SOIL SURVEY OF

Antelope County, Nebraska

United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Nebraska
Conservation and Survey Division

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

Major fieldwork for this soil survey was completed in the period 1967-73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. 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 Upper Elkhorn Natural Resources District. The Antelope County Board of Supervisors contributed financially to the purchase of aerial photography used in this soil survey.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

The soils of Antelope County are shown on the detailed map at the back of this survey. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map soil areas are outlined and are identified by symbols. 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 Map Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit in which the soil has been placed. It lists the range site and windbreak suitability group of each soil.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes 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 from the soil descriptions and from the discussions of the capability units, the range sites, and the windbreak suitability groups.

Foresters and others can refer to the section "Native woodland and windbreaks" where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

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

Engineers and builders can find, under "Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about soil formation and classification in the section "Formation and Classification of Soils."

Newcomers in Antelope County may be interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "Environmental Factors Affecting Soil Use."

Cover: Landscape on Thurman-Boelus-Nora association. Field windbreaks help control erosion on Thurman and Boelus soils. (Courtesy of Richard Hufnagle, photographer.)

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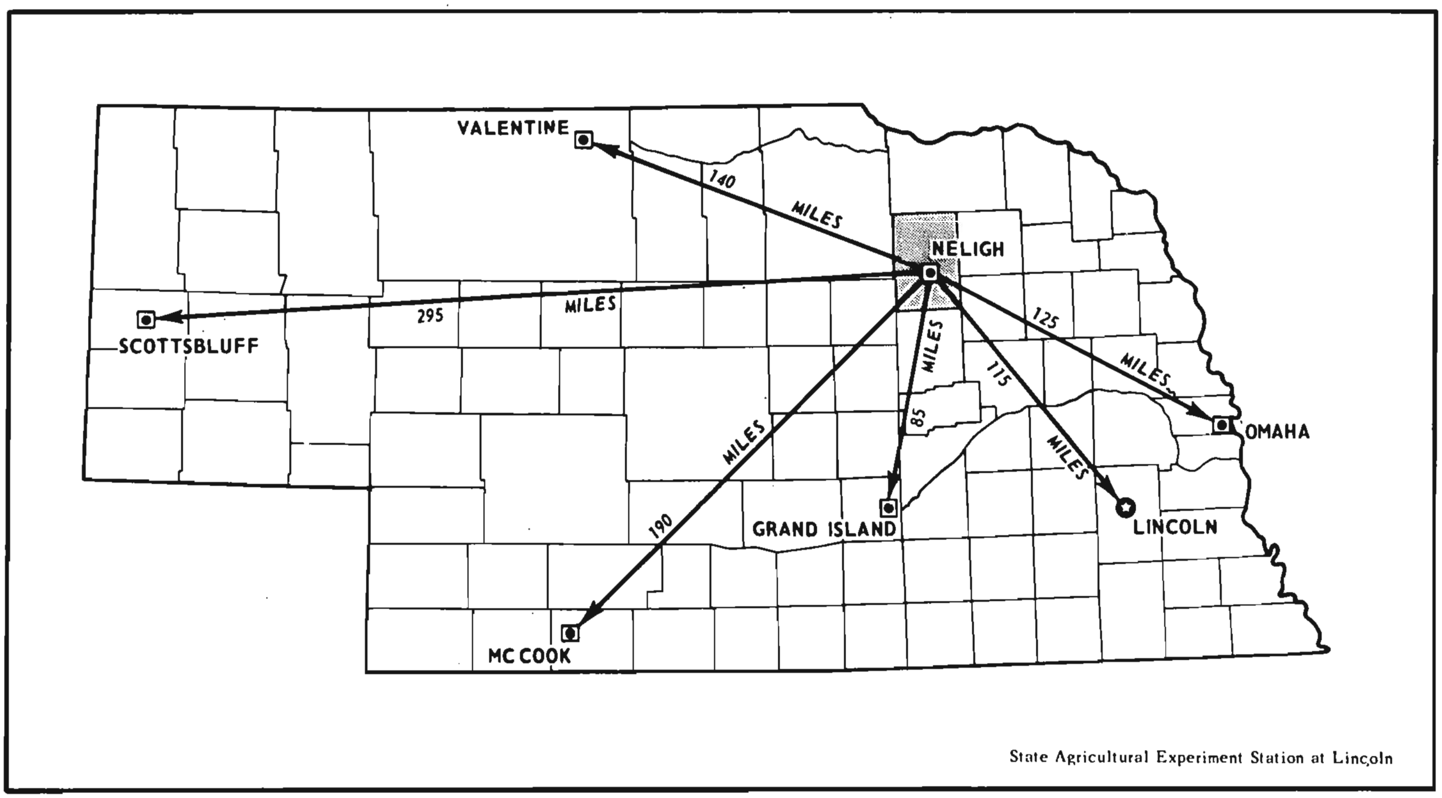

Location of Antelope County in Nebraska.

