varies from place to place. These soils are on bottom lands, stream terraces, broad alluvial fans, and uplands. They are in the Keith, McCook, Mitchell, Otero, Bayard, and Tripp series.

The soils in this unit are friable and easy to cultivate. They take in water at a medium rate and have medium water-holding capacity. Permeability of their subsoil ranges from moderate to moderately rapid. Runoff is slow. The organic-matter content ranges from low to medium.

These soils are suited to small grains, sorghum, safflower, trees, and grass. Wheat is the main crop.

Even though these soils are mainly irrigated, a few fields are dryfarmed. Low rainfall is the principal factor limiting use in dryfarmed areas. If crops are alternated with summer fallow, enough moisture is generally stored while the soil lies fallow to insure a crop the following year. These soils are subject to soil blowing if they are not protected by a growing crop or by crop residue. A stubble mulch on these soils provides a cover while they life fallow. Burning crop residue is not a desirable practice. Wind stripcropping aids in reducing soil blowing. If moisture is available, planting a catch crop of sudangrass or millet after a crop fails is a good practice. Nitrogen may be needed to help maintain soil fertility.

CAPABILITY UNIT IIIe-1 (DRYLAND)

This unit consists of deep, very gently sloping to gently sloping, well-drained soils that have a medium-textured surface layer and subsoil. In a few areas, these soils are moderately eroded. They are on colluvial foot slopes, stream terraces, and uplands. The soils in this unit are in the Bridgeport, Creighton, Duroc, Keith, Keota, Ulysses, Mitchell, and Tripp series.

These soils take in water readily and store it for use by plants. Their water-holding capacity is medium. They are easily worked and are fertile. Runoff is slow to medium. Because most areas are cultivated, these soils are subject to both soil blowing and water erosion. The risk of drought is great because the climate is semiarid, and measures are needed that conserve all available moisture.

The soils of this unit are suited to small grains, sorghum, and safflower. Small areas are in native grass. Some windbreaks are on farmsteads in this unit.

By leaving these soils fallow in alternate years, moisture is conserved for use the following year. On the soils left fallow the stubble should be lightly tilled so that all of the crop residue is held at the surface. This tillage also keeps the surface soil loose and permits water to enter. Burning crop residue is not a good practice.

Water erosion is a hazard on these soils, particularly where slopes range from 3 to 5 percent. Terraces on the contour are needed where slopes are more than 1 percent. Contour farming, stripcropping, and stubble mulching are practices that can be used with terraces. Contour strips that are twice as wide as the distance between the terraces are satisfactory. Diversion terraces can be used to intercept runoff from higher lying areas and divert it safely to a grassed waterway or to an area in pasture. A cropping sequence that provides a cover of legumes or a grass-legume mixture also helps to control water erosion.

A good stubble mulch can be used to control soil blowing on soils that are left fallow. Cultivation that brings clods up to the surface helps to protect the soils where there is not enough stubble. Wind stripcropping also helps in nearly level areas. During years when crops fail because of drought, hail, insects, or diseases, fields can be planted to millet, sorghum, sudangrass, or another catch crop to provide cover. In areas where the soils have a thin surface layer, crops respond to applications of nitrogen.

Range seeding, contour furrowing, and pitting are practices needed in areas of this unit that are in native grasses. Deferred grazing, rotation grazing, and other good practices are needed to maintain a good stand of grass.

CAPABILITY UNIT IIIe-2 (DRYLAND)

Buffington silty clay loam, 1 to 3 percent slopes, is the only soil in this unit. This is a deep, gently sloping, moderately well drained soil. The surface layer subsoil are moderately well drained soil. The surface layer and subsoil are moderately fine textured. The substratum consists of stratified alluvium of medium texture.

This soil absorbs moisture at a moderately slow rate and has moderately slow permeability in the subsoil. The soil tends to crack when it dries and to swell as it becomes wet. It is sticky when wet and hard when dry. This soil must be cultivated only within a narrow range of moisture content. It warms more slowly in spring than do coarser textured soils. A fairly large amount of water is held by this soil, but only a moderately small amount is available to plants. Runoff is medium and needs to be controlled.

This soil is suited to wheat, sorghum, millet, oats, and barley and to trees and grass. Because irrigation water is available in most areas, only a few acres of this soil is dryfarmed.

Where this soil is dryfarmed, contour terraces are needed to save all the rainwater. Soil blowing and water erosion are lessened if strips of crops are alternated with stubble-mulched strips of fallow. By allowing the soil to lie fallow every other year, enough moisture is generally provided for successful dryfarming. Increasing the content of organic matter improves tillage and increases the intake of water.

CAPABILITY UNIT IIIe-3 (DRYLAND)

This unit consists of deep, nearly level to gently sloping soils on bottom lands, stream terraces, broad colluvial fans, and uplands. The surface layer is moderately coarse textured, and the subsoil is medium textured to moderately coarse textured. Texture of the substratum varies from place to place. These soils are in the Alice, Anselmo, Bayard, Glenberg, Haverson, Mitchell, Otero, Santanta, and Tripp series.

The soils of this unit absorb water well and release it readily to plants. Permeability of the subsoil is moderate to moderately rapid. These soils are easy to cultivate, but they are susceptible to soil blowing, especially when unprotected. They have a small to medium content of organic matter. Crops on these soils are likely to be damaged by drought unless practices are used that conserve all available moisture. Water erosion is a hazard in all except the nearly level areas.

These soils are suited to wheat and other small grains and to sorghum, safflower, and grass. They are also suited to trees and other plants in windbreaks and shelterbelts. Small areas are still in native pasture.

Strips of crops alternated with strips of fallow under a stubble mulch help to conserve moisture and control soil blowing. Crop residue should be kept on the surface and not burned. Wind stripcropping helps control soil blowing in the nearly level areas. Contour stripcropping in strips as wide as the distance between the terraces is suitable on soils that have slopes of 1 to 3 percent. Contour terraces are needed on all slopes of more than 1 percent. A cover crop of rye or another small grain can be used to protect these soils from soil blowing in winter and to provide a green-manure crop to turn under in spring.

In years when crops fail, fields can be planted in spring to millet, sorghum, or sudangrass to protect the soils until the regular cropping sequence can be resumed. Emergency tillage that roughens the surface may be needed during periods of high wind or of drought. Blank listing in strips perpendicular to the direction of the prevailing winds helps to control soil blowing.

On soils of this unit that are in native grass, deferred grazing, rotation grazing, contour furrowing, and other good practices of pasture management are needed.

CAPABILITY UNIT IIIs-2 (DRYLAND)

Buffington silty clay loam, 0 to 1 percent slopes, is the only soil in this unit. This is a deep, nearly level, modererately well drained soil. The surface layer and subsoil are moderately fine textured. The substratum consists of stratified alluvium of medium texture.

This soil absorbs and releases water slowly, but it retains plant nutrients well. Roots are not restricted, but the clayey texture makes tillage somewhat difficult. Because this soil is sticky when wet and hard when dry, it must be tilled only within a narrow range of moisture content. It warms more slowly in spring than coarser textured soils. Runoff is slow, and erosion is slight.

This soil is suited to wheat, sorghum, oats, and barley and to trees and grass. Fair to good yields of dryfarmed crops can be expected if management is good. Because irrigation water is available in most areas, very few fields are dryfarmed.

Where this soil is dryfarmed, water is conserved and soil blowing is reduced by alternating strips of crops with stubble-mulched strips of fallow. The fields need to be wind stripcropped, or farmed in strips perpendicular to the prevailing wind. Organic matter left on the soil increases the intake of water.

CAPABILITY UNIT IIIw-6 (DRYLAND)

This unit consists of deep and moderately deep soils that are somewhat poorly drained and have a moderately coarse textured surface layer and subsoil. The substratum consists of mixed sand and gravel and is at depth of 20 to 60 inches. The water table is at a depth of 3 to 6 feet. These soils are on nearly level bottom lands. They are in the Las Animas and McGrew series.

These soils take in water readily but do not hold it so well as the finer textured soils. Crops receive some moisture from the water table during periods when it is high. These soils are droughty when the water table is low or rainfall is lacking. Practices are needed that increase water intake and prevent excessive evaporation.

These soils are suited to small grains, sorghum, safflower, and alfalfa. A few areas are used for farmstead windbreaks, and a small acreage is in native pasture.

Practices that save moisture and help control soil blowing are using stubble mulch, leaving the soil fallow, and planting crops in alternate strips. Crop residue kept on areas lying fallow protect the soil from blowing. The use of alfalfa or a grass-legume mixture in the cropping sequence helps to stabilize the soil and adds organic matter and nitrogen.

If a crop planted in fall fails, an emergency crop of winter rye can be planted to provide cover during winter and a green crop to turn under in spring. If a crop planted in spring fails and enough moisture is available, a catch crop of sudangrass, millet, or sorghum can be planted. A nonlegume responds to added nitrogen in fields where a legume has not been grown for several years. Alfalfa generally responds to added phosphate.

Managing meadows for seed production, deferred grazing, rotation grazing, range seeding, and other good practices are needed where this soil is in permanent grass.

CAPABILITY UNIT IVe-1 (DRYLAND)

This unit consists mainly of deep, medium-textured, nearly level to sloping soils. One soil, McCook silty clay loam, gravel substratum variant, 0 to 1 percent slopes, is moderately fine textured. The substratum of most soils in this unit varies from place to place. These soils occur on bottom lands, stream terraces, colluvial foot slopes, and uplands. They are in the Bridgeport, Creighton, Keota, Keith, Ulysses, McCook, Mitchell, Rosebud, and Tripp series.

The soils of this unit are fertile and easily worked. They are moderately permeable to air, water, and roots. These soils have medium to high water-holding capacity, but considerable water is lost through runoff. Measures are needed that control runoff and that store water for crops. Use of these soils is limited by inadequate rainfall and soil blowing.

These soils are suited to the dryfarmed crops commonly grown in the county. These crops are mainly wheat, sorghum, millet, safflower, and grass, but some oats and barley are grown. These soils are also suited to trees.

These soils should lie fallow for 1 year before the crop is planted. When a field is lying fallow, a stubble mulch is needed for keeping the surface soil open so that the water intake is increased. When these soils are cultivated, the hazard of both water erosion and soil blowing is high. Some protection is provided by a legume or a grass-legume mixture used in the cropping sequence at least half of the time.

Terraces are needed on most soils of this unit. Contour stripcropping in strips that are as wide as two terrace intervals is needed to control both water erosion and soil blowing. In years when crops fail, a catch crop of millet or sudangrass can be planted to protect the soils until the regular cropping sequence can be resumed. If the soils are too dry for a catch crop, emergency tillage that brings clods to the surface may be needed. Even in years when no crop is harvested, these soils still need protection. Grassed waterways are needed to carry away excess water from terraced fields. In places diversion terraces can be used for intercepting runoff from higher lying areas.

Where soils of this unit are in permanent grass, range seeding, contour furrowing, and pitting can be used. Other good practices are proper stocking, deferred grazing, and rotation grazing.

CAPABILITY UNIT IVe-3 (DRYLAND)

This unit consists of deep and moderately deep, very gently sloping to sloping soils that occur on stream terraces, colluvial foot slopes, and uplands. These soils have a moderately coarse textured surface layer and a medium-textured to moderately coarse textured subsoil. A few of these soils are shallow and have a gravelly substratum. In some places these soils are moderately eroded. They are in the Alice, Anselmo, Mitchell, Otero, and Bayard series and the Chappell-Dix complex.

These soils are easily worked and are readily penetrated by roots, air, and water. Because these soils have large pores, they dry out rapidly and are somewhat more droughty than finer textured soils. Water-holding capacity is medium to slow. Practices are needed that increase the intake of water and prevent excessive evaporation. These soils release water readily to plants. Both soil blowing and water erosion are hazards to use.

The soils in this unit are suited to small grains, sorghum, and safflower. They are also suited to trees and grass and as wildlife habitat. Most of the acreage is dryfarmed to cultivated crops, but a significant part is in native pasture. In a few places, shelterbelts and farmstead windbreaks have been established.

By alternating crops and fallow, moisture is stored for the crop that follows the fallow. In the fallowed areas, a good stubble mulch keeps the fallowed soil from blowing and crusting. Also helpful is contour stripcropping in strips as wide as the distance between terraces. Contour terraces help slow the flow of water during heavy rains. Organic-matter content can be increased by returning all crop residue and by adding barnyard manure.

Because these soils are susceptible to soil blowing, legumes and grasses should be used in the cropping sequence at least half of the time. When crops planted in fall fail, winter rye can be planted to provide plant cover during winter and a green-manure crop that is turned under in spring. If enough moisture is available, a catch crop of millet or sudangrass can be planted in spring for cover. Tillage with a blank lister may be needed on bare soils to control soil blowing. Windbreaks can be established in places to help reduce soil blowing. Additions of nitrogen help to maintain fertility.

Where these soils are in native grass, range seeding, contour furrowing, pitting, and other good practices are needed. In addition, the pasture should not be overgrazed. Deferred grazing and rotation grazing are practices that help keep pastures productive.

CAPABILITY UNIT IVe-5 (DRYLAND)

This unit consists of deep, nearly level to sloping soils on bottom lands, stream terraces, colluvial foot slopes, and uplands. In some areas erosion is moderate. These soils have a loamy fine sand surface layer and a coarse textured to moderately coarse textured subsoil. They are in the Alice, Bankard, Dunday, Valetine, and Otero series.

The soils in this unit have low water-holding capacity. They are excessively drained and rapidly permeable. Their content of organic matter is low to medium. All these characteristics tend to make these soils droughty. Because they are sandy and droughty, these soils are susceptible to soil blowing. Practices are needed that prevent blowing and that reduce the loss of moisture by percolation and excessive evaporation.

These soils are suited to sorghum, rye, and vetch and to trees and grass. In addition, some areas can be developed into good habitat for wildlife.

These soils should lie fallow for a year to store moisture for a crop planted the following year. A stubble mulch with adequate crop residue left on soils lying fallow holds nearly all the rainfall and slows evaporation. The content of organic matter can be increased and erosion controlled by using a cropping sequence in which grasses and legumes are grown one-half to two-thirds of the time. Wind stripcropping can be used where slopes are less than 3 percent but the strips must be narrow to control soil blowing.

During years when crops fail because of drought, hail, or insects, vetch or rye can be planted to protect the soils from blowing in winter. In spring, millet or sorghum can be planted. When there is an emergency because of soil blowing, the blowing can be controlled by blank listing in strips about 20 feet apart. Leaving the stubble high to catch snow is a good practice when crops are harvested. Fall plowing is not advisable. Nonlegumes on these soils respond to added nitrogen.

Where these soils are in permanent grass, range seeding and practices that insure uniform grazing are needed.

CAPABILITY UNIT IVe-9 (DRYLAND)

Mitchell silt loam, thin, 1 to 5 percent slopes, is the only soil in this unit. This soil is on foot slopes. It is a well-drained soil that has a medium-textured surface layer and subsoil. The surface layer is light colored and limy.

This soil has medium water-holding capacity and moderate permeability in the subsoil. Natural fertility and the content of organic matter are low. Runoff is medium. Because structure is weak, this soil is easily eroded if cultivated.

This soil is suited to dryfarmed crops commonly grown in the county. The main crops are wheat, oats, and barley. This soil is also used for safflower and for trees and grass.

The main concerns of management are improving and maintaining fertility and tilth, increasing the content of organic matter, and controlling erosion. Because this soil is easily eroded, protection from moving water and wind is needed. Terraces, contour stripcropping, and stubble mulching are helpful in controlling runoff and erosion in cultivated fields. By alternating crops and summer fallow, enough water is stored in soils lying fallow to provide moisture for the following year. All crop residue should be kept on the soil so as to increase the organic-matter content and the supply of plant nutrients. A cropping sequence that provides a legume or a legume-grass mixture helps control water erosion. Where there is not enough stubble to protect the soil from blowing, clods for protection can be brought to the surface with a shovel-type implement. In years when crops fail, a catch crop of sudangrass, sorghum, or millet can be planted to provide plant cover.

Much of this soil is still in native pasture. In these areas deferred grazing, rotation grazing, and contour furrowing are practices that help to keep the pastures productive.

CAPABILITY UNIT IVs-1 (DRYLAND)

This unit consists of deep and moderately deep soils that are moderately affected by salts and alkali and occur on bottom lands, broad colluvial fans, and uplands. Texture ranges from moderately fine to coarse in both the surface layer and subsoil; in the substratum texture varies from place to place. Most all of these soils are nearly level, but a few are very gently sloping. The soils in this unit are in the Anselmo, Bankard, Buffington, Gering, Las, Las Animas, McGrew, Mitchell, and Keith series.

In most places the water table is at a depth of 3 to 5 feet. In the soils on uplands and colluvial fans, the water table is below a depth of 5 feet or is perched. The soils on bottom lands are affected mainly by white alkali or soluble salts, though in some places black alkali, or sodium carbonate, may also occur.

All areas of soils in this unit are not uniformly saline-alkali. Light-colored areas, or slickspots, occur in most fields. In these slickspots, the alkali is at the surface and the surface is white during some periods. In cultivated fields the soil material in slickspots is puddled. In some soils the alkali is in only the subsoil or substratum. The crops most affected on these soils are deep-rooted ones, and they are affected late in the growing season. Except where the surface layer is sandy, erosion normally is not serious on these soils.

The soils in this unit are suited to small grains, trees, sweetclover, millet, sudangrass, alfalfa, vetch, trefoil, and many kinds of pasture grasses. Yields are lower on these soils than they are on similar soils that are not affected by alkali, but they are generally favorable between spots of alkali.

Barnyard manure applied on puddled soils tends to open the soil and allow better penetration of water. Mixing crop residue into puddled spots also helps. Agricultural sulfur and gypsum can be added to help neutralize the alkali, but the additions may not be profitable on dry-farmed soils. Legumes used in the cropping sequence improve fertility and tilth.

Where slopes are more than 2 percent, terracing is needed. In terraced areas, ditches lined with concrete prevent seepage and accumulation of alkali. Where stripcropping is used, it is effective if the strips are twice as wide as the distance between the terraces. Nearly level soils can be protected from soil blowing by wind stripcropping.

More moisture is available for a crop planted after a period of fallow than is available for a crop that follows another crop. It is not necessary, however, for soils to lie fallow if their water table is high most of the year. Keeping a stubble mulch on the surface protects these soils from soil blowing, crusting, and loss of moisture.

On the more sandy soils in this unit extra care is needed for controlling erosion. Cover crops can be grown to protect the soils during winter, and catch crops planted in spring help to provide cover on fields where a crop planted in fall has failed. Emergency tillage may be needed at times when soil is blowing. Legumes generally respond to applications of phosphate in areas where the water table is high.

Most soils of this unit that are in native grass produce favorable yields, and many areas are mowed for hay. Deferred grazing, rotation grazing, and other practices of good management are needed. The pastured areas should not be overgrazed.

CAPABILITY UNIT IVw-5 (DRYLAND)

Bankard loamy fine sand, wet variant, is the only soil in this unit. This soil is on bottom lands. It is a deep,nearly level soil that has a coarse-textured surface layer and subsoil. The substratum is mixed sand and gravel. The water table is at a depth of 3 to 5 feet. In some places slopes are as much as 2 percent.

In dry periods when the water table is low, this soil is droughty, but deep-rooted plants can obtain some moisture from the water table. Water-holding capacity is low, though this soil absorbs water well and releases it readily to plants. Also low are the organic-matter content and natural fertility.

This soil is suited to sorghum, alfalfa, and small grains. It is also suited to trees and grass.

Management is needed to control soil blowing, maintain fertility, and conserve moisture. A good cropping sequence for these purposes consists of small grains and fallow in alternate years. Alfalfa or grass should be used for two-thirds of the time. A good stubble mulch on the surface of fallowed soil helps to prevent soil blowing and evaporation of water. In fields that are large enough, wind stripcropping can be used. Rye can be planted to provide cover during winter in fields where there is not enough stubble mulch for protection. If the normal cropping sequence is interrupted, sorghum and millet can be planted in spring to provide cover and prevent erosion until the sequence can be resumed. Blank listings can be used where soil blowing creates an emergency. Nonlegumes respond to added nitrogen if moisture is sufficient. Where lime is excessive in the surface layer, alfalfa responds to added phosphate.

Many areas of this soil are in permanent pasture. In these areas deferred grazing, rotation grazing, and other good practices of pasture management can be used.

CAPABILITY UNIT Vw-1 (DRYLAND)

Only Wet alluvial land is in this unit. This land ranges from moderately fine to moderately coarse in texture. The water table is at or near the surface most of the time, but it fluctuates to a depth of 30 inches. Areas of this soil are scattered throughout the county. In areas adjacent to the North Platte River, this land is shallow over mixed sand and gravel, and in areas farther from the river, it is deep or moderately deep. Some areas of this land are kept wet by seepage, and in other areas the water table is permanently high. Some areas are affected by soluble salts. In these areas salts form a white crust on the surface of the land and on plants during dry periods.

Without drainage this land is too wet for successful cultivation. Some areas have been successfully drained by using V-ditches that keep the water table below a depth of 3 feet. In most places, however, this land is surrounded by higher areas and outlets for drainage ditches are not available.

Most areas of this land are in native pasture. Tall sedges, inland saltgrass, and prairie cordgrass are the principal native plants.

Nearly all the acreage of this land is used for pasture. In some wet periods, its use for grazing is limited. If it is grazed when the water table is too high, bogs develop in areas where the soil material is shallow over gravel. These bogs have many small mounds as much as 18 inches high, which lower the value of the land for grazing. If hay is spread over the bogs when they are dry, the trampling of cattle as they eat the hay tends to level the area. This land produces more forage per acre than any other pasture in the county, though the quality of this forage is not so good as that of forage grown in some other pastures.

Range seeding, rotation grazing, and other good practices of pasture management can be used. Areas in this unit can be developed as habitat for wildlife.

CAPABILITY UNIT VIe-1 (DRYLAND)

Bridgeport very fine sandy loam, 9 to 20 percent slopes, is the only soil in this unit. It is a deep, well-drained soil on foot slopes.

This soil is too steep for safe cultivation. Runoff is very rapid, and the soil is susceptible to excessive erosion. This soil takes in water at a medium rate, and its water-holding capacity is medium. Permeability of the subsoil is moderate. Natural fertility is high, and yields of forage are high where pasture management is good.

This soil is suited to grass and to trees. Areas now cultivated should be seeded to crested wheatgrass, intermediate wheatgrass, or another suitable tame grass. In some areas near rangeland, native grasses are suitable.

Good practices of pasture management are needed for favorable yields of forage. These practices include reseeding, contour furrowing, and pitting. Other good practices that can be used are deferred grazing and rotation grazing. In most areas of this soil, water for livestock can be obtained from drilled wells. In some areas, there are good sites for building dams and impounding water for livestock and for use in recreation.

CAPABILITY UNIT VIe-3 (DRYLAND)

This unit consists of deep, gently sloping to moderately steep soils that have a moderately coarse textured surface layer and subsoil. These soils are on colluvial foot slopes and uplands. They are in the Anselmo, Bayard, and Otero series.

The soils of this unit have a moderately low water-holding capacity. Where they are not under a good cover of grass, they are susceptible to soil blowing. Their organic-matter content is low to medium.

These soils are too steep or too low in natural fertility for cultivated crops. Some areas that have been cultivated have been severely eroded by wind. These eroded areas need to be reseeded with a mixture of good native grasses that are suited to the soils. Other good practices of pasture management for these areas are water spreading, contour furrowing, and pitting.

Where they are not overgrazed or otherwise abused, the soils of this unit produce favorable yields of native grasses. Rotation grazing allows the grasses to reseed. Weeds and brush can be controlled by mowing or using chemical sprays. Drilled wells are usually successful on these soils, and there are sites suitable for building dams and impounding water for livestock and for recreational uses.

CAPABILITY UNIT VIe-5 (DRYLAND)

This unit consists of deep, gently sloping to rolling soils that have a coarse-textured surface layer and subsoil. In many places they are hummocky. These soils are on uplands and stream terraces. The soils on terraces have been reworked by wind. The soils in this unit are in the Dunday, Valentine, and Dwyer series.

The soils of this unit are too droughty and generally are too steep for cultivated crops. They are suited to grass and trees. Some areas were severely eroded by wind when they were cultivated, but these areas are now in permanent plants. Normally, fertility is low. Runoff is slow. Permeability of the subsoil is rapid.

Areas of these soils now in cultivation ought to be seeded to a suitable mixture of cool-season and warm-season native grasses. A few blowouts on the soils should be reseeded to native grasses.

Areas in permanent pasture are productive when they are not abused. Mowing and spraying with chemicals control most weeds and brush. A rest period, or deferred grazing, during the growing season permits natural reseeding of grasses. Grazing too early in spring should be avoided. Dune stabilization and good practices of pasture management are needed. Most areas of this unit have good water wells, but the soils are too permeable to hold water in ponds.

CAPABILITY UNIT VIe-9 (DRYLAND)

This unit consists of young, light-colored, sloping to steep soils. These soils are mainly deep, but in a few places they are only moderately deep. They formed on colluvial foot slopes in material weathered from siltstone. The soils in this unit are in the Keota, Epping, and Mitchell series.

These soils are low in both organic-matter content and natural fertility. They have medium water-holding capacity. Permeability of the subsoil is moderate. Because these soils have weak structure, they are easily eroded when they are tilled. They are susceptible to both soil blowing and water erosion. Runoff is rapid.

Soils of this unit are suited to grass and trees. They are too steep or too droughty for dryfarmed crops.

The main concerns of management are establishing a good cover of grass on fields previously dryfarmed and maintaining the cover on fields already in pasture. Fields that have been tilled can be reseeded to native grasses or seeded to crested wheatgrass. For fields already in grass, good practices of pasture management are needed. These practices include rotation grazing and deferred grazing and pasture grooving to catch water.

CAPABILITY UNIT VIs-1 (DRYLAND)

This unit consists of deep and moderately deep, somewhat poorly drained, nearly level soils that are strongly affected by salts and alkali. In texture, the surface layer and subsoil vary widely. The water table is at a depth of 3 to 5 feet. These soils occur on bottom lands. The soils in this unit are in the Janise and Minatare series.

The soils of this unit absorb water slowly and release it slowly to plants. In some small depressions, water stands on the surface until it evaporates. If these soils are disturbed, they become puddled. The effect of salts and alkali is most severe in the small depressions in pastures or in the slickspots in cultivated fields.

These soils are not suited to cultivation. The content of salts and alkali is too high for crops and causes the soils to become puddled when they are tilled. These soils are better suited to grass. Native grasses that tolerate salts and alkali grow best. Tall wheatgrass is a tame grass that can be used to seed cultivated fields.

In overgrazed pastures saltgrass tends to crowd out the more desirable plants. Rotation grazing and deferred grazing keep the pasture productive. Mowing pastures regularly destroys gumweed, goldenrod, and other weeds. Saltbush and other large woody plants need to be grubbed. In some of the larger areas, big V-ditches can be used for better drainage of the surface, the surface layer, and the subsoil. Reseeding to grass is a good practice on these soils. Ground water is adequate for developing good wells, but these soils are not suitable for building farm ponds or dams.

CAPABILITY UNIT VIs-11 (DRYLAND)

Only Slickspots-Keith complex is in this unit. This complex is made up of deep, nearly level, somewhat poorly drained soils that are strongly affected by alkali. These soils occupy small, irregularly shaped, shallow depressions. About 40 percent of the acreage consists of Keith soils, and about 60 percent consists of the Slickspots. Use and management is determined by the acreage of Slickspots. This complex of soils occurs in the uplands in the southwestern part of the county.

These soils absorb water slowly and release it slowly to plants. Runoff is slow. Because the alkali is so strong, many areas are barren, but some areas have a sparse stand of saltgrass or western wheatgrass.

These soils are difficult to till and are too strongly alkaline for cultivated crops. They are not suited to trees. Pasture is about the only use for these soils. Reseeding with grasses that tolerate alkali might be successful in some formerly cultivated areas. Tall wheatgrass is suitable for reseeding. Barnyard manure added to the soils makes them more friable, allows them to absorb water more readily, and provides plant nutrients. Deferred grazing, rotation grazing, and other good practices of pasture management are needed. Drainage by small V-ditches that extend to suitable natural drainageways may be feasible in some places.

The soils of this unit are generally not suitable sites for dams and farm ponds. Ground water is plentiful for wells for watering livestock.

CAPABILITY UNIT VIs-41 (DRYLAND)

This unit consists mainly of soils that are generally 10 to 20 inches thick over gravel. In a few places these soils are shallower than 10 inches or deeper than 20 inches. They occur on terrace breaks and are moderately coarse textured and gently sloping to steep. The soils in this unit are in the Dix series and the Dix-Bayard complex.

These shallow soils have low water-holding capacity. Their organic-matter content and natural fertility are generally low.

These soils are not suitable for cultivation. They are droughty when dryfarmed and are better suited to grass or trees than to crops. A few areas of this unit support a sparce stand of native pine and redcedar.

Under good grazing management, these soils produce fair to good stands of desirable grasses. The deeper soils produce a higher yield of forage than the shallower ones. Deferred grazing and rotation grazing are needed to keep these soils productive. Mowing and spraying with chemicals kill weeds that use up moisture. If grasses are not allowed to produce seed, reseeding may be needed.

Most areas of this unit have an abundant supply of ground water. Wells can be developed to provide water for livestock, for domestic use, and for irrigation. In some areas, however, water cannot be found by drilling. Where these soils overlie gravel, they are not suitable for ponds, and material for building erosion control dams on them is not readily available.

CAPABILITY UNIT VIs-42 (DRYLAND)

This unit consists mainly of limy soils that are generally 10 to 20 inches thick over bedrock. In some small areas, the soils are deeper, but use and management are determined by the shallow soils. Slopes range from 1 to 30 percent. Some cultivated areas are moderately eroded, and in small areas the bedrock commonly crops out. The soils in this unit are in the Epping and Shingle series and the Tassel-Anselmo complex.

These soils have low water-holding capacity and are droughty where cultivated. Runoff is medium to rapid. These soils are low in natural fertility and organic-matter content.

The soils of this unit are not suited to dryfarming, because they are droughty and rock crops out in many places. In addition, many areas are too steep. These soils are better suited to grass and trees and as wildlife habitat.

Properly managed areas of these soils produce favorable yields of forage. The shallower soils produce less forage than the deeper ones. Deferred grazing, rotation grazing, and other good practices of pasture management are needed. Mowing and spraying with chemicals kill undesirable weeds. Reseeding some areas to a mixture of native grasses is desirable.

Many areas of soils in this unit have suitable sites for dams and farm ponds. Most areas also have sufficient ground water and wells that can provide water for livestock.

CAPABILITY UNIT VIs-43 (DRYLAND)

Only Sandy alluvial land is in this unit. This land is along the sides of intermittent streams and is flooded occasionally. Flooding occurs nearly every spring and is caused both by overflow of the channel and by runoff from adjacent steep slopes. Most areas are moderately deep or deep, some areas are shallow, and a few small areas consist of rock outcrop. This land is nearly level to gently sloping and is mainly sandy or very sandy throughout the profile. It occurs in the sandstone uplands.

The organic-matter content, water-holding capacity, and natural fertility are low. This land is not suited to cultivated crops, because it is flooded, is droughty, and has many rock outcrops and loose stones on the surface.

Native pasture is a better use for this land. Areas along the channels produce a fair to good growth of grasses, mainly blue grama, needle-and-thread, Indian ricegrass, and sand dropseed. Because this soil is in narrow areas, it is generally used in the same way as a nearby larger area. Adjustments in grazing may be needed on this land, however, because it produces more forage than the adjacent areas. Deferred grazing allows the grasses to make good growth in spring before livestock are turned on the pasture. Stones and rocks on the surface hinders mowing in most areas.

CAPABILITY UNIT VIw-1 (DRYLAND)

Only Loamy alluvial land is in this unit. This deep, nearly level to gently sloping land is on low bottom lands adjacent to small intermittent streams. These streams overflow frequently and flood the adjacent areas. The floodwaters generally cover this land for only short periods, but long enough to prevent its use for cultivated crops. The surface layer and subsoil are medium textured to moderately coarse textured.

This land is suited to grass and trees. It supports a fair to good growth of grasses and annual weeds and can be grazed during much of the year. Because this land is in long, narrow areas, its use is difficult where these areas extend through irrigated cropland. In some places reseeding of desirable grasses increases the usefulness of this land. Structures that control gullies are needed in places.

Some areas of this land may be suitable sites for dams and farm ponds, but a careful investigation of each site is needed to determine the quantity and speed of runoff that can be expected. Ground water is sufficient for wells in most areas, but floodwaters may cover the wells in these low areas.

CAPABILITY UNIT VIw-4 (DRYLAND)

This unit consists of nearly level or very gently undulating, very shallow to shallow, somewhat poorly drained soils on bottom lands. The water table is at a depth of 2 to 5 feet. The surface layer is thin, limy, and widely variable in texture. It overlies mixed sand and gravel, and gravel is at the surface in places. Permeability of the subsoil is rapid to very rapid. These soils are cut by many shallow channels. This unit consists of Platte soils and Mixed alluvial land.

The soils of this unit are generally low in natural fertility and in content of organic matter. Because they are shallow, they have low water-holding capacity. Even though the water table is moderately high, dryfarmed crops on these soils are generally damaged by lack of moisture.

The soils of this unit are suited to grass or trees. Fair to good yields of forage are produced if practices of pasture management are used that allow the grasses to reseed and to make good growth in spring and early in summer. These practices include deferred grazing and rotation grazing. Some areas where there are no trees to interfere with haying operations are used as meadow. Control of weeds and brush may be needed in some areas nearest to the North Platte River.

CAPABILITY UNIT VIIe-9 (DRYLAND)

Only Gullied land is in this unit. This land consists of deep deposits of light-colored, medium-textured soil material on foot slopes. This material washed mainly from weathered siltstone. It occupies the sides of large gullies and slopes along the drainageways of intermittent streams. Slopes range from 30 to 100 percent. Erosion is rapid, and soil development is slight. The gullies and drainageways originate mainly in the Wildcat Hills and become deeper and narrower as they cross the more nearly level foot slopes. There are some vertical escarpments and many outcrops of siltstone.

This land is moderately permeable. The organic-matter content and natural fertility are very low. Runoff is very rapid, and severe erosion is likely.

Areas of this land are too steep for the use of machinery. Reseeding of grass is needed in many areas but cannot be done because of steepness. The gullies have only a sparse stand of native grasses, but the banks of some intermittent streams are fairly well covered. Ranchers use this land largely as they find it. Structures designed to control moving water can be installed in some places to prevent further enlargement of old gullies and the formation of new and smaller ones. These structures also protect the lower lying soils from flooding. Small dams can be constructed in places where the volume of moving water is not too large.

Areas of this land have few sites suitable for development as watering places for livestock. Deferred grazing and other good practices of pasture management allow the maximum production of forage.

CAPABILITY UNIT VIIs-1 (DRYLAND)

This unit consists of nearly level to very gently sloping, clayey soils that are moderately to strongly affected by alkali. These soils are very sticky when wet and very hard when dry. They formed in material that weathered from shale. In this unit are Clayey alkali land and Orella soils.

The soils of this unit absorb water slowly and have very slow permeability. Runoff is slow. These soils have high water-holding capacity, but they do not release water readily to plants. The use of these soils is limited by the high content of alkali and the difficulty of tillage. These soils crack badly as they become dry and swell as they become wet. They are easily puddled if they are disturbed when wet.

The soils of this unit are not suitable for cultivation or for trees. Trees planted on them likely would fail. They are suitable for grazing, but yields of forage are low. These soils could be reseeded to a mixture of plants that tolerate alkali in areas where the present stand is thin. Establishment of a satisfactory stand of any kind of plants is difficult, and the chances of success depends mainly on the availability of moisture at the time of seeding. Barnyard manure added to the soils makes them more friable and provides plant nutrients. These soils are used mainly for pasture as they are, and allowances are made for the low forage production by deferring grazing, rotating grazing, and adjusting the stocking rate.