SOIL SURVEY OF ANTELOPE COUNTY, NEBRASKA

By Charles Mahnke, Roger Hammer, Charles Hammond, and Ronald Shulte, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska Conservation and Survey Division

ANTELOPE COUNTY is in north-central Nebraska (see facing page). It extends 36 miles from north to south and 24 miles from east to west. It covers an area of 853 square miles, or 545,920 acres. Neligh, named for John D. Neligh, an early settler, is the largest town and county seat.

The first permanent settlement in Antelope County was in November, 1868. The county was established and organized in 1871. Its population in 1970 was 9,047.

The early settlers came from many northern and eastern States. German, Danish, Swedish, and French were the major nationalities of the early settlement. The first railroad in the county was completed in the 1880's.

Agriculture is the principal enterprise in the county. About 65 percent of the county is cultivated cropland, 30 percent is rangeland or hay meadow, and 5 percent is woodland, windbreaks, streams, and towns. About 12 percent of the cultivated cropland is irrigated. Corn, soybeans, rye, alfalfa, and grain sorghum are the principal crops. Raising beef cattle and swine are the major livestock enterprises. There are a few dairy herds.

The upland landscape in Antelope County is one of rolling loess hills, hummocky sandhills, a rolling transition zone between the loess hills and the sandhills, and deeply dissected uplands in the northwestern part of the county. The Elkhorn River Valley, which is about 2 miles wide, crosses the county from east to west. The elevation of the county ranges from 1,645 to 2,162 feet.

Soils of Antelope County vary widely in their characteristics. Nora, Crofton, and Moody soils are the main soils in the loess uplands. Valentine and Thurman soils are the main soils in the sandhills. Thurman and Boelus soils are the principal soils in the transitional uplands. The loamy Brunswick soil is in the dissected uplands. Ord and Elsmere soils are on bottom land in the Elkhorn River Valley. Cozad and Hord soils are on stream terraces and foot slopes in the Elkhorn River Valley.

Soils of Antelope County have good potential for a variety of crops. Water for irrigation is generally available throughout the county except in the northern part. Most soils of the county are favorable building sites for small buildings and roads.

An older soil survey of Antelope County was published in 1924. The present survey updates the earlier one and provides additional information and larger maps that show the soils in greater detail.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Antelope County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and nature of streams, the kinds of native plants or crops, the 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 the action of plant roots.

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. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

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. Crofton and Valentine, 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 affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Nora silt loam, 2 to

6 percent slopes, is one of several phases within the Nora series.

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 help in drawing boundaries accurately. The soil map at the back of this survey was prepared from aerial photographs.

The areas shown on a soil map are called map units. On most maps detailed enough to be useful in planning the management of farms and fields, a map unit is nearly equivalent to a soil phase. 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 kind that have been seen within an area that is dominantly of a recognized soil phase.

Some map units are made up of soils of different series, or of different phases within one series. Two such kinds of map units are shown on the soil map of Antelope County: soil complexes and undifferentiated soil groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that it is not practical to show them separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Brunswick-Paka complex, 11 to 30 percent slopes, is an example.

An undifferentiated soil group is made up of two or more soils that could be mapped individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils joined by "and." Inavale and Elsmere soils, 0 to 2 percent slopes, is an undifferentiated soil group in this county.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Blownout land is a land type in this survey.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also 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 soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the 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 current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for broad planning on a watershed, a wooded tract, or a wildlife area or for broad planning of recreational facilities, community developments and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey area have been grouped into general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations in it are described on the following pages.

Sandy Soils on Uplands

Only one association, nearly level to hilly soils of the sandhills, is in this group.

1. Valentine-Thurman association

Deep, nearly level to hilly, sandy soils on uplands

This soil association consists mainly of sandhills. Soils of the higher areas are undulating to hilly, and those of the lower areas are nearly level or gently undulating.

This soil association (fig. 1) makes up about 13 percent of the county. It is about 60 percent Valentine