CAPABILITY UNIT VIIs-3 (DRYLAND)

This unit consists of steep soils that are mainly sandy and that are very shallow over gravel or bedrock. These soils occur on side slopes and on the breaks of stream terraces. Slopes range from 9 to 100 percent. The soil material is generally less than 10 inches thick, and over much of the area gravel is at the surface. In this unit are Gravelly land, Rock outcrop-Epping complex, and Rock outcrop-Tassel complex.

The soils have very low water-holding capacity, are droughty, and normally are low in fertility. Vegetation is sparse because of the droughtiness and the gravel and rock outcrops on the surface.

Generally, these soils are too shallow, too rocky, and too steep for successful reseeding. They are suited to native grass, but trees cannot be successfully established. Most areas of this unit are in pastures that have other more productive soils. Careful management to prevent overgrazing is needed.

Ground water for wells is plentiful in this unit. In a few areas, sites are suitable for dams, but suitability needs to be determined for each site.

CAPABILITY UNIT VIIs-4 (DRYLAND)

Only Tassel soils, 20 to 50 percent slopes, is in this unit. These soils are mainly shallow, moderately coarse textured, light colored, and limy. In places these soils are less than 10 inches deep to sandstone, but in some canyons they are deep. The sandstone crops out in places. In most places these soils have a fairly good cover of grass or grass and short trees. Where these soils occur in the Wildcat Hills, cedar and pine are common, but these trees are absent where the soils occur in the steep, northeastern part of the county. Where the cover of grass and trees is sparse, erosion is slight to moderate.

Runoff from these soils is rapid, and water-holding capacity is low. Although these soils are steep, water enters at a moderate rate because the surface layer is moderately coarse textured and has a fairly good cover of grass that helps to slow runoff.

These soils are too steep for cultivated crops. They are suited to native grass and trees. They are also suited as wildlife habitat and for recreation uses. Reseeding of grasses is possible on the crest of some ridges and in draws of canyons; other areas are too steep or too rocky. Deferred grazing, rotation grazing, permitting natural reseeding, and other good practices of pasture management are needed.

Good wells for watering livestock can be dug in most areas of this unit. These soils are not generally good sites for dams or farm ponds, though some likely could be built and used. Areas of these soils in the Wildcat Hills are excellent for development as habitat for deer, wild turkey, and other wildlife. They make good campsites and picnicking areas.

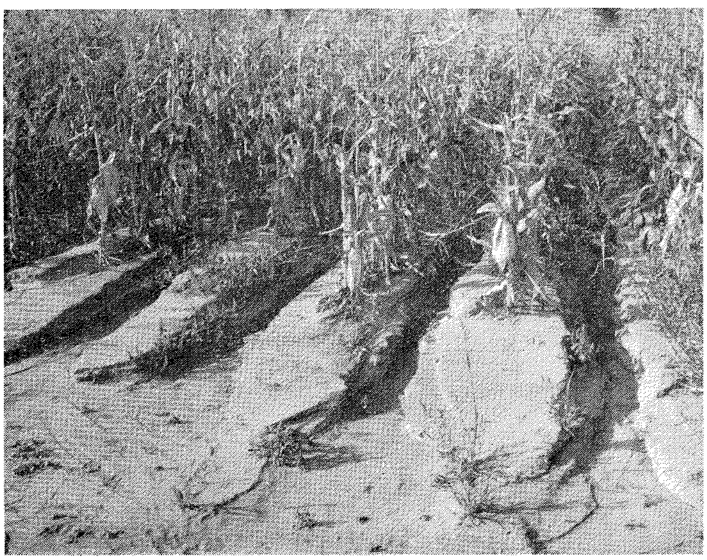

Figure 11.—**Runoff of irrigation water has formed gullies 8 to 12 inches deep between rows of corn. The soil is Mitchell silt loam, 0 to 1 percent slopes.**

CAPABILITY UNIT VIIIs-3 (DRYLAND)

Making up this unit are Barren badlands. Except for some grass in the lowest part of the landscape, there is little or no vegetation. This vegetation is not enough to furnish any appreciable grazing. About the only use for Barren badlands in this unit is for recreation and for the natural protection of wildlife.

CAPABILITY UNIT VIIIw-1 (DRYLAND)

Only Marsh is in this unit. Water 2 to 18 inches deep covers the surface most, but not all, of the year. The water generally is not deep enough to prevent the growth of cattails, willows, and tall reedgrass. Open, shallow water covers some areas. The soil material in this unit is variable.

Small areas of Marsh can be drained and the water table lowered by using drainage ditches. Areas that are kept wet by seepage from irrigation canals can be reclaimed by lining the canals with concrete. Large areas of Marsh that cannot be drained can be developed as useful habitat for wildlife. Assistance in developing these habitats is available through the local office of the Soil Conservation Service.

Management by irrigated capability units

According to the 1959 Census of Agriculture, more than 180,000 acres of harvested crops in Scotts Bluff County was irrigated. This is more than 75 percent of the total acres of cropland. The main crops irrigated are corn, field beans, sugar beets, alfalfa, potatoes, oats, barley, and grasses. Corn is the most important irrigated crop. Field beans and sugar beets are suited to a wide range of soils. Alfalfa, a popular hay crop in the county, is suited to long rotations. Potatoes grow well on friable, well-drained soils. Oats and barley are competing crops that are seeded in spring, commonly as a nurse crop for alfalfa. Tame grasses are generally needed in stubble of oats or barley late in summer. These grasses are grazed for a while in spring, then irrigated and deferred from grazing until they recover.

Using water efficiently, distributing it uniformly, and protecting the soils from erosion, the main purposes of management, are influenced by the slope of the soils and the smoothness of their surface. Land leveling is needed on most soils in the county, especially on the deep, less sloping ones. Smoothing the surface allows more uniform distribution of water, even when sprinklers are used. Both land leveling and smoothing help to prevent runoff and erosion (fig. 11).

Water is distributed on fields by furrows, borders, controlled flooding, sprinklers, and corrugations. Different methods of distribution are suitable for different crops and for different soils. When to irrigate, how often, and how much water to apply are questions that must be answered for each field. In dry periods irrigation before planting is needed for some fields. On nearly level fields that have few or no natural waterways, provision should be made to dispose of excess irrigation water.

Irrigated soils produce larger yields than dryfarmed soils. Consequently, more plant nutrients are removed in the harvested crops. To keep irrigated soils fertile, the farmer must return these nutrients to the soil. All crop residue and other organic matter should be returned to the soil and mineral fertilizer added. Nitrogen is the element most deficient, but most crops also respond to phosphate. Potash commonly is not deficient. Soil tests will indicate the kinds and amount of fertilizer needed for specific crops.

Farmers need technical help in planning for irrigation. This help is available through the local office of the Soil Conservation Service and the county agricultural agent. Estimates of cost and information about equipment can be obtained from representatives of equipment dealers.

On the following pages, the capability units, or groups of soils similar in management requirements for irrigated farming, are described; some limitations are given; and suitable management is discussed. The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all soils of a given series appear in the unit. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I-1 (IRRIGATED)

This unit consists of deep, well-drained soils that have a medium-textured or moderately fine textured surface layer. Texture of the subsoil ranges from moderately fine to moderately coarse. The substratum is also variable in texture. These soils are nearly level and have not been appreciably eroded. They are on high bottoms, stream terraces, broad alluvial fans, and uplands. The soils in this unit are in the Buffington, Keith, McCook, Mitchell, Otero, Bayard, and Tripp series.

Most soils in this unit absorb water at a rate of about 1 inch per hour. Their water-holding capacity is medium, and they release water readily to plants. These soils are easily worked, and their limitations are few in irrigated areas. Runoff is slow, but runoff from higher lying soils sometimes covers the surface and stands for a short time before it soaks in.

The soils of this unit are well suited to corn (fig. 12), alfalfa, field beans, potatoes, sugar beets, small grains, and grasses. Trees grow well in windbreaks.

Soil fertility can be maintained by adding commercial fertilizer and using practices that protect the soil and conserve irrigation water. After row crops are grown for as many as 6 consecutive years, a legume or a grass-legume mixture is beneficial because it helps to improve soil tilth, increase the organic-matter content, and increase water intake.

Land leveling is needed to prepare the soils of this unit for gravity irrigation, but deep cuts normally are not needed. The moderately fine textured soils in this unit have a slower intake rate but a higher water-holding capacity than the medium-textured soils. Any good method of distributing water can be used. These methods include border dikes, furrows, controlled flooding from ditches, sprinklers, and corrugations. Water can be applied to the soils through gated pipes, siphon tubes, or, in places, simple openings in the field laterals.

During periods when they are not protected by a growing crop or by crop residue, these soils are subject to slight to moderate soil blowing. Soil blowing ordinarily can be stopped by roughening the surface with a chisel, duckfoot cultivator, lister, or similar implement. For producing nonlegume crops, nitrogen normally is needed on all soils in this unit.

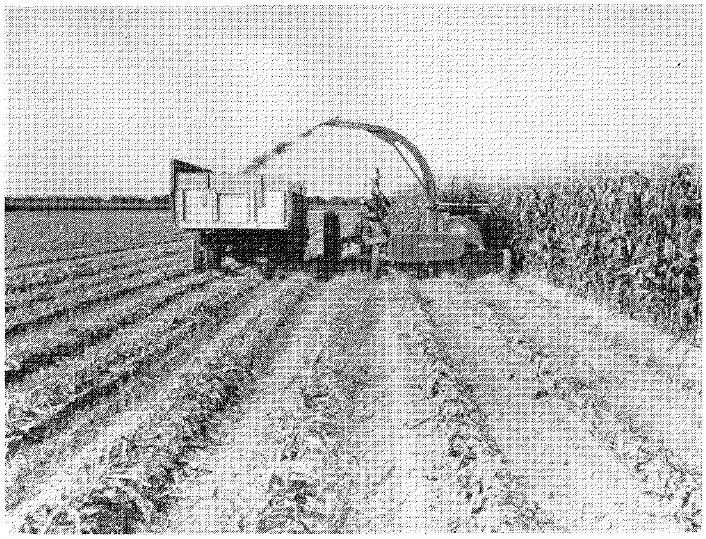

Figure 12.—**Harvesting corn with an ensilage cutter on irrigated McCook loam. This soil is in capability unit I-1 (irrigated).**

CAPABILITY UNIT IIe-1 (IRRIGATED)

This unit consists of deep and moderately deep, medium-textured and moderately fine textured soils that have slopes of 1 to 3 percent. The underlying material varies from place to place. Some of these soils are moderately eroded, but most are only slightly eroded. These soils occur on stream terraces, alluvial fans, colluvial foot slopes, and uplands. They are in the Bridgeport, Buffington, Keith, Keota, Mitchell, and Tripp series.

The soils of this unit take in water at a rate of about 1 inch to 1.25 inches per hour. Their moisture-holding zone ranges from 2 to 5 feet in thickness, and their water-holding capacity is about 2 inches of water per foot of soil depth. The moderately fine textured soils take in water at a slightly slower rate, but they store slightly more than the other soils. The Keota soils in this unit are underlain by siltstone at a depth of about 30 inches; consequently, their moisture-holding zone is thinner than that of the other soils. The soils of this unit release water readily to plants. They are easily worked. Because these soils are very gently sloping, loss of soil and water is likely and is the main hazard if these soils are used for irrigated crops.

These soils are suited to irrigated corn, alfalfa, potatoes, sugar beets, field beans, and small grains. They are also suited to trees and tame grass.

High fertility can be maintained by using good conservation practices. Soil tilth is better and the organic-matter content and water intake are higher where a legume or a grass-legume mixture is included in the cropping sequence. Returning all crop residue helps to protect the soils from water erosion and aids in conserving moisture. Applying barnyard manure to the soils add plant nutrients and micro-organisms.

In most places some land leveling is needed to prepare these soils for gravity irrigation. This leveling encourages an even growth of plants because water is distributed evenly and drainage is uniform. Corn and potatoes can be planted on the contour, and field beans and sugar beets can be planted in contour furrows. Sprinkler irrigation is suited to all crops. If borders are used, bench leveling is needed. Corrugations and flooding from open ditches can be used for close-growing crops. Siphon tubes and gated pipes can be used in some places. More frequent irrigations are needed on the moderately deep soils than on the deep soils.

Nitrogen is needed for all nonlegume crops. On soils that are limy in the surface layer, alfalfa responds to added phosphate.

CAPABILITY UNIT IIe-3 (IRRIGATED)

This unit consists of deep, nearly level to very gently sloping soils that have a fine sandy loam surface layer. The subsoil is medium textured to moderately coarse textured. Texture of the substratum varies from place to place. In places these soils have been affected by both soil blowing and water erosion. They occur on high bottom lands, stream terraces, colluvial foot slopes, and uplands. These soils are in the Alice, Anselmo, Bayard, Glenberg, Haverson, Mitchell, Otero, and Tripp series.

The soils of this unit take in water at a rate of about 2 inches per hour. Their moisture-holding zone ranges from 3 to more than 5 feet in thickness. The surface layer holds about 1.75 inches of water per foot of soil depth, and the subsoil holds from 1.75 to 2 inches of water per foot. These soils are easily penetrated by roots. The surface layer is very friable and easy to work.

These soils are well suited to irrigated corn, alfalfa, potatoes (fig. 13) sugar beets, field beans, small grains, and tame grass.

Management is needed to reduce soil blowing and the leaching of plant nutrients by excessive irrigation and to maintain fertility. Soil fertility can be maintained by using good conservation practices and adding commercial fertilizer. More nitrogen is generally needed on sandy soils than on loamy soils. A cropping sequence that provides a legume, green-manure crop, or crops that leave a large amount of residue is particularly beneficial to these soils. A sequence of this kind helps in controlling soil blowing and in keeping leaching at the minimum. Adding barnyard manure is also beneficial. After field beans or sugar beets have been harvested, emergency tillage may be needed to control soil blowing.

Some land leveling is generally needed to prepare these soils for gravity irrigation. Where slopes are between 1 and 3 percent, corn and potatoes can be planted on the contour to control erosion, and field beans and sugar beets can be planted in contour furrows. Irrigation by sprinklers is suited to these soils for all crops. Corrugations are not so well suited as they are on finer textured soils. Alfalfa can be irrigated from contour ditches and small grains from border dikes, contour ditches, or sprinklers. On slopes of less than 1 percent, straight furrows are suitable for all row crops, and crops can be irrigated by gated pipes or siphon tubes.

Figure 13.—**Harvesting potatoes on Alice fine sandy loam, 0 to 3 percent slopes. This soil is in capability unit IIe-3 (irrigated).**

CAPABILITY UNIT IIs-5 (IRRIGATED)

McCook silty clay loam, gravel substratum variant, 0 to 1 percent slopes, is the only soil in this unit. This soil is 20 to 40 inches deep over mixed sand and gravel. The surface layer is moderately fine textured, and the subsoil is medium textured. Erosion is slight. This soil is on bottom lands south of Henry in an area where the water table has declined in recent years.

This soil absorbs water at a fairly slow rate. Thickness of the water-holding zone averages about 30 inches. Available water capacity is about 2.1 inches of water per foot of soil depth in the surface layer and about 2 inches per foot in the subsoil. Because the content of clay is high, this soil cracks on drying and is sticky when wet. The soil tends to clod if it is worked when dry, and it is difficult to till if it is worked when wet. It can be tilled when the moisture content is slightly less than field capacity.

This soil is suited to irrigated corn, alfalfa, sugar beets, field beans, small grains, and grass. Potatoes can be grown, but they are not well suited to this soil, because of its moderately fine textured surface layer.

Management is needed that increases the rate of water intake, increases water-holding capacity, and makes tillage easier. If crop residue, barnyard manure, or green manure is added to this soil, organic matter is increased and the soil is more friable and easier to till.

Very little land leveling is needed on this nearly level soil to prepare it for gravity irrigation. Row crops can be planted in furrows and irrigated by sprinklers or by means of level borders. Alfalfa, small grains, and grass can be irrigated by using borders, corrugations, or sprinklers. Where suitable, siphon tubes or gated pipes can be used. Shorter irrigation runs and more frequent irrigations are needed on this soil than on deeper soils. Nitrogen is needed for favorable yields.

CAPABILITY UNIT IIw-4 (IRRIGATED)

This unit consists of deep and moderately deep, somewhat poorly drained soils that have a medium-textured surface layer and a medium-textured to moderately coarse textured subsoil. The substratum varies in texture, but in most places it is mixed sand and gravel at a depth of 3 to 5 feet. Depth to the water table ranges from 3 to 5 feet. Most of these soils are on bottom lands, but some are in low areas in the Gering Valley and on the Lyman Plain. They are in the Gering, Las Animas, Las, McGrew, and Mitchell series.

The soils of this unit absorb water at a rate of about 1 inch per hour. The moisture-holding zone is 2 to more than 5 feet thick. Available water capacity is about 2 inches of water per foot of soil depth in the upper part and 1.75 to 2 inches in the lower part. The moderately high water table is the main hazard, and drainage is needed in places. Preparation of seedbeds is delayed in spring because these soils do not warm as rapidly as well-drained soils.

These soils are suited to irrigated corn, alfalfa, sugar beets, potatoes, small grains, and tame grasses. They are suited to field beans, though not so well as to other crops. Trees in farmstead windbreaks grow well.

The fertility of these soils can be maintained by using good conservation practices. Because all the soils in this unit are calcareous in the surface layer, legumes on them generally respond to added phosphate. Heavy applications of fertilizer generally pays on these soils because the excess lime in the surface layer makes natural plant nutrients unavailable.

Only a small amount of land leveling is needed to prepare these soils for gravity irrigation. Some areas are slightly channeled, and the channels need to be filled before leveling. Row crops on these soils can be irrigated either by furrows or sprinklers. Alfalfa, small grains, and grass can be irrigated by borders, corrugations, or sprinklers. Gated pipes or siphon tubes are suitable in places. Where wetness is serious, V-ditches can be used. Tile drains or canals lined with concrete also can be used in some seepy areas.

CAPABILITY UNIT IIw-6 (IRRIGATED)

This unit consists of moderately deep and deep, nearly level soils that are somewhat poorly drained. The water table is at a depth of 2 to 6 feet. These soils have a moderately coarse textured surface layer and subsoil. In most places the substratum is mixed sand and gravel, but in a few it is fine sandy loam. These soils are mainly uneroded. Nearly all areas occur on bottom lands of the North Platte River, but a few are in low, moderately wet areas on colluvial foot slopes. These soils are in the Las Animas and McGrew series.

The soils of this unit absorb water readily, and runoff is slow. Permeability of the subsoil is moderate. Available water capacity is about 2 inches of water per foot of soil depth in the surface layer and 1.75 inches per foot in the subsoil. Because the lower subsoil is wet, deep-rooted plants do not live long. These soils are commonly so wet in spring that a seedbed cannot be prepared early, and they do not warm so quickly as well-drained soils. Soil blowing is a hazard during periods when the soils are not covered by growing plants, stubble, or a mulch. In these periods, a helpful emergency practice is roughening the surface.

The soils in this unit are suited to irrigated corn, alfalfa, sugar beets, small grains, and tame grasses. Field beans are grown in places, but they grow better on well-drained soils. Trees grow well in farmstead windbreaks and shelterbelts.

A legume or a grass-legume mixture in the cropping sequence every 6 or 8 years helps to increase the content of nitrogen and organic matter, improve tilth, and decrease soil blowing. If grazing of tame pasture is rotated, grasses are allowed to make full growth and produce more forage.

Little land leveling is needed to prepare these soils for gravity irrigation. Row crops can be irrigated by furrows, borders, or sprinklers, and alfalfa, small grains, and grass by borders and sprinklers. Corrugations do not endure well in these sandy soils. Siphon tubes and gated pipes can be used where they are suitable.

Nitrogen is needed for above-average yields. The excess of lime in the surface layer makes some natural plant nutrients unavailable. Because of this deficiency, legumes generally give good response to added phosphate.

CAPABILITY UNIT IIIe-1 (IRRIGATED)

Most of the soils in this unit are deep, but a few are moderately deep. Texture is medium in the surface layer and subsoil and is variable but generally medium in the substratum. Slopes are generally between 3 to 5 percent but are 2 percent in a few areas. Erosion is only slight in most places, but it is moderate in a few. These soils occur mainly on stream terraces, colluvial foot slopes and uplands. They are in the Bridgeport, Keith, Keota, Mitchell, Tripp, and Ulysses series.

The soils of this unit absorb water at a rate of 1 inch to 1.25 inches per hour. Permeability of the subsoil is moderate. The moisture-holding zone ranges from 2 to more than 5 feet in thickness. Available water capacity is about 2 inches of water per foot of soil depth. Runoff is medium. These soils are easily worked, and crops on them respond well to added fertilizer. Controlling erosion and managing irrigation water are the main concerns of management.

The soils of this unit are suited to irrigated corn, alfalfa, potatoes, sugar beets, field beans, small grains, and grasses. They are also suited to trees in farmstead windbreaks and shelterbelts.

A cropping sequence that includes alfalfa or a grass-legume mixture every 6 to 8 years helps to maintain soil fertility, good tilth, and high organic-matter content. Also helpful is a small grain seeded with sweetclover and plowed under while green. Erosion is easier to control where the intake of water is improved by adding barnyard manure, green manure, and crop residue. On the soils of this unit legumes are generally allowed to grow for 3 to 5 years; then they are plowed under, and the soils are seeded to row crops.

Generally, some land leveling is needed to prepare these soils for efficient gravity irrigation. Bench leveling may be preferable. Because slopes are between 3 and 5 percent in most places, contour furrows supplemented with terraces are suitable for corn and potatoes. Sprinkler irrigation is suitable for field beans and sugar beets. Where slopes are less than 4 percent, corrugations are suitable for close-growing crops. Contour-ditch and sprinkler irrigation can be used for alfalfa, small grains, and grass. Gated pipes or siphon tubes may be used in some places.

Nitrogen is needed if above-average yields are to be produced and soil fertility maintained. Yields of legumes generally can be increased for 2 to 4 years by adding phosphate.

CAPABILITY UNIT IIIe-3 (IRRIGATED)

This unit consists mainly of deep, gently sloping soils, but a few soils are moderately deep and very gently sloping. The surface layer is moderately coarse textured, and the subsoil is medium-textured or moderately coarse textured. Texture of the substratum varies from place to place. Some of these soils are eroded, and some are uneroded. The soils of this unit occur on foot slopes, stream terraces, and uplands. They are in the Alice, Anselmo,

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Bayard, and Mitchell series, the Chappel-Dix complex, and Otero-Bayard complex.

These soils take in water at a rate of about 2 inches per hour. The moisture-holding zone is 4 to 5 feet thick in the deep soils and averages about 2 feet in thickness in the moderately deep soils. Permeability of the subsoil is moderately rapid. Available moisture capacity ranges from 1.75 to 2 inches of water per foot of soil depth, depending on the texture of the subsoil. In hot weather frequent irrigations are needed to prevent the burning of crops. In most places these soils are easily worked. Their organic-matter content is medium to low. Although soil blowing is the main concern of management, a considerable amount of plant nutrients is leached from the surface layer and subsoil.

The soils of this unit are suited to irrigated crops of corn, field beans, sugar beets, potatoes, alfalfa, small grains, and tame grasses. They are also suited to trees in windbreaks and shelterbelts.

Especially important in improving the fertility of these soils is the inclusion of legumes or a legume-grass mixture in the cropping sequence every 7 to 9 years. These crops also provide organic matter, increase available water capacity, improve tilth, and aid in controlling erosion. Adding barnyard manure also improves fertility and increases available water capacity. Alfalfa can be sown with a small grain and allowed to grow for 3 to 5 years; then, it can be turned under as a green-manure crop.

Except where sprinkler irrigation is used, some land leveling is generally needed. Bench leveling may be preferable on some soils. Irrigated corn or potatoes are suited if they are planted on the contour on terraces. Sprinkler irrigation is suitable for field beans and sugar beets that are planted on the contour. Contour-ditch and sprinkler irrigation are suitable for alfalfa, small grains, and grass. Siphon tubes and gated pipes are suitable methods of irrigation in some places.

Escarpments and steep areas resulting from land leveling should be protected until plants become established. Lining irrigation canals and ditches with concrete will prevent leaching of irrigation water.

A large amount of nitrogen is needed for nonlegume crops if favorable yields are to be produced and soil fertility maintained. Leaching of plant nutrients can be partially controlled by increasing the content of organic matter through the use of manure and crop residue.

CAPABILITY UNIT IIIe-5 (IRRIGATED)

Alice loamy fine sand, 0 to 3 percent slopes, is the only soil in this unit. This deep, nearly level soil has a coarse-textured surface layer and a moderately coarse textured subsoil. The substratum is moderately coarse textured to a depth of 5 feet or more. Generally, this soil is only slightly eroded, though small areas are moderately eroded or severely eroded. This soil occurs on stream terraces.

This soil absorbs water at a rate of about 4 inches per hour. The effective moisture-holding zone ranges from 4 to 5 feet in thickness. Permeability of the subsoil is moderately rapid. Available water capacity of the subsoil is about 1.75 inches of water per foot of soil depth. Frequent irrigations are needed on this soil. The natural fertility is medium to low, but the response of crops to fertilizer is good. Soil blowing and maintenance of fertility are the main concerns of management.

This soil is suited to irrigated corn, field beans, sugar beets, potatoes, small grains, and grass. It is also suited to trees in shelterbelts and farmstead windbreaks.

Management is needed that prevents soil blowing and maintains fertility. A cropping sequence that includes a legume or a grass-legume mixture about half of the time helps to prevent soil blowing and adds nitrogen and organic matter to the soil. Planting row crops for more than 2 consecutive years is not a good practice. Small grains can be used in the sequence if sweetclover is seeded with the grain and left as cover after the grain is harvested. Adding barnyard manure helps to control soil blowing and to improve fertility. Stubble and crop residue left on the surface help to conserve moisture and to control soil blowing. Large amounts of nitrogen are generally needed for row crops that are not legumes.

A small amount of land leveling is needed to prepare this soil for gravity irrigation. Row crops can be irrigated by furrows and sprinklers, and alfalfa and small grains by borders, contour ditches, or sprinklers. Siphon tubes and gated pipes can be used in places.

CAPABILITY UNIT IIIs-1 (IRRIGATED)

This unit consists of deep and moderately deep soils that are moderately affected by salts and alkali. Their surface layer and subsoil range from moderately fine to coarse in texture. In most areas the water table is at a depth of 3 to 6 feet. A few areas are poorly drained because water seeps in from irrigation canals. Most of these soils are nearly level, but a few are gently sloping. The nearly level soils are less eroded than the gently sloping ones. The soils in this unit occur on bottom lands, stream terraces, and colluvial foot slopes. They are in the Anselmo, Buffington, Gering, Las, Las Animas, McGrew, Mitchell, and Buffington series.

These soils take in water at a variable rate because their surface layer varies in texture and in degree of alkalinity. The moisture-holding zone ranges from 2 to more than 5 feet in thickness. Available water capacity ranges from 1.75 to 2.1 inches of water per foot of soil depth, depending on the texture of the solum. Permeability of the subsoil is variable.

Some of the soils of this unit are free of salts and alkali in the surface layer, but not in the subsoil or substratum. In these soils, the effect of the salts and alkali is more apparent on deep-rooted crops. Where the salts and alkali are at the surface, tillage is more difficult, less water is taken in, and crop yields are lower. On all soils affected by salts and alkali, plant nutrients are less available and aeration is poor. Permanent improvement of these soils is difficult.

The soils of this unit are suited to irrigated corn, sugar beets, alfalfa, small grains, and tame grasses. The tame grasses can be irrigated when the animals are moved to a new pasture to permit recovery of plants from grazing. These soils are also suited to trees in shelterbelts and farm windbreaks. They are not so well suited to potatoes and field beans, because those crops cannot tolerate salts and alkali.

A cropping sequence that includes legumes or a grass-legume mixture helps to improve fertility, organic-matter content, tilth, and infiltration. Also helpful are additions of barnyard manure and green manure. If legumes are not included in the cropping sequence, productivity can be maintained by adding organic matter and fertilizer and by using other good management.

Soils affected by alkali take in water slowly. Adding manure, corncobs, and other organic material to the alkali spots makes the soils more friable so that they absorb water faster. Adding gypsum or sulfur helps to neutralize the alkali and to allow more rapid intake of water. More of these materials may be needed in 4 or 5 years if alkali accumulates. If the sulfur is disked into the soil early in spring, warm weather increases activity of the soil microorganisms and hastens chemical reactions and reclamation. Light applications of barnyard manure also hasten reclamation.

Surface drainage is needed if these soils are irrigated. Water stands for weeks on some alkali spots, unless these spots are drained artifically or are filled by land leveling. Normally, land leveling is desirable because it conserves water, helps regulate runoff, provides more uniform drainage, and allows a more even growth of plants. Because these soils have slow permeability, the rate of applying irrigation water must be slow. Frequent irrigations are desirable because plants cannot absorb water readily from soils affected by salts or alkali.

In nearly level areas, corn and sugar beets may be irrigated by furrows, borders, or sprinklers. On slopes of 2 percent, borders should be on the contour; on slopes of 4 percent or more, furrows should be supplemented with terraces. Small grains, alfalfa, and tame grasses can be irrigated by borders, corrugations, or sprinklers. Siphon tubes and gated pipes are suitable for controlling water in some places.

Nitrogen is needed on these soils if yields are to be satisfactory and soil fertility maintained. Legumes are particularly responsive to applications of phosphate.

CAPABILITY UNIT IVe-1 (IRRIGATED)

This unit consists of deep and moderately deep soils that have a medium-textured surface layer and subsoil. Texture of the substratum varies from place to place. Slopes range from 5 to 9 percent, and erosion ranges from slight to moderate. These soils occur on colluvial foot slopes, stream terraces, and uplands. They are in the Bridgeport, Keith, Keota, Mitchell, Tripp and Ulysses series.

The soils of this unit are medium to high in natural fertility and organic-matter content. They take in water at a rate of 1 inch to 1.25 inches per hour. The moisture-holding zone in nearly all of these soils ranges from 4 to 5 feet in thickness but in the moderately deep soils it is only about 2 to 3 feet. Permeability of the subsoil is moderate. The available water capacity is about 2 inches of water per foot of soil depth. Runoff is moderately rapid. Erosion is always a hazard. Controlling erosion and irrigation water and maintaining fertility are the main concerns of management.

The steepness of slopes is the main limitation to use of these soils for irrigated crops. Where slopes are less than 6 percent and the soils are terraced, corn and potatoes can be irrigated by contour furrows. On soils that are contour farmed and terraced, field beans and sugar beets can be irrigated by sprinklers. Row crops are not irrigated where slopes are 6 to 8 percent, because the hazard of erosion is high and water is difficult to control. Alfalfa and small grains can be irrigated by contour ditches or by sprinklers on slopes of 6 to 8 percent. Grasses can be irrigated by contour ditches or by sprinklers on slopes of 5 to 9 percent and by corrugations on slopes of 5 to 6 percent. These soils can be bench leveled and farmed economically with modern machinery if slopes are not more than 5 or 6 percent.

Under good management, the soils of this unit can be cultivated safely. Because these soils are sloping, they need to be kept in close-growing crops most of the time. Alfalfa or a grass-alfalfa mixture helps to control erosion and can be turned under while green after 4 or 5 years. A green crop turned under increases the fertility of the soil and the content of organic matter. Row crops can be grown for not more than 2 consecutive years; then, a small grain can be seeded to prepare the soil for a legume. Rotation grazing permits irrigation of pastures when the animals are removed and allows the plants to recover from grazing.

Some land reshaping is generally needed to provide smoother slopes and to help in controlling irrigation water. Even irrigation by sprinklers is easier and more effective where the surface has been smoothed. Grassed waterways are needed in places to prevent serious gullying. Terraces can be used to slow runoff and divert water to safe disposal areas. Normally, nitrogen is needed on all these soils.

CAPABILITY UNIT IVe-3 (IRRIGATED)

This unit consists of deep and moderately deep soils that have a moderately coarse textured surface layer and a medium-textured or moderately coarse textured subsoil. Texture of the substratum varies from place to place. In most places slopes are 5 to 9 percent, but in a few they are 1 to 5 percent. Erosion ranges from slight to moderate. These soils occur on colluvial foot slopes and on uplands. They are in the Anselmo, Bayard, Chappell, Dix, Mitchell, and Otero series.

These soils take in water at a rate of about 2 inches per hour. The moisture-holding zone ranges from 4 to 5 feet in thickness in the deep soils, and from 1 to 3 feet in the moderately deep soils. In the surface layer the available water capacity is about 1.75 inches of water per foot of soil depth; in the subsoil it ranges from 1.75 to 2 inches of water per foot, depending on the texture.

The soils in this unit are subject to soil blowing. Because they absorb water readily, frequent irrigations are needed. The fertility is moderate to low, and plants respond well to added fertilizer. Erosion by wind and water and the maintenance of fertility are the main concerns of management.

In areas where the slopes are 5 to 6 percent, erosion can be controlled by terracing the soils and planting on the contour. Corn and potatoes can be irrigated by either contour furrows or sprinklers, but field beans and sugar beets can be irrigated only by sprinklers, even if the soils are terraced and the crops are planted on the contour. Alfalfa, grass, and small grains can be irrigated by contour ditches or sprinklers on slopes of 5 to 6 percent. In areas where the slopes are 6 to 8 percent, only alfalfa, small grains, and grass are suited, and sprinkler irrigation is most efficient.

Some land reshaping is generally needed to prepare the soils of this unit for irrigation by gravity. Even where sprinklers are used, water can be applied more uniformly if the surface is smooth. Before attempting to reshape the moderately deep and shallow soils, however, the owner should determine the depth to gravel. Irrigation water and erosion can be controlled on the steeper slopes by reducing the size of the irrigation stream.

Maintaining fertility on these soils is difficult. Generally, large amounts of nitrogen are needed. Because leaching is serious on these sandy soils, a good practice is adding large quantities of organic matter as barnyard manure, green manure, or crop residue. The organic matter tends to bind the soil particles together, which helps to reduce soil blowing; it saves moisture by reducing evaporation; and it supplies needed plant nutrients. A crop sequence that provides alfalfa or a grass-alfalfa mixture at least half of the time helps to control erosion and to increase the organic-matter content of the soils. This sequence also produces high-quality forage. Controlling water and protecting the soils are more effective if row crops are limited to not more than 2 consecutive years and small grains to 2 consecutive years before growing a legume. These soils can be safely cultivated, provided that their limitations are recognized and the necessary precautions taken.

CAPABILITY UNIT IVe–5 (IRRIGATED)

This unit consists of deep, nearly level to gently sloping loamy fine sands that have a moderately coarse textured to coarse textured subsoil. Texture of the underlying layers vary from place to place. Erosion ranges from slight to severe. These soils occur on bottom lands, stream terraces, colluvial foot slopes, and uplands. They are in the Bankard, Dunday, Otero, and Valentine series.

The soils of this unit take in water at a rate of about 4 inches per hour. The moisture-holding zone ranges from 4 to more than 5 feet in thickness. Available water capacity is about 1.25 inches of water per foot of soil depth in the surface layer; in the subsoil it ranges from 1.25 to 1.75 inches per foot of soil depth. Permeability of the subsoil is moderately rapid to rapid. Because the surface layer is coarse textured and slopes are nearly level to gentle, runoff is slow to medium.

Frequent irrigation is needed on these soils because they take in water rapidly and have moderately rapid to rapid permeability in the subsoil. Runs should be short. Rainwater and excess irrigation water readily leach plant nutrients from these coarse-textured soils. Fertility is low, but crops on these soils respond well to added fertilizer. Erosion by wind and water and the maintenance of fertility are the main concerns of management.