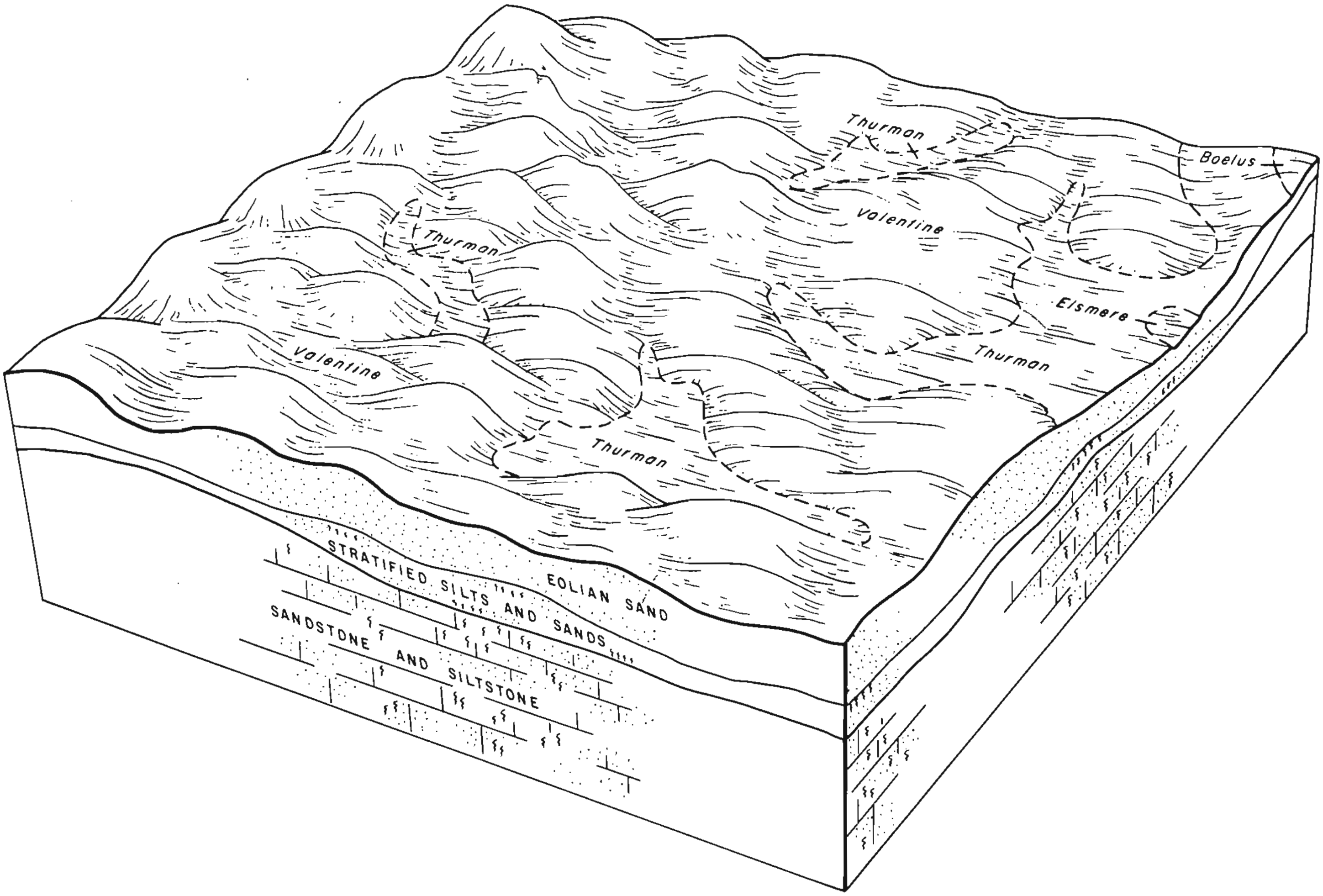

***Figure 1.*—Pattern of soils and parent material in Valentine-Thurman association.**

soils, 27 percent Thurman soils, and 13 percent minor soils and land types.

The excessively drained Valentine soils occur throughout the landscape. They have a thin grayish brown fine sand surface layer. Beneath this is a transitional layer of light brownish gray fine sand. At a depth of 11 inches is the pale brown and very pale brown fine sand underlying material.

The well drained Thurman soils occupy concave and nearly level uplands. They have a dark gray and dark grayish brown loamy fine sand or fine sand surface layer. Below this is a transitional layer of grayish brown loamy fine sand or fine sand. At a depth of 24 inches is the pale brown fine sand underlying material.

Minor in this association are Boelus, Doger, and Elsmere soils and Blownout land. Boelus and Doger soils occupy the concave areas near Valentine and Thurman soils. Elsmere soils are on the stream terraces and have a water table at a depth of 2 to 6 feet. Blownout land is on the ridgetops and hilltops that have been severely eroded by wind.

Farms are mainly in native grass and used for range and native hay. Some of the nearly level to gently sloping areas are cultivated and irrigated by center pivot systems. Some of the areas on the outer edge of the association are in dryland cultivated crops. Corn, alfalfa, and rye are the main dryland crops. Corn and alfalfa are the main irrigated crops. Some livestock is fattened in feedlots and marketed.

Soil blowing is a serious hazard, particularly where these soils are cultivated. Low fertility, low available water capacity, and lack of adequate rainfall commonly limit the production of dryfarmed crops and grass. Regulating the use and improving the condition of the grass is the main concern on range. Maintaining high fertility is a concern on irrigated land.

Farms on this association average about 960 acres in size. Most owners and operators live outside the association. Most of the farms are part of cash grain-livestock enterprises; they are the cattle-producing part. Wells on every farm provide sufficient water for livestock. Gravel or paved roads are on some section lines. Most of the cash grain crops are marketed within the county. Many of the cattle are delivered to markets outside the county. There is a gradual trend toward larger irrigated acreages and larger and fewer farms.

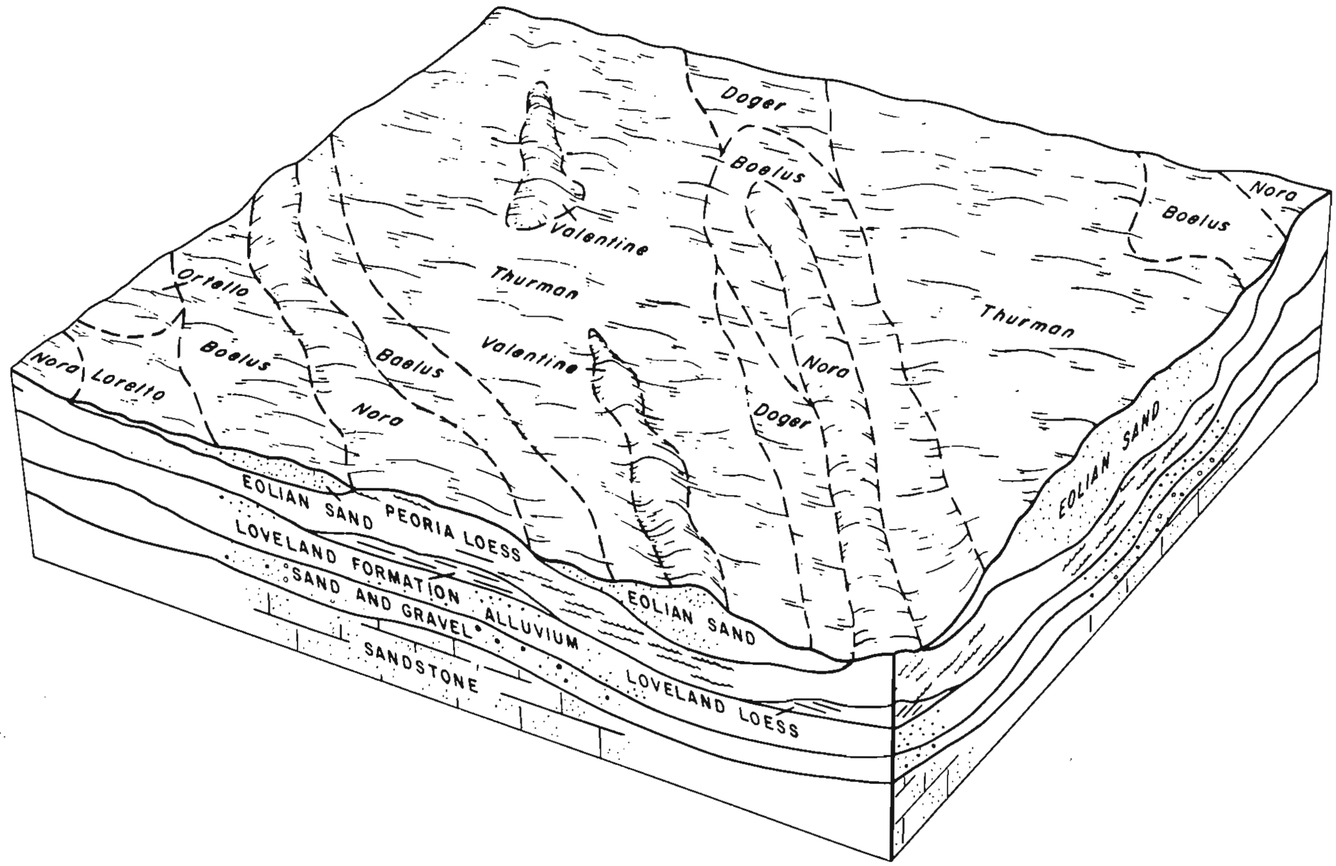

Figure 2.—**Pattern of soils and parent material in Thurman-Boelus-Nora association.**

Sandy and Silty Soils on Uplands

Only one association, nearly level to strongly sloping soils on uplands, is in this group.

2. *Thurman-Boelus-Nora association*

Deep, nearly level to strongly sloping, sandy and silty soils on uplands

This soil association consists of low, undulating and rolling hills on uplands, a few side slopes along drainageways, and a few small stream terraces. The side slopes are generally strongly sloping; a few are steep. The drainageways are intermittent tributaries of the Elkhorn River, Verdigris Creek, and Bazile Creek.