Where the slopes are less than 1 percent, corn, sugarbeets, field beans, and potatoes can be irrigated by furrows or sprinklers. Where slopes are between 1 and 2 percent, row crops can be irrigated by contour furrows and sprinklers. Row crops can also be irrigated by contour furrows and sprinklers on terraced soils where the slopes are between 2 and 6 percent. Alfalfa, small grains, and grass are more efficiently irrigated in border strips or by sprinklers where the slopes are less than 1 percent. Contour ditches or sprinklers are suited where the slopes are between 1 and 4 percent. On slopes of 4 to 6 percent, only sprinklers can be used. In suitable places water may be controlled by siphon tubes or by gated pipes.

Some land reshaping normally is needed to prepare these soils for irrigation by gravity. Deep cuts may be needed on uneven areas. Areas where the surface soil has been cut away or has been severely eroded should receive large amounts of barnyard manure or other organic matter and of commercial fertilizer.

The maintenance of fertility is difficult on these coarse-textured soils. Nitrogen is needed for good crop growth each year. Because these soils are susceptible to blowing, they need to be kept in close-growing crops most of the time. Alfalfa or an alfalfa-grass mixture can be used to stabilize the soils, to add nitrogen, and to increase the organic-matter content. In addition, these plants provide high-quality protein forage. After the alfalfa or an alfalfa-grass mixture has been grown for 4 or 5 years, it can be turned under as green manure; then row crops can be grown for 1 or 2 years. After the row crops, alfalfa can be seeded the following spring on small grain that was seeded in fall. Barnyard manure added to these soils helps to increase fertility, control soil blowing, and reduce evaporation. Crop residue and a stubble mulch left on the surface help to conserve moisture and control blowing.

CAPABILITY UNIT IVs–1 (IRRIGATED)

Bankard loamy fine sand, alkali, wet variant is the only soil in this unit. This is a nearly level to gently sloping, deep, coarse-textured soil that has a water table at a depth of 3 to 5 feet. It is moderately affected by alkali and salts. In some areas the alkali is near the surface, but in others it is at a depth of 18 to 36 inches. Most areas are nearly level, but a few are gently sloping. This unit occurs on bottom lands and colluvial slopes.

This soil takes in water at a rate of about 4 inches per hour, though this rate varies from place to place depending on the amount of alkali. Thickness of the moisture-holding zone ranges from 4 to more than 5 feet. The available water capacity is about 1.25 inches of water per foot of soil depth. Except in a few small areas where a buried silty soil occurs, permeability is rapid. Because the surface layer is coarse textured, runoff is slow.

In areas where the alkali is in the surface layer, crops are mainly affected when the plants are young. Care is needed to provide enough moisture for maximum growth during this period. In areas where the alkali is in the lower layer, the effect is mainly on deep-rooted crops. Sufficient irrigation water is needed during this critical period to keep plant growth at the maximum.Plant nutrients are not so readily available and aeration is not so good in soils affected by salts and alkali as in soils not affected. Permanent reclamation of this soil is difficult, unless the water table is lowered. V-ditches can be used in places to lower the water table.

Adding large quantities of barnyard manure helps to prevent soil blowing and to reduce the adverse effect of salts. Keeping growing crops or organic matter on the surface also helps to control soil blowing.

This soil is suited to irrigated crops of corn, sugar beets, alfalfa, small grains, and tame grasses. Tame grasses can be irrigated when the animals are moved to a new pasture. This soil is also suited to trees in windbreaks and shelterbelts. Because potatoes and field beans are not tolerant of salts or alkali, they are not well suited.

CAPABILITY UNIT IVs–4 (IRRIGATED)

This unit consists of shallow soils that have a medium textured to moderately coarse textured surface layer and subsoil. Along the North Platte River, these soils are nearly level and their substratum consists of mixed sand and gravel. The water table is at a depth of 3 to 5 feet. In the uplands, these soils are very gently sloping, are slightly to severely eroded, and have siltstone bedrock at a depth of 10 to 20 inches. The soils in this unit are in the Epping and Platte series.

These soils take in water at a rate of 1 to 2 inches per hour. The moisture-holding zone ranges from 1 to 2 feet in thickness. Available water capacity is 1.75 to 2 inches of water per foot of soil depth, depending on the texture. Because the water-holding capacity is low, frequent irrigation and short runs are needed. Land leveling is difficult because these soils are shallow to sand and gravel or to bedrock. Fertility is moderate to low.

These soils are suited to irrigated corn, field beans, sugar beets, potatoes, alfalfa, small grains, and grass. Row crops are difficult to grow on uplands where the the soils are underlain by siltstone, but they can be grown on bottom lands and irrigated by furrows or sprinklers. Alfalfa, small grains, and grass grown on bottom lands are suitable for irrigation by border strips, corrugations, and sprinklers. On uplands these crops are suitable for irrigation by borders, contour ditches, and sprinklers. On some fields water can be applied and controlled by gated pipes or siphon tubes.

A good cropping sequence on soils of this unit provides alfalfa or a grass-alfalfa mixture at least half of the time. This sequence increases the fertility and organic-matter content and improves tilth. Barnyard manure added to the soils helps to increase fertility and to conserve moisture. Tame pasture that is grazed in rotation can be irrigated when the animals are removed. Rotation grazing prevents damage to the plants and helps keep them vigorous. Crops on these soils respond well to added nitrogen, and legumes generally respond well to phosphate.

CAPABILITY UNIT IVw-5 (IRRIGATED)

Bankard loamy fine sand, wet variant, is the only soil in this unit. This is a nearly level, somewhat poorly drained soil that has a coarse-textured surface layer and subsoil. The underlying layers are coarse textured and in places consists of a mixture of sand and gravel. The water table is at a depth of 3 to 5 feet. This soil generally is not eroded. It occurs along the North Platte River and in low areas on colluvial foot slopes.

This soil takes in water at a rate of about 4 inches per hour. The moisture-holding zone ranges from 3 to more than 5 feet in thickness. Available water capacity, from the surface to the water table, is about 1.25 inches of water per foot of soil depth. Runoff is slow. Because of wetness, deep-rooted crops ordinarily are short lived. This soil is commonly too wet for early preparation of the seedbed. Soil blowing is a hazard when the soil is not protected by growing plants, stubble, or crop residue. Fertility is low to moderate. Because permeability is rapid, irrigation runs on this soil must be short and irrigation frequent.

This soil is suited to irrigated corn, field beans, sugar beets, potatoes, alfalfa, small grains, and grass. Row crops can be irrigated by furrows or sprinklers. Borders and sprinklers are suitable for irrigating small grains, alfalfa, or grass on slopes of not more than 0.5 percent. Contour ditches can be used for irrigating these crops on slopes of 0.5 to 1 percent. On some fields water can be applied by gated pipes or siphon tubes.

Alfalfa or an alfalfa-grass mixture included in the cropping sequence helps to control erosion, to maintain fertility, and to increase the content of organic matter. A legume should be planted every 5 or 6 years and allowed to remain on the soil for 3 or 4 years. Row crops should not be grown for more than 2 consecutive years.

Only a small amount of land leveling is needed on this soil to prepare it for irrigation by gravity. Drainage may be needed in places. A V-ditch built in the lowest areas is generally used to improve drainage. Nitrogen added to this soil stimulates the growth of plants, and alfalfa responds to phosphate.

CAPABILITY UNIT VIs-1 (IRRIGATED)

This unit consists of soils that are strongly affected by salts or alkai. These soils vary widely in depth, texture, and other characteristics. In nearly all places slopes are less than 1 percent. These soils are not appreciably eroded, but in some places they are slightly channeled or gullied. They occur on bottom lands and on colluvial foot slopes. In this unit are Clayey alkali land and Janise and Minatare soils.

In their natural condition, these soils are not suited to irrigated crops. If the owner wishes to spend the time, effort, and money required, these soils can be treated and their saline-alkali condition reduced from severe to not more than moderate. After the saline-alkali condition has been reduced to moderate or lower, capability would be changed to IVs-1, or even IIIs-1. The owners should be cautioned, however, that reclamation of these saline-alkai soils is difficult, expensive, and time consuming, and that success is generally only temporary unless treatment is continued. Technical help is needed before reclamation is begun, and each area needs to be fully investigated. Areas not treated should be in native plants that tolerate salts and alkali.

The rate of water intake ranges from about 0.35 inch per hour in the clayey soils to 2 inches per hour in the sandy soils. Saline-alkali soils take in water more slowly than soils of similar textures that are not affected. The moisture-holding zone ranges from 2 to 5 feet in thickness. Available water capacity ranges from 2.2 inches of water per foot of soil depth in the clayey soils to 1.75 inches per foot of soil depth in the sandy soils.

These soils generally are difficult to till. They slick over, or become puddled, when they are disturbed, and farm machines frequently become mired when the soils are wet.

Attempts to cultivate these soils without reclamation result in poor stands and scant growth. Only grasses that tolerate salts and alkali are suited. Inland saltgrass, alkali sacaton, and western wheatgrass are tolerent native plants, and tall wheatgrass is a tolerant tame grass. Sugar beets, barley, and alfalfa are somewhat tolerant of salts and alkali, but they are not suited unless the effect of salts and alkali has been lowered to moderate or less.

Land leveling is needed if these soils are to be reclaimed or improved for cultivation. Because in most places alkali is a result of a rising water table, improved drainage would also be considered.

Predicted Yields

The predicted average acre yields for the principal irrigated and dryfarmed crops grown on the soils in Scotts Bluff County are given in table 2. Omitted from the table are soils that are not used for at least one of the principal crops.

The predictions in table 2 are based on information furnished by farmers, ranchers, the Extension Service, the Scotts Bluff Experiment Station, the Soil Conservation Service, and others familiar with the soils of the county. The yields are averages over a long period of time. In periods when rainfall is above average, the yields of dryfarmed crops are higher than those listed in the table. Yields are lower than those listed for all crops when the crops are damaged by hail, disease, insects, or other natural causes.

These predictions do not reflect the history of yields in the county. Data from the period when outmoded farming methods were used were not considered. The predictions therefore reflect the yields expected by farmers using new and tried practices common in modern farming today.

The predicted yields in table 2 are listed under two levels of management. Those in columns A can be expected under average management. Under this management, the farmer fails to carry out all the practices needed for a higher level of management. For example, under average management for irrigated crops, some fertilizer is applied; water is applied but not uniformly, not at the right time, or in sufficient quantity; insects and diseases are not controlled; and the most suitable cropping sequence is not used.

TABLE 2.—*Predicted average acre yields of principal irrigated and dryfarmed crops under two levels of management*

[Yields in columns A are those expected under average management; yields in columns B are those expected under a high level of management. Absence of yield indicates that crop is not grown on the soil]

Soil	Irrigated														Dryfarmed			
	Corn		Sugar beets		Field beans		Potatoes		Alfalfa		Oats		Tame pasture		Wheat		Tame pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Animal-unit-months* [1]	*Animal-unit-months* [1]	*Bu.*	*Bu.*	*Animal-unit-months* [1]	*Animal-unit-months* [1]
Alice fine sandy loam, 0 to 3 percent slopes	63	85	14	18	23	35	325	435	3.2	4.2	41	59	5.5	8.8	17	22	0.9	1.2
Alice fine sandy loam, 3 to 5 percent slopes	54	72	12	15	21	34	295	395	2.9	3.9	36	54	4.0	7.2	13	18	.8	1.0
Alice loamy fine sand, 0 to 3 percent slopes	55	70	13	17	21	30	300	400	2.5	3.6	36	55	4.8	7.5	11	17	.8	1.0
Anselmo fine sandy loam, 1 to 3 percent slopes	55	80	13	17	22	34	290	410	2.9	4.0	40	58	5.0	8.0	15	20	.7	1.0
Anselmo fine sandy loam, 3 to 5 percent slopes	44	65	10	14	16	29	270	365	2.4	3.6	36	54	3.5	6.5	12	17	.6	.9
Anselmo fine sandy loam, 5 to 9 percent slopes	38	55	8	12	14	26	210	280	1.9	3.0	32	50	3.0	5.9	10	14	.4	.7
Anselmo fine sandy loam, alkali variant, 0 to 3 percent slopes	50	65	11	16	14	22	220	320	3.2	4.1	36	55	4.9	6.3	12	16	.5	.8
Bankard loamy fine sand, 0 to 3 percent slopes	30	43	7	12	14	22	200	310	1.5	3.0	32	46	2.5	4.5	----	----	----	----
Bankard loamy fine sand, alkali, wet variant	25	40	6	10	12	21	175	260	1.4	2.5	30	44	3.7	5.7	10	15	1.3	1.6
Bankard loamy fine sand, wet variant	37	52	7	11	20	29	220	315	1.9	2.6	38	53	4.2	6.3	11	16	1.7	1.9
Bayard fine sandy loam, 0 to 3 percent slopes	63	85	14	18	22	34	315	420	3.1	4.2	40	58	5.5	9.0	16	21	.9	1.2
Bayard fine sandy loam, 3 to 5 percent slopes	53	70	11	14	20	33	290	380	2.7	3.9	36	54	4.0	7.0	12	17	.8	1.1
Bayard fine sandy loam, 5 to 9 percent slopes	42	63	9	12	15	26	240	320	2.2	3.3	31	50	3.0	6.0	10	14	.4	.7
Bridgeport very fine sandy loam, 1 to 3 percent slopes	70	94	15	19	27	40	370	470	3.6	4.7	48	68	5.8	9.7	19	25	.9	1.4
Bridgeport very fine sandy loam, 3 to 5 percent slopes	62	82	13	16	24	37	330	430	3.3	4.4	40	59	4.5	8.0	17	22	.8	1.2
Bridgeport very fine sandy loam, 5 9 percent slopes	44	64	9	12	17	28	260	330	2.7	3.9	32	52	4.4	6.4	13	19	.5	.8
Buffington silty clay loam, 0 to 1 percent slopes	63	80	13	17	25	35	285	385	3.0	4.1	45	60	5.0	8.5	14	19	.7	1.0
Buffington silty clay loam, 1 to 3 percent slopes	53	65	11	14	23	33	235	330	2.7	3.9	40	56	4.5	7.5	12	16	.6	.9
Buffington silty clay loam, alkali, 0 to 1 percent slopes	49	60	10	13	15	25	210	280	2.5	3.6	38	54	4.3	7.3	11	14	.5	.8

See footnote at end of table.

TABLE 2.—*Predicted average acre yields of principal irrigated and dryfarmed crops under two levels of management*—Con.

Soil	Irrigated														Dryfarmed			
	Corn		Sugar beets		Field beans		Potatoes		Alfalfa		Oats		Tame pasture		Wheat		Tame pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Animal-unit-months* [1]	*Animal-unit-months* [1]	*Bu.*	*Bu.*	*Animal-unit-months* [1]	*Animal-unit-months* [1]
Chappell-Dix complex, 1 to 3 percent slopes:																		
Chappell soil	54	74	12	15	22	34	260	360	2.7	3.9	39	54	4.7	7.1	14	18	0.7	1.0
Dix soil	23	35	8	11	13	16	130	200	1.3	2.3	25	33	2.0	4.0	8	12	.4	.6
Chappell-Dix complex, 3 to 5 percent slopes:																		
Chappell soil	40	56	7	11	16	26	210	330	2.2	3.4	33	47	2.8	5.6	10	15	.5	.8
Dix soil	20	30	6	9	11	14	110	180	1.0	2.0	20	28	1.7	3.7	7	9	.3	.5
Creighton very fine sandy loam, 3 to 5 percent slopes	--	--	--	--	--	--	--	--	--	--	--	--	--	--	17	22	.8	1.2
Creighton very fine sandy loam, 5 to 9 percent slopes	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13	19	.5	.8
Dunday and Valentine loamy fine sands, 0 to 3 percent slopes:																		
Dunday soil	50	62	10	14	18	25	260	355	2.2	3.0	33	49	4.0	5.3	10	14	.6	.8
Valentine soil	38	50	8	12	15	22	240	335	2.0	2.7	30	45	3.7	4.7	9	12	.5	.7
Dunday and Valentine loamy fine sands, 3 to 5 percent slopes:																		
Dunday soil	38	48	8	12	14	22	215	325	2.0	2.8	30	46	2.8	4.8	--	--	--	--
Valentine soil	35	43	6	10	13	20	200	300	1.8	2.5	27	43	2.5	4.5	--	--	--	--
Duroc loam, 1 to 5 percent slopes	--	--	--	--	--	--	--	--	--	--	--	--	--	--	19	25	1.5	2.0
Epping silt loam, 1 to 3 percent slopes	23	35	8	11	13	16	130	220	1.3	2.3	25	33	2.0	4.0	--	--	--	--
Gering loam	51	65	12	15	21	30	280	375	3.2	4.0	40	57	5.0	6.8	16	19	2.2	2.5
Gering loam, alkali	40	58	11	14	13	20	180	290	2.7	3.7	36	52	4.4	5.3	13	17	1.7	2.0
Glenberg fine sandy loam, 0 to 3 percent slopes	65	87	14	18	24	36	300	425	3.1	4.2	44	64	5.5	9.0	15	20	.9	1.2
Haverson fine sandy loam, 0 to 1 percent slopes	70	93	15	19	26	39	345	460	3.2	4.6	47	67	5.7	9.5	18	23	.9	1.3
Keith loam, 0 to 1 percent slopes	75	100	16	20	30	42	375	490	3.9	5.0	46	67	6.0	10.0	22	27	1.0	1.5
Keith loam, 1 to 3 percent slopes	70	95	15	19	27	40	355	460	3.7	4.8	43	64	5.8	9.7	22	27	.9	1.4
Keith loam, 3 to 5 percent slopes	--	--	--	--	--	--	--	--	--	--	--	--	--	--	17	23	.7	1.2
Keith loam, alkali substratum variant, 0 to 3 percent slopes	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14	20	.5	.8
Keith-Ulysses loams, 3 to 5 percent slopes, eroded:																		
Keith soil	64	85	13	16	23	36	320	420	3.3	4.4	38	56	4.7	8.2	15	18	.7	1.2
Ulysses soil	50	72	9	12	20	31	280	385	2.9	4.0	32	50	4.5	8.0	12	15	.5	.9
Keith-Ulysses loams, 5 to 9 percent slopes:																		
Keith soil	48	68	9	13	20	32	270	350	2.9	4.1	33	53	3.8	6.8	14	20	.6	.9
Ulysses soil	43	60	8	11	18	29	250	330	2.7	3.9	28	48	3.5	6.4	12	17	.4	.8
Keota silt loam, 1 to 3 percent slopes	55	70	12	15	24	36	290	400	2.6	3.8	39	57	4.5	7.3	16	21	.5	.8
Keota silt loam, 3 to 5 percent slopes	45	62	10	13	20	31	270	375	2.3	3.4	35	52	3.8	6.7	13	18	.4	.7
Las fine sandy loam, alkali	48	63	11	15	12	20	200	290	3.1	3.9	40	56	5.1	6.2	14	18	1.6	2.0
Las loam	65	90	15	19	28	40	340	455	4.0	5.0	45	65	6.0	9.7	21	26	2.7	3.0
Las loam, alkali	53	68	13	17	14	23	210	310	3.3	4.1	42	60	5.5	7.0	16	20	1.9	2.4
Las Animas fine sandy loam	58	82	13	17	25	32	320	435	3.6	4.3	42	60	5.5	8.0	17	22	2.2	2.5
Las Animas fine sandy loam, alkali	45	60	10	14	11	19	190	280	3.0	3.8	38	54	5.0	6.0	13	17	1.5	1.9
Las Animas loam	60	85	14	18	22	33	330	440	3.8	4.6	44	62	5.7	8.5	19	24	2.4	2.7
Las Animas loam, alkali	47	62	11	15	12	20	200	290	3.1	3.9	40	56	5.1	6.3	14	19	1.7	2.1
McCook loam, 0 to 1 percent slopes	75	100	16	20	30	42	370	485	4.0	5.0	50	70	6.0	10.0	22	27	1.0	1.5
McCook silty clay loam, gravel substratum variant, 0 to 1 percent slopes	50	70	11	14	20	31	250	350	2.9	4.2	41	57	4.8	7.3	13	18	.6	1.0
McGrew fine sandy loam	49	60	11	14	19	28	260	360	2.8	3.6	32	51	4.6	6.2	14	17	1.7	2.2
McGrew loam	50	64	12	15	21	30	275	380	2.9	3.7	34	53	4.7	6.3	15	18	1.8	2.3
McGrew loam, alkali	38	51	10	13	11	18	165	270	2.5	3.5	30	43	4.2	5.0	10	16	1.4	1.7
Mitchell fine sandy loam, 0 to 3 percent slopes	68	91	15	19	24	36	340	450	3.5	4.6	44	65	5.7	9.4	19	24	.9	1.3
Mitchell fine sandy loam, 3 to 5 percent slopes	55	76	12	16	20	32	290	390	3.1	4.2	39	60	4.2	7.4	15	20	.7	1.1

See footnote at end of table.

TABLE 2.—*Predicted average acre yields of principal irrigated and dryfarmed crops under two levels of management*—Con.

Soil	Irrigated														Dryfarmed			
	Corn		Sugar beets		Field beans		Potatoes		Alfalfa		Oats		Tame pasture		Wheat		Tame pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Animal-unit-months* [1]	*Animal-unit-months* [1]	*Bu.*	*Bu.*	*Animal-unit-months* [1]	*Animal-unit-months* [1]
Mitchell fine sandy loam, 5 to 9 percent slopes	43	60	10	13	18	29	240	300	2.9	3.8	36	58	3.6	6.0	12	16	0.5	0.8
Mitchell silt loam, 0 to 1 percent slopes	75	100	16	20	28	39	365	480	3.6	5.0	46	67	6.0	10.0	24	29	1.0	1.5
Mitchell silt loam, 1 to 3 percent slopes	70	95	15	19	25	37	345	445	3.3	4.8	43	64	5.8	9.7	21	26	.9	1.4
Mitchell silt loam, 3 to 5 percent slopes	60	80	13	16	22	34	325	425	3.0	4.4	39	59	4.5	8.0	17	23	.8	1.2
Mitchell silt loam, 5 to 9 percent slopes	48	65	9	12	19	30	270	340	2.9	4.1	34	54	3.8	6.8	14	20	.6	.9
Mitchell silt loam, thin, 1 to 5 percent slopes	45	61	9	13	16	29	260	350	2.4	3.7	33	49	4.1	6.0	11	16	.6	1.1
Mitchell silt loam, thin, 5 to 9 percent slopes	39	55	7	10	13	25	240	300	2.1	3.5	27	41	3.5	5.0	----	----	------	------
Mitchell silt loam, wet variant, 0 to 1 percent slopes	63	86	14	18	30	42	310	420	3.8	5.0	44	60	6.5	8.7	20	24	2.3	2.7
Otero fine sandy loam, 1 to 5 percent slopes	50	66	12	16	20	28	240	355	2.5	3.6	36	55	4.2	8.0	12	18	.7	.9
Otero fine sandy loam, 5 to 12 percent slopes	32	48	7	10	12	22	230	280	2.0	3.1	25	39	3.3	5.2	----	----	------	------
Otero loamy fine sand, 0 to 5 percent slopes	40	60	8	11	14	25	230	330	2.2	3.3	29	46	4.0	6.0	10	15	.6	.8
Otero-Bayard fine sandy loams, 0 to 3 percent slopes:																		
Otero soil	50	66	12	16	20	28	280	385	2.7	3.9	36	55	4.2	8.0	12	18	.7	.9
Bayard soil	63	85	14	18	22	35	315	420	3.1	4.2	40	58	5.5	9.0	17	22	.9	1.2
Otero-Bayard fine sandy loams, 3 to 5 percent slopes:																		
Otero soil	47	63	10	13	18	26	270	370	2.5	3.7	33	50	3.6	6.8	10	15	.6	.8
Bayard soil	53	70	11	14	20	31	290	380	2.7	3.9	36	54	4.0	7.0	13	18	.8	1.1
Otero-Bayard fine sandy loams, 5 to 9 percent slopes:																		
Otero soil	38	60	8	11	13	24	220	290	2.1	3.2	29	48	2.8	5.8	9	14	.3	.6
Bayard soil	42	63	9	12	15	26	240	320	2.2	3.3	31	50	3.0	6.0	11	16	.4	.7
Otero-Bayard very fine sandy loams, 0 to 1 percent slopes:																		
Otero soil	67	92	15	19	28	40	330	470	3.7	4.8	48	68	5.7	9.4	20	25	.9	1.3
Bayard soil	70	95	17	20	29	41	350	490	3.9	5.0	51	72	5.9	9.7	22	27	1.0	1.5
Platte soils	40	50	8	10	11	20	150	260	1.6	2.1	26	40	3.6	5.0	----	----	------	------
Rosebud loam, 5 to 9 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	------	------	14	20	.5	.8
Satanta fine sandy loam, 1 to 3 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	------	------	17	21	.9	1.3
Tripp fine sandy loam, 0 to 3 percent slopes	72	93	15	19	27	41	345	460	3.6	4.6	44	65	5.7	9.5	19	24	.9	1.3
Tripp very fine sandy loam, 0 to 1 percent slopes	75	100	16	20	30	42	375	490	4.0	5.0	46	67	6.0	10.0	24	29	1.0	1.5
Tripp very fine sandy loam, 1 to 3 percent slopes	70	95	15	19	27	40	355	460	3.7	4.8	43	64	5.8	9.7	22	27	.9	1.4
Tripp very fine sandy loam, 3 to 5 percent slopes, eroded	60	80	12	16	23	36	320	420	3.3	4.4	38	58	4.5	8.0	16	22	.8	1.2
Tripp very fine sandy loam, 5 to 9 percent slopes, eroded	48	65	9	13	20	32	270	250	2.9	4.1	33	53	3.8	6.8	14	20	.6	.9

[1] An animal-unit-month is the number of months that 1 acre will provide grazing for 1 animal, or 1,000 pounds of live weight, or it is the number of months times the number of animal units. For example, at a high level of management, 1 acre of Alice fine sandy loam, 0 to 3 percent slopes, in irrigated tame pasture will graze 1 animal for 8.8 months, or 2 animals for 4.4 months.

Yields in columns B can be expected under a high level of management, or when the farmer does these things:

1. Uses practices that control soil blowing and water erosion.
2. Uses a suitable cropping sequence that maintains tilth and the organic-matter content.
3. Applies fertilizer of the kind and in the amount needed.
4. Tills, plants, and irrigates according to approved methods.
5. Uses insect, weed, and disease controls consistently.
6. Plants adapted crop varieties at the proper rate.
7. Use terraces and contour farming, or bench leveling, on irrigated soils that have slopes of 2 to 6 percent and are row cropped.
8. Drains the soil where needed.
9. Performs all practices of management at the time needed.

Wheat is the only dryfarmed crop grown on a large acreage in the county. The yields in column A for wheat are those expected under management that provides for stripcropping, alternating crops with fallow, and turning under the stubble. The yields in column B are those expected under management that includes stubble mulching, alternating crops with fallow, and stripcropping. This management also provides terraces, grassed waterways, and contour farming where these are needed. Because wheat is grown only on soils that are left fallow the preceding year, the yields listed in table 2 can be expected only every other year.

On well-drained soils crested wheatgrass is the most important tame grass used in dryfarmed pasture, but in a few pastures bromegrass and intermediate wheatgrass are grown. Tall wheatgrass is grown on alkali bottom lands, and the total yield of this grass is greater than that shown in table 2 for dryland tame pasture.

Use of Soils for Range [2]

The soils of Scotts Bluff County developed mainly under grass. A few trees grew on the steep bluffs and breaks in the southern part of the county. These trees were fairly short and generally were scrubby. The stand was thin, and enough grasses and forbs grew among the trees to form a good cover. Because of this cover, all of the county was considered rangeland, but much of the acreage of the better soils has been plowed and is farmed under irrigation.

Approximately 267,700 acres, or 58 percent of the county, is now in native grass. In this subsection this acreage is referred to as range. According to the 1959 Census of Agriculture, 6,953 acres of this range was mowed for hay; the rest was grazed.

The largest area of range is in the southwestern and southern parts of the county. Another large and contiguous area is in the northeastern part on the steeper slopes and on shallow soils. Much of the acreage adjacent to the channel of the North Platte River is in native grass. Some of this acreage was plowed and farmed early in the period of settlement, but farming was discontinued later because of excessive salts, alkali, or both, in some soils. Native grasses have come back in most of this area, but in many places the species are not the most desirable.

A considerable acreage of strongly sloping soils was plowed and irrigated when irrigation was first started. Since then, farming has been discontinued on some of this acreage, and natural reseeding has started to restore the cover of native grasses. Much of this cover is weedy, however, and it would be improved by seeding. Except where these areas are irrigated efficiently, they should be seeded with a mixture of native grasses.

Most of the southwestern and northeastern parts of the county is in ranches. On most of the large ranches, breeding herds of cattle are kept. Breeding herds are also kept on some of the smaller ranches, but on most of them, the pasture is used for grazing yearlings. The small ranches are on the river bottoms.

About 80 percent of the farmers who irrigate keep some kind of livestock so that the animals can eat the hay, cornstalks, and other roughage. These animals generally are sold as feeders. The rest of the farmers fatten their cattle to the grade of prime or better. The trend in the county is toward growing more corn and using it to fatten more cattle to the higher grades.

According to the 1959 Census of Agriculture, about 55 percent of the total farm income in the county was from the sale of all kinds of livestock. About 43 percent of the total farm income was from the sale of cattle and calves.

Range sites and condition classes

Range sites are distinctive kinds of rangeland that have different potentials for producing native, or climax, forage plants. Each site has its own combination of environmental factors that produce a characteristic plant community. A range site retains its potential to reproduce this original plant community, unless the soils are materially altered physically.

Distinctions between range sites are recognized by (1) significant differences in the kinds or proportions of plants that compose the potential plant community, and (2) significant differences in the total production of herbage from about the same composition of a potential plant community. A significant difference is one large enough to require different grazing practices or range management.

The rancher needs to know the kinds of sites on his range and the kinds of plants each site can support; then, he can determine how well his range is producing forage and how it can be improved. He needs to know range plants and the combinations of those plants that are most productive on each site. Some of the more important plants are listed in the descriptions of the individual range sites.

The soils in any one range site produce about the same kind and amount of climax vegetation. *Climax vegetation* is the combination of plants that grew originally on a site. It is generally the most suitable and the most productive vegetation for the site. Moreover, most plants in the climax vegetation are palatable and nutritious for grazing animals.

The characteristic of range plants most significant to ranchers is how they respond to grazing. The more palatable and nutritious plants are grazed first when the animals have a free choice. Without good range management, these plants decrease in number or are eliminated. They are, therefore, called *decreasers*. Consequently, the less

[2] By LORENZ BREDEMEIER and PETER N. JENSEN, range conservationists, Soil Conservation Service.

palatable plants increase in number and are called *increasers*. If grazing is continued, the less palatable plants, or increasers, are thinned or eliminated. Then the undesirable plants, called *invaders*, replace the decreasers and increasers.

Ranchers estimate range condition to determine the approximate deterioration or improvement of the range. The ratings can be used as a guide for predicting the degree of improvement possible under good management.

Range condition is rated in terms of condition classes to express the relation of the existing vegetation to the original, or climax, vegetation. The ratings express the degree to which the present vegetation on any site departs in kind or amount from the climax. There are four range condition classes—*excellent*, *good*, *fair*, and *poor* (*3*).

A range is in *excellent condition* if 76 to 100 percent of the present vegetation is the same kind as that in the original stand; it is in *good condition* if the percentage is between 51 and 75; it is in *fair condition* if the percentage is between 26 and 50; and it is in *poor condition* if the percentage is 25 or less.

If the rancher knows the kind of range site, the kinds of soils on the site, and the condition of the range, he can judge how well the range will produce forage and how it can be improved. This knowledge will enable him to keep his range in better condition, protect the soils from erosion, and produce larger yields of herbage. Help is available to ranchers through the local office of the Soil Conservation Service.

Descriptions of range sites

On the following pages the 16 range sites in Scotts Bluff County are described. To find the soils on each site, refer to the "Guide to Mapping Units," at the back of this survey. The principal plants in the climax vegetation are listed for each site along with the decreasers, increasers, and invaders. Because they are not suited to range or are not generally used for it, Barren badlands (BB), Marsh (M), McCook silty clay loam, gravel substratum variant, 0 to 1 percent slopes (3Mo), and the Rock outcrop parts of Rock outcrop-Epping complex (RE) and Rock outcrop-Tassel complex (RT) were not placed in a range site.

WET LAND RANGE SITE

This site consists of marshy and subirrigated soils. These soils are seepy, have a high water table, or are ponded during part of the growing season. This site occurs in small areas throughout the county and makes up about 2 percent of the acreage.

The main decreasers on this site are prairie cordgrass, alkali cordgrass, tall sedges, and reedgrass. Increasers are some species of mid sedges and rushes. The invaders are inland saltgrass, willow, and many annual plants.

The decreasers are the main forage producers on this site. The total annual yield of air-dry herbage ranges from 3,400 pounds per acre in less favorable years to 6,000 pounds in favorable years.

SUBIRRIGATED RANGE SITE

This site consists of soils that have a fluctuating water table that, during the growing season, is rarely at the surface but is generally within reach of plant roots. On terraces and in colluvial areas, wetness is caused by seepage from higher areas. This site makes up about 8 percent of the county.

The decreasers on this site are switchgrass, indiangrass, and big bluestem. Increasers are western wheatgrass, tall dropseed, plains bluegrass, scouring-rush, and sedges. The invaders are inland saltgrass, red three-awn, Kentucky bluegrass, willow, cottonwood, and cedar.

The decreasers are the main forage producers on this site. The total annual yield of air-dry herbage ranges from 2,400 pounds per acre in less favorable years to 3,600 pounds in favorable years.

SALINE SUBIRRIGATED RANGE SITE

This site consists of subirrigated soils in which salts, alkali, or both have accumulated. It is mainly on nearly level bottom lands along the North Platte River and its main tributaries. Salt-tolerant plants grow in most areas. The site makes up about 4 percent of the county.

The decreasers on this site are alkali sacaton, western wheatgrass, slender wheatgrass, and thickspike wheatgrass. Increasers are inland saltgrass, arrowgrass, plains bluegrass, sand dropseed, black greasewood, shadscale saltbush, and Gardner saltbush. The invaders are foxtail barley, Kentucky bluegrass, annual brome, and other annual plants.

The most important herbage-producing plants on this site are alkali sacaton, western wheatgrass, slender wheatgrass, and inland saltgrass. The total annual yield of air-dry herbage, ranges from 1,500 pounds per acre in less favorable years to 2,500 pounds in favorable years.

SILTY OVERFLOW RANGE SITE

This site consists of soils on bottom lands along creeks and in draws. In addition to rainfall, these soils regularly receive floodwater from the streams and water that runs off higher lying soils. The surface layer and subsoil of these soils range from silt loam to silty clay loam. This site makes up less than 0.5 percent of the county.

The decreasers on this site are western wheatgrass, slender wheatgrass, needle-and-thread, green needlegrass, little bluestem, big bluestem, and prairies sandreed. Increasers are blue grama, sand dropseed, and sedge. The invaders are western ragweed, fringed sagewort, and annual plants.

The main herbage-producing plants on this site are western wheatgrass, slender wheatgrass, needle-and-thread, and blue grama. In some places, however, there are significant amounts of green needlegrass, little bluestem, big bluestem, and prairie sandreed. The total annual yield of air-dry herbage ranges from 1,400 pounds per acre in less favorable years to 2,600 pounds in favorable years.

SANDY LOWLAND RANGE SITE

This site consists of soils that receive beneficial moisture from a water table 5 to 8 feet below the surface and from periodic overflow of streams. These soils are on nearly level bottom lands and terraces. They have a sandy loam to loamy sand surface layer and a sandy loam to fine sand subsoil. This site makes up about 2 percent of the county.

The decreasers on this site are prairie sandreed, western wheatgrass, sand bluestem, and little bluestem. Increasers are needle-and-thread, Indian ricegrass, blue grama, sand dropseed, and threadleaf sedge. The invaders are biennial sagewort, annual brome, six-weeks fescue, and other annual plants.

The main herbage-producing plants on this site are prairie sandreed, needle-and-thread, western wheatgrass, Indian ricegrass, and blue grama. The total annual yield of air-dry herbage ranges from 3,400 pounds per acre in less favorable years to 6,000 pounds in favorable years.

SILTY LOWLAND RANGE SITE

This site consists of soils on terraces, foot slopes, and bottom lands that are seldom flooded. On these soils, water that runs off higher lying areas adds to that received as rainfall. The texture of these soils ranges from very fine sandy loam to silty clay loam in both the surface layer and subsoil. This site makes up about 2 percent of the county.

The decreasers on this site are western wheatgrass, needle-and-thread, Indian ricegrass, and green needlegrass. Increasers are blue grama, threadleaf sedge, and sand dropseed. The invaders are tumblegrass, curlycup gumweed, and annual plants.

The main herbage-producing plants are western wheatgrass, needle-and-thread, blue grama, green needlegrass, Indian ricegrass, and threadleaf sedge. The total annual yield of air-dry herbage ranges from 1,200 pounds per acre in less favorable years to 2,300 pounds in favorable years.

SANDS RANGE SITE

This site consists of rolling and sloping loamy fine sands and fine sands. It occurs in fairly large areas scattered throughout the county. This site makes up about 8 percent of the county.

The decreasers on this site are sand bluestem, little bluestem, switchgrass, and leadplant. Increasers are prairie sand reed, needle-and-thread, Indian ricegrass, sand dropseed, blue grama, sun sedge, and sand sagebrush. The invaders are sandhill muhly, biennial sagewort, western ragweed, annual brome, and other annual plants.

The principal herbage-producing plants are prairie sandreed, needle-and-thread, sand bluestem, Indian ricegrass, little bluestem, sand dropseed, and blue grama. The total annual yield of air-dry herbage ranges from 1,200 pounds per acre in less favorable years to 1,900 pounds in favorable years.

SANDY RANGE SITE

This site consists of deep, nearly level to steep soils in the uplands that have a sandy loam, fine sandy loam, or loamy fine sand surface layer. This site is well distributed throughout the county and makes up about 25 percent of it.

The decreasers on this site are prairie sandreed, western wheatgrass, sand bluestem, and little bluestem. Increasers are needle-and-thread, Indian ricegrass, blue grama, sand dropseed, and threadleaf sedge. The invaders are biennial sagewort, annual brome, six-weeks fescue, and other annual plants.

The principal herbage-producing plants are prairie sandreed, needle-and-thread, western wheatgrass, Indian ricegrass, and blue grama. The total annual yield of air-dry herbage ranges from 1,100 pounds per acre in less favorable years to 2,000 pounds in favorable years.

SILTY RANGE SITE

This site consists of deep and moderately deep very fine sandy loams, loams, and silt loams that occur on uplands and stream terraces. These soils are nearly level to rolling and have slopes that are generally less than 10 percent. This site occurs throughout the county and makes up 15 percent of the acreage.

The decreasers on this site are western wheatgrass, needle-and-thread, Indian ricegrass, and green needlegrass. Increasers are blue grama, threadleaf sedge, sand dropseed, and buffalograss. The invaders are tumblegrass, broom snakeweed, curlycup gumweed, and annual plants.

The principal herbage-producing plants are western wheatgrass, needle-and-thread, and blue grama. Green needlegrass, Indian ricegrass, and threadleaf sedge produce smaller amounts of forage. The total annual yield of air-dry herbage ranges from 1,000 pounds per acre in less favorable years to 2,000 pounds in favorable years.

LIMY UPLAND RANGE SITE

This site consists of deep, very gently sloping to steep soils that have a thin, light-colored loam surface layer and a medium-textured subsoil. These soils occur below outcrops of Brule siltstone. The site makes up about 25 percent of the county.

The decreasers on this site are western wheatgrass, sideoats grama, little bluestem, and perennial legumes. Increasers are needle-and-thread, blue grama, threadleaf sedge, hairy grama, and buffalograss. The invaders are broom snakeweed and annual plants.

About 90 percent of the herbage consists of needle-and-thread, western wheatgrass, little bluestem, blue grama, sideoats grama, and threadleaf sedge. The total annual yield of air-dry herbage ranges from 800 pounds per acre in less favorable years to 1,800 pounds in favorable years.

SHALLOW TO GRAVEL RANGE SITE

This site consists of medium-textured to coarse-textured, very gently sloping to steep soils that are 10 to 20 inches deep over mixed clean sand and gravel. The penetration of roots into the sand and gravel is limited. This site is on or below the edge of terraces in scattered areas north of the North Platte River. It makes up about 1 percent of the county.

The decreasers on this site are needle-and-thread, western wheatgrass, and prairie sandreed. Increasers are blue grama, threadleaf sedge, hairy grama, and sand dropseed. The invaders are broom snakeweed, biennial sagewort, and annual plants.

The main herbage-producing plants are needle-and-thread, blue grama, and little bluestem. Other plants that produce smaller amounts are western wheatgrass, prairie sandreed, sand dropseed, and threadleaf sedge. The total annual yield of air-dry herbage ranges from 700 pounds per acre in less favorable years to 1,700 pounds in favorable years.

SHALLOW LIMY RANGE SITE

This site consists of very gently sloping to steep soils that are 10 to 20 inches deep over siltstone or sandstone. The surface layer of these soils ranges from moderately fine to moderately coarse in texture. Root penetration is shallow. Shrubs and stunted trees grow in pockets of deep soil that are in joints of the bedrock and in places where their roots can get moisture that has accumulated on top of the bedrock. This site occurs in small areas scattered throughout the county and makes up about 6 percent of it.

The decreasers on this site are needle-and-thread, sideoats grama, little bluestem, and western wheatgrass. Increasers are blue grama, threadleaf sedge, hairy grama, and sand dropseed. The invaders are broom snakeweed, biennial sagewort, and annual plants.

The main herbage-producing plants on this site are needle-and-thread, sideoats grama, little bluestem, and blue grama. Smaller amounts of forage are produced by western wheatgrass, threadleaf sedge, and sand dropseed. The total annual yield of air-dry herbage ranges from 3,400 pounds per acre in less favorable years to 6,000 pounds in favorable years. In some spots 20 percent of the total herbage is from trees.

THIN LOESS RANGE SITE

This site consists of deep, very steep soils that range from silt loam to fine sandy loam in texture. Slopes generally are more than 30 percent. This site occurs along drains and gullies south of the North Platte River and makes up about 0.5 percent of the county.

The decreasers on this site—little bluestem, sideoats grama, and needle-and-thread—are the main producers of forage. Increasers are blue grama, sand dropseed, and brushy plants. The invaders are mostly annual plants.

The total annual yield of air-dry herbage ranges from 600 pounds per acre in less favorable years to 1,600 pounds in favorable years.

VERY SHALLOW GRAVEL RANGE SITE

This site consists of soils that are shallow to gravel or sand. The surface layer is loam, gravelly sandy loam, or gravelly loamy sand that is less than 10 inches deep over mixed sand and gravel. Gravel is at the surface in many places. Few roots penetrate deeper than 10 inches. Slopes range from 9 to 30 percent. This site is on the edge of terraces north of the North Platte River and makes up less than 1 percent of the county.

The main decreasers on this site are little bluestem, sideoats grama, needle-and-thread, and native legumes. Increasers are blue grama, hairy grama, red three-awn, Fendler three-awn, fringed sagewort, sand sagebrush, hairy goldaster, sandwort, and nailwort. The invaders are broom snakeweed and annual plants.

The main herbage-producing plants are little bluestem, sideoats grama, needle-and-thread, blue grama, and hairy grama. The total annual yield of air-dry herbage ranges from 500 pounds per acre in less favorable years to 1,300 pounds in favorable years.

SALINE UPLAND RANGE SITE

This site consists of shallow to deep, clayey soils that are moderately to strongly affected by salts, alkali, or both. This site is in an area south of Lyman; it makes up less than 0.5 percent of the county.

Alkali sacaton and western wheatgrass are the decreasers on this site and produce most of the forage. Increasers are mainly inland saltgrass and Gardner saltbush. The invaders are cactus and annual plants.

The total annual yield of air-dry herbage ranges from 800 pounds per acre in less favorable years to 1,200 pounds in favorable years.

PANSPOTS RANGE SITE

This site consists of nearly level soils that are in depressions and are affected by alkali and salts. The surface layer ranges from silt loam to clay loam in texture and from nonsaline to strongly saline. The subsoil ranges from silt loam to clay and, about 8 inches from the surface, is strongly affected by salts or alkali. This site makes up less than 0.25 percent of the county.

On this site the principal herbage-producing plants are the decreasers alkali sacaton and western wheatgrass and the increaser inland saltgrass. The total annual yield of air-dry herbage ranges from 300 pounds per acre in less favorable years to 1,000 pounds in favorable years.

Principles of range management

The main objective in managing range is maintaining production in those areas in good or excellent condition and in increasing production in those areas where the forage has been depleted. Practices are needed that conserve soil and water and that encourage the growth of the better native plants.

Grazing practices that maintain or improve range condition are economical and needed on all rangeland in the county. These practices are (1) proper range use, (2) deferred grazing, and (3) rotation-deferred grazing. Livestock can be distributed better and more uniform grazing obtained by correctly locating fences; by developing watering places, such as ponds, wells, and springs; and by moving salt to areas where grazing is desired.

On some sites range condition can be improved by range seeding. This improvement can be accomplished by seeding improved grasses or by reseeding grasses of either wild or improved strains on soils that are suitable as rangeland. Mitchell silt loam, thin, 9 to 20 percent slopes, and Bayard fine sandy loam, 9 to 20 percent slopes, are examples of soils that are still being cultivated but that should be seeded to grasses. The soils selected for seeding should have climate and soil characteristics that favor the natural growth of desirable plants so that the only management needed is the regulation of grazing.

The native meadows in Scotts Bluff County that are cut for hay each year are limited mainly to those on the Wet Land, Subirrigated, and Saline Subirrigated range sites of the bottom lands along the North Platte River. The hay is generally baled or stacked for emergency use.

Use of Soils for Woodland and Windbreaks [3]

The only native woodland in Scotts Bluff County is in the valley of the North Platte River and on the Wildcat Hills in the southwestern part. The trees along the river are primarily in areas immediately adjacent to the channel. Cottonwood dominates in these areas, though willow, American plum, and Russian-olive are common. The cottonwoods produce a few usable sawlogs, but the other species have no economic value. The Russian-olive is invading lands flooded by the North Platte River and is becoming somewhat of a pest. It apparently has been brought downstream from plantings in Wyoming. This species is not native to the United States.

[3] By GEORGE W. ALLEY, woodland conservationist, Soil Conservation Service.

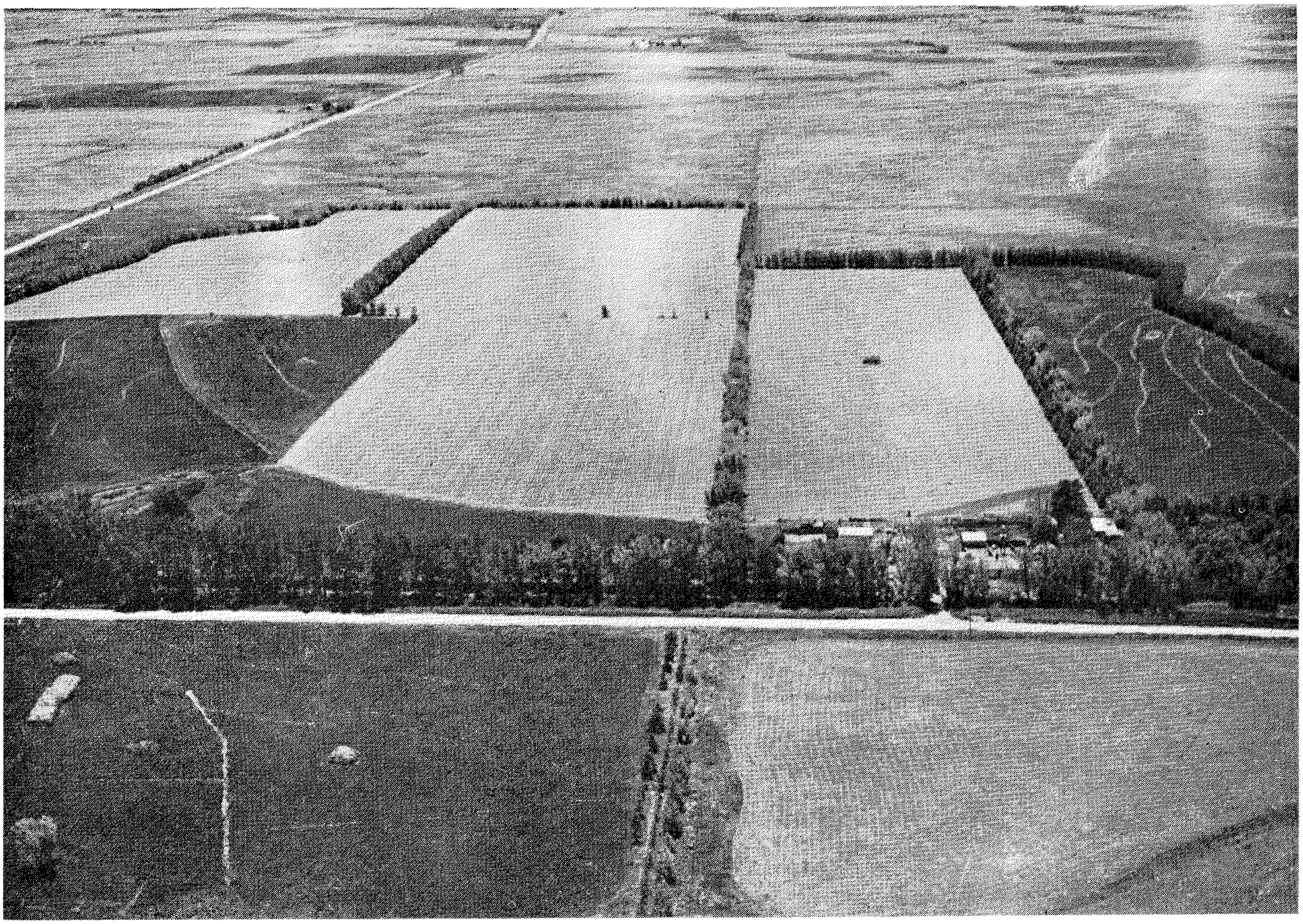

Figure 14.—**Windbreaks and shelterbelts are helping to control soil blowing effectively on this farm. The soil, Bayard fine sandy loam, is highly susceptible to soil blowing unless adequately protected.**

Although the Wildcat Hills support a considerable acreage of timber, similar hills north and east of the city of Scottsbluff support no native trees. The reason for this difference is not known. The trees on the Wildcat Hills are mostly conifers and include ponderosa pine, eastern redcedar, and Rocky Mountain juniper. Growing along some of the spring-fed streams in canyons are a fairly large number of broad-leaved species, including cottonwood, hackberry, boxelder, American plum, chokecherry, buffaloberry, wild grape, gooseberry, wild rose, coralberry, and poison-ivy. These plants have little economic value, though they give some protection to livestock. Also, they add to the beauty of the area, and they improve the wildlife habitat.

The eastern redcedar and ponderosa pine on the hills were used by early settlers for fuel and for shelter, and some probably were used for crossties in the early days of the railroad. It is not likely that future stands of native trees will have much economic value.

Windbreaks

The most important use of trees in Scotts Bluff County is for windbreaks. Because the county is naturally nearly treeless in most areas and because it has extremes of severe weather, windbreaks are much needed for the protection of fields, farmsteads, and livestock (fig. 14). Although windbreaks are expensive, the many benefits derived from them more than repay the farmer for his expense and labor. These benefits include reduced costs of home heating, control of drifting snow, shelter for livestock, savings in feed costs, improved habitat for wildlife, protection of fields, buildings, lots, and gardens from soil blowing, and beautification of the home grounds.

Trees are extremely difficult to establish in the county because rainfall is low and winds are hot and dry. Healthy seedlings of suitable species survive and grow, however, if they are kept in good condition and are planted by good methods in a well-prepared site.

The species most likely to succeed in windbreak plantings are the conifers, chiefly Rocky Mountain juniper, eastern redcedar, and ponderosa pine. These species, especially the redcedar and juniper, have been vigorous and have had a high rate of survival in older windbreaks. Recent studies of windbreaks show that redcedar and juniper grew a little less than 1 foot per year on most soils and that they will probably reach a height of 15 to 25 feet at maturity, the height depending on the kind of soil in the site. Pine and broad-leaved trees grow somewhat faster and probably are taller at maturity than the redcedar and juniper. Recent studies of older windbreaks show that Siberian elm, honeylocust, hackberry, cotoneaster, and caragana are among the broad-leaved trees and shrubs suitable for planting in Scotts Bluff County.

The rate that trees grow in windbreaks varies considerably according to the condition of the soil and the kind of tree. Important to growth are available moisture, soil fertility, exposure, and arrangement of the species in the windbreak. Some species grow much faster than others. Some grow fast at first but die at a young age. Cottonwood is an example. Cottonwood, Siberian elm, Russian-olive, boxelder, and green ash are seldom used in windbreaks. Siberian elm and Russian-olive grow fast, but in places they spread where they are not wanted and frequently are short lived. Boxelder is killed in severe winters, and green ash damaged heavily by borers.

A good windbreak is designed to fit the soil in which the trees and shrubs grow. Also, the purpose of the windbreak is considered. Specific information on design, establishment, and care of windbreaks is available through the local offices of the Soil Conservation Service and the Extension Service.

The soils of Scotts Bluff County have been grouped according to their characteristics that affect the growth of trees. Because they are not suitable for, or not generally used for windbreaks, the following soils were not placed in windbreak suitability groups.

Barren badlands (BB).
Clayey alkali land (2Cx).
Gravelly land (Gv).
Janise soils (Jn).
Marsh (M).
Minatare-Janise soils (MJ).
Rock outcrop-Epping complex (RE).
Slickspots-Keith complex (SK).
Mixed alluvial land (3Sx).

To find the soils in each windbreak suitability group, refer to the "Guide to Mapping Units" at the back of this survey. The soils in each group have similar characteristics that affect survival and growth. In the following paragraphs the soils in each group are briefly described, and trees and shrubs suitable for planting in windbreaks on those soils are listed.

SILTY TO CLAYEY WINDBREAK SUITABILITY GROUP

This group consists of deep, well-drained, silty or clayey soils. Competition from weeds and grass is the primary hazard to trees planted on the soils of this group, and erosion is likely on the sloping soils.

Trees and shrubs suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Austrian pine, Siberian elm, honeylocust, hackberry, green ash, Russian-olive, boxelder, cotoneaster, caragana, western chokecherry, skunkbush sumac, American plum, Siberian crabapple, honeysuckle, lilac, and sand cherry.

SANDY WINDBREAK SUITABILITY GROUP

This group consists of slightly sandy soils and nearly level very sandy soils. Weeds and grass compete with the planted trees and shrubs, and erosion is likely on the sloping soils. In addition, soil blowing is a hazard.

Trees and shrubs suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, honeylocust, hackberry, skunkbush sumac, American plum, and lilac.

VERY SANDY WINDBREAK SUITABILITY GROUP

This group consists of very sandy soils and loose sandy soils that cannot be cultivated safely. Weeds and grass compete with the planned trees and shrubs, and erosion is likely on the sloping soils. In addition soil blowing is a hazard.

Trees suitable for planting are eastern redcedar and ponderosa pine.

MODERATELY WET WINDBREAK SUITABILITY GROUP

This site consists of soils on bottom lands, terraces, or upland depressions that are made wet occasionally by a high water table or by short, frequent floods. Weeds and grass compete with the planted trees and shrubs. Also, only species that tolerate wetness are suitable.

Trees and shrubs suitable for planting are eastern redcedar, Scotch pine, Russian-olive, boxelder, diamond willow, honeylocust, hackberry, white willow, golden willow, green ash, Siberian elm, cottonwood, red-osier dogwood, buffaloberry, and western chokecherry.

WET WINDBREAK SUITABILITY GROUP

This group consists of soils on bottom lands, terraces, and upland depressions that are wet most of the time because of a high water table, frequent flooding, or poor drainage. Weeds and grass compete with the planted trees and shrubs. Also, only species that tolerate wetness are suitable.

Trees and shrubs suitable for planting are diamond willow, white willow, golden willow, cottonwood, white poplar, and red-osier dogwood.

MODERATELY SALINE OR ALKALI WINDBREAK SUITABILITY GROUP

This group consists of moderately saline or moderately alkaline soils. Weeds and grass compete with the planted trees and shrubs. Also, only species tolerant of salts and alkali are suitable.

Trees and shrubs suitable for planting are eastern redcedar, Scotch pine, Austrian pine, Russian-olive, diamond willow, Siberian crabapple, Siberian elm, green ash, honeylocust, cottonwood, skunkbush sumac, and buffaloberry.

SHALLOW WINDBREAK SUITABILITY GROUP

This group consists of shallow soils that have a limited root zone above bedrock, shale, or gravel. In all areas of the county prolonged drought is a hazard, but the shallow soils in this group are the most susceptible to drought. Also, roots generally do not have enough space to grow.

The only tree suitable for planting on the soils of this group is eastern redcedar.

Use of Soils for Wildlife and Recreation [4]

Scotts Bluff County is a recreational center because of its history, its unique relief, and its good fishing and hunt-

[4] By C. V. BOHART, recreation specialist, Soil Conservation Service.

ing. The people in the county not only enjoy the recreational areas, but they also benefit economically from the money spent by visitors who come for hunting, fishing, and other recreation. Important tourist attractions are the Wildcat Hills Recreation Area and Refuge and the Scotts Bluff National Monument. Important game refuges are around Lake Minatare, Lake Alice, and Winter Creek Lake.

This subsection describes the wildlife and recreation in the county and discusses management of wildlife habitat and recreational areas. In the discussion reference is made to the soil associations, which are shown on a colored map at the back of this survey and are described in the section "General Soil Map." Table 3 rates the potential of each association for producing woody cover, herbaceous cover, and aquatic environment and the food suitable for openland, woodland, and wetland wildlife.

Woodland wildlife are birds and mammals that normally live in areas of trees and shrubs or that require a large amount of this kind of habitat. Examples in Scotts Bluff County are white-tailed and mule deer, wild turkey, raccoon, bobcat, crows, and woodpeckers. *Openland wildlife* are birds and mammals that live in and around rangeland and cropland. Some species make use of wooded areas. Examples are antelope, pheasant, cottontail rabbit, badger, fox, meadowlark, and grouse. *Wetland wildlife* are birds and mammals that normally frequent marshes, swamps, ponds, rivers, and streams. Examples are ducks, geese, shore birds, beaver, mink, and muskrat.

A knowledge of the soils is essential to the landowner who desires to manage all or part of his land for wildlife and recreation. The soil and climate largely determine the kinds and amounts of vegetation produced, and this vegetation and its distribution affect the production and maintenance of wildlife.

Soils that resist compaction and yet are stable are favorable for recreational areas. Compaction may cause excessive runoff and erosion and the loss of moisture needed for plant growth. Also, plant growth is limited in compacted soils because air space is reduced. A soil that has good structure resists compaction and yet stands up under heavy recreational use.

Relief and fertility also influence use of soils as wildlife habitat and recreational areas. Relief affects drainage and therefore the amount of vegetation produced. Vegetation and the food and cover it provides for wildlife are generally abundant on fertile soils, and the wildlife are vigorous and abundant. Large amounts of fish are produced in ponds fed by water that has run in from fertile soils.

In addition to its effect on drainage, relief is important in wildlife management because of the odd areas available where relief is uneven. These odd areas cannot readily be farmed or fenced for grazing, but they can be managed for producing food and cover for wildlife. Odd areas in the Mitchell-Keith-Epping soil association can be developed for openland wildlife. In this county odd areas are most numerous in the Tassel-Anselmo-Rock outcrop and the Bayard-Bridgeport soil associations. Because of its relief, the Tassel-Anselmo-Rock outcrop association is particularly scenic in some areas (fig. 15). This association also provides sites that can be managed for deer and

TABLE 3.—*Potential of the soil associations for producing woody cover, herbaceous cover, aquatic environment, and food for openland, woodland, and wetland wildlife*

Soil association and class of wildlife	Potential for—			
	Woody cover	Herbaceous cover	Aquatic environment	Food plants
Tassel-Anselmo-Rock outcrop:				
Woodland wildlife	Very good	Fair	Not suited	Good.
Openland wildlife	Fair	Fair	Not suited	Fair.
Bayard-Bridgeport:				
Woodland wildlife	Fair	Good	Not suited	Fair.
Openland wildlife	Good	Good	Not suited	Good.
Mitchell-Keith-Epping, Mitchell-Otero-Buffington, and Tripp-Alice-Dunday:				
Woodland wildlife	Fair	Fair	Not suited	Good.
Openland wildlife	Good	Good	Not suited	Very good.
Valentine-Dwyer:				
Openland wildlife	Fair	Good	Not suited	Fair.
Las-Alluvial land-McCook:				
Woodland wildlife	Very good	Fair	Not suited	Good.
Openland wildlife	Good	Very good	Not suited	Very good.
Wetland wildlife	Not suited	Not suited	Good	Fair.
Minatare-Janise:				
Openland wildlife	Fair	Fair	Not suited	Fair
Wetland wildlife	Not suited	Not suited	Good	Fair
Gravelly land-Dix-Chappell:				
Woodland wildlife	Fair	Fair	Not suited	Fair
Openland wildlife	Fair	Fair	Not suited	Fair.

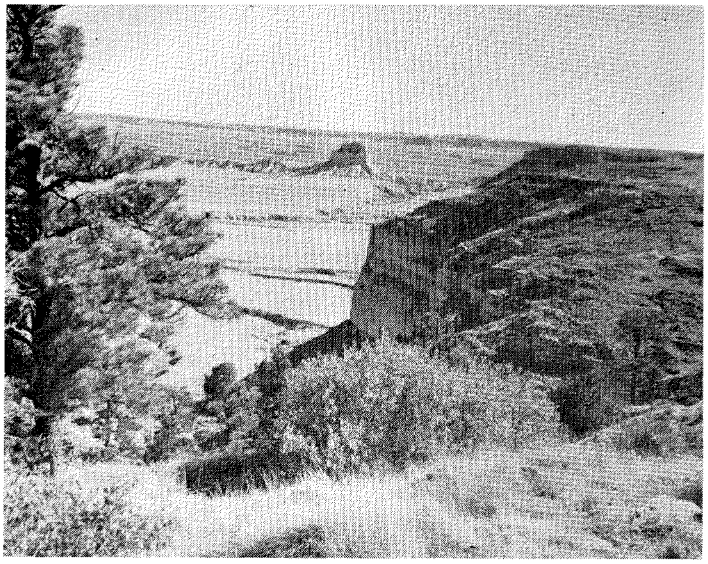

Figure 15.—**Scenic view of bluffs in the Tassel-Anselmo-Rock outcrop soil association.**

turkey hunting, and on some of its ranches facilities for guests can be developed as the main part or a supplemental part of the ranch operation. Where the soils of the Tassel-Anselmo-Rock outcrop association are used intensively for camping, picnicking, and other recreation, facilities must be planned and managed carefully so as to prevent deterioration through erosion and loss of plant cover.

The few depressions that occur in the Valentine-Dwyer association collect water and provide a small amount of habitat for wetland wildlife. Also, antelope use this fairly small association in connection with cropped areas in the Mitchell-Keith-Epping association. Antelope use the rougher areas of the Bayard-Bridgeport association for winter cover.

Soil structure and its effect on water-holding capacity of soils are important where ponds or marshy areas are developed for fish, waterfowl, and other wildlife requiring aquatic habitat. In the Minatare-Janise association, the marshy areas can be improved so as to increase waterfowl, and new aquatic habitat can be developed.

Along the North Platte River, parts of the Las-Alluvial land-McCook association can be improved as habitat for wetland and woodland wildlife. In selected areas fishponds can be built by excavating a pit to ground water. These pits, or dugout ponds, are suitable for many kinds of fish, though they are somewhat difficult to manage. Ponds large enough for water skiing, boating, and other recreation can be built where sites are suitable. Hunting waterfowl is now important in the Las-Alluvial land-McCook association.

Water from springs and from seeps in irrigated areas of the Gravelly land-Dix-Chappell association can be impounded for fishponds. In some ponds the water is cold and clear and suitable for trout, but undesirable aquatic weeds and low fertility are concerns of management. Important species that live in cold water are brown, brook, and rainbow trout. Species of fish that live in warm water include white and black bass, crappie, northern pike, bluegill, and catfish.

Fishing, power boating, and water skiing provide important recreation on Lake Minatare in the northeastern part of the county. Trout fishing is good on Ninemile, Winter, Sheep, Dry Spottedtail, and Spottedtail Creeks, but the trout available could be increased if these and other creeks in the county were improved. Hunting waterfowl along these creeks is also good on cold and stormy days because the water does not freeze, and vegetation along the banks provides a windbreak for the birds using the streams.

Because the soils of the Mitchell-Otero-Buffington and the Tripp-Alice-Dunday associations are highly productive, few areas can be used as wildlife habitat. Wildlife in these associations can be increased, however, if banks of drainage ditches and other odd areas are kept in adapted permanent plants and if areas are protected from burning and mowing. If these areas are kept in suitable plant cover, management is reduced and the need for burning is eliminated in most places. Wildlife on farms can be increased by using, in the field and farmstead windbreaks, the kinds of trees and shrubs that the desired wildlife prefer.

Development of a wildlife habitat depends to a large extent on the nature of the soils and the kinds and amount of plants that the soil can produce. Fishponds may require special engineering design. Technical assistance in planning wildlife habitat and in determining the kinds of plants needed can be obtained from the local office of the Soil Conservation Service. Information and assistance are also available from the Bureau of Sports, Fisheries, and Wildlife, from the Extension Service, and from the Nebraska Game, Forestation, and Parks Commission.

Use of Soils for Homesites

Soil erosion is sometimes more severe in developed areas than it is in rural areas. The large areas of paved roads, sidewalks, and parking lots, the roofs of industrial buildings, and the like tend to cause rapid runoff of a large volume of water. Consequently, those who live in developed areas have to cope with large amounts of runoff. A good way of preventing erosion is that of keeping the ground completely covered with growing plants or a mulch. Running water can be controlled by (1) keeping it well spread and moving slowly, (2) diverting it from areas that are easily damaged, or (3) diverting it to areas covered by sod, concrete, or other resistant material.

Laying out and planting on the contour reduce runoff. Cross-slope planting designs give better results than planting up and down the slope. Complicated patterns are not necessary; simple designs across the slope are sufficient on small, sloping plots. Some grading may be needed. Where water concentrates, a grassed waterway protects the soil from gullying. Where water seeps from a high water table, tile lines may be needed to insure a dry basement. Technical engineering help is generally needed in areas where poor drainage is serious.

Well-kept lawns and ornamental plantings beautify the home grounds and help to control erosion. Windbreaks and hedges can be used to protect delicate plants, to reduce evaporation and soil blowing, and to add some privacy for the home. A pond near a home is useful and attractive.

Special management is needed on soils used for vegetables and flowers because they are cultivated each year and generally are left bare during winter. Contour planting on sloping areas reduces runoff and erosion. In small gardens straight rows across the slope are practical, for they are near enough to the contour. Generally needed on steep soils are benches or terraces to control runoff, and also places to dispose of the water safely.

Residue from crops and weeds or other material can be used as cover to reduce soil erosion. Leaves, hay, straw, grass clippings, and residue from vegetable plants and flowers should be returned to the soil. Besides preventing erosion, this material improves soil structure and fertility and helps to suppress weeds. A compost heap can be used to convert leaves or other organic material into a valuable soil conditioner. To provide the balanced supply of nutrients needed by plants, commercial fertilizer can be added to supplement the nutrients supplied by crop residue, compost, legumes, and cover crops.

Technical assistance is available to homeowners through the local office of Soil Conservation Service, Extension Service, and Agricultural Experiment Station.

Soil problems affecting homeowners

Residences and other buildings that are built in areas where there is seepage or a high water table frequently have cracked foundations and walls. The cracking is caused by ground water that weakens the soil material on which the building rests. This weakening can be compensated for by using a wider, broader footing or by digging the foundation deeper. Before construction a careful investigation is needed to determine the height of the water table in the Janise, Las Animas, Platte, Minatare, Gering, and McGrew soils. Mitchell silt loam, wet variant, and Mitchell and Buffington soils, alkali, also need to be investigated. Wet alluvial land and Marsh are too wet to be used as building sites.

Foundations fail and walls crack because soils shrink and swell. Soils that contain large amounts of clay are most susceptible to shrinking and swelling. The weight of the building sometimes causes slippage of the foundation and serious cracking. Clayey alkali land and the Orella soils are clayey enough to cause such difficulties. Buffington soils also crack slightly as they dry and swell slightly when made wet, but they are not so likely to cause trouble. Minatare and Janise soils not only are clayey but also have a high water table. All of these soils need to be investigated at the site and compensations made for these adverse characteristics.

Before septic tanks or other sewage disposal systems are installed, a careful investigation of the soil at the proposed site is needed. The percolation rate should be acceptable, and there should be no interference to absorption by ground water or by bedrock or another impervious layer.

In general, at least 4 feet of pervious material is essential above the water table or bedrock. The Epping, Shingle, Tassel, and Keota are examples of soils that have severe limitation to use for sewage disposal because they are shallow to bedrock. In Marsh and Wet alluvial land the water table is too high. Investigation of the Platte, Gering, Las. Las Animas, Minatare, McGrew, and Janise soils and Mixed alluvial land is needed because the water table is moderately high.

A standard percolation test is used to determine the absorptive capacity of soils. Generally, the coarser textured soils—sands and loamy sands—have a high absorptive capacity. These soils are suitable for septic tanks and other sewage disposal systems for homesites. The medium textured soils—loams, silt loams, and very fine sandy loams—are generally suitable except where compact or clayey layers occur in the upper 4 feet. In the fine-textured soils, absorption is slower, and absorption tests need to be made. In Scotts Bluff County, soils that are likely to cause trouble are the Orella and Buffington soils and Clayey alkali land.

The Epping, Tassel, Shingle, and Keota soils generally have bedrock within a depth of 40 inches and have severe limitations to use for home sewage systems.

Although the soil map can be of value in making a preliminary appraisal of most soils, a detailed investigation at the site of the proposed construction is needed because much of an area designated as a special soil on the map may consist of areas of other soils that are not shown. For quantitative information, engineers must still depend on direct measurements based on water absorption rates, as measured in a percolation test.

Engineering Uses of Soils [5]

Some soil properties are of special interest to engineers because these properties affect the construction and maintenance of highways, airports, pipelines, building foundations, facilities for water storage, erosion control structures, irrigation systems, drainage systems, sewage disposal systems, and structures to protect soil and conserve water. The properties most important are texture, permeability, shear strength, plasticity, compaction characteristics, compressibility, workability, and soil drainage. Also important are topography, depth to the water table, and depth to bedrock, sand, or gravel.

The information in this survey can be used by engineers to—

1. Make studies of soil and land use that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of engineering properties of soils that will help in planning agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for protecting soil and conserving water.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways and airports and in planning detailed investigations at the selected locations.
4. Locate probable sources of sand, gravel, and other material for use in construction.
5. Correlate performance of engineering structures with soil mapping units to develop information for preliminary planning that will be useful in designing and maintaining engineering practices and structures.
6. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.

[5] This subsection was prepared by JOSEPH E. PESHEK, area engineer, and DONALD A. YOST, soil scientist, Soil Conservation Service, assisted by LEE E. SMEDLEY, assistant State conservation engineer, Soil Conservation Service.

7. Supplement information obtained from other published maps and surveys and aerial photographs to make soil maps and reports that can be used readily by engineers.
8. Locate sites that readily require special methods or the use of special designs to insure satisfactory structures.