This soil association (fig. 2) makes up about 43 percent of the county. It is about 49 percent Thurman soils, 16 percent Boelus soils, 8 percent Nora soils, and 27 percent minor soils.

The well drained Thurman soils are on uplands. They have a surface layer of dark gray and dark grayish brown loamy fine sand and fine sand. Below this is a transitional layer of grayish brown loamy fine sand and fine sand. At a depth of 24 inches is the pale brown fine sand underlying material.

The well drained Boelus soils occupy nearly level flats and side slopes of uplands. They have a surface layer that is gray loamy fine sand in the upper part and grayish brown loamy fine sand in the lower part. Below this is a pale brown and a very pale brown, silt loam buried subsoil. At a depth of 48 inches is the very pale brown silt loam underlying material.

The well drained Nora soils are on side slopes and a few nearly level uplands. They have a surface layer of dark grayish brown silt loam. The subsoil is a grayish brown, light brownish gray, and pale brown light silty clay loam or silt loam. At a depth of 32 inches is the light gray silt loam underlying material.

Minor in this association are Valentine, Doger, Loretto, Ortello, and Blendon soils. Valentine soils are on the higher hills. Doger soils are in swales and on the lower parts of the side slope. Loretto and Ortello soils are on the nearly level ridges and flats. Blendon soils are on the lower hillsides.

Farms are diversified, mostly cash grain-livestock enterprises. Much of the nearly level to gently sloping acreage is in either dryland or irrigated cultivated crops. Most of the irrigated acreage is irrigated by center pivot systems. Corn, soybeans, alfalfa, and rye are the principal dryland crops. Corn, alfalfa, and soybeans are the main irrigated crops. The areas in grass are used for range. Many of the livestock are fattened in feedlots and marketed.

Soil blowing is the main hazard, particularly if these soils are cultivated. Water erosion is also a hazard on unprotected fields. Lack of adequate rainfall commonly limits the production of dryfarmed crops. Maintaining fertility and organic matter content and preventing soil blowing are concerns on the cultivated soils. Regulating the use and improving the condition of the grass are the main concerns on range.

Farms on this association average about 480 acres in size. Wells on every farm provide sufficient water for domestic use. Gravel or improved dirt roads are on many section lines. Highways and some county roads that cross the area are paved. Most of the cash grain crops are marketed within the county. Many of the cattle and swine are marketed outside the county. There is a continuing trend toward larger irrigated acreages and larger and fewer farms.

Loamy and Sandy Soils on Uplands

Two associations of nearly level tableland, rolling hills, and steep dissected areas on uplands are in this group.

3. Bazile-Paka-Thurman association

Deep, nearly level to gently sloping, loamy and sandy soils on uplands

This soil association consists of nearly level to rolling uplands and a few strongly sloping areas along shallow drainageways. These drainageways are intermittent tributaries of Verdigris Creek and Bazile Creek.

This soil association makes up about 9 percent of the county. It is about 24 percent Bazile soils, 23 percent Paka soils, 13 percent Thurman soils, and 40 percent minor soils.

The well drained Bazile soils occupy nearly level and rolling uplands. Typically the surface layer is dark grayish brown loam. In many areas, however, it is an overblow of fine sandy loam, loamy fine sand, and fine sand 8 to 32 inches thick. The subsoil is grayish brown and light brownish gray light silty clay loam and silt loam. At a depth of 31 inches is the pale brown and very pale brown fine sand and sand underlying material.

The well drained Paka soils occupy nearly level uplands and sloping areas that border drainageways. Typically the surface layer is dark gray loam, but in many areas it is an overblow of fine sandy loam, loamy fine sand, and fine sand 8 to 32 inches thick. The subsoil is grayish brown and light brownish gray light clay loam and loam. At a depth of 35 inches is the light gray loam underlying material. Below a depth of 47 inches is light gray siltstone.

The well drained Thurman soils occupy undulating uplands. They have a surface layer of dark gray and dark grayish brown loamy fine sand and fine sand. Below this is a transitional layer of grayish brown loamy fine sand and fine sand. At a depth of 24 inches is the pale brown fine sand underlying material.

Minor in this association are Blendon, Longford, Loretto, O'Neill, Ortello, Simeon, and Trent soils. O'Neill and Simeon soils are generally on narrow convex ridges. Trent soils are in the lower, somewhat concave pockets in the tablelands. Blendon, Longford, Loretto, and Ortello soils are adjacent to the major soils of this association.

Farms are diversified, mostly cash grain-livestock enterprises. A large acreage is in dryland cultivated crops. Some areas are irrigated by center pivot systems. Corn, soybeans, alfalfa, and rye are the main dryland crops. Corn and alfalfa are the main irrigated crops. The areas in grass are used for range. Some livestock is fattened in feedlots and marketed.