With this soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works that involve heavy loads or where the excavations are deeper than the depth of layers here reported. Even in these situations, however, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used in this subsection have special meaning to the soil scientist and may not be understood by engineers. Many of the more common terms are defined in the Glossary at the back of this survey. More specific information is given in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

The three tables—4, 5, and 6—in this subsection contain a summary of soil properties significant to engineering and some engineering interpretations.

Engineering classification systems

Two systems of classifying soils are in general use by engineers. Both of these systems are used in this survey.

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system, soil materials are classified in seven principal groups on the basis of field performance. The groups range from A–1 (gravelly soils having high bearing capacity) to A–7 (clayey soils having low strength when wet). Within each group, the relative engineering value of the material is indicated by a group index number. The group index number ranges from 0 for the best material (A–1 and A–3) to 20 for the poorest (A–7).

Many engineers prefer to use the Unified soil classification system (*15*). In this system the soils are identified according to their texture and plasticity and are grouped according to their performance as engineering construction material. Of the 15 classes in this system, eight are for coarse-grained material, six for fine-grained material, and one for highly organic material. Each class is identified by a letter symbol, for example, CL. The classes range from GW, consisting of well-graded gravels or gravel-sand mixtures with little or no fines, to Pt, consisting of peat and other highly organic material. The only classes represented in Scotts Bluff County are SW, SP, SM, ML, CL, CH, and the borderline classes SP-SM, ML-CL, and MH-CH. Soils that have characteristics near the borderline between two classes are given a dual classification.

The Unified system provides for a simple field method and a laboratory method for determining the amount and kind of coarse and fine materials in soils. Both methods are based on textural and plasticity qualities and vary only in degree of accuracy. In the laboratory method, mechanical analyses, liquid limit, and plasticity index are used for an exact classification. For a more accurate classification of the fine-grained soils, the liquid limit and the plasticity index are plotted on a plasticity chart. The classification of the soils tested according to the Unified system is given in table 4.

Engineering test data

Table 4 gives engineering test data for several soil series. Samples were taken, by horizons, from 10 soil profiles and tested especially for this survey. The tests were made by the Division of Materials and Tests, Nebraska Department of Roads, according to standard procedures of the American Association of State Highway Officials (*1*).

Each soil type listed in table 4 was sampled at only one location, and the data given for the soil are those at that location. From one location to another, a soil may differ considerably in characteristics that affect engineering. Even where soils are sampled at more than one location, the test data probably do not show the widest range in characteristics.

The engineering classifications in the last two columns of table 4 are based on data obtained by mechanical analysis and on tests to determine the liquid limit and plastic limit. The mechanical analysis was made by a combination of the sieve and hydrometer methods.

The tests for liquid limit and plastic limit measure the effect of water on the consistency of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content, expressed as a percentage of the oven-dry weight of the soil, at which the soil material passes from a semisolid to a plastic state. The *liquid limit* is the moisture content at which the material passes from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates a range of moisture content within which a soil material is in a plastic condition. Some silty and sandy soils are nonplastic, that is they will not become plastic at any moisture content.

Engineering properties of soils

In table 5 soil properties significant to engineering are estimated. For more detailed information about the soils, refer to the section "Descriptions of the Soils," and for information about geology, to the section "Formation and Classification of Soils."

The estimates in table 5 were based on the engineering test data in table 4, other information obtained in the county during the survey, and knowledge about the same kinds of soils obtained in other areas. The data are listed by layers that have properties significant to engineering. These data include the textural classification of the United States Department of Agriculture and the AASHO and Unified engineering classifications. Also listed for each layer are the percentages of material that will pass a No. 4 sieve, a No. 10 sieve, and a No. 200 sieve.

In table 5 permeability refers to the rate at which water moves through undisturbed soil material. It depends largely on soil texture and structure. The rate is listed for each layer of soil in inches of soil permeated per hour. Terms used to describe permeability and their equivalent ratio in inches per hour are as follows: *Very slow* (less than 0.05), *slow* (0.05 to 0.20), *moderately slow* (0.20 to

0.80), *moderate* (0.80 to 2.50), *moderately rapid* (2.50 to 5.00), *rapid* (5.00 to 10.00), and *very rapid* (over 10.00).

Available water capacity, estimated in inches per inch of soil depth, is the approximate amount of capillary water in a soil that is wet to field capacity. When the soil is air dry, this amount of water will wet the soil material to a depth of 1 inch without deeper percolation.

Reaction of the soils is shown in numerical terms of pH. A pH value of 7.0 is precisely neutral; a lower pH value indicates that the soil is acid; and a pH value higher than 7.0 indicates that the soil is alkaline. In this county the reaction of most soils ranges from about pH 7.0 to 8.5 when tested by the saturated paste method. If the pH value did not exceed pH 8.6 under this method and if the 2:1 water-soil dilution method did not show an increase of this value by more than 0.6, sodium salts were assumed not to be present in detrimental amounts, and the pH value obtained in the saturated paste method is shown in table 5. If the increase in the pH value by the water-dilution method was 0.7 or more, however, sodium salts were assumed to be present in detrimental amounts, and the pH value obtained by that method is shown in table 5.

Soils in this county vary widely in the degree in which they are affected by soluble salts. Most of the soils affected have a water table 1 to 6 feet below the surface. Exceptions are Orella clay, 0 to 3 percent slopes; Clayey alkali land; Slickspots-Keith complex; Keith loam, alkali substratum variant, 0 to 3 percent slopes; and a few areas of Janise soils. These soils are slightly to moderately saline, but they do not have a high water table. They have a crust of salt on the surface, and the amount of salt increases year after year. Terms used to describe salinity in table 5 and their equivalent in percent are as follows: *None* (less than 0.15), *slight* (0.15 to 0.25), *moderate* (0.25 to 0.35), *severe* (0.35 to 0.65), and *very severe* (0.65 and higher).

Dispersion is a term used to describe the separation of soil aggregates in water into individual particles. It occurs in soils that contain a large amount of exchangeable sodium. Where dispersion of silt and clay occurs, the soil loses its distinctive structure when disturbed and tends to run together and become puddled. Also, the surface crusts and permeability is slow. Soils of the Janise and Minatare series are subject to a high rate of dispersion.

The rating for shrink-swell potential indicates how much a soil changes in volume when subjected to a change in moisture content. In general, soils that have a high content of clay, such as the Orella and the Minatare soils and Clayey alkali land, have a high shrink-swell potential. Moderate in shrink-swell potential are the Buffington soils, Slickspots, and the surface layer of McCook silty clay loam. Clean sands and gravel have low shrink-swell potential.

Engineering interpretations of soils

The interpretations in table 6 will help engineers and others plan the use of soils in construction. In this table the soils are rated according to their suitability as a source of topsoil and of mixed sand and gravel. They are also rated according to their suitability as subgrade for paved roads and for gravel roads. In addition, features are named that affect highway location, foundations, low dams, agricultural drainage, irrigation, terraces and diversions, and waterways. Also in table 6 are the degree and kinds of limitations if the soils are used as sites for sewage disposal systems.

Most of the soils in Scotts Bluff County are not suitable as a source of sand, and their suitability for this purpose was not rated in table 6. The Dunday and Valentine soils, however, are good to fair as a source of sand; Bankard, good to fair below a depth of 5 feet; and Las Animas, poor between a depth of 1 foot and 3 feet. Extensive exploration is needed to find sand that meet gradation requirements. Suitability for sand and gravel was rated in table 6 because a mixture of sand and gravel occurs at a depth of 2 to 5 feet in many soils.

Dikes and levees are not rated in table 6 because they are not needed on most soils of the county. They are suitable on the Duroc, Janise, Las Animas, and Platte soils and on Loamy alluvial land and Mixed alluvial land. Soil features that affect the building of dikes and levees on these soils are the erodibility of slopes and susceptibility to piping.

Topsoil in table 6 is fertile soil material that ordinarily is rich in organic matter. It is used to topdress roadbanks, gardens, and lawns. The soils are rated *good*, *fair*, and *poor* as a source of topsoil. Soils rated fair or poor generally are eroded, are low in organic-matter content or natural fertility, or have layers that are sticky and difficult to work.

Ratings are listed for the suitability of soils for road subgrade for paved roads, either bituminous or concrete, and for gravel roads. Because gravel and sand make the best subgrade for paved roads, and fines the poorest, the soil material is rated *good* if the AASHO classification is A–1 or A–3; *good to fair*, A–2; *fair to poor*, A–4; and *poor*, A–6 or A–7. Sand and gravel are not cohesive and, unless confined, do not make good subgrade for gravel roads. Fines provide a more stable surface. The ratings in table 6 for subgrade of gravel roads is for the material immediately below the gravel. Therefore, all soils classified A–1 or A–3 are rated *poor;* A–2, *poor to fair;* A–4, *good to fair;* and A–6 or A–7, *good.* The ratings for road subgrade for paved roads can be used to determine the best material for road fill because the ratings for the two uses are essentially the same.

Generally, soil features affecting engineering practices are rated according to the difficulties encountered in building and maintaining highways on those soils. For soil features affecting highway locations, most soils are rated in table 6 for their susceptibility to frost action. These ratings are based mainly on the texture of the surface layer and subsoil. Clayey and silty soils are susceptible to frost action if the underlying layers are pervious enough for water to rise and form lenses of ice. Because they have a high water table, many soils in the county are susceptible to severe frost action.

For foundations, the soils in table 6 are rated for bearing capacity and for susceptibility to piping of soil material below a depth of 3 feet. The bearing capacity of soils in the county varies widely, and engineers and others should not apply specific values to the estimates given for bearing capacity, or bearing strength, of soils. The resistance to piping ranges from good to poor. Draining or lowering the water table at the site of foundations may be required. All soils that have a high water table should be investigated thoroughly before structures are built on them.

TABLE 4.—*Engineering*

[Tests performed by the Nebraska Department of Roads in cooperation with U.S. Department of Commerce, Bureau of Public

Soil name and location	Parent material	Nebraska report No.	Depth	Horizon	Moisture-density[1]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Bayard fine sandy loam: 350 feet east and 50 feet south of the northwest corner of section 17, T. 21 N., R. 56 W. (Modal profile.)	Colluvium	S62–81	0–7	A1	100	18
		S62–82	20–25	C1	104	17
		S62–83	47–58	C2	103	17
Bridgeport very fine sandy loam: 0.5 mile east and 0.35 mile south of the northwest corner of section 28, T. 21 N., R. 56 W. (Modal profile for the county.)	Colluvium	S61–6462	0–12	A	102	18
		S61–6463	12–27	C1	103	18
		S61–6464	27–60	C2	103	16
Buffington silty clay loam: 0.44 mile east and 0.03 mile south of the northwest corner of section 11, T. 22 N., R. 58 W. (Modal profile for the county.)	Colluvium-alluvium over alluvium.	S61–6465	0–9	Ap	96	21
		S61–6466	9–13	A1	92	27
		S61–6467	32–56	C3	93	26
Clayey alkali land: 0.48 mile north and 0.22 mile west of the southeast corner of section 15, T. 22 N., R. 58 W. (Modal profile for the county.)	Colluvium-alluvium over alluvium.	S61–6476	0–4	A	85	30
		S61–6477	4–15	B2	80	34
		S61–6478	34–56	C	86	32
Dunday loamy fine sand: 0.1 mile west and 75 feet south of the northeast corner of section 16, T. 20 N., R. 57 W. (Modal profile for the county.)	Eolian sands	S61–6468	0–8	A	108	14
		S61–6469	16–60	C2	112	12
Minatare loam: 0.1 mile west and 50 feet north of the southeast corner of section 29, T. 21 N., R. 52 W. (Modal profile.)	Alluvium	S61–6473	1.5–4	A2	97	20
		S61–6474	4–12	B2t	95	24
		S61–6475	12–26	B3	99	22
Mitchell silt loam: 0.58 mile west and 100 feet south of the northeast corner of section 31, T. 21 N., R. 55 W.	Brule siltstone	S61–6470	0–9	Ap	104	19
		S61–6471	22–33	C1	102	19
		S61–6472	33–60	C2	101	22
Tripp very fine sandy loam: 0.26 mile east and 150 feet north of the southwest corner of section 12, T. 22 N., R. 55 W. (Modal profile.)	Alluvium	S61–6479	0–8	Ap	111	15
		S61–6480	11–21	B2	111	15
		S61–6481	21–32	Cca	106	20
		S61–6482	32–54	C1	109	17
Valentine fine sand: 0.53 mile north and 0.2 mile east of the southwest corner of section 29, T. 21 N., R. 57 W. (Modal profile for the county.)	Eolian sands	S61–6483	0–6	A	108	14
		S61–6484	10–60	C	107	14

[1] Based on AASHO Designation T99–57, Method A (*1*).

[2] Mechanical analyses according to the American Association of State Highway Officials Designation: T 88–57 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the 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 for soil.

test data

Roads (BPR), in accordance with Standard Procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—			Percentage smaller than—						AASHO [3]	Unified [4]
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
100	98	51	25	12	7	5	[5] NP	[5] NP	A-4(3)	ML
100	98	50	26	10	5	3	NP	NP	A-4(3)	SM
100	99	60	35	14	6	4	NP	NP	A-4(5)	ML
100	99	65	40	17	9	7	NP	NP	A-4(6)	ML
100	99	65	34	14	6	4	NP	NP	A-4(6)	ML
100	99	62	33	14	6	4	NP	NP	A-4(5)	ML
100	99	75	61	45	27	17	41	18	A-7-6(11)	CL
100	99	81	72	59	40	28	49	23	A-7-6(15)	ML-CL
100	99	76	68	53	38	27	44	18	A-7-6(12)	ML-CL
----------	100	91	85	70	45	30	56	26	A-7-5(18)	MH-CH
----------	100	94	90	77	52	35	71	40	A-7-5(20)	CH
----------	----------	98	92	75	44	31	63	32	A-7-5(20)	MH-CH
100	93	39	21	9	5	3	NP	NP	A-4(1)	SM
100	94	27	14	7	3	2	NP	NP	A-2-4(0)	SM
100	98	85	66	20	7	3	32	2	A-4(8)	ML
100	98	90	82	55	33	22	53	23	A-7-5(16)	MH-CH
100	91	81	69	50	28	17	46	25	A-7-6(15)	CL
----------	100	74	48	22	12	6	28	3	A-4(8)	ML
100	99	78	58	23	8	5	29	3	A-4(8)	ML
100	93	74	57	19	7	3	32	2	A-4(8)	ML
[6] 98	92	68	48	22	10	6	28	6	A-4(7)	ML-CL
[6] 99	92	68	54	27	13	7	32	11	A-6(7)	CL
100	97	84	70	38	18	10	34	10	A-4(8)	ML-CL
[7] 99	97	84	71	29	12	7	30	3	A-4(8)	ML
100	97	7	5	4	3	2	NP	NP	A-3(0)	SP-SM
100	98	4	4	3	3	2	NP	NP	A-3(0)	SP

[3] Based on AASHO Designation M: 145-49 (*1*).

[4] Based on the Unified Soil Classification System (*15*). The Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points from A-line are to be given a borderline classification. An example of a borderline classification so obtained is "ML-CL."

[5] Nonplastic.

[6] 99 percent passes a No. 4 sieve and 100 percent passes a ¾-inch sieve.

[7] 100 percent passes a No. 4 sieve.

TABLE 5.—*Estimated*

[Because Barren badlands (BB), Marsh (M), Sandy alluvial land (Sx), Broken alluvial land (Sy)

Soil	Description of soil and site		Depth from surface	Classification		
	Underlying material [1]	Depth to water table		USDA	Unified	AASHO
		Feet	*Inches*			
Alice:						
Fine sandy loam (AcA, AcB)	Sand and gravel	>10	0–26	Fine sandy loam	ML	A–4
			26–57	Fine sandy loam	ML	A–4
			57–60	Very fine sandy loam	ML	A–4
Loamy fine sand (AeA)	Silt and sand	>10	0–10	Loamy fine sand	SM	A–2
			10–36	Fine sandy loam	SM	A–4
			36–46	Silt loam	ML	A–4
			46–60	Fine sandy loam	SM	A–4
Anselmo:						
Fine sandy loam (AnA, AnB, AnC, AnD).	Silt and sand	>10	0–14	Fine sandy loam	SM	A–4
			14–38	Fine sandy loam	SM	A–4
			38–60	Fine sandy loam	SM	A–2 or A–4
Fine sandy loam, alkali variant (2An).	Silt and sand	4–7	0–11	Fine sandy loam	SM	A–4
			11–22	Very fine sandy loam or fine sandy loam.	ML or SM	A–2 or A–4
			22–51	Silt loam or fine silt loam.	ML or SM	A–2 or A–4
Bankard:						
Loamy fine sand (Bc)	Sand	6–12	0–3	Loamy fine sand	SM	A–2
			3–55	Loamy sand	SM	A–2
Loamy fine sand, alkali, wet variant (2Bc).	Sand	3–6	0–22	Loamy fine sand	SM	A–2 or A–4
			22–60	Loamy fine sand	SM	A–2 or A–4
Loamy fine sand, wet variant (5Bc).	Sand	3–6	0–10	Loamy fine sand	SM	A–2 or A–4
			10–46	Loamy sand	SM	A–2
			46–60	Sand and gravel	SW or SP	A–1
Bayard (BfA, BfB, BfC, BfD)	Sand	>10	0–14	Fine sandy loam	SM	A–4
			14–60	Fine sandy loam	SM or ML	A–4
Bridgeport (BvA, BvB, BvC, BvD)	Silt and sand	>10	0–14	Very fine sandy loam.	ML	A–4
			14–60	Very fine sandy loam.	ML	A–4
Buffington:						
Silty clay loam (Bg, BgA)	Silt and clay	>10	0–38	Silty clay loam	CL	A–7
			38–60	Loam and silty clay loam.	CL	A–7
Silty clay loam, alkali (2Bg)	Silt and clay	>10	0–9	Silty clay loam	CL	A–7
			9–18	Silty clay loam	CL	A–7
			18–30	Silty clay loam	CL	A–7
			30–60	Loam	CL	A–7
Chappell (CZA, CZB) (For the Dix part of units CZA and CZB, refer to the Dix series.)	Sand and gravel	10–25	0–8	Sandy loam	SM	A–2 or A–4
			8–28	Coarse sandy loam to gravelly sandy loam.	SM	A–2
			28–60	Sand and gravel	SW or SP	A–1
Clayey alkali land (2Cx)	Silt and clay	>10	0–4	Silty clay	CH	A–7
			4–15	Silty clay	CH	A–7
			15–56	Silty clay loam	CH	A–7
Creighton (CoB, CoC)	Sandstone	>10	0–60	Very fine sandy loam.	ML	A–4
Dix (DBD, DxD) (For the Bayard part of unit DBD, refer to the Bayard series.)	Sand and gravel	>10	0–3	Sandy loam	SM	A–2 or A–4
			3–12	Loamy coarse sand	SM–SP or SM	A–1 or A–2
			12–24	Sand and gravel	SW or SP	A–1

See footnotes at end of table.

properties of soils

Tassel soils (Tl), and Wet alluvial land (Wx) are variable, their properties were not estimated]

Percentage passing sieve— No. 4	No. 10	No. 200	Permeability	Available water capacity	Reaction	Salinity	Dispersion	Shrink-swell potential
			Inches per hour	*Inches per inch of soil*	*pH value*			
100	95–100	50–60	2.5– 5.0	0.15	7.0– 8.5	None	Low	Low.
100	95–100	50–60	2.5– 5.0	.15	7.5– 8.5	None	Low	Low.
100	95–100	55–70	2.5– 5.0	.15	7.5– 8.5	None	Low	Low.
100	95–100	15–35	5.0–10.0	.10	7.0– 8.0	None	Low	Low.
100	95–100	40–50	2.5– 5.0	.15	7.3– 8.3	None	Low	Low.
	100	75–90	0.8– 2.5	.16	7.7– 8.5	None	Low	Low.
100	95–100	40–50	2.5– 5.0	.15	7.5– 8.5	None	Low	Low.
	100	40–50	2.5– 5.0	.15	7.0– 7.5	None	Low	Low.
	100	40–50	2.5– 5.0	.15	7.3– 8.3	None	Low	Low.
100	90–100	20–40	5.0–10.0	.10	7.8– 8.5	None	Low	Low.
	100	40–50	2.5– 5.0	.15	7.5– 8.5	None	Low	Low.
	100	30–80	0.8– 5.0	0.15–0.16	9.0–10.0	None	Low	Low.
	100	30–90	0.8– 5.0	0.15–0.16	9.5–10.2	None or slight	Low	Low.
	100	15–30	5.0–10.0	.10	7.0– 8.0	None	Low	Low.
100	95–100	15–25	5.0–10.0	.10	7.5– 8.5	None	Low	Low.
95–100	95–100	15–40	5.0–10.0	.10	7.0– 9.0	None or slight	Low	Low.
95–100	95–100	15–40	5.0–10.0	.10	9.0–10.0	None or slight	Low	Low.
95–100	90–100	20–40	5.0–10.0	.10	7.5– 8.5	None	Low	Low.
95–100	90–100	15–35	5.0–10.0	.10	7.5– 8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06		None	Low	Low.
95–100	95–100	40–50	2.5– 5.0	.15	7.0– 8.0	None	Low	Low.
95–100	95–100	40–65	5.0–10.0	.15	7.4– 8.6	None	Low	Low.
	100	60–70	0.8– 2.5	.16	7.0– 7.8	None	Low	Low.
	100	60–70	0.8– 2.5	.16	7.2– 8.5	None	Low	Low.
	100	70–85	0.2– 0.8	.17	7.5– 8.5	None	Low	Moderate.
	100	60–80	0.8– 2.5	.16	7.5– 8.5	None	Low	Moderate.
	100	70–80	0.2– 0.8	.17	7.5– 8.5	None	Low	Moderate.
	100	70–80	0.2– 0.8	.17	8.5– 9.5	None	Low	Moderate.
	100	70–80	0.2– 0.8	.17	9.0– 9.7	Slight	Low	Moderate.
	100	55–70	0.8– 2.5	.16	9.0– 9.7	None	Low	Moderate.
75–90	60–95	30–45	2.5– 5.0	.15	7.0– 8.0	None	Low	Low.
75–90	15–50	5–20	5.0–10 0	.10	7.5– 8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	[2]	None	Low	Low.
100	100	85–95	0.2– 0.8	.18	0.8– 8.5	None	Low	High.
	100	90–98	0.2– 0.8	.18	8.5– 9.2	None	Moderate	High.
	100	90–99	0.8– 2.5	.16	8.5– 9.2	Slight	Low	High.
	100	60–70	0.8– 2.5	.16	7.0– 8.5	None	Low	Low.
70–85	60–95	30–45	2.5– 5.0	.15	6.8– 7.5	None	Low	Low.
60–85	15–50	5–20	5.0–10.0	.10	6.8– 7.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	[2]	None	Low	Low.

TABLE 5.—*Estimated*

Soil	Description of soil and site		Depth from surface	Classification		
	Underlying material [1]	Depth to water table		USDA	Unified	AASHO
		Feet	*Inches*			
Dunday (DVA, DVB) (For the Valentine part of units DVA and DVB, refer to the Valentine series.)	Silt and sand	>10	0–60	Loamy fine sand	SM	A–2 or A–4
Duroc (Dr)	Silt	>10	0–33 33–60	Loam Loam	ML ML	A–4 A–4
Dwyer (Mapped only with Valentine soils.)	Sand	>10	0–60	Fine sand	SM	A–2
Epping ((EpA, EpD, RE) (Properties for Rock outcrop in unit RE were not estimated.)	Siltstone	>10	0–5 5–15 15	Silt loam Loam Siltstone.	ML ML	A–4 A–4
Gering:						
Loam (Gr)	Sand and gravel	3–5	0–29 29–60	Loam Sand and gravel	ML SW or SP	A–4 A–1
Loam, alkali (2Gr)	Sand and gravel	3–5	0–9 9–29 29	Loam Loam Sand and gravel	ML ML SW or SP	A–4 A–4 A–1
Glenberg (Gd)	Sand and gravel	5–10	0–19 19–60	Fine sandy loam Fine sandy loam	ML SM	A–4 A–4
Gullied land (GL)	Silt and sand or siltstone.	>10	0–60	Silt loam	ML	A–4
Gravelly land (Gv)	Sand and gravel	>10	0–6 6–18	Gravelly loamy sand Sand and gravel	SP–SM or SM SW or SP	A–1 or A–2 A–1
Haverson (Hf)	Sand and gravel	5–10	0–16 16–36 36–56	Fine sandy loam Loam Fine sandy loam	ML ML SM	A–4 A–4 A–4
Janise soils (Jn)	Silt and sand	3–10	0–1 1–8 8–48	Loam Silty clay loam Silt loam	ML ML or CL ML	A–4 A–4 or A–6 A–4
Keith:						
Loam (Ke, KeA, KeB, KUB2, KUC) (For the Ulysses part of units KUB2 and KUC, refer to the Ulysses series.)	Silt (Peorian loess)	>10	0–24 24–60	Loam Silt loam	ML ML	A–4 A–4
Loam, alkali substratum variant (2KeA).	Silt (Peorian loess)	5–8	0–17 17–23 23–49	Loam Loam Silt loam	ML ML ML	A–4 A–4 A–4
Keota (KEC, KoA, KoB) (For the Epping part of unit KEC, refers to the Epping series.)	Siltstone	>10	0–8 8–23 23	Silt loam Silt loam Siltstone.	ML ML	A–4 A–4
Las:						
Fine sandy loam, alkali (2Ls)	Stratified silt and sand.	3–6	0–10 10–47 47–60	Fine sandy loam Loam Stratified loamy materials.	ML ML ML	A–4 A–4 A–4
Loam (Lt)	Sand and gravel	3–6	0–41 41–60	Loam Sand and gravel	ML SW or SP	A–4 A–1
Loam, alkali (2Lt)	Sand and gravel	3–6	0–38 38–60	Loam Sand and gravel	ML SW or SP	A–4 A–1

See footnotes at end of table.

properties of soils—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Salinity	Dispersion	Shrink-swell potential
No. 4	No. 10	No. 200						
			Inches per hour	*Inches per inch of soil*	*pH value*			
95–100	95–100	20–40	5.0–10.0	0.10	7.3–8.3	None	Low	Low.
100	95–100	60–75	0.8–2.5	.16	7.0–8.5	None	Low	Low.
100	95–100	65–85	0.8–2.5	.16	7.5–8.5	None	Low	Low.
	100	15–30	5.0–10.0	.10	6.5–8.0	None	Low	Low.
85–100	85–95	50–80	0.8–2.5	.16	7.5–8.5	None	Low	Low.
80–100	75–95	50–65	0.8–2.5	.16	7.5–8.5	None	Low	Low.
95–100	95–100	55–70	0.8–2.5	.16	7.3–8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	55–70	0.8–2.5	.16	8.0–9.0	Slight	Low	Low.
95–100	95–100	55–70	0.8–2.5	.16	8.0–9.0	None or slight	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	50–60	2.5–5.0	.15	7.5–8.5	None	Low	Low.
95–100	95–100	35–50	2.5–5.0	.15	7.5–8.5	None	Low	Low.
	100	60–80	0.8–2.5	.16	7.2–8.5	None	Low	Low.
60–85	15–50	5–20	5.0–10.0	.10	7.5–8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	7.5–8.5	None	Low	Low.
95–100	95–100	50–60	2.5–5.0	.15	7.0–8.0	None	Low	Low.
95–100	95–100	55–70	0.8–2.5	.16	7.5–8.5	None	Low	Low.
95–100	90–100	35–50	2.5–5.0	.15	7.5–8.5	None	Low	Low.
	100	55–70	0.8–2.5	.16	8.0–9.0	None	Low	Low.
	100	70–85	0.2–0.8	.17	9.5–10.4	Slight	High	Moderate.
	100	65–80	0.8–2.5	.16	9.5–10.4	Slight	High	Low.
	100	70–90	0.8–2.5	.16	6.7–7.7	None	Low	Low.
	100	65–85	0.8–2.5	.16	7.5–8.3	None	Low	Low.
	100	70–90	0.8–2.5	.16	6.7–7.8	None	Low	Low.
	100	70–90	0.8–2.5	.16	7.5–8.5	Slight	Low	Low.
	100	65–85	0.8–2.5	.16	9.0–9.7	None	Moderate	Low.
95–100	95–100	65–80	0.8–2.5	.16	7.5–8.5	None	Low	Low.
95–100	95–100	55–70	0.8–2.5	.16	8.0–8.8	None	Low	Low.
95–100	95–100	50–65	2.5–5.0	.15	7.8–9.0	Slight	Low	Low.
95–100	95–100	55–70	0.8–2.5	.16	7.8–9.0	None	Low	Low.
90–100	90–100	50–65	0.8–2.5	.16	7.8–8.5	None	Low	Low.
95–100	95–100	55–70	0.8–2.5	.16	7.3–8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	55–70	0.8–2.5	.16	8.0–9.0	Slight	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.

TABLE 5.—*Estimated*

Soil	Description of soil and site		Depth from surface	Classification		
	Underlying material [1]	Depth to water table		USDA	Unified	AASHO
		Feet	*Inches*			
Las Animas:						
Fine sandy loam (Lq)	Sand and gravel	3–7	0–54	Fine sandy loam	SM	A–4
			54–60	Sand and gravel	SW or SP	A–1
Fine sandy loam, alkali (2Lq)	Sand and gravel	3–7	0–11	Fine sandy loam	SM	A–4
			11–40	Stratified sandy materials.	SM	A–4
			40	Sand and gravel	SW or SP	A–1
Loam (Lr)	Sand and gravel	3–7	0–10	Loam	ML	A–4
			10–38	Fine sandy loam	SM	A–4
			38	Sand and gravel	SW or SP	A–1
Loam, alkali (2Lr)	Sand and gravel	3–7	0–6	Loam	ML	A–4
			6–42	Stratified sandy materials.	SM	A–4
			42	Sand and gravel	SW or SP	A–1
Loamy alluvial land (Lx)	Stratified silt and sands.	>10	0–7	Loam	ML	A–4
			7–60	Stratified loamy materials.	SM or ML	A–4
McCook:						
Loam (Mo)	Sand and gravel	5–10	0–14	Loam	ML	A–4
			14–38	Silt loam	ML	A–4
			38–50	Fine sandy loam	SM	A–4
Silty clay loam, gravel substratum variant (3Mo).	Sand and gravel	7–11	0–12	Silty clay loam	CL	A–6 or A–7
			12–24	Loam	ML	A–4
			24	Sand and gravel	SW or SP	A–1
McGrew:						
Fine sandy loam (Mf)	Sand and gravel	3–5	0–27	Fine sandy loam	SM	A–4
			27	Sand and gravel	SW or SP	A–1
Loam (Mg)	Sand and gravel	3–5	0–10	Loam	ML	A–4
			10–28	Fine sandy loam	SM	A–4
			28–60	Sand and gravel	SW or SP	A–1
Loam, alkali (2Mg)	Sand and gravel	3–5	0–7	Loam	ML	A–4
			7–24	Stratified sandy materials.	SM	A–4
			24	Sand and gravel	SW or SP	A–1
Minatare (MJ) (For the Janise part of unit MJ, refer to the Janise series.)	Sand and gravel	3–5	0–7	Loam and clay loam.	ML	A–4
			7–20	Clay	CH	A–7
			20–40	Clay loam	CL	A–6 or A–7
Mitchell:						
Silt loam (2MBB, Mt, MtA, MtB, MtC). (For the Buffington part of unit 2MBB, refer to the Buffington series.)	Silt	>10	0–60	Silt loam	ML	A–4
Silt loam, thin (2MtB, 2MtC, 2MtD).	Silt	>10	0–3	Loam	ML	A–4
			3–60	Very fine sandy loam	ML	A–4
Silt loam, wet variant (5Mt)	Silt	3–5	0–38	Loam	ML	A–4
			38–60	Silt loam	ML	A–4
Fine sandy loam (MzA, MzB, MzC).	Silt	>10	0–8	Fine sandy loam	ML	A–4
			8–42	Silt loam	ML	A–4
			42–60	Loam	ML	A–4

See footnotes at end of table.

properties of soils—Continued

Percentage passing sieve— No. 4	No. 10	No. 200	Permeability	Available water capacity	Reaction	Salinity	Dispersion	Shrink-swell potential
			Inches per hour	*Inches per inch of soil*	*pH value*			
95–100	95–100	40–50	2.5– 5.0	0.15	7.5– 8.7	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	40–50	2.5– 5.0	.15	7.5– 8.5	None to slight	Low	Low.
95–100	95–100	35–50	2.5– 5.0	.15	7.5– 8.5	None to moderate.	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	60–75	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
95–100	95–100	35–50	2.5– 5.0	.15	7.5– 8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	60–75	0.8– 2.5	.16	7.5– 8.5	None to slight	Low	Low.
95–100	95–100	35–50	2.5– 5.0	.15	7.5– 8.5	None to moderate.	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
----------	100	55–70	0.8– 2.5	.16	7.3– 8.3	None	Low	Low.
----------	100	45–70	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
95–100	95–100	55–70	0.8– 2.5	.16	7.0– 8.0	None	Low	Low.
95–100	95–100	65–80	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
95–110	90–100	35–50	2.5– 5.0	.15	7.5– 8.5	None	Low	Low.
95–100	95–100	70–80	0.2– 0.8	.17	7.5– 8.5	None	Low	Moderate.
95–100	95–100	50–70	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	35–50	2.5– 5.0	.15	7.5– 8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	60–75	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
95–100	95–100	35–50	2.5– 5.0	.15	7.5– 8.5	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
95–100	95–100	60–75	0.8– 2.5	.16	7.7– 8.7	None to slight	Low	Low.
95–100	95–100	35–50	2.5– 5.0	.15	7.7– 8.7	None to moderate.	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
----------	100	75–85	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
----------	100	80–95	0.05– 0.2	.18	9.5–10.2	Slight to moderate.	High	Moderate to high.
100	95–100	75–85	0.2– 0.8	.17	9.3– 9.9	Slight to moderate.	High	Moderate.
----------	100	70–85	0.8– 2.5	.16	7.3– 8.0	None	Low	Low.
----------	100	60–80	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
----------	100	55–75	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
----------	100	60–80	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
----------	100	70–85	0.8– 2.5	.16	7.5– 8.5	None	Low	Low.
----------	100	50–65	2.5– 5.0	.15	7.0– 8.0	None	Low	Low.
----------	100	70–85	0.8– 2.5	.16	7.3– 8.3	None	Low	Low.
----------	100	55–75	0.8– 2.5	.16	7.3– 8.3	None	Low	Low.

TABLE 5.—*Estimated*

Soil	Description of soil and site: Underlying material [1]	Description of soil and site: Depth to water table	Depth from surface	Classification: USDA	Classification: Unified	Classification: AASHO
		Feet	*Inches*			
Mixed alluvial land (3Sx)	Sand and gravel	2–4	0–8	Loamy materials	SM to CL	A–2, A–4 or A–6
			0–8	Sand and gravel	SW or SP	A–1
Orella (OrA)	Silt and clay	>10	0–13	Clay	CH	A–7
			13–18	Clay	CH	A–7
Otero:						
Fine sandy loam (OBA, OBB, OBC, OC, OtB, OtD). (For the Bayard part of units OBA, OBB, OBC, and OC, refer to the Bayard series.)	Sand	>10	0–20	Fine sandy loam	SM	A–2 or A–4
			20–60	Loamy very fine sand	SM	A–2 or A–4
Loamy fine sand (OdB)	Sand	>10	0–16	Loam fine sand	SM	A–2 or A–4
			16–60	Fine sandy loam	SM	A–4
Platte (P)	Sand and gravel	3–5	0–6	Loam	SM or ML	A–4
			6–19	Stratified sandy materials.	SM	A–4, A–2
			19	Sand and gravel	SW or SP	A–1
Rosebud (RbC)	Arikaree sandstone	>10	0–28	Loam	ML	A–4
			28–60	Loam	ML	A–4
Satanta (Sa)	Silt (Peorian loess)	>10	0–9	Fine sandy loam	SM	A–4
			9–32	Loam	ML	A–4
			32–60	Loam	ML	A–4
Shingle (ShC)	Clay and sandstone (interbedded).	>10	0–5	Loam	ML	A–4
			5–12	Silty clay loam	ML or CL	A–6 or A–7
			12–32	Interbedded clay and sandstone.		
Slickspots (SK) (For the Keith part of unit SK, refer to the Keith series.)	Silt (Peorian loess)	5–10	0–2	Loam	ML	A–4
			2–6	Silty clay	CL or CH	A–7
			6–18	Silty clay loam	CL or CH	A–6 or A–7
			18–60	Silt loam	ML	A–4
Tassel (TA, RT) (For the Anselmo part in unit TA, refer to the Anselmo series. Properties for Rock outcrop in unit RT were not estimated.)	Arikaree sandstone	>10	0–6	Very fine sandy loam.	SM	A–2 or A–4
			6–14	Fine sandy loam	SM	A–2 or A–4
			14–60	Sandstone.		
Tripp:						
Fine sandy loam (TrA)	Silt and sand	10–30	0–12	Fine sandy loam	ML	A–4
			12–32	Loam	ML	A–4
			32–60	Silt loam	ML	A–4
Very fine sandy loam (Tv, TvA, TvB2, TvC2).	Silt and sand	10–30	0–35	Very fine sandy loam	ML	A–4
			35–63	Loam	ML	A–4
Ulysses (Mapped only with the Keith soils.)	Silt (Peorian loess)	>10	0–20	Loam	ML	A–4
			20–60	Silt loam	ML	A–4
Valentine (VD, VDy) (For the Dwyer part of units VD and VDy, refer to the Dwyer series.)	Sand	>10	0–14	Fine sand	SP or SP–SM	A–3
			14–60	Fine sand	SP	A–3

[1] Materials below the soil profile, generally those between depths of 4 and 10 feet.

properties of soils—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Salinity	Dispersion	Shrink-swell potential
No. 4	No. 10	No. 200						
			Inches per hour	*Inches per inch of soil*	*pH value*			
100	95–100	30–70	0.20–5.0	0.15–0.17	7.5–8.5	None to slight	Low	Low to moderate.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
	100	85–97	0.05–0.2	.18	8.5–9.1	None	High	High.
	100	93–99	0.05–0.2	.18	7.8–9.0	Slight to moderate.	Low to moderate.	High.
	100	25–50	2.5–5.0	.15	7.5–8.5	None	Low	Low.
	100	20–40	2.5–5.0	.15	7.8–8.5	None	Low	Low.
95–100	95–100	25–45	5.0–10.0	.10	7.0–8.0	None	Low	Low.
95–100	95–100	35–50	2.5–5.0	.15	7.4–8.4	None	Low	Low.
95–100	95–100	45–75	0.8–2.5	.16	7.3–8.3	None to slight	Low	Low.
90–100	90–100	30–50	2.5–5.0	.17	7.8–8.8	None	Low	Low.
50–75	5–50	0–5	>10.0	.06	(2)	None	Low	Low.
	100	60–80	0.8–2.5	.16	7.0–7.9	None	Low	Low.
	100	60–85	0.8–2.5	.16	7.3–8.5	None	Low	Low.
	100	40–50	2.5–5.0	.15	6.7–7.5	None	Low	Low.
	100	75–90	0.8–2.5	.16	7.0–7.5	None	Low	Low.
	100	65–80	0.8–2.5	.16	7.5–8.3	None	Low	Low.
80–95	75–90	50–70	0.8–2.5	.16	7.8–8.5	None	Low	Low.
80–95	75–90	60–80	0.2–0.8	.17	8.0–9.0	None	Low	Moderate.
	100	70–85	0.8–2.5	.16	7.5–8.5	None	Low	Low.
	100	85–95	0.05–0.20	.20	8.5–9.5	Slight	Moderate	High.
	100	80–90	0.20–0.80	.17	9.0–10.4	Moderate	High	Moderate.
	100	75–95	0.8–2.5	.16	8.5–10.0	Slight	High	Low.
85–100	85–100	20–50	0.8–2.5	.16	7.5–8.5	None	Low	Low.
85–100	80–100	20–40	2.5–5.0	.15	7.5–8.5	None	Low	Low.
	100	50–60	2.5–5.0	.15	7.0–8.0	None	Low	Low.
	100	55–70	0.8–2.5	.16	7.5–8.0	None	Low	Low.
	100	80–90	0.8–2.5	.16	7.5–8.5	None	Low	Low.
95–100	95–100	60–75	0.8–2.5	.16	7.0–8.0	None	Low	Low.
95–100	95–100	60–90	0.8–2.5	.16	7.5–8.5	None	Low	Low.
	100	60–90	0.8–2.5	.16	7.0–7.5	None	Low	Low.
	100	65–90	0.8–2.5	.16	7.5–8.3	None	Low	Low.
	100	2–10	5.0–10.0	0.06–0.08	6.5–7.5	None	Low	Low.
	100	2–10	5.0–10.0	0.06–0.08	6.5–8.0	None	Low	Low.

[2] Reaction (pH) not determined.

TABLE 6.—*Engineering*

[Absence of entry indicates structure or

Soil series and map symbols [1]	Suitability as source of—		Suitability as road subgrade for—		Soil features affecting engineering structures or practices for—	
	Topsoil	Mixed sand and gravel	Paved roads [2]	Gravel roads	Highway location	Foundations
Alice (AcA, AcB, AeA)	Fair	Poor below a depth of 5 feet in some areas.	Good to poor.	Poor to good.	Low to moderate susceptibility to frost action; erodibility of slopes.	Good to poor bearing strength, depending on density; good to fair stability.
Anselmo (AnA, AnB, AnC, AnD, 2An).	Fair	Generally not suitable.	Good to poor.	Fair to good.	Low to moderate susceptibility to frost action; erodibility of slopes.	Good to poor bearing strength, depending on density.
Bankard (Bc, 2Bc, 5Bc)	Poor: erodibility.	Fair in some areas below a depth of 6 feet.	Good to poor.	Poor to good.	Low susceptibility to frost action; erodibility of slopes; high susceptibility to soil blowing.	Good to poor bearing strength, depending on density; good in wet variant below a depth of 4 feet.
Bayard (BfA, BfB, BfC, BfD)	Fair	Generally not suitable.	Fair to poor.	Fair to good.	Low susceptibility to frost action; erodibility of slopes.	Poor bearing strength; poor shear strength.
Buffington (Bg, BgA, 2Bg)	Fair	Generally not suitable.	Poor	Good	High susceptibility to frost action.	Good to poor bearing strength; fair stability.
Bridgeport (BvA, BvB, BvC, BvD).	Good	Generally not suitable.	Fair to poor.	Good to fair.	Low to moderate susceptibility to frost action; erodibility of slopes.	Poor bearing strength; fair to poor stability.
Chappell (CZA, CZB) (For Dix part of units CZA and CZB, refer to the Dix series.)	Poor: erodibility; sand and gravel at shallow depth.	Good below a depth of 3 feet.	Good to poor.	Fair to poor.	Low susceptibility to frost action; erodibility of slopes.	Good bearing strength.

See footnotes at end of table.

interpretations of soils

practice is not needed or does not apply]

Soil features affecting engineering structures or practices for—Continued						Degree and kind of limitations for—	
Low dams		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tanks and filter fields	Sewage lagoons
Reservoirs	Embankments						
High seepage where coarse-textured substratum is exposed.	Fair to poor stability above a depth of 5 feet; piping may be severe; may require toe drains.		Moderate water-holding capacity; heavy fertilization needed.			Slight	Moderate to severe: moderate permeability; piping.
Moderate to high seepage, depending on horizon exposed.	Fair to poor stability above a depth of 5 feet; piping may be severe; may require toe drains.		Moderate water-holding capacity; high erodibility.	High erodibility.	High erodibility.	Slight to severe: moderate for alkali soil because of restricted permeability; moderate to severe for steep slopes.	Moderate to severe: some soils have moderately rapid permeability; some slopes of more than 5 percent.
Extreme susceptibility to seepage; where substratum is exposed.	Fair to good stability; piping may be a hazard; may require toe drains.	Excessively drained subsoil except in wet variant where water table may be high.	Low water-holding capacity; wet variant requires drainage.	High erodibility.	High erodibility; low fertility.	Slight to severe: high water table in places.	Severe: rapid permeability; high water table in places.
Seepage generally is not a problem.	Fair to poor stability; good moisture control necessary.	Natural drainage may be excessive.	Moderate water-holding capacity; high erodibility.	Moderate erodibility.	High erodibility; low fertility.	Slight to moderate: moderate for steeper slopes.	Severe: rapid permeability; some slopes of more than 5 percent.
Seepage is not a problem.	Good stability; impervious core needed; fair to good workability.	Natural drainage poor; moderately slow internal drainage.	High water-holding capacity; drainage required for alkali soil; slow intake rate.	Features favorable.	Special design required on flatter slopes.	Moderate to severe: slow permeability; poor drainage.	Slight.
Seepage is only a minor problem.	Fair to poor stability; close moisture control needed.		Moderate to high water-holding capacity; high erodibility on steep slopes.	Moderate erodibility.	Moderate erodibility.	Moderate to severe: moderately slow permeability; some slopes of more than 5 percent.	Moderate to severe: moderately slow permeability; some slopes of more than 5 percent.
Severe susceptibility to seepage where substratum is exposed.	Good stability below a depth of 3 feet; fair to good workability; may require toe drains.	Excessive internal drainage.	Low water-holding capacity; shallow root zone.	High erodibility; low fertility below a depth of 2 feet.	High erodibility; low fertility below surface layer.	Slight	Severe: rapid permeability.

TABLE 6.—*Engineering*

Soil series and map symbols [1]	Suitability as source of—		Suitability as road subgrade for—		Soil features affecting engineering structures or practices for—	
	Topsoil	Mixed sand and gravel	Paved roads [2]	Gravel roads	Highway location	Foundations
Clayey alkali land (2Cx)	Poor: high content of clay.	Generally not suitable.	Poor	Good	High susceptibility to frost action; low position; subject to flooding.	Unstable; fair to poor bearing strength; high shrink-swell potential; poor shear strength.
Creighton (CoB, CoC)	Good	Generally not suitable.	Fair to poor.	Good to fair.	Low to moderate susceptibility to frost action; erodibility of slopes.	Poor bearing strength; fair to poor stability.
Dix (DxD, DBD) (For Bayard part of unit DBD, refer to the Bayard series.)	Poor: very shallow over sand.	Generally good below a depth of 2 feet.	Good to poor.	Fair to poor.	Low susceptibility to frost action; mixed sand and gravel near surface; erodibility of slopes.	Good bearing strength if confined.
Dunday (DVA, DVB) (For Valentine part of units DVA and DVB, refer to the Valentine and Dwyer soils.)	Fair	Generally not suitable.	Good to poor.	Good to poor.	Not susceptible to frost action; highly susceptible to soil blowing.	Good to poor bearing strength, depending on density; fair shear strength.
Duroc (Dr)	Good	Generally not suitable.	Fair to poor.	Good to fair.	Moderate susceptibility to frost action; low position; subject to flooding; erodibility of slopes.	Poor bearing strength; fair to poor stability.
Epping (EpA, EpD, RE) (For Rock outcrop part of unit RE, no interpretations were made.)	Poor: erodibility; siltstone at a depth of about 1 foot.	Generally not suitable.	Fair to poor.	Good to fair.	Moderate to low susceptibility to frost action; siltstone near the surface; erodibility of slopes.	Fair to poor stability; siltstone at a depth of about 3 feet.

See footnotes at end of table.

interpretations of soils—Continued

Soil features affecting engineering structures or practices for—Continued						Degree and kind of limitations for—	
Low dams		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tanks and filter fields	Sewage lagoons
Reservoirs	Embankments						
Seepage is not a problem.	Fair to poor stability on flat slopes; fair to poor workability; high compressibility.	Very slow internal drainage; may have perched water table; drainage may be difficult.	Slow intake rate; drainage may be required; high water-holding capacity; alkali may restrict crops.	----------	Slow permeability; low fertility; special design may be needed on flatter slopes.	Severe: slow permeability; high water table.	Moderate: poor compaction.
Seepage is only a minor problem.	Fair to poor stability; close moisture control needed.	----------	Moderate to high water-holding capacity; high erodibility on steep slopes.	Moderate erodibility.	Moderate erodibility.	Moderate: moderate permeability.	Severe: moderate permeability; some slopes of more than 5 percent.
High susceptibility to seepage.	Fair to good stability; may be subject to piping.	Excessively drained; moderately rapid to very rapid permeability.	----------	Slight erodibility; shallow to mixed sand and gravel.	Shallow to mixed sand and gravel; low fertility; cost of construction and maintenance high.	Moderate to severe: steep slopes.	Severe: rapid permeability; steep slopes.
Seepage is a problem.	Fair stability; good workability; piping may be a hazard; close moisture control needed.	Excessively drained; rapid permeability.	Low water-holding capacity; rapid intake rate; frequent irrigations needed.	High erodibility.	High erodibility.	Slight--------	Severe: rapid permeability.
Low to moderate seepage.	Poor stability; moisture control needed; good to poor workability.	May be flooded occasionally; good internal drainage; moderate permeability.	Moderate water-holding capacity; slight erodibility.	Slight erodibility.	Slight erodibility.	Moderate: subject to flooding.	Severe: moderate permeability.
Seepage not a problem except where Brule siltstone is fractured.	Fair to poor stability if moisture control is close; subject to piping.	----------	Low water-holding capacity; shallow root zone; high erodibility on steeper slopes.	Slight erodibility; shallow to siltstone; cost of construction and maintenance may be excessive.	Slight erodibility; low fertility; shallow to siltstone; cost of construction and maintenance high.	Severe: siltstone near the surface; some slopes are steep.	Severe: shallow to siltstone; some slopes are more than 5 percent.

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TABLE 6.—*Engineering*

Soil series and map symbols [1]	Suitability as source of—		Suitability as road subgrade for—		Soil features affecting engineering structures or practices for—	
	Topsoil	Mixed sand and gravel	Paved roads [2]	Gravel roads	Highway location	Foundations
Gering (Gr, 2Gr)	Good	Fair below a depth of 5 feet.	Fair to poor.	Good to fair.	Highly susceptible to frost action.	Good bearing strength; drainage needed.
Glenberg (Gd)	Fair	Good below a depth of 5 feet.	Fair to poor.	Good to fair.	Low to moderate susceptibility to frost action; erodibility of slopes.	Good stability if density is good.
Gravelly land (Gv)	Poor: gravelly	Excellent below a depth of 1 foot.	Good	Poor	Not susceptible to frost action; mixed sand and gravel near surface; springs or seeps on lower slopes.	Good bearing strength.
Gullied land (GL)	Poor: erodibility; shallow over siltstone.	Generally not suitable.	Fair to poor.	Good to fair.	Low to moderate susceptibility to frost action; siltstone near surface; erodibility of slopes; some slopes very steep.	Fair to poor stability.
Haverson (Hf)	Good	Good below a depth of 5 feet.	Fair to poor.	Good to fair.	Low susceptibility to frost action; erodibility of slopes.	Fair to good bearing strength if density is good.
Janise (Jn)	Poor: high content of clay.	Fair below a depth of 4 feet.	Fair to poor.	Good to fair.	Moderately susceptible to frost action.	Poor to fair bearing strength; fair to poor stability.

See footnotes at end of table.

interpretations of soils—Continued

Soil features affecting engineering structures or practices for—Continued						Degree and kind of limitations for—	
Low dams		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tanks and filter fields	Sewage lagoons
Reservoirs	Embankments						
High seepage where substratum is exposed.	Fair to poor stability; subject to piping; close moisture control needed.	Slow natural drainage; moderate to rapid internal drainage; high water table; adequate outlets not available in places.	Moderate water-holding capacity; drainage needed.	-------	-------	Severe: high water table.	Severe: moderate permeability.
Extreme susceptibility to seepage where substratum is exposed.	Fair to poor stability; close moisture control required; subject to piping; toe drains may be required.	Somewhat excessively drained; moderately rapid permeability.	Moderate water-holding capacity; slight erodibility.	High erodibility.	Medium to low fertility; low organic-matter content.	Slight-------	Severe: moderately rapid permeability.
Seepage is a problem.	Good stability; pervious; good to fair workability; may require toe drains.	Excessively drained; rapid permeability.	-------	-------	-------	Severe: steep slopes.	Severe: rapid permeability.
Seepage is not a problem, except where siltstone is fractured.	Fair to poor stability; subject to piping.	-------	-------	-------	-------	-------	
Seepage a problem where substratum is exposed.	Fair to poor stability; close moisture control required; fair workability.	Well drained; moderate permeability.	Moderate water-holding capacity.	Moderate erodibility.	Moderate erodibility.	Moderate: moderate permeability.	Severe: moderate permeability.
Seepage is a problem.	Good to poor stability; close moisture control needed; subject to piping.	Seepage water may be within 3 feet of surface; moderate internal drainage; alkalinity may offset advantage of drainage.	-------	-------	Alkalinity restricts kinds of grass; cost of installation may be high.	Moderate to severe: moderate to moderately slow permeability; high rate of dispersion.	Moderate: moderate to moderately slow permeability.

TABLE 6.—*Engineering*

Soil series and map symbols [1]	Suitability as source of—		Suitability as road subgrade for—		Soil features affecting engineering structures or practices for—	
	Topsoil	Mixed sand and gravel	Paved roads [2]	Gravel roads	Highway location	Foundations
Keith (Ke, KeA, 2KeA, KeB, KUB2, KUC). (For Ulysses part of units KUB2 and KUC, refer to the Ulysses series.)	Good	Generally not suitable.	Fair to poor.	Good to fair.	Low susceptibility to frost action.	Fair to poor bearing strength; fair to poor stability.
Keota (KoA, KoB, KEC) (For Epping part of unit KEC, refer to the Epping series.)	Good	Generally not suitable.	Fair to poor	Good to fair	Low to moderate susceptibility to frost action.	Fair to poor bearing strength.
Las (2Ls, Lt, 2Lt)	Good	Fair below a depth of 5 feet.	Fair to poor	Good to fair	High to very high susceptibility to frost action; water table at a depth of 3 feet; erodibility of slopes.	Good below a depth of 4 feet, good to poor above 4 feet, depending on density.
Las Animas (Lq, 2Lq, Lr, 2Lr)	Poor: erodibility; shallow over sand.	Fair below a depth of 5 feet.	Fair to poor	Good to fair	High to very high susceptibility to frost action; water table at a depth of nearly 4 feet; erodibility of slopes.	Good below a depth of 4 feet; part above good to poor, depending on density.
Loamy alluvial land (Lx)	Fair	Generally not suitable.	Fair to poor	Good to fair	Low to moderate susceptibility to frost action; subject to frequent flooding; erodibility of slopes.	Fair to poor, depending on density.
McCook (Mo, 3Mo)	Good	Good below a depth of 5 feet.	Fair to poor	Good to fair	Moderate to high susceptibility to frost action; mixed sand and gravel at a depth of 4 to 5 feet.	Good to poor; drainage needed in places.

See footnotes at end of table.

interpretations of soils—Continued

Soil features affecting engineering structures or practices for—Continued						Degree and kind of limitations for—	
Low dams		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tanks and filter fields	Sewage lagoons
Reservoirs	Embankments						
Seepage is not a problem.	Good to poor stability; close moisture control needed; subject to piping; fair workability.	Moderate permeability.	High water-holding capacity; practice does not apply to alkali substratum variant.	Slight erodibility.	Slight erodibility.	Moderate: moderate permeability; practice does not apply to alkali substratum variant.	Moderate: moderate permeability; some slopes of more than 5 percent; practice does not apply on alkali substratum variant.
Seepage is not a problem.	Good to poor stability; close moisture control needed; fair workability.	Internal drainage generally good; overirrigation may cause seeps; 1½ feet to siltstone.	Moderate water-holding capacity; shallow root zone.	Slight erodibility; siltstone near surface may hinder construction.	Shallow to siltstone; low fertility.	Severe: siltstone near the surface.	Severe: siltstone near the surface; some slopes of more than 5 percent.
Seepage not a problem, except where substratum is exposed.	Good to poor stability; close moisture control needed; subject to piping.	Fair internal drainage; water table at a depth of 3 feet; outlets not available in places.	High water-holding capacity; drainage needed.	----------	----------	Moderate: high water table.	Moderate to severe: moderate permeability.
Moderate; seepage is severe where substratum is exposed.	Good to poor stability; close moisture control needed; subject to piping; fair workability.	Moderate to rapid permeability below the surface layer; outlets not available in places.	Low to moderate water-holding capacity; drainage needed; does not apply to alkali soil.	----------	----------	Slight	Severe: moderate to rapid permeability.
Seepage not a problem.	Good to poor stability; close moisture control needed; subject to piping; fair workability.	Subject to frequent flooding; fairly good internal drainage.	----------	Moderate erodibility.	----------	Severe: subject to flooding.	Severe: subject to flooding.
Seepage may be a problem where sand and gravel layer is exposed.	Good to poor stability above substratum; good below substratum; fair to good workability above substratum, good below substratum.	Moderate permeability; naturally well drained.	Slow intake rate; high water-holding capacity, except in gravel substratum variant.	----------	Slight erodibility; flat slopes may require special design.	Slight	Moderate to severe: moderate permeability.

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TABLE 6.—*Engineering*

Soil series and map symbols [1]	Suitability as source of—		Suitability as road subgrade for—		Soil features affecting engineering structures or practices for—	
	Topsoil	Mixed sand and gravel	Paved roads [2]	Gravel roads	Highway location	Foundations
McGrew (Mf, Mg, 2Mg)	Fair to good	Fair below a depth of about 3 feet.	Fair to poor	Good to fair	Moderate susceptibility to frost action; water table at a depth of 3 feet; erodibility of slopes.	Generally good; drainage needed in places.
Minatare (MJ). (For Janise part of unit MJ, refer to the Janise series.)	Poor: high content of clay.	Fair below a depth of 6 feet.	Fair to poor.	Good to fair.	Very high susceptibility to frost action; water table at a depth of 3 feet; mixed sand and gravel at a depth of 3 to 6 feet; erodibility of slopes.	Good to poor; good in substratum.
Mitchell (Mt, MtA, MtB, 2MtB, MtC, 2MtC, 2MtD, 5Mt, MzA, MzB, MzC, 2MBB). (For Buffington part of unit 2MBB, refer to the Buffington series.)	Good	Generally not suitable.	Fair to poor.	Good to fair.	High to moderate susceptibility to frost action; seeped areas from irrigation water may require fill; erodibility of slopes.	Good to poor bearing strength, depending on density.
Mixed alluvial land (3Sx)	Not suitable	Generally good below a depth of 1 foot.	Good to poor.	Good to fair.	Very high to moderate susceptibility to frost action; water table at a depth of 2 to 4 feet; mixed sand and gravel near surface.	Fair to good; drainage needed in places.
Orella (OrA)	Poor: high content of clay.	Generally not suitable.	Poor	Good	Moderate susceptibility to frost action; heavy plastic material at a depth of 10 to 20 inches.	Fair to poor; high shrink-swell potential; poor shear strength.
Otero (OdB, OtB, OtD, OBA, OBB, OBC, OC). (For Bayard part of units OBA, OBB, OBC, and OC refer to the Bayard series.)	Fair	Generally not suitable.	Good to poor.	Good to fair.	Low to moderate susceptibility to frost action; erodibility of slopes.	Good to poor, depending on density.

See footnotes at end of table.

interpretations of soils—Continued

Soil features affecting engineering structures or practices for—Continued						Degree and kind of limitations for—	
Low dams		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tanks and filter fields	Sewage lagoons
Reservoirs	Embankments						
Seepage is a problem where substratum is is exposed.	Good to poor stability above substratum; close moisture control needed; good below substratum; fair to good workability.	Internal drainage generally good; outlets not readily available in places.	Moderate water-holding capacity.			Moderate: high water table.	Moderate to severe: moderately rapid permeability.
Seepage may be a problem where substratum is exposed.	Good to poor stability, depending on density; close moisture control needed; good to poor workability; high compressibility.	Low permeability of subsoil; internal drainage above mixed sand and gravel fair; seepage from irrigation; outlets not available in places.	Alkali severely restricts kinds of crops.			Severe: slow permeability; high water table.	Moderate: cost of sealing sandy and gravelly material high.
Seepage generally not a problem.	Good to poor stability; fair to poor workability; may need toe drains.	Moderate permeability; fair internal drainage; seepage from irrigation; slow surface drainage on flat slopes.	High water-holding capacity; drainage needed in places.	Moderate erodibility.	Moderate erodibility.	Moderate: moderate permeability; some strong slopes.	Moderate to severe: moderate permeability; some slopes of more than 5 percent.
Seepage is a problem.	Fair to good if moisture control is close; fair to good workability: subject to piping.						
Seepage not a problem.	Fair to poor workability; plasticity; imperviousness; high compressibility.	Slow permeability; poor internal drainage.				Severe: slow permeability.	Slight.
Seepage generally not a problem.	Good if moisture control is close; subject to piping; semipervious to impervious; may need toe drains.	Moderately rapid permeability; somewhat excessively drained.	Moderate water-holding capacity; thin surface layer; low fertility.	High erodibility.	High erodibility.	Slight	Severe: moderately rapid permeability; some slopes of more than 5 percent.

TABLE 6.—*Engineering*

Soil series and map symbols [1]	Suitability as source of—		Suitability as road subgrade for—		Soil features affecting engineering structures or practices for—	
	Topsoil	Mixed sand and gravel	Paved roads [2]	Gravel roads	Highway location	Foundations
Platte (P)	Poor to fair	Generally good below a depth of 1½ feet.	Fair to poor.	Good to poor.	Moderate to high susceptibility to frost action; sand and gravel near the surface; may need fill.	Good to fair; good bearing strength; low shrink-swell potential; high water table.
Rosebud (RbC)	Good	Generally not suitable.	Fair to poor.	Good to fair.	Moderate susceptibility to frost action; sandstone is at a depth of 3 feet in places.	Fair to poor stability.
Satanta (Sa)	Good	Generally not suitable.	Fair to poor.	Good to fair.	Moderate susceptibility to frost action; erodibility of slopes.	Good to poor, depending on density; fair shear strength.
Shingle (ShC)	Poor to not suitable: high content of clay.	Generally not suitable.	Fair to poor.	Good to fair.	Moderate susceptibility to frost action; sandstone or shale near the surface.	Good to poor; shale or sandstone at a depth of 10 to 20 inches.
Slickspots (SK) (For Keith part of unit SK, refer to the Keith series.)	Not suitable: high content of clay; high content of salts and alkali.	Generally not suitable.	Fair to poor.	Good to fair.	Moderate to high susceptibility to frost action; erodibility of slopes.	Fair to poor bearing strength; fair to poor stability.

See footnotes at end of table.

interpretations of soils—Continued

Soil features affecting engineering structures or practices for—Continued						Degree and kind of limitations for—	
Low dams		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tanks and filter fields	Sewage lagoons
Reservoirs	Embankments						
Seepage is a problem.	Good to poor above a depth of 1½ feet; close moisture control needed; subject to piping; good below a depth of 1½ feet; pervious.	Generally good internal drainage; water table is at a depth of about 3 feet.	Very low water-holding capacity; shallow to sand and gravel; low fertility.	----------	----------	Moderate: high water table.	Severe: moderate to moderately rapid permeability.
Seepage not a problem.	Good to poor stability; close moisture control needed; subject to piping; may need toe drains; erodibility of slopes.	----------	Moderate water-holding capacity; erodibility of steeper slopes.	Slight erodibility; rocky near the surface in places.	Slight erodibility; low fertility where subsoil is exposed; cost of construction and maintenance generally high.	Moderate to severe: shallowness to sandstone.	Moderate to severe: shallowness to sandstone; moderate permeability; slopes more than 5 percent.
Seepage is not a problem.	Good to poor stability; close moisture control needed; subject to piping; may need toe drains; erodibility of slopes.	Moderate permeability, naturally well drained.	High water-holding capacity; erodibility of steeper slopes.	Slight erodibility.	Low fertility.	Slight----------	Moderate to severe: moderate permeability.
Seepage is not a problem.	Good to poor stability; close moisture control needed; limited fill material; erodibility of slopes.	----------	----------	----------	----------	Severe: moderately slow permeability.	Moderate to severe: some slopes of more than 5 percent.
Seepage is not a problem.	Good to poor stability; close moisture control needed; subject to piping in places.	Very slow permeability of subsoil; high rate of dispersion.	----------	Moderate erodibility; slow permeability.	Moderate erodibility; high alkalinity; cost of construction and maintenance high.	Severe: slow permeability.	Slight.

TABLE 6.—*Engine ering*

Soil series and map symbols [1]	Suitability as source of—		Suitability as road subgrade for—		Soil features affecting engineering structures or practices for—	
	Topsoil	Mixed sand and gravel	Paved roads [2]	Gravel roads	Highway location	Foundations
Tassel (TA, RT) (For rock outcrop part of unit RT, no interpretations were made.)	Not suitable to fair: erodibility; shallow.	Generally not suitable.	Good to poor.	Fair to poor.	Moderate to low susceptibility to frost action; sandstone near the surface.	Good to fair if density is good; fair shear strength.
Tripp (TrA, Tv, TvA, TvB2, TvC2).	Good	Poor below a depth of 5 feet in some places.	Fair to poor.	Good to fair.	Moderate to high susceptibility to frost action; erodibility of slopes.	Poor stability
Ulysses (Mapped only with the Keith soils.)	Good	Generally not suitable.	Fair to poor.	Good to fair.	Low susceptibility to frost action.	Fair to poor stability.
Valentine and Dwyer soils (VD, VDy) [3].	Poor to fair	Generally not suitable.	Good to fair.	Fair to poor.	Low susceptibility to frost action; erodibility of slopes.	Good to fair, depending on density.
Wet alluvial land (Wx)		Poor below a depth of 3 feet.			High susceptibility to frost action; water table at or near the surface; may require fill.	

[1] Barren badlands (BB), Marsh (M), Sandy alluvial land (Sx), Broken alluvial land (Sy), and Tassel soils (Tl) have characteristics that are too variable for interpretations.

Most reservoirs behind small earth dams lose water through seepage. This seepage is severe from reservoirs on soils that overlie sand and gravel. To insure that reservoirs built on these soils hold water, some kind of sealing material should be used in nearly all reservoirs in the county.

Compacted embankments are rated for stability in table 6 for the soils of the county. Stability ranges from good to poor. Workability is generally fair to good except Orella clay, Clayey alkali land, and other plastic soils. Toe drains may be required for embankments built on these soils.

Natural drainage of some soils on bottom lands is poor. On these soils, poor drainage results from slow internal drainage or, in places, from a seasonally high water table that is at or near the surface at times. Some soils are kept wet by seepage from overirrigated adjacent soils. Some soils also are subject to flooding, and others are nearly level and have slow runoff. Permeability, topography, height of the water table, and availability of outlets determine the kind of drainage that can be used effectively. In table 6, these features are named for the soils to which they apply.

interpretations of soils—Continued

Soil features affecting engineering structures or practices for—Continued						Degree and kind of limitations for—	
Low dams		Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tanks and filter fields	Sewage lagoons
Reservoirs	Embankments						
Seepage not a problem.	Good stability above sandstone if moisture control is close; subject to piping; semipervious.	Naturally excessively drained.	----------	----------	----------	Severe: shallowness to sandstone.	Severe: shallowness to sandstone; some steep slopes.
Seepage is moderate to high, depending on depth of excavation.	Good to poor stability; close moisture control is needed; fair workability; subject to piping; may require toe drains.	Generally good internal drainage.	High water-holding capacity; erodibility of steeper slopes.	Slight erodibility.	Slight erodibility; gravelly in some places; fertility is low in the deeper cuts.	Moderate: moderate permeability.	Moderate to severe: moderate permeability; some slopes of more than 5 percent.
Seepage is not a problem.	Good to poor stability; close moisture control needed; subject to piping; fair workability.	Moderate permeability.	High water-holding capacity.	Slight erodibility.	Slight erodibility.	Slight	Moderate: moderate permeability.
Seepage is severe.	Good stability; close moisture control is needed; subject to piping; may require toe drains; fair to good workability.	Excessively drained.	----------	----------	----------	Moderate to severe: some steep slopes.	Severe: moderate permeability; some slopes of more than 5 percent.
----------	----------	Drainage outlets not available in places.	----------	----------	----------	Severe: high water table.	Severe: water table at or near the surface much of the time.

[2] Suitability for road fill is the same as for road subgrade for paved roads.
[3] Interpretations for both the Valentine and Dwyer soils in units VD and VDy are the same.

In table 6, the water-holding capacity and the intake of water have been rated for soils because these properties affect irrigation. The ratings for water-holding capacity are to a depth of 4 feet. The water-holding capacity is *high* if the soil holds more than 8 inches of water to that depth; it is *moderate* if the soil holds 5 to 8 inches; it is *low* if the soil holds 3 to 5 inches; and it is *very low* if the soil holds less than 3 inches. The intake of water for irrigation is rated only if the rate is rapid or slow. Intake is *rapid* if the soil takes in 2 inches or more of water per hour; it is *slow* if the soil takes in 0.5 inch or less per hour. Irrigation hazards related to slope are not listed in table 6. Information on the suitability of different soils and slopes for irrigation is contained in the "Nebraska Irrigation Guide for Western Nebraska."

Although terraces are not commonly used, their use is increasing in the county. Features affecting terraces and diversions are shown in table 6. The slopes of terraces are generally erodible, but the cost of maintenance generally is not extremely high. Exceptions are terraces built on the Tassel and Epping soils. Steepness and hummocky topography are limitations to the use of terraces and diversions.

Diversions are used generally at the foot of slopes to protect the lower lying, more nearly level soils from runoff.

The use of waterways in the county is limited, but features affecting their construction and maintenance are named or rated in table 6. Because of the semiarid climate and prior erosion, the establishment of good grass cover in waterways is difficult.

The degree and kinds of limitations for sewage disposal systems are rated in table 6. Residences outside the areas served by public sewer systems normally use a septic tank and filter field, and developers of small housing areas prefer to use the sewer lagoon. Therefore, the limitations of soils for both methods of sewage disposal are shown in table 6. The limitations are rated *slight*, *moderate*, and *severe*, and some of the limiting features are shown. It should be pointed out that the ability of a soil to transmit water during a short period is not necessarily a measure of its ability to absorb sewage effluent over a long period. Before installing a septic tank and filter field, percolation tests should be made at the site. A sewage system close to a well may contaminate the well water.

The suitability of soils for winter grading is not rated in table 6. This suitability depends on the moisture content of the soils and on the temperature, both of which vary widely from year to year. The predominance of coarse-textured and medium-textured soils in the county, however, makes winter grading possible in most years. Some low-lying areas are subject to flooding for short periods from local heavy rains.

On those soils that are susceptible to moderate or severe soil blowing, sites should be protected during construction. This hazard is most severe on the Bankard, Dunday, Dwyer, and Valentine soils; it is moderate on the Duroc, Keith, Keota, and Mitchell soils. Soil blowing is generally not a problem on the Buffington and Orella soils and on Clayey alluvial land.

Formation and Classification of Soils

This section consists of two main parts. The first part discusses the factors of soil formation as they relate to the development of soils in Scotts Bluff County. In the second part, the current system of soil classification is discussed, and the soil series represented in the county are placed in some of the higher categories of the current system and in the great soil groups of the older system.

Factors of Soil Formation

Soil is formed by the physical and chemical weathering of parent materials. The characteristics of the soil are determined by the interaction of five factors of soil formation. Each of these five factors modifies the effect of the others. The five interacting factors are (1) the physical and mineralogical composition of the parent material; (2) the climate under which the parent material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time these forces have acted on the parent material. All five of these factors are important, but, in different locations and under different conditions, some are more effective than others. In places where any one factor varies widely, different soils are formed.