Water erosion and soil blowing are the main hazards on these associations. Lack of adequate rainfall commonly limits the production of dryfarmed crops. Maintaining fertility and preventing soil blowing and runoff are concerns on the cultivated soils. Regulating the use and improving range condition are the main concerns on range.

Farms on these associations average about 400 acres in size. Wells on every farm provide sufficient water for domestic use. Gravel or improved dirt roads are on most section lines. Highways and some county roads that cross the area are paved. Most of the cash grain crops are marketed within the county. Some of the cattle and swine are marketed within the county, but many are delivered to markets outside the county. There is a gradual trend toward fewer and larger farms.

4. Brunswick-Paka-Valentine association

Moderately deep and deep, gently sloping to steep, loamy and sandy soils on uplands

This soil association is an area of dissected uplands. The narrow ridges are gently sloping to strongly sloping, and the side slopes are moderately steep to steep. A few ridgetops are nearly level. The drainageways are intermittent or spring-fed tributaries of Verdigris Creek.

This soil association (fig. 3) makes up about 5 percent of the county. It is about 26 percent Brunswick soils, 18 percent Paka soils, 13 percent Valentine soils, and 43 percent minor soils.

The moderately deep, well drained Brunswick soils occupy side slopes. They have a surface layer of dark gray fine sandy loam. The subsoil is a grayish brown and pale brown fine sandy loam. The upper part of the underlying material, at a depth of 17 inches, is light brownish gray loamy fine sand.

The well drained Paka soils are on ridgetops and side slopes. Typically the surface layer is dark gray loam, but in many areas it is an overblow of fine sandy loam, loamy fine sand, or fine sand 8 to 32 inches thick. The subsoil is a grayish brown and light brownish gray light clay loam and loam. At a depth of 35 inches is the light gray loam underlying material. Below a depth of 47 inches is light gray siltstone.

The excessively drained Valentine soils are on the upper undulating hills and on the upper part of side slopes. They have a surface layer of grayish brown fine sand. Below this is a transitional layer of light brownish gray fine sand. At a depth of 11 inches is the pale brown and very pale brown fine sand underlying material.

Minor in this association are Bazile, Loup, Meadin, O'Neill, Simeon, Inavale, and Elsmere soils. Bazile soils are on the ridgetops. Loup soils are on the poorly drained bottom lands. Meadin and O'Neill soils are on