The five main factors of soil formation are discussed in the following paragraphs.

Parent material

The soils of Scotts Bluff County formed from many kinds of parent material. The parent materials are weathered clays from the Lance formation of Cretaceous deposits, weathered shale from the Chadron formation, weathered sandstone from the Arikaree formation, weathered siltstone from the Brule formation, and deposits of colluvium-alluvium, loess, eolian sands, and alluvium (fig. 16). The deposited material may have weathered from any one of these geologic materials or from a mixture of one or more.

Only soils of the Shingle complex formed in material that weathered from the Lance formation. This formation consists of interbedded gray to yellow clay and yellowish sandstone. The sandstone in this formation is only slightly weathered.

The shallow soils of the Orella series developed in place in material weathered from claystone of the Chadron formation. In some places this weathered material has been transported and deposited as colluvial-alluvial or alluvial fans, and the Buffington soils have formed. The material that weathered from the Chadron formation is olive gray and moderately fine textured to fine textured. It is very hard when dry, very firm when moist, and sticky when wet. It cracks badly in dry weather. Salinity is slight and alkalinity is moderate to strong in many areas where the parent material weathered from the Chadron formation.

Soils of the Creighton, Rosebud, and Tassel series formed in the residuum from weathered sandstone of the Arikaree formation that in places is mixed with silty material that is probably loess. The weathered sandstone is fine sandy loam and very fine sandy loam where it has not been mixed with the silty material. Freshly weathered material is generally calcareous, but the carbonates have been leached down to the subsoil of most soils. In most areas the Otero, Bayard, and Bridgeport soils formed in colluvial-alluvial materials that first weathered from the sandstone of the Arikaree formation and then were moved by gravity and water to the base of steep bluffs.

In extensive areas of Scotts Bluff County, the parent material weathered from siltstone of the Brule formation. This buff-colored, soft, calcareous, massive rock weathers fairly fast. The Keota and Epping soils formed in place from this weathered material. The Mitchell soils formed in similar material that has been transported by water and gravity to foot slopes and alluvial fans. Soils that developed in weathered siltstone are medium textured in almost all places and are commonly silty.

The soils on foot slopes at the base of the bluffs, hills, eroded uplands, terrace breaks, and escarpments formed in colluvial-alluvial materials. These materials accumulated as a result of the combined forces of gravity and water, though gravity was a minor force. Colluvial-alluvial materials vary widely, depending on the kinds of higher lying formations. Chappell, Bridgeport, Bayard, Otero, and Mitchell soils formed in colluvial-alluvial materials.

Areas of wind-deposited silty materials, or loess, commonly occur in Scotts Bluff County. These deposits are thickest in the southwestern part of the county, but they

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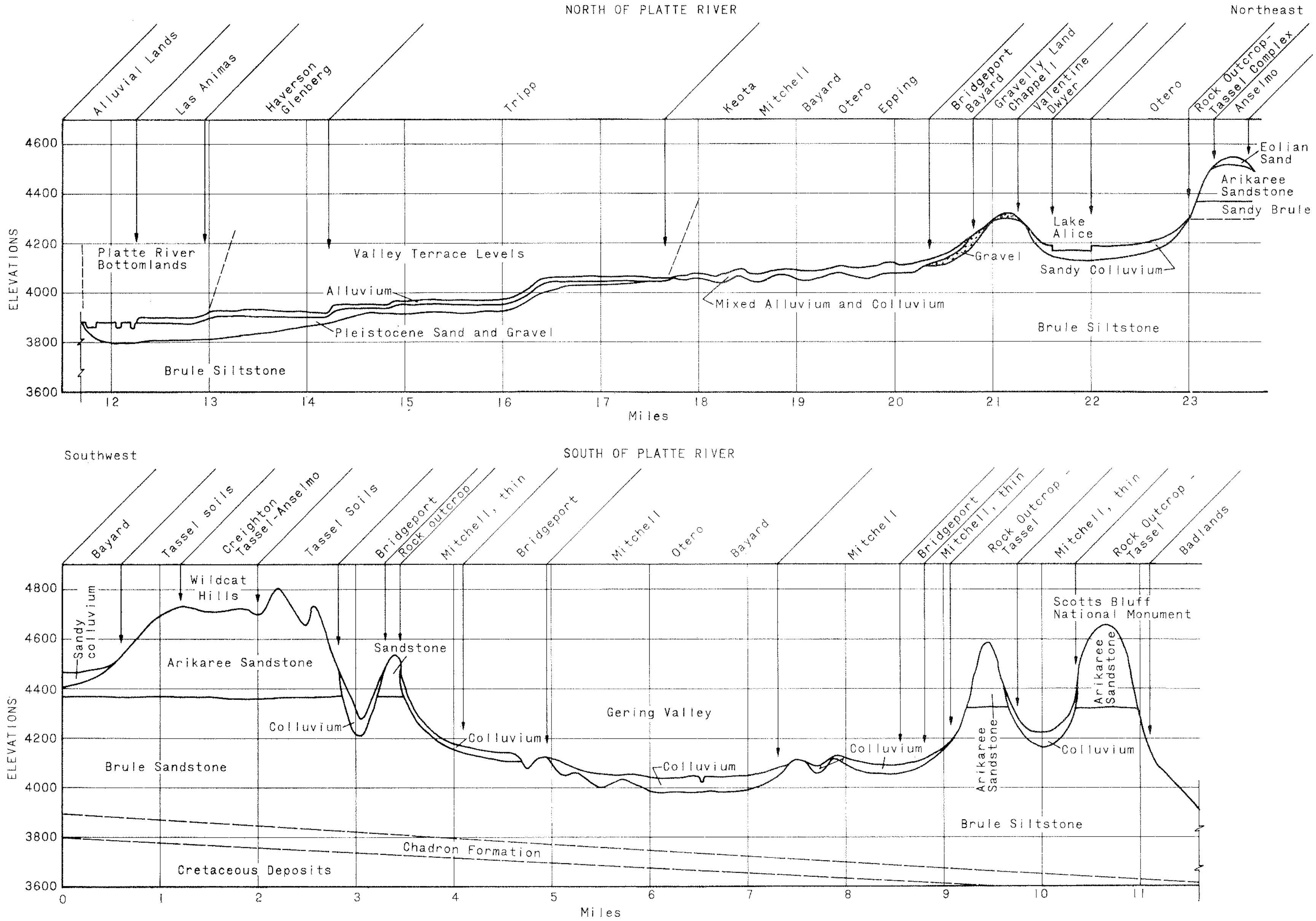

Figure 16.—**A generalized geologic cross-section of Scotts Bluff County that shows the relationship of parent material, valley development, and elevation to specified soils.**

generally are not more than 4 to 6 feet thick. Because so much of the wind-deposited material was blown from areas of weathered Brule siltstone, it is difficult to distinguish areas of residual parent material from those of transported or mixed parent material. In Scotts Bluff County, Keith soils formed in loess.

Soils formed in eolian, wind-deposited sands occur in many widely separated areas of the county. Examples are the Valentine, Dwyer, and Anselmo soils. In some places the wind reworked coarse-textured alluvium and colluvium and shaped these materials into low hummocks and dunes. Most soils formed from eolian material have a noncalcareous surface layer but are slightly calcareous at a depth of 12 to 36 inches. In several large areas, however, Valentine soils formed in noncalcareous parent material that apparently is coarse-textured old alluvium.

Alluvium may be clayey, silty, loamy, or sandy. In this county the oldest alluvium is on some of the higher terraces along the North Platte River. In these places the soil horizons in the subsoil are more distinct than those in the subsoil of soils formed in more recent alluvium. The Tripp and Alice soils formed in the old alluvium of terraces and have distinct horizons in the subsoil. Because the alluvium on bottom lands is more recent than that on old terraces, the soils formed in it are not so well developed as are the older soils.

Some soils formed in mixed materials. Much of the parent material of the Minatare soils was derived from weathered Brule siltstone, but in some areas along the North Platte River, part of the parent material is mixed with recent alluvium. The Dix soils formed mainly in old alluvium, but in some places loess has been mixed into it. Where Dix soils are at the base of terrace breaks, they formed in colluvium-alluvium. Some areas of Keota and Epping soils are capped with loess, and some areas of Keith soils have a substratum of weathered siltstone. Janise soils are on alluvial fans where the material is deep and silty, and they are also in alluvium on bottom lands of the North Platte River.

Climate

Through its influence on the vegetation, on activity of micro-organisms, and on the physical condition of soil materials, climate has been important in the development of soils in Scotts Bluff County.

The county has semiarid continental climate. The average annual precipitation is 14.38 inches. The county has wide seasonal variations in temperature. The length of the growing season averages 136 days. In general, the uplands receive more rainfall than the valleys. Because many of the soils are very young, the carbonates have not been leached from the surface layer. As a result of the semiarid climate and lack of much leaching, more than 95 percent of the acreage has a pH value of more than 7.0. Practically no large acreage of soils in the county is acid.

In Scotts Bluff County the amount of clay moved downward through the soils is not so great as it is in similar soils where the rainfall is higher. Where the soils are dryfarmed or pastured, they are seldom wet below the depth of live roots, except in very wet years. The low humidity causes a fairly high loss of water through evaporation. This loss has influenced soil formation because it reduces the amount of water that percolates through the soil.

Because of relatively low rainfall, infrequent high temperatures, cool nights, and shallow frost penetration, the chemical and biological processes of soil formation proceed slowly. Organic matter decomposes more slowly in Scotts Bluff County than it does in areas of greater rainfall and higher summer temperatures, and the soils are lighter colored.

Strong winds have influenced the formation of the soils generally, and have caused local changes in individual farms and fields. Winds have removed much of the original surface soil from some silty and sandy soils and have exposed the subsoil material and substratum. In some places winds add material to soils; in other places they remove it.

Plant and animal life

The native vegetation in Scotts Bluff County consisted primarily of tall, mid, and short grasses and scattered trees, but grasses have been more important than trees in the processes of soil formation. Roots penetrate the soil material and increase its permeability to air and water. The decay of roots adds organic matter to both the surface layer and subsoil. As this organic matter decays, needed nutrients are released for plants and also food for earthworms. Plants help to counteract leaching by bringing water and minerals upward from lower horizons.

The number and kinds of living micro-organisms are significant to the development of soils. The undecomposed organic matter in the soil provides food for micro-organisms and is changed by them into humus. Prairie dogs, gophers, badgers, and other burrowing animals are common in the county. They aid in mixing the soil materials by bringing up deeper material to the surface layer. Earthworms feed on organic matter and help to mix the soil materials. Worm casts increase the fertility of soils.

Man has affected the development of soils, mainly through the management he has practiced in farming. He also has affected development when he manipulated the soils in other ways.

Relief

In many areas relief is the most important factor in determining the kinds of soils that formed in a particular landscape. Relief affects the formation of soils through its influence on drainage, runoff, and erosion. Internal drainage and moisture content differ in areas of different relief. If in two areas the plant cover and the amount of rainfall are about the same, runoff is more rapid where slopes are steep than it is where they are more nearly level. On the steeper slopes, there is a greater movement of materials downslope through creep and erosion. Ridges and hilltops are more exposed to air currents than are lower areas and therefore are more susceptible to loss of moisture by evaporation.

The soils on steep slopes generally have a thinner surface layer and less development in the subsoil than soils in more nearly level areas. Unless a good vegetative cover is maintained, soil erosion may remove soil material faster than it forms. Also, where other factors are equal, the zone of carbonate accumulation is nearer the surface in steep soils.

Soils on mild relief often contain more water to affect soil development, because runoff is slower and because they receive water from higher lying areas or from flooding.

The extra moisture causes more rapid weathering. Where the water table is high, the subsoil is commonly gray and mottled. On soils in depressions, aeration is poor and oxidation is restricted. These conditions cause gleying and an accumulation of appreciable amounts of organic matter.

Time

The formation of soil requires time, the length of time depending to a large extent on the kind of parent materials. In soils formed in place from residuum, the process of rock weathering and the formation of soil horizons in the weathered parent material generally go on simultaneously. In the transported, unconsolidated materials, such as loess and alluvium, soil formation can begin as soon as the materials are stabilized. A soil profile may be formed in some fresh materials within a few years; in other materials it may be centuries before a distinct B horizon is formed. A long interval may pass even before parent materials accumulate in which horizon development can begin.

Frequently, the degree of development, or maturity, of a soil can best be evaluated by specific soil characteristics rather than by the length of time the soil has been developing. Soil characteristics commonly used to determine the comparative maturity of soils are thickness and color of the surface horizon, degree of structure in the subsoil, evidence of the movement of clay downward in the soil, and the thickness of the solum.

Soils are often referred to as young, mature, or old. In general, the old soils have reached an equilibrium with their environment. When different land use, irrigation, land leveling, or something else changes the environment, the soils will then begin to establish a new equilibrium with the new environment. It is doubtful, however, if some soils ever reach absolute equilibrium with their environment, because the environment is continually changing.

The soils of Scotts Bluff County range from young soils with very little horizonation to nearly mature soils with well-developed B horizons. The youngest soils are those of the Mitchell and Otero series. These soils have a surface horizon that is less than 6 inches thick and a zone of accumulated carbonates at or near the surface. Other young soils are the Valentine and Dwyer. In these soils the surface horizon is thin, and the B horizon is lacking. Alluvial soils on low bottom lands are young, but those on high bottom lands are older and have slightly better developed horizons, thicker surface layers, and stronger structure in their subsoils.

The Keith, Tripp, and Rosebud soils have moderately well developed B horizons and fairly thick A horizons. In these soils the carbonates have been leached to the lower part of the subsoil. Genetically, they are the oldest soils of the county and are near equilibrium with their environment.

Formation of Horizons

Several processes take place in the formation of soil horizons. The main processes are (1) the accumulation of organic matter, (2) the leaching of calcium carbonates and bases, (3) the formation and translocation of silicate clay minerals, and (4) the reduction and transfer of iron. In most soils in the county, two or more of these processes have been active in the formation of horizons. Because the climate of Scotts Bluff County is semiarid, the effect of the soil-forming processes has been limited.

The soils of Scotts Bluff County range from moderate to very low in content of organic matter. The accumulation of organic matter in the upper part of the profile has been important in the formation of an A1 horizon in some soils.

Carbonates and bases have been leached from most soils in the county. Soil scientists agree that generally the leaching of bases precedes the translocation of silicate clay minerals in soils. This leaching has contributed to the formation of horizons, for most soils in the county are slightly to moderately leached.

The translocation of silicate clay minerals also has contributed to the development of horizons in only a few soils. The B horizon of some soils shows clay as thin films in pores and on ped surfaces. The Keith soils are an example. These soils were probably highly leached of carbonates and soluble salts before the translocation of the silicate clay minerals. In some soils calcium carbonate has accumulated after the clayey B horizon formed. An example is in areas of Minatare-Janise soils.

Reduction and transfer of iron, a process called gleying, is evident in the poorly drained and very poorly drained soils. This reduction and transfer is indicated by grayish colors in the horizons and some soils. The reddish-brown mottles in some horizons indicate the segregation of iron.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First, through classification and then through use of soil maps, we can apply our knowledge to specific fields or other tracts of land.

Thus in classification, soils are placed in narrow categories that are used to detail surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and ranches; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils generally have been used in the United States. The older system was adopted in 1938 (*4*) and later revised (*12*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*10*, *13*). Therefore, readers interested in developments of this system should search the latest literature available. In this subsection some of the classes in the current system and the great soil groups of the older system are given for each soil series in table 7. The classes in the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils.

TABLE 7.—*Soil series classified according to the current system and the 1938 classification system*

Series	Current system			1938 classification
	Family	Subgroup	Order	Great soil group
Alice	Coarse-loamy, mixed, mesic	Mollic Camborthids	Aridisols	Chestnut soils intergrading to Regosols.
Anselmo	Coarse-loamy, mixed, mesic	Typic Haplustolls	Mollisols	Chestnut soils.
Bankard	Sandy, mixed, mesic	Typic Ustifluvents	Entisols	Alluvial soils.
Bayard	Coarse-loamy, mixed, mesic	Entic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Bridgeport	Fine-silty, mixed, mesic	Entic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Buffington	Fine, mixed, mesic	Entic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Chappell	Sandy, mixed, mesic	Typic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Creighton	Coarse-loamy, mixed, mesic	Typic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Dix	Sandy-skeletal, mixed, mesic	Entic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Dunday	Sandy, mixed, mesic	Entic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Duroc	Fine-silty, mixed, mesic	Pachic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Dwyer	Sandy, mixed, mesic	Typic Ustipsamments	Entisols	Regosols.
Epping	Loamy, mixed, calcareous, mesic, shallow.	Typic Ustorthents	Entisols	Lithosols.
Gering	Fine-loamy, mixed, calcareous, mesic	Aquic Ustifluvents	Entisols	Alluvial soils.
Glenberg	Coarse-loamy, mixed, calcareous, mesic	Typic Ustifluvents	Entisols	Alluvial soils.
Haverson	Fine-loamy, mixed, calcareous, mesic	Typic Ustifluvents	Entisols	Alluvial soils.
Janise	Fine-loamy, mixed, calcareous, mesic	Typic Ustorthents	Entisols	Solonetz soils.
Keith	Fine-silty, mixed, mesic	Typic Argiustolls	Mollisols	Chestnut soils.
Keota	Coarse-silty, mixed, calcareous, mesic	Typic Ustorthents	Entisols	Regosols.
Las	Fine-loamy, mixed, calcareous, mesic	Aquic Ustifluvents	Entisols	Alluvial soils.
Las Animas	Coarse-loamy, mixed, calcareous, mesic	Fluventic Haplaquepts	Entisols	Alluvial soils.
McCook	Fine-loamy, mixed mesic	Fluventic Haplustolls	Mollisols	Alluvial soils.
McGrew	Coarse-loamy, mixed, calcareous, mesic	Aquic Ustifluvents	Entisols	Alluvial soils.
Minatare	Fine, mixed, mesic	Mollic Natrargids	Aridisols	Solodized Solonetz soils.
Mitchell	Coarse-silty, mixed, calcareous, mesic	Typic Ustorthents	Entisols	Regosols.
Orella	Clayey, mixed, calcareous, mesic, shallow	Typic Ustorthents	Entisols	Lithosols.
Otero	Coarse-loamy, mixed, calcareous, mesic	Typic Ustorthents	Entisols	Regosols.
Platte	Sandy, mixed, mesic	Mollic Psammaquents	Entisols	Alluvial soils.
Rosebud	Fine-loamy, mixed, mesic	Typic Argiustolls	Mollisols	Chestnut soils.
Satanta	Fine-loamy, mixed, mesic	Typic Argiustolls	Mollisols	Chestnut soils.
Shingle	Loamy, mixed, calcareous, mesic, shallow.	Typic Ustorthents	Entisols	Lithosols.
Tassel	Loamy, mixed, calcareous, mesic, shallow.	Typic Ustorthents	Entisols	Lithosols.
Tripp	Coarse-silty, mixed, mesic	Typic Haplustolls	Mollisols	Chestnut soils.
Ulysses	Fine-silty, mixed, mesic	Typic Haplustolls	Mollisols	Chestnut soils intergrading to Regosols.
Valentine	Sandy, mixed, mesic	Typic Ustipsamments	Entisols	Regosols.

Two exceptions, Entisols and Histosols, occur in many different climates.

Table 7 shows the three soil orders in the county—Entisols, Aridisols, and Mollisols. Entisols are recent soils that are without genetic horizons or have only the beginnings of such horizons. Aridisols are primarily soils of dry places. They have a light-colored surface horizon and weakly or moderately well developed horizons in the subsoil. Mollisols have a thick, soft, friable surface layer that has been darkened by organic matter.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of those characteristics that seem to produce classes having great genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Soil orders are separated into great groups on the basis of uniformity in the kinds and sequences of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans interfering with growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 7, because it is the last word in the name of the subgroup.

SUBGROUP: Great groups are divided into subgroups, one representing the central (Typic) segment of the group and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties integrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplustolls.

FAMILY: Families are separated within subgroups primarily on the basis of properties important to the growth of plants, or behavior of soils where used for engineering work. Among the properties considered are texture, mineralogy, reaction, soil temperature, thickness of horizons, and consistency. An example is the coarse-loamy, mixed, mesic family of Typic Haplustolls.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established, and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the survey program across the country. A proposed new series has tentative status until review of the series concept at the State, regional, and national levels of responsibility for soil classification results in a judgment that the new series should be established. Most of the soil series described in this publication have been established earlier. Ten of the soil series used in this survey had tentative status when the survey was sent to the printer. They are the Alice, Buffington, Creighton, Duroc, Gering, Janise, Keota, McGrew, Shingle, and Tassel series.

The soil survey of Scotts Bluff County does not join in all respects with the soil survey of the Southern Goshen Area, Wyoming, because of differences in time of mapping and use of different concepts in setting up some of the mapping units.

Mechanical and Chemical Analyses

The data obtained by mechanical and chemical analyses for some selected soils in Scotts Bluff County are given in table 8. The profiles of these soils are described in the section "Descriptions of the Soils". The data in table 8 are useful to soil scientists in classifying soils and in developing concepts of soil genesis. They are also helpful for estimating fertility, tilth, water-holding capacity, susceptibility to soil blowing, and other characteristics that affect soil management. The data on reaction, electrical conductivity, and percentage of exchangeable sodium are helpful in evaluating the possibility of reclaiming and managing saline-alkali soils.

Data obtained by mechanical and chemical analyses for other soils including the Keith, Rosebud, and Valentine are published in Soil Survey Investigations Report No. 5 (*14*).

Field and Laboratory Methods

All samples used to obtain the data in table 8 were collected from carefully selected pits. The samples are representative of the soil material that is made up of particles less than three-fourths of an inch in diameter. Estimates of the fraction of the sample consisting of particles larger than three-fourths of an inch were made during the sampling. If necessary, the sample was sieved after it was dried and rock fragments larger than three-fourths of an inch in diameter were discarded. Then the material made up of particles less than three-fourths of an inch in diameter was rolled, crushed, and sieved by hand, and rock fragments larger than 2 millimeters in diameter were discarded. The fraction that consists of particles between 2 millimeters and three-fourths of an inch in diameter was recorded on the data sheets and in table 8 as the percentage greater than 2 millimeters. This value is calculated from the total weight of the particles smaller than three-fourths of an inch in diameter.

The content given for the fractions that consist of particles larger than three-fourths of an inch is somewhat arbitrary. The accuracy of the data depends on the severity of the preparative treatment, which may vary with the objectives of the study. But it can be said that the two fractions contain relatively unaltered rock fragments that are larger than 2 millimeters in diameter and that they do not contain slakable clods of earthy material.

Unless otherwise noted, all laboratory analyses are made on material that passes the 2-millimeter sieve and are reported on an oven-dry basis. In table 8, values for exchangeable sodium are for the amount of sodium that has been extracted by the ammonium acetate method, minus the amount that is soluble in the saturation extract.

Standard methods of the Soil Survey Laboratory were used to obtain most of the data in table 8. Determinations of clay were made by the pipette method (*5, 6, 7*). The reaction of the saturated paste, and that of the 1:1 and 1:10 soil water suspension were measured with a glass electrode. Organic carbon was determined by wet combustion, using a modification of the Walkley-Black method (*8*). Nitrogen was determined by using a modification of procedure of the Association of Official Agricultural Chemists (*2*). The calcium carbonate equivalent was determined by measuring the volume of carbon dioxide evolved from soil samples treated with concentrated hydrochloric acid. The cation-exchange capacity was determined by direct distillation of absorbed ammonia (*8*). To determine the extractable calcium and magnesium, calcium was separated as calcium oxalate and magnesium as magnesium ammonium phosphate (*8*). Extractable sodium and potassium were determined on original extracts with a flame spectrophotometer. The saturation extract was obtained by using the methods of the U.S. Salinity Laboratory (*9*). For the saturation extract, soluble sodium and potassium were determined with a flame spectrophotometer.

In several of these determinations, the amounts of the samples or of the chemicals used were varied from those given in the procedure to make the determination suitable for handling.

TABLE 8.—*Analytical data*

[Analyses of Bayard, Janise, and Minatare soils made at Soil Survey Laboratory,

Soil	Horizon	Depth	Particle-size distribution: Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (0.002 mm.)	Larger than 2 mm.
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Bayard loamy very fine sand, (Sample No. S61Nebr-79-4 Lab. No. 00-05).	A	0–10	0.2	1.3	2.3	13.6	60.7	14.4	7.5	----
	AC	10–18	.1	.8	2.2	14.2	63.0	13.3	6.4	----
	C1	18–31	----	.4	1.4	12.7	65.1	14.2	6.2	----
	C2	31–40	----	.5	1.6	13.5	66.3	12.4	5.7	----
	C3	40–54	----	.2	1.0	10.5	59.4	23.0	5.9	----
	C4	54–66	----	.2	1.0	11.6	65.2	15.7	6.3	----
Janise loam, (Sample No. S62Nebr-79-1 Lab. No. 55-59).	A2	0–1	.4	1.9	2.0	5.9	28.4	47.6	13.8	----
	B2t	1–4	.6	2.6	2.8	7.4	26.0	33.5	27.1	----
	B3t	4–8	.1	.7	1.1	5.4	16.7	48.2	27.8	----
	C1	8–30	<.1	.2	.8	8.1	15.3	55.3	20.3	----
	C2	30–60	.2	.4	2.0	14.2	23.6	52.3	7.3	----
Minatare silt loam, (Sample No. S62Nebr-79-4; Lab. No. 17475 to 17482).	A1	0– 1½	.5	1.0	.8	3.8	28.2	50.5	15.2	
	A2	1½– 3	.6	2.0	1.6	5.9	39.8	43.0	7.1	----
	B2t	3– 7	.4	.9	.6	3.3	21.4	34.5	38.9	----
	B3t	7–20	.7	1.3	.7	2.6	18.8	32.5	43.4	----
	C1ca	20–26	5.9	7.2	3.2	3.2	16.0	33.7	30.8	4
	C2ca	26–33	6.4	9.4	4.9	4.2	12.2	31.4	31.5	5
	IIC3g	33–40	20.3	27.6	14.5	11.6	4.3	5.6	16.1	51
	IIIC4	40–60	16.8	36.3	25.0	13.7	2.8	1.7	3.7	48

[1] Percent soluble salt = soluble cations me/1 × 0.058 × $\frac{\text{water at saturation.}}{1000}$

General Nature of the County

This section was prepared mainly for those not familiar with Scotts Bluff County. Physiography, relief, and drainage; climate; agriculture; and other general information about the county are discussed.

History

Prehistoric campsites in the valley of the North Platte River indicate that man lived in Scotts Bluff County several thousand years ago. The first white men to enter the area found Sioux, Cheyenne, and Arapahoe Indians hunting the vast herds of buffalo that drank from the river. In 1812 the first known white men saw the area that is now Scotts Bluff. Hiram Scott, an employee of the Rocky Mountain Fur Company, died in the vicinity of this bluff in 1828 after being deserted by his companions.

In the 1820's Scotts Bluff was frequently passed by trappers and traders. In 1843 the first large migration of people to Oregon passed Scotts Bluff. This was the vanguard of a horde of pioneers migrating to Oregon. The Scotts Bluff National Monument is west of Gering (fig. 17). It commemorates the early pioneers of the Oregon Trail and is a popular tourist attraction. This landmark is surrounded by about 4 square miles maintained by the National Park Service. In 1847 Brigham Young led the first group of his followers past Scotts Bluff along the north side of the North Platte River to an area near the Great Salt Lake in Utah. This route later became known as the Mormon Trail. Westward migration boomed after gold was discovered in California in 1848.

During the period 1860–61, the Pony Express carried mail through Mitchell Pass, and soon after that the first transcontinental telegraph lines were built. To protect these lines, in 1864 the Government established Fort Mitchell, which was an outpost of Fort Laramie. The completion of the Union Pacific Railroad in 1869 marked the beginning of the decline of the Oregon Trail as an overland route to the west coast.

The first town in the area was established in 1887. Scotts Bluff County was formed from a part of Cheyenne County *for selected soil profiles*

Soil Conservation Service, Lincoln, Nebr. Dashes indicate values not determined]

USDA textural class	Chemical analysis												
	Reaction			Organic carbon	Estimated salt [1]	Electrical conductivity (Ec × 10³ millimhos per cm at 25° C.)	Calcium carbonate equivalent	Cation exchange capacity (NH⁴OAc)	Extractable cations (NH4Cl–ETOH) (meq. per 100 grams of soil)				Exchangeable sodium percentage
	Saturated paste	H₂O 1:1	H₂O 1:10						Ca	Mg	Na	K	
	pH	*pH*	*pH*	*Percent*	*Percent*		*Percent*	*Meq./100 g. of soil*					
Loamy very fine sand.	--------	7.1	------	0.58	--------	----------	<1	12.7	11.2	1.2	------	------	--------
Loamy very fine sand.	--------	7.8	------	.37	--------	----------	<1	12.7	17.5	.8	------	------	--------
Loamy very fine sand.	--------	7.9	------	.32	--------	----------	<1	12.5	------	------	------	------	--------
Loamy very fine sand.	--------	7.9	------	.32	--------	----------	1	12.4	------	------	------	------	--------
Loamy very fine sand.	--------	7.9	------	.33	--------	----------	1	13.6	------	------	------	------	--------
Loamy very fine sand.	--------	7.9	------	.32	--------	----------	1	13.6	------	------	------	------	--------
Loam	7.7	8.2	9.2	2.23	--------	1.69	1	15.7	8.8	2.6	3.4	2.4	17
Clay loam	8.8	9.7	10.3	.80	--------	1.86	6	20.0	3.4	1.4	15.2	3.5	71
Clay loam	9.4	10.2	10.6	.26	--------	5.00	13	26.5	.9	.6	30.0	3.5	98
Silt loam	10.1	10.6	10.8	.07	--------	19.8	13	26.3	.8	.4	43.6	2.3	113
Silt loam	10.2	10.7	10.7	.04	--------	11.5	3	22.2	.8	.4	31.4	2.1	109
Silt loam	7.4	7.5	8.0	4.61	0.08	1.42	<1	22.3	17.6	4.0	1.8	1.8	5
Loam	8.2	8.9	9.6	1.43	.05	1.82	<1	10.0	5.7	1.7	3.2	1.7	24
Clay loam	8.8	9.5	10.3	.64	.32	7.1	8	22.8	11.8	1.4	26.8	4.5	94
Clay	9.8	10.1	10.3	.28	1.34	26.9	6	25.5	1.0	.4	47.2	4.4	96
Clay loam	9.8	10.2	10.4	.15	1.11	24.2	13	19.6	1.2	.3	40.6	3.4	110
Clay loam	9.6	10.0	10.4	.11	.71	20.2	11	18.4	1.2	.4	30.4	3.1	99
Sandy clay loam.	8.9	9.6	10.3	.10	.17	9.4	2	9.5	11.5	.4	10.0	1.7	76
Sand and gravel.	8.4	9.3	9.6	.02	--------	----------	<1	3.2	2.2	.8	1.7	.4	--------

in 1888 and was officially organized in 1889. Settlement of the county began rapidly with the arrival of homesteaders. These homesteaders were of mixed nationality, religion, creed, political belief, and ability. Industry soon began to flourish. By 1930 the population had increased to 28,644, but there has been little increase since 1940. In 1960 the population of Scotts Bluff County was 33,809.

Physiography, Drainage, and Relief

Scotts Bluff County lies in the central part of the High Plains in a deeply eroded area. In this area the North Platte River flows southeastward in a valley about 1,000 feet deep. The valley floor is 5 to 8 miles wide and consists of low and high bottoms adjacent to the river. On the valley floor are the towns, routes of transportation, and land that is intensively farmed because it can be irrigated. Along the sides of the valley floor are higher lying terraces, or benches, and some rougher slopes that have been cut by earlier erosion.

The terraces on the north side of the North Platte River are well formed and are made up of some of the best soils for farming in western Nebraska. Bedrock crops out in many places in an eroded area north of these terraces and south of Lake Minatare and Lake Alice. The many areas capped with gravel indicate that this area is a remnant of an old alluvial terrace. Between the outcrops of bedrock are nearly level to steep young soils that were formed mainly by the combined action of gravity and running water. North of this eroded area, in the northeastern part of the county, is a distinct line of hills. These hills formed mainly from grayish sandstone that overlies buff-colored siltstone.

Gering Valley, Mitchell Bottom, and the Lyman Plain are parts of the valley of the North Platte River that have been filled or partly filled with soil washed from the surrounding uplands. The foot slopes of the Wildcat Hills are cut by many gullies. The area south of the Wildcat Hills slopes southward and is part of the Pumpkin Creek watershed. The Wildcat Hills, "66" Mountain, and the area around the Scotts Bluff National Monument are rem-

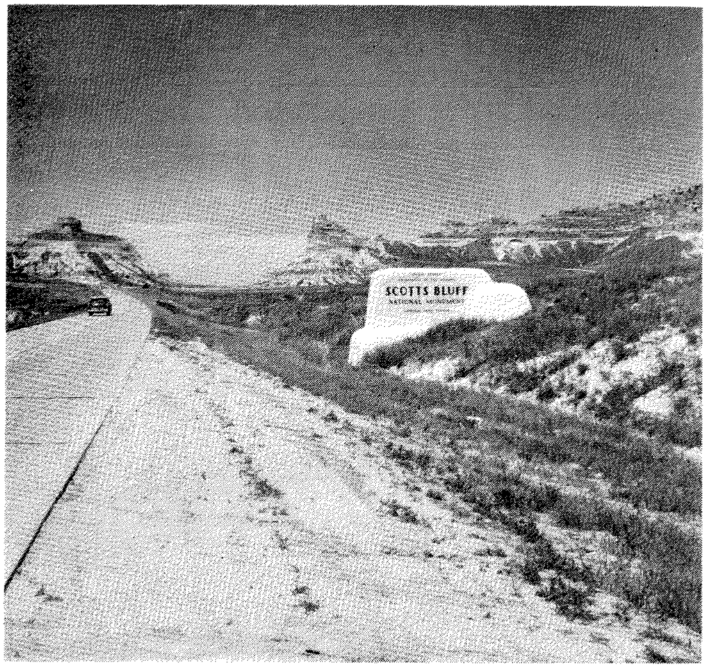

Figure 17.—**Scotts Bluff National Monument and Mitchell Pass. This famous landmark commemorates the pioneers of the Oregon Trail.**

nants of old higher areas of High Plains. These are steep, rugged hills or ridges capped by gray sandstone. Areas of wind-formed sandhills are scattered throughout the county. The largest areas of these sandhills are in the extreme southeastern corner and in areas about 6 miles south of Stegall, at the mouth of Sheep Creek northwest of Morrill, and about 4 miles south of Morrill.

Many tributaries of the North Platte River enter the county from the north. These tributaries have narrow valleys. Sheep Creek is the largest, but northwest of Morrill its valley is partly closed by windblown sand. Other streams entering from the north are Dry Sheep Creek, Dry Spottedtail Creek, and Spottedtail Creek. Winter Creek enters the valley about 2 miles northeast of Scottsbluff, and Ninemile Creek is the most eastern tributary. Water from Lake Minatare flows into Ninemile Creek and is channeled into Ninemile Ditch, which enters the North Platte River about three-fourths of a mile northwest of McGrew. Owl, Kiowa, and Horse Creeks flow through the Lyman Plain in a northeasterly direction and empty into the North Platte River.

Poorly drained soils in depressions occur in the Gering Valley, on the Lyman Plain, and in areas north of Morrill, north of Mitchell, and in other parts of the county. The valleys of most tributaries on the north side of the North Platte River have one or more large areas that are poorly drained. Open ditches built in most of these areas have lowered the water table.

In most of the county, elevations are between 3,800 and 4,200 feet above sea level. The lowest elevation, 3,765 feet, is at a point where the North Platte River leaves the county. The river enters the county at an elevation of approximately 4,036 feet. The difference, or amount of fall between the highest and lowest points, is 270 feet. The highest elevation in the county—4,920 feet—is on the Wyoming State line, 1.5 miles north of the southwest corner of the county. The difference between the highest and lowest elevation in the county is 1,155 feet. The highest elevation in the northeastern part of the county is about 4,600 feet; in the Wildcat Hills, from 4,300 to 4,800; and at Scottsbluff airport, 3,950.

Climate [6]

Scotts Bluff County is near the center of a large land mass and is far from any large body of water. The climate in this county is semiarid and is influenced by several features of relief. The influence of the valley of the North Platte River is distinctive in this county and in some areas eastward, but the influence of other features are common to all of the western part of Nebraska.

Most of the county is in the valley of the North Platte River. This river enters the northwest corner of the county and flows southeastward. Most of the time winds are deflected so that they blow up and down the valley. This valley extends northwesterly into Wyoming, where only a low rise separates it from the valley of the Wind River.

The Black Hills are north of the county. They shunt many currents of cold Canadian air to the east of this county in winter. Although the days in summer are fairly hot, the nights are comfortably cool because the elevation averages about 4,000 feet.

Weather records for Gering and Scottsbluff have been kept continuously since 1891. Table 9 lists the average monthly temperature and precipitation and gives other pertinent weather information for the county.

Winters are considerably milder in this county than they are at the same latitude in the eastern part of Nebraska. Mild westerly winds blow much more of the time. These winds bring warm days with tempertaures well above freezing in the afternoon and moderately cold nights with temperatures only a little below freezing in the early morning. Wind velocities are highest during March and April, when they average 12.35 miles per hour. Occasionally, cold northerly winds blow from the central part of Canada over the high elevations and bring severely cold weather, particularly at night. The coldest month on record was February, 1899, when the average temperature was 7.4° F. The coldest temperature ever recorded was −45°. It occurred on February 12, 1891. Snowfall is generally light in winter. It alternately covers the ground and disappears at short intervals. Frost penetrates to a depth of 6 to 8 inches, depending on the amount of soil moisture and of snow cover.

Spring is the most unpredictable season. In this season the amount of precipitation increases rapidly, and heavy snow falls as late as May in some years. The most snow falls in March. The average date of the last freezing temperature in spring is May 13, but freezing temperature has been recorded as late as the first week in June. Late in spring and early in summer air at the surface of the ground warms rapidly because rays from the sun are more direct and days are longer. The mixing of this warm surface air with the cold air aloft causes many thunderstorms. These storms frequently are accompanied by excessive

[6] By Richard E. Myers, State climatologist, U.S. Weather Bureau, Department of Commerce.

TABLE 9.—*Temperature and precipitation data at Scottsbluff, Nebr.*

Month	Average temperature [1]	Average precipitation [1]	Precipitation in driest month [2]	Year	Precipitation in wettest month [2]	Year	Average snowfall [2]	Percentage of months with less than half of average precipitation [2]
	° F.	Inches	Inches		Inches		Inches	Percent
January	24.8	0.29	(3)	1961 [4]	1.80	1891	4.7	21
February	28.5	.40	(3)	1954 [4]	1.78	1900	5.4	19
March	34.8	.86	0.01	1911	2.99	1927	7.7	29
April	46.1	1.81	.19	1928	6.13	1942	5.3	29
May	56.8	2.70	.16	1894	7.72	1899	.8	19
June	66.9	3.10	.32	1933	8.33	1947	(3)	26
July	74.7	1.45	.07	1946	5.33	1912	0	21
August	72.6	1.01	.08	1919	5.66	1915	0	22
September	62.3	1.21	(3)	1953 [4]	4.12	1902	.2	31
October	50.4	.69	(3)	1934 [4]	2.79	1908	1.6	32
November	35.3	.46	0	1939	2.86	1922	4.1	36
December	28.1	.40	(3)	1929 [4]	2.22	1913	5.1	26
Annual	48.4	14.38	9.40	1960	27.48	1915	34.9	

[1] Based on records for 30-year period, 1931–60.
[2] Based on records for the period, 1889–1961.
[3] Trace.
[4] Also occurred on dates earlier than those shown.

rainfall or hail. Crops are destroyed occasionally by hail. The spring rains generally supply enough moisture for crops to start growing without irrigation. The average annual precipitation is 14.38 inches.

In summer the amount of rainfall decreases rapidly from about the end of June to September (fig. 18). The average rainfall for August is less than half that for June. This is in sharp contrast to eastern Nebraska, where the average rainfall for August or September is about three-fourths of that for June. However, the precipitation during this period frequently falls in heavy thunderstorms. Also, in this period there may be local flooding rains, destructive hail, or long, dry intervals between storms. The highest average monthly temperature—74.7°—is in July, and the warmest month on record was July, 1936, when the temperature averaged 80.9°. A temperature of 100° is recorded, on the average, about once each year. The highest temperature ever recorded was 110° in July, 1939. But even in the hottest weather, the nights are generally comfortable.

In fall the sun is lower and the days are shorter. Temperatures begin to drop rapidly by the end of August. This is also in contrast to eastern Nebraska, where summer temperatures frequently linger well into September. The average date of the first freezing temperature in fall is September 27, but the earliest freeze on record occurred on August 25, 1910. The relative humidity recorded at 11:00 a.m. is lowest in September, when the average is 40 percent. Dry, sunny weather predominates during the latter part of summer and facilitates the harvesting of crops.

Blizzards of short duration occur on the average of about once each year. A severe blizzard of long duration occurs about once every 30 years. Hailstorms that cause extensive destruction are fairly frequent, especially in summer. Local heavy rains sometimes accompany the hailstorms and cause temporary flooding of bottom lands and gullying of the sloping lands that are adjacent to the hills. Because artificial reservoirs are ample, the threat of prolonged flooding is not great.

Tornadoes are rare in the county; only about three are likely to occur in a 40-year period. Tornadoes generally follow a narrow path and are of short duration. An exception was in June, 1955, when a series of tornadoes moved from Henry down the valley of the North Platte River for more than 30 miles and did extensive damage.

In Scotts Bluff County the average length of the growing season is 136 days. This season is shorter than that farther east at a similar latitude but at a lower elevation. The growing season is long enough, however, for all crops commonly grown in the county to mature. Occasionally, early frost damages corn that was planted late.

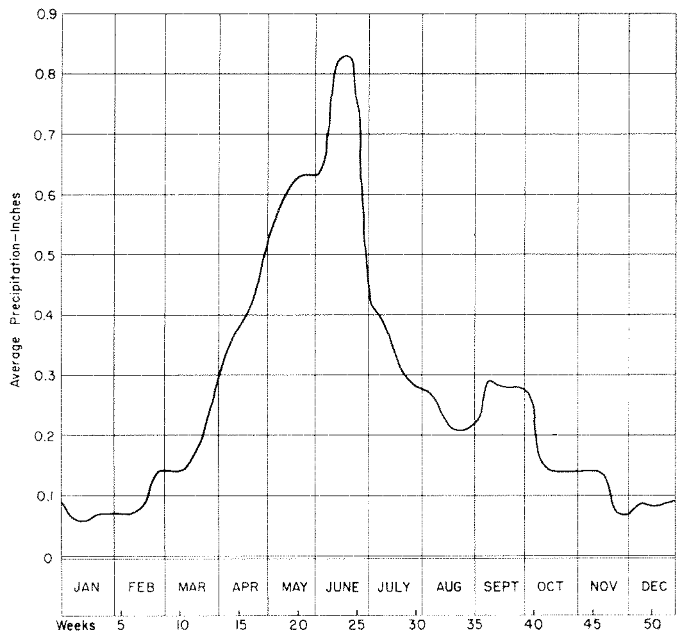

Figure 18.—**Average precipitation at Scottsbluff for a 30-year period, 1930–60.**

Drought is always a risk in dryfarming, but nearly all dryfarmed wheat is now grown in a sequence with summer fallow. This sequence tends to reduce drastically the likelihood of crop failure because moisture is lacking. High winds cause soil blowing in times of drought on both dryfarmed and irrigated soils. A lack of moisture in spring often makes one or two replantings of corn and sugar beets necessary. Hail is a threat to all crops during spring and summer. Favorable yields, however, are generally produced by those farmers who conserve moisture, irrigate where irrigation is possible, and use other good management.

Water Supply

The North Platte River is the principal source of surface water in Scotts Bluff County. The flow is fairly constant since the completion of the Pathfinder and Guernsey Reservoirs in Wyoming. These reservoirs are a stabilizing force in controlling water derived from snow melting in the Rocky Mountains.

Lake Alice, Little Lake Alice, and Lake Minatare are artificial reservoirs in the Interstate Canal system. These lakes were formed by damming basinlike valleys. Winter Creek Lake is a shallow lake in a natural basin northwest of Lake Minatare. These four lakes provide about 3,300 acres of open water.

The ground water recharge in Scotts Bluff County is chiefly from seepage of irrigation water, from precipitation, and from the underground flow of water. The amount and frequency of the recharge vary considerably from place to place and from year to year, depending on precipitation and on the amount and distribution of the water diverted for irrigation.

Ground water moves slowly through the underlying sand and gravel formation from the higher lying areas to lower lying areas. The gradient of the water table along the North Platte River averages about 7 feet per mile. As a result of continued irrigation, springs have appeared in favorable topography at many places. These springs are along the edge of the terraces at the contact of the Brule formation and the overlying gravel.

The temperature of ground water ranges from 50° F. to 53°. The water in the sand and gravel formation is of moderate hardness and contains from 126 to 345 parts of dissolved solids per 1,000,000 parts of water.

Irrigation water

Irrigation water in Scotts Bluff County comes from two main sources (1) surface water diverted from the North Platte River into canals, and (2) ground water pumped from wells. In 1943 there were 33 flowing, or artesian, wells in the county, of which three were used for irrigation.

In the 1880's many farmers had found that the normal precipitation was insufficient in most years to produce favorable crops and that supplemental water was needed.

Irrigation was first tried in 1886 on some small fields northeast of the town of Scottsbluff. Plow furrows were run to the fields from Winter Creek, a small spring-fed stream. A group of farmers formed the Farmers Canal Company, and on September 16, 1887 they posted the first notice of water appropriation on the North Platte River.

The North Platte River seemed to be an unlimited supply of water. Soon farmers of other canal companies and irrigation districts built canals and diversion dams to conduct water to their fields. At present there are 10 irrigation districts and two irrigation canal companies operating in Scotts Bluff County.

Each year the use of irrigation water from wells is becoming more important. The number of irrigation wells in the county has increased from 97 in 1954 to 317 in 1962.

Wells are used primarily to increase the supply of irrigation water. Most farms that have wells also obtain water from surface ditches. During years when surface water is limited, water from wells is used advantageously. Also, well water can be used early in spring before surface water is plentiful and occasionally later when the surface water is shut off in one area to provide the amount needed in another area. A delay of a day or two in irrigating crops that are in crucial need of moisture may be the difference between success and failure. For this reason, many farmers are digging irrigation wells to insure against the lack of surface water.

Most of the wells in Scotts Bluff County are dug into the sand and gravel formation of Pleistocene geologic age. This formation underlies the bottom lands and the lower terraces along the North Platte River. A few wells drilled into fissures of the Brule siltstone formation provide a good supply of water.

Most of the irrigation wells range from 30 to 100 feet in depth. Wells outside the valley of the North Platte River are as much as 200 or 300 feet deep.

Centrifugal pumps are mainly used where wells are only a few feet deep, but turbine pumps are used where the wells are deeper. Most pumps are operated by tractors, but some are powered by electricity, stationary gasoline or propane engines, and automobile engines.

Agriculture

For 25 years before the first homesteaders arrived, the native grasses of Scotts Bluff County were grazed by cattle on large ranches. The raising and selling of livestock continued to be the main enterprise in the county until irrigation was introduced and expanded. The low bottom lands produced hay for winter feeding, and the high terraces and uplands provided vast areas for grazing. Cultivation was attempted only on bottom lands near the North Platte River. The grasslands were overgrazed, however, and by 1885 the homesteaders were arriving in increasing numbers. In 1887, a law was enacted that enabled farmers to protect crops from roaming herds of cattle. Barbed wire fences became permanent.

In 1888, the first large irrigation canals were constructed from the North Platte River to the soils nearby. By 1890, 10 irrigation companies or districts had been organized in the valley of the North Platte River; and 118 miles of canals had been built by 1895. Sugar beets were introduced experimentally about 1890. Raising irrigated sugar beets has brought more prosperity to Scotts Bluff County than any other enterprise.

Before 1889, corn was the main cultivated crop. By 1909, corn, potatoes, sugar beets, and alfalfa were the main irrigated crops. Dryfarmed crops were wheat, oats, and barley. Field beans did not become important until about 1929.

Three distinct kinds of agriculture are practiced today. Where water is available, the farmers grow irrigated row crops, alfalfa, and oats. These crops are fed to cattle or sheep in feedlots by many farmers who sell the animals. Where water for irrigation is not available, farmers alternate crops with summer fallow and grow dryfarmed crops, mainly wheat, but also some oats. A third group uses large areas in the county for ranching. These areas are mainly in the Wildcat Hills and in the northeastern part of the county.

A few chickens and hogs are raised on many farms; but few farms are left of the old kind that provided milk, eggs, meat, and butter for the family. Most farmers have a small garden plot and raise and preserve vegetables.

Crops

Corn is the most extensively cultivated crop grown in the county, and nearly all the acreage is irrigated. Yields have risen steadily since improved hybrid varieties were introduced, the amount of fertilizer was increased, weeds and insects were controlled by spraying, and irrigation water was used more effectively.

Field beans has been an important cash crop since it became established in the county about 1929. Great Northern and Pinto are the kinds of dry edible beans best suited to soils and climate in the county.

Sugar beets is one of the most popular cash crops on the irrigated soils. The acreage is controlled by a local sugar company through which the crop is marketed. Sugar beets are dependable and are suited to many soils in the county.

Alfalfa has been a popular crop in the county since the early days of settlement. It is suited to very sandy soils and to moderately alkali soils. Both alfalfa and corn are needed on most farms where livestock is fed. Without alfalfa, the cost of producing beef and mutton would be greatly increased.

Irish potatoes began to be a popular cash crop about 1905, and by 1939 more than 24,000 acres were grown in the county. Money from the sale of potatoes bought and paid for many irrigated farms. Since 1949, however, the market for potatoes has been unpredictable, and many farmers have discontinued potatoes as a cash crop.

Winter wheat is the main dryfarmed crop in this county. Nearly all of the wheat is grown south of the North Platte River, mainly in the southwestern corner of the county.

Spring oats is a fairly important feed crop in this county, and most of the acreage is irrigated. Nearly all the crop is used locally, either fed alone to livestock or mixed with corn. Spring oats commonly is used as a nurse crop to help establish a stand of alfalfa.

Barley is used as a substitute for corn in feeding livestock. It is a popular feed among lamb feeders who mix the barley with corn and molasses. Barley can be used as a nurse crop for alfalfa. Spring barley is generally irrigated and is grown instead of oats. Winter barley is susceptible to winterkilling, but occasionally it is grown instead of wheat.

Sorghums, rye, onions and safflower are minor crops in the county. Some farmers have had success in growing onions for market.

Livestock

Sheep and beef cattle are the main kinds of livestock. On a few farms meat, milk, and eggs are still produced only for home use, but this kind of farm is decreasing fast. Many farmers still keep a small flock of chickens. The use of horses for work is limited. Most of the horses are cow ponies that are used on the range, and most ranchers keep from two to six horses used for other purposes. A few horses are kept for pleasure.

Ranching is the most important livestock enterprise in the county. Many herds of beef cattle graze the excellent grass in the Wildcat Hills, sandhills, and the uplands in the northeastern part of the county. The grass-fed calves are sold at auction and then are fattened in large or small feedlots, or they are sold as breeding stock to other ranchers.

In many areas, ewes and lambs are used to graze irrigated lands after crops are harvested. The lambs are fattened for market in several large feedlots in the county. Many lambs are shipped in from ranges in other states and are fed in these feedlots the year round.

In 1964, there were 16 dairy farms in the county. Many farmers breed and fatten hogs for market.

Except for protein supplement, most of the feed for livestock is produced on farms. Protein supplement is purchased. Many farmers that have bottom lands mow native grass meadows and bale hay for winter feed or for sale.

Type, size, and tenure of farms

Field-crop, livestock, and general farms are the principal types in the county. The 1964 Census of Agriculture shows that 1,371 farms in the county ranged from less than 10 acres to more than 2,000 acres in size.

The 1964 census also shows that owners or part owners operated more than 52 percent of all farms; tenants, more than 46 percent; and managers, about 0.5 percent. Nearly all the ranches are operated by their owner, but a few have a foreman who supervises some of the operations. Leases or less formal arrangements for use of cultivated land generally are for 1 year. The size of the operating unit tends to increase. The peak of farm labor is from May 15 to July 31, the period when sugar beets are being blocked, thinned, and weeded by hand. Migrant workers come into the county from Texas, Oklahoma, New Mexico, and Colorado and generally provide adequate labor during this time. Many farmers are using machines to eliminate the need for much hand labor. For example, since World War II, nearly all sugar beets have been harvested by machines. The use of weedicides is also lessening the need for hand labor. Many farmers use hand labor to pick potatoes, but use of mechanical harvesters is increasing.

Transportation and Markets

The Union Pacific and the Chicago, Burlington, and Quincy Railroads cross the county and provide good rail transportation. U.S. Highway No. 26 and State Routes 29, 87, and 92 serve as main routes to markets. Gravel roads are on most sections lines. The facilities of a major commercial airline are at Scottsbluff. The principal farm market is in the Scottsbluff-Gering area, but Mitchell and Morrill are also important market areas.

Industry

Scotts Bluff County has many kinds of industries. The main industries are the refining of sugar and petroleum, meat packing, and manufacturing potato products.

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has such a high degree of alkalinity (pH 8.5 or higher) or such a high percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is reduced.

Alluvium. Fine material, such as sand, silt or clay, that has been deposited on land by streams.

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

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.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

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; soil will not hold together in a mass.

Friable.—When moist, soil crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, soil crushes easily under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, soil is 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, soil adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, soil is moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, soil breaks into powder or individual grains under very slight pressure.

Cemented.—Soil is hard and brittle; little affected by moistening.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon. The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon. The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and it is therefore marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon. The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has (1) distinctive characteristics caused by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) some combination of these. The combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon. The weathered rock material immediately beneath the solum. On most soils, this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer. Consolidated rock beneath the soil. The rock usually underlines a C horizon but may be immediately beneath an A or B horizon.

Internal drainage (soil). The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Leaching, soil. The removal of soluble materials from soils or other material by percolating water.

Loess. A fine-grained eolian deposit consisting dominantly of silt-sized particles.

Mottled (soil). Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, value of 6, and chroma of 4.

Nutrients, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Nutrients obtained from the soil are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps others. Carbon, hydrogen, and oxygen are obtained largely from the air and water.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A verticle section of the soil through all its horizons and extending into the parent material. See **Horizon, soil.**

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. In words the degrees of acidity or alkalinity are expressed thus:

	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.

Runoff. The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The location in the profile of the salts and exchangeable sodium is such that growth of most crop plants is less than normal.

Saline soil. A soil that contains soluble salts in amounts that impair growth of crop plants but that does not contain excessive exchangeable sodium.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickspots. Small areas in a field that are slick when wet because they contain excess exchangeable sodium, or alkali.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate, and living matter acting upon parent material, as conditioned by relief over periods of time.

Soil variant. A soil having properties sufficiently different from those of other known soils to justify establishing a new soil series, but of such limited known area that creation of a new series is not believed to be justified.

Subirrigation. Water supplied to the soil from underground tile lines, perforated pipes, or by natural subsoil moisture, in sufficient amounts to supply adequate water for crop needs.

Subsoil. Technically, the B horizon; roughly, the part of the profile below the plow depth.

Terrace (engineering). An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy 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 condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

[For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which it belongs.

[See table 1, page 9, for approximate acreage and proportionate extent of the soils and table 2, page 68, for predicted yields under dryland and irrigation management. For discussion of windbreak suitability groups, see section beginning on page 75; for information significant to engineering, see section beginning on page 79]

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Name
AcA	Alice fine sandy loam, 0 to 3 percent slopes	10	IIIe-3	53	IIe-3	62	Sandy	73	Sandy
AcB	Alice fine sandy loam, 3 to 5 percent slopes	10	IVe-3	55	IIIe-3	63	Sandy	73	Sandy
AeA	Alice loamy fine sand, 0 to 3 percent slopes	11	IVe-5	55	IIIe-5	64	Sandy	73	Sandy
AnA	Anselmo fine sandy loam, 1 to 3 percent slopes	11	IIIe-3	53	IIe-3	62	Sandy	73	Sandy
AnB	Anselmo fine sandy loam, 3 to 5 percent slopes	11	IVe-3	55	IIIe-3	63	Sandy	73	Sandy
AnC	Anselmo fine sandy loam, 5 to 9 percent slopes	12	IVe-3	55	IVe-3	65	Sandy	73	Sandy
AnD	Anselmo fine sandy loam, 9 to 20 percent slopes	12	VIe-3	57	-----	--	Sandy	73	Sandy
2An	Anselmo fine sandy loam, alkali variant, 0 to 3 percent slopes	12	IVs-1	56	IIIs-1	64	Sandy	73	Moderately Saline or Alkali
BB	Barren badlands	13	VIIIs-3	60	-----	--	-----	--	-----
Bc	Bankard loamy fine sand, 0 to 3 percent slopes	13	IVe-5	55	IVe-5	66	Sandy Lowland	72	Sandy
2Bc	Bankard loamy fine sand, alkali, wet variant	13	IVs-1	56	IVs-1	66	Subirrigated	72	Moderately Saline or Alkali
5Bc	Bankard loamy fine sand, wet variant	13	IVw-5	56	IVw-5	67	Subirrigated	72	Moderately Wet
BfA	Bayard fine sandy loam, 0 to 3 percent slopes	14	IIIe-3	53	IIe-3	62	Sandy	73	Sandy
BfB	Bayard fine sandy loam, 3 to 5 percent slopes	14	IVe-3	55	IIIe-3	63	Sandy	73	Sandy
BfC	Bayard fine sandy loam, 5 to 9 percent slopes	14	IVe-3	55	IVe-3	65	Sandy	73	Sandy
BfD	Bayard fine sandy loam, 9 to 20 percent slopes	14	VIe-3	57	-----	--	Sandy	73	Sandy
Bg	Buffington silty clay loam, 0 to 1 percent slopes	16	IIIs-2	54	I-1	61	Limy Upland	73	Silty to Clayey
BgA	Buffington silty clay loam, 1 to 3 percent slopes	17	IIIe-2	53	IIe-1	61	Limy Upland	73	Silty to Clayey
2Bg	Buffington silty clay loam, alkali, 0 to 1 percent slopes	17	IVs-1	56	IIIs-1	64	Limy Upland	73	Moderately Saline or Alkali
BvA	Bridgeport very fine sandy loam, 1 to 3 percent slopes	15	IIIe-1	53	IIe-1	61	Silty	73	Silty to Clayey
BvB	Bridgeport very fine sandy loam, 3 to 5 percent slopes	15	IIIe-1	53	IIIe-1	63	Silty	73	Silty to Clayey

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Name
BvC	Bridgeport very fine sandy loam, 5 to 9 percent slopes	15	IVe-1	54	IVe-1	65	Silty	73	Silty to Clayey
BvD	Bridgeport very fine sandy loam, 9 to 20 percent slopes	15	VIe-1	57	-----	--	Silty	73	Silty to Clayey
CoB	Creighton very fine sandy loam, 3 to 5 percent slopes	19	IIIe-1	53	-----	--	Silty	73	Silty to Clayey
CoC	Creighton very fine sandy loam, 5 to 9 percent slopes	19	IVe-1	54	-----	--	Silty	73	Silty to Clayey
2Cx	Clayey alkali land	18	VIIs-1	59	VIs-1	67	Saline Upland	74	------
CZA	Chappell-Dix complex, 1 to 3 percent slopes	18	IVe-3	55	IIIe-3	63	Sandy and Shallow to Gravel	73	Sandy
CZB	Chappell-Dix complex, 3 to 5 percent slopes	18	IVe-3	55	IVe-3	65	Sandy and Shallow to Gravel	73	Sandy
DBD	Dix-Bayard complex, 5 to 20 percent slopes	20	VIs-41	58	-----	--	Shallow to Gravel and Sandy	73	Shallow
Dr	Duroc loam, 1 to 5 percent slopes	22	IIIe-1	53	-----	--	Silty Overflow	72	Silty to Clayey
DVA	Dunday and Valentine loamy fine sands, 0 to 3 percent slopes	20	IVe-5	55	IVe-5	66	Sandy	73	Sandy
DVB	Dunday and Valentine loamy fine sands, 3 to 5 percent slopes	21	VIe-5	57	IVe-5	66	Sandy and Sands	73	Very Sandy
DxD	Dix complex, 5 to 30 percent slopes	20	VIs-41	58	-----	--	Shallow to Gravel	73	Shallow
EpA	Epping silt loam, 1 to 3 percent slopes	23	VIs-42	58	IVs-4	66	Shallow Limy	73	Shallow
EpD	Epping silt loam, 3 to 30 percent slopes	23	VIs-42	58	-----	--	Shallow Limy	73	Shallow
Gd	Glenberg fine sandy loam, 0 to 3 percent slopes	25	IIIe-3	53	IIe-3	62	Sandy Lowland	72	Sandy
GL	Gullied land	25	VIIe-9	59	-----	--	Thin Loess	74	Silty to Clayey
Gr	Gering loam	24	IIw-4	52	IIw-4	62	Sub-irrigated	72	Moderately Wet
2Gr	Gering loam, alkali	24	IVs-1	56	IIIs-1	64	Sub-irrigated	72	Moderately Saline or Alkali
Gv	Gravelly land	25	VIIs-3	59	-----	--	Very Shallow Gravel	74	-----
Hf	Haverson fine sandy loam, 0 to 1 percent slopes	26	IIIe-3	53	IIe-3	62	Sandy Lowland	72	Sandy
Jn	Janise soils	27	VIs-1	57	VIs-1	67	Saline Sub-irrigated	72	-----
Ke	Keith loam, 0 to 1 percent slopes	27	IIIc-1	53	I-1	61	Silty	73	Silty to Clayey

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Name
KeA	Keith loam, 1 to 3 percent slopes---	27	IIIe-1	53	IIe-1	61	Silty	73	Silty to Clayey
2KeA	Keith loam, alkali substratum variant, 0 to 3 percent slopes----	28	IVs-1	56	-----	--	Silty	73	Moderately Saline or Alkali
KeB	Keith loam, 3 to 5 percent slopes---	28	IIIe-1	53	IIIe-1	63	Silty	73	Silty to Clayey
KEC	Keota-Epping silt loam, 5 to 9 percent slopes----------------------	29	VIe-9	57	IVe-1	65	Limy Upland and Shallow Limy	73	Silty to Clayey
KoA	Keota silt loam, 1 to 3 percent slopes----------------------------	29	IIIe-1	53	IIe-1	61	Limy Upland	73	Silty to Clayey
KoB	Keota silt loam, 3 to 5 percent slopes----------------------------	29	IVe-1	54	IIIe-1	63	Limy Upland	73	Silty to Clayey
KUB2	Keith-Ulysses loams, 3 to 5 percent slopes, eroded--------------------	28	IIIe-1	53	IIIe-1	63	Silty	73	Silty to Clayey
KUC	Keith-Ulysses loams, 5 to 9 percent slopes---------------------------	28	IVe-1	54	IVe-1	65	Silty	73	Silty to Clayey
Lq	Las Animas fine sandy loam----------	31	IIIw-6	54	IIw-6	63	Sub-irrigated	72	Moderately Wet
2Lq	Las Animas fine sandy loam, alkali--	31	IVs-1	56	IIIs-1	64	Sub-irrigated	72	Moderately Saline or Alkali
Lr	Las Animas loam---------------------	32	IIw-4	52	IIw-4	62	Sub-irrigated	72	Moderately Wet
2Lr	Las Animas loam, alkali-------------	32	IVs-1	56	IIIs-1	64	Sub-irrigated	72	Moderately Saline or Alkali
2Ls	Las fine sandy loam, alkali---------	30	IVs-1	56	IIIs-1	64	Sub-irrigated	72	Moderately Saline or Alkali
Lt	Las loam----------------------------	30	IIw-4	52	IIw-4	62	Sub-irrigated	72	Moderately Wet
2Lt	Las loam, alkali--------------------	30	IVs-1	56	IIIs-1	64	Sub-irrigated	72	Moderately Saline or Alkali
Lx	Loamy alluvial land-----------------	32	VIw-1	59	-----	--	Silty Overflow	72	Moderately Wet
M	Marsh-------------------------------	32	VIIIw-1	60	-----	--	-----	--	-----
2MBB	Mitchell and Buffington soils, alkali, 0 to 5 percent slopes-----	39	IVs-1	56	IIIs-1	64	Sub-irrigated	72	Moderately Saline or Alkali
Mf	McGrew fine sandy loam--------------	34	IIIw-6	54	IIw-6	63	Sub-irrigated	72	Moderately Wet
Mg	McGrew loam-------------------------	34	IIw-4	52	IIw-4	62	Sub-irrigated	72	Moderately Wet
2Mg	McGrew loam, alkali-----------------	34	IVs-1	56	IIIs-1	64	Sub-irrigated	72	Moderately Saline or Alkali

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Capability unit: Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Name
MJ	Minatare-Janise soils----------------	35	VIs-1	57	VIs-1	67	Saline Subirrigated	72	-----
Mo	McCook loam, 0 to 1 percent slopes--	33	IIIc-1	53	I-1	61	Silty Lowland	73	Silty to Clayey
3Mo	McCook silty clay loam, gravel substratum variant, 0 to 1 percent slopes---------------------------	33	IVe-1	54	IIs-5	62	-----	--	Silty to Clayey
Mt	Mitchell silt loam, 0 to 1 percent slopes---------------------------	37	IIIc-1	53	I-1	61	Limy Upland	73	Silty to Clayey
MtA	Mitchell silt loam, 1 to 3 percent slopes---------------------------	37	IIIe-1	53	IIe-1	61	Limy Upland	73	Silty to Clayey
MtB	Mitchell silt loam, 3 to 5 percent slopes---------------------------	37	IIIe-1	53	IIIe-1	63	Limy Upland	73	Silty to Clayey
2MtB	Mitchell silt loam, thin, 1 to 5 percent slopes--------------------	38	IVe-9	55	IIIe-1	63	Limy Upland	73	Silty to Clayey
MtC	Mitchell silt loam, 5 to 9 percent slopes---------------------------	38	IVe-1	54	IVe-1	65	Limy Upland	73	Silty to Clayey
2MtC	Mitchell silt loam, thin, 5 to 9 percent slopes--------------------	38	VIe-9	57	IVe-1	65	Limy Upland	73	Silty to Clayey
2MtD	Mitchell silt loam, thin, 9 to 20 percent slopes--------------------	38	VIe-9	57	-----	--	Limy Upland	73	Silty to Clayey
5Mt	Mitchell silt loam, wet variant, 0 to 1 percent slopes---------------	39	IIw-4	52	IIw-4	62	Subirrigated	72	Moderately Wet
MzA	Mitchell fine sandy loam, 0 to 3 percent slopes--------------------	36	IIIe-3	53	IIe-3	62	Limy Upland	73	Sandy
MzB	Mitchell fine sandy loam, 3 to 5 percent slopes--------------------	37	IIIe-3	53	IIIe-3	63	Limy Upland	73	Sandy
MzC	Mitchell fine sandy loam, 5 to 9 percent slopes--------------------	37	IVe-3	55	IVe-3	65	Limy Upland	73	Sandy
OBA	Otero-Bayard fine sqndy loams, 0 to 3 percent slopes------------------	41	IIIe-3	53	IIe-3	62	Sandy	73	Sandy
OBB	Otero-Bayard fine sandy loams, 3 to 5 percent slopes------------------	42	IVe-3	55	IIIe-3	63	Sandy	73	Sandy
OBC	Otero-Bayard fine sandy loams, 5 to 9 percent slopes------------------	42	IVe-3	55	IVe-3	65	Sandy	73	Sandy
OC	Otero-Bayard very fine sandy loams, 0 to 1 percent slopes-------------	42	IIIc-1	53	I-1	61	Limy Upland and Sandy	73	Silty to Clayey
OdB	Otero loamy fine sand, 0 to 5 percent slopes---------------------------	41	IVe-5	55	IVe-5	66	Sandy	73	Sandy
OrA	Orella clay, 0 to 3 percent slopes--	40	VIIs-1	59	-----	--	Saline Upland	74	-----
OtB	Otero fine sandy loam, 1 to 5 percent slopes-----------------------	41	IVe-3	55	IVe-3	65	Sandy	73	Sandy
OtD	Otero fine sandy loam, 5 to 12 percent slopes-----------------------	41	VIe-3	57	IVe-3	65	Sandy	73	Sandy
P	Platte soils-----------------------	43	VIw-4	59	IVs-4	66	Subirrigated	72	Moderately Wet
RbC	Rosebud loam, 5 to 9 percent slopes-	44	IVe-1	54	-----	--	Silty	73	Silty to Clayey

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Name
RE	Rock outcrop-Epping complex---------	43	VIIs-3	59	-----	--	Shallow Limy	73	-----
RT	Rock outcrop-Tassel complex---------	43	VIIs-3	59	-----	--	Shallow Limy	73	Shallow
Sa	Satanta fine sandy loam, 1 to 3 percent slopes-----------------------	45	IIIe-3	53	-----	--	Sandy	73	Sandy
ShC	Shingle complex, 3 to 9 percent slopes----------------------------	46	VIs-42	58	-----	--	Shallow Limy	73	Shallow
SK	Slickspots-Keith complex------------	46	VIs-11	58	-----	--	Panspots and Silty	74, 73	-----
Sx	Sandy alluvial land-----------------	44	VIs-43	58	-----	--	Sandy Lowland	72	Shallow
3Sx	Mixed alluvial land-----------------	39	VIw-4	59	-----	--	Sub-irrigated	72	-----
Sy	Broken alluvial land----------------	16	VIe-9	57	-----	--	Limy Upland	73	Silty to Clayey
TA	Tassel-Anselmo complex, 3 to 30 percent slopes-----------------------	47	VIs-42	58	-----	--	Shallow Limy and Sandy	73	Shallow
Tl	Tassel soils, 20 to 50 percent slopes----------------------------	47	VIIs-4	60	-----	--	Shallow Limy and Sandy	73	Shallow
TrA	Tripp fine sandy loam, 0 to 3 percent slopes-----------------------	48	IIIe-3	53	IIe-3	62	Sandy	73	Sandy
Tv	Tripp very fine sandy loam, 0 to 1 percent slopes--------------------	49	IIIc-1	53	I-1	61	Silty	73	Silty to Clayey
TvA	Tripp very fine sandy loam, 1 to 3 percent slopes--------------------	49	IIIe-1	53	IIe-1	61	Silty	73	Silty to Clayey
TvB2	Tripp very fine sandy loam, 3 to 5 percent slopes, eroded------------	49	IIIe-1	53	IIIe-1	63	Silty	73	Silty to Clayey
TvC2	Tripp very fine sandy loam, 5 to 9 percent slopes, eroded------------	49	IVe-1	54	IVe-1	65	Silty	73	Silty to Clayey
VD	Valentine and Dwyer fine sands, rolling---------------------------	50	VIe-5	57	-----	--	Sands	73	Very Sandy
VDy	Valentine and Dwyer loamy fine sands, rolling--------------------	50	VIe-5	57	-----	--	Sands	73	Very Sandy
Wx	Wet alluvial land-------------------	51	Vw-1	56	-----	--	Wet Land	72	Wet

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