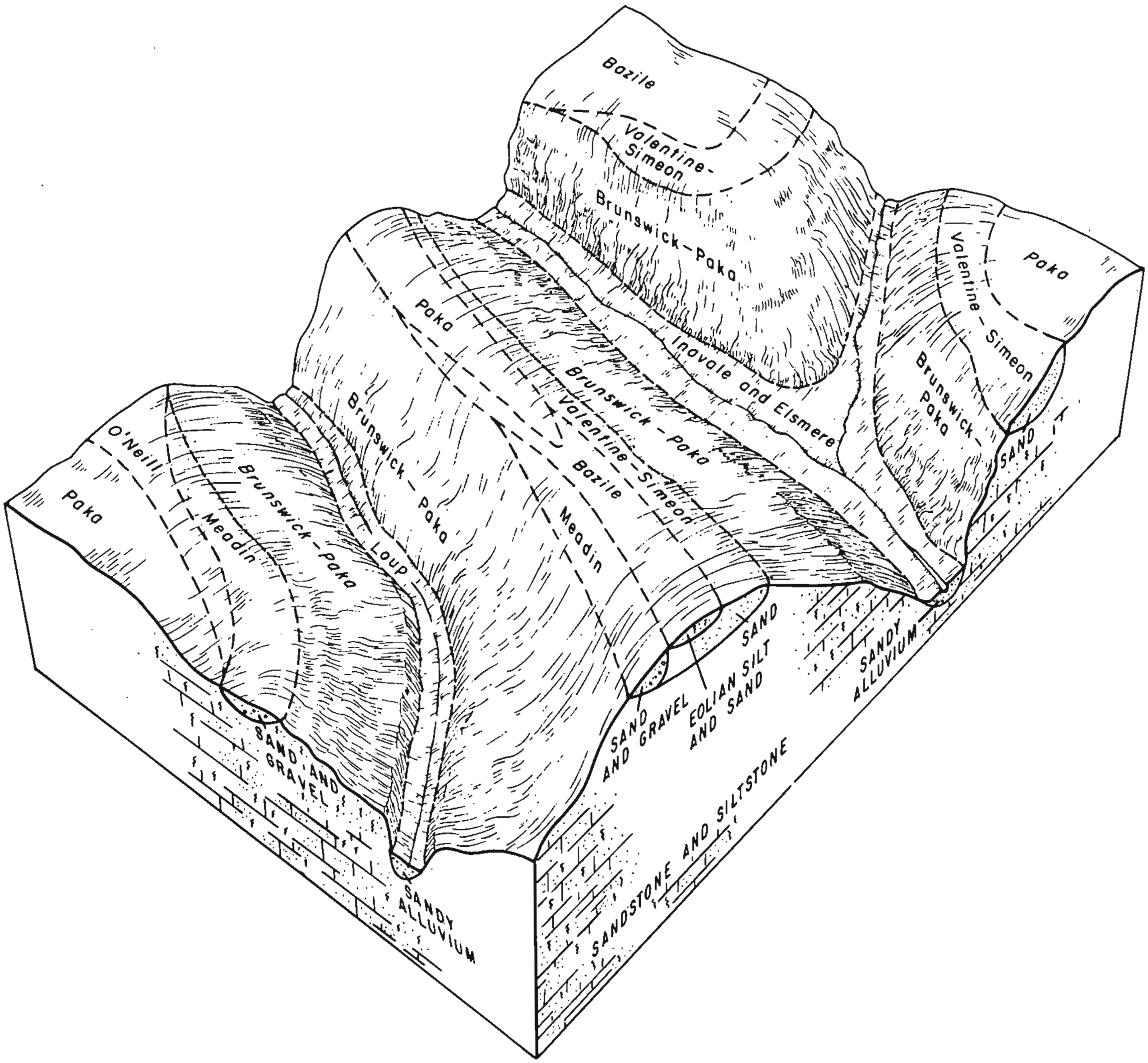

Figure 3.—**Pattern of soils and parent material in Brunswick-Paka-Valentine association.**

the gently sloping and strongly sloping ridges and upper side slopes bordering drainageways. Simeon soils are associated with the Valentine soils. Inavale and Elsmere soils are on the bottom land along larger drainageways that have meandering, spring-fed stream channels.

Farms on this association are mainly in native grass and are used for range. A few of the ridges are cultivated; corn and alfalfa are the principal crops. Some livestock is fattened in feedlots and marketed.

Water erosion is the main hazard on this association. Lack of adequate rainfall commonly limits the production of grass and crops. Maintaining fertility and preventing soil blowing and water erosion are concerns on cultivated soils. Regulating the degree of use and improving range condition are the main concerns on range.

Farms on this association average about 960 acres in size. Many of the owners and operators live outside this association. Many of the farms are part of cash grain-livestock enterprises; they are the cattle-producing part. Wells on every farm provide sufficient water for domestic use. A few gravel and improved dirt roads are on section lines or parallel the streams. The cash grain crops are marketed locally. Most of the cattle are marketed outside the county. In a few areas sand and gravel are mined. In this association there is a slight trend toward more use of the land for recreation.

Silty Soils on Uplands

Only one association, ridges and side slopes of the loess uplands, is in this group.

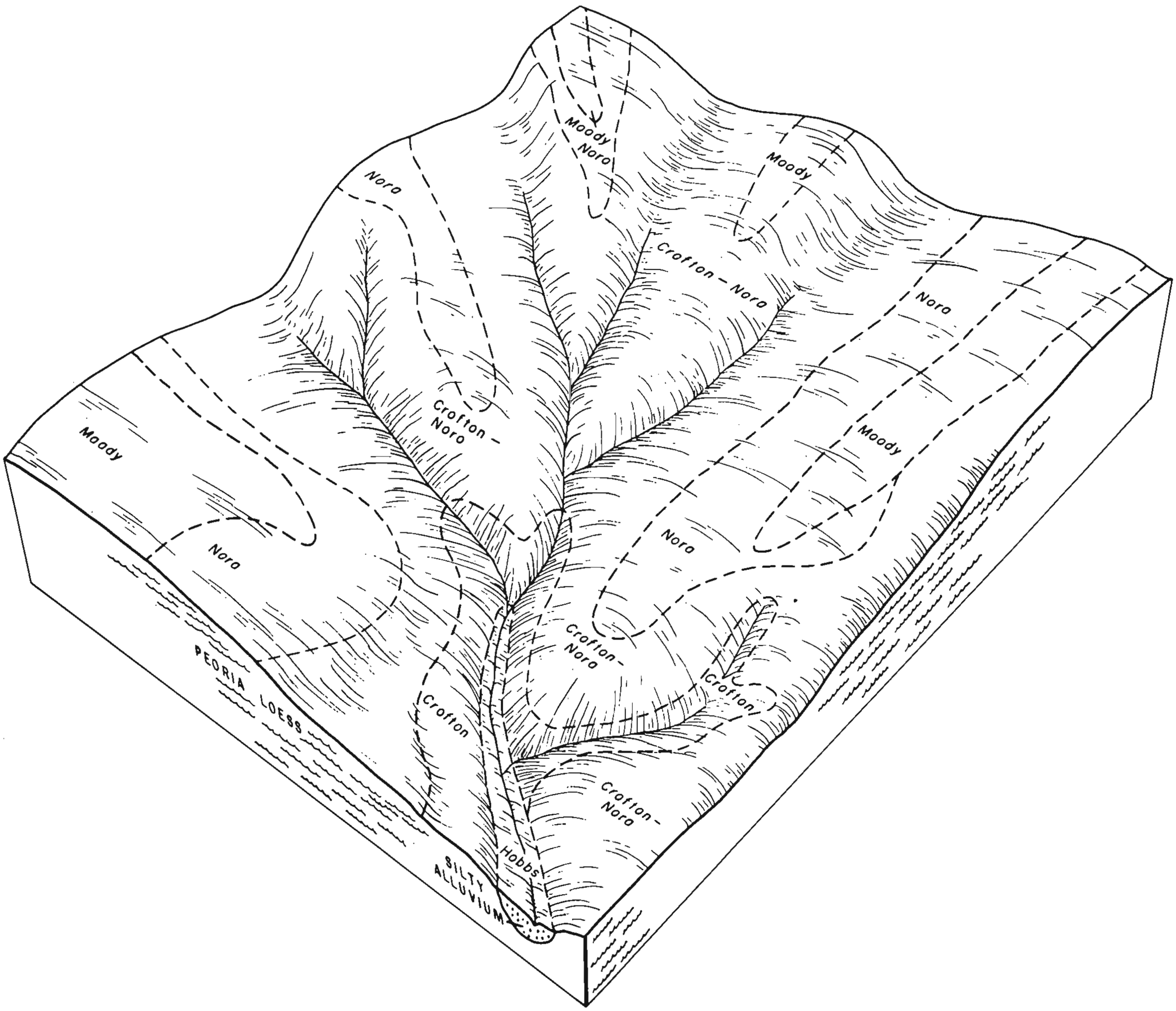

***Figure 4.*—Pattern of soils and parent material in Nora-Crofton-Moody association.**

5. Nora-Crofton-Moody association

Deep, gently sloping to steep, silty soils on loess uplands

This soil association consists of ridgetops and side slopes of rolling hills. The ridges are mostly gently sloping to strongly sloping, and the side slopes are generally moderately steep to steep. Drainageways are intermittent or spring-fed tributaries of the Elkhorn River.

This soil association (fig. 4) makes up about 22 percent of the county. It is about 30 percent Nora soils, 28 percent Crofton soils, 16 percent Moody soils, and 26 percent minor soils.

The well drained Nora soils occupy ridges and areas that border the upper ends of drainageways. They have a surface layer of dark grayish brown silt loam. The subsoil is grayish brown, light brownish gray, and pale brown light silty clay loam or silt loam. At a depth of 32 inches is a light gray silt loam underlying material.

The well drained Crofton soils occupy eroded ridges and areas that border entrenched drainageways. They have a surface layer of thin, dark grayish brown silt loam. Below this is a transitional layer of grayish brown silt loam. At a depth of 9 inches is the pale brown silt loam underlying material.

The well drained Moody soils are in the more nearly level areas and on the wider ridgetops. They have a surface layer of very dark grayish brown silty clay loam. The subsoil is a dark grayish brown, grayish brown, and pale brown silty clay loam or silt loam. At a depth of 40 inches is the very pale brown silt loam underlying material.

Minor in this association are Hord, Hobbs, Cozad, and Fillmore soils. Hord soils are on foot slopes, in concave pockets in uplands, and on bottom land and stream terraces. Hobbs soils are on occasionally or frequently flooded bottom land along drainageways. Cozad soils are on bottom land and stream terraces along drainageways. Fillmore soils are in depressions in the uplands.

Farms are diversified, mostly cash grain-livestock enterprises. Corn, soybeans, grain sorghum, small grain, and alfalfa are the principal dryland crops. Corn, soybeans, grain sorghum, and alfalfa are the main irrigated crops. The steeper soils are generally in grass and are used for range. Some livestock is fattened for market.

Water erosion is the main hazard on this association. Lack of adequate rainfall commonly limits the production of dryfarmed crops. Maintaining fertility and preventing runoff are concerns on the cultivated soils. Regulating the degree of use and improving range condition are the main concerns on range.

Farms on this association average about 400 acres in size. Wells on every farm provide sufficient water for livestock and domestic use. Gravel or improved dirt roads are on most section lines. Highways and some county roads that cross the area are paved. Most of the cash grain crops are marketed within the county. Cattle and swine are the main livestock, and many of these are marketed outside the county. There is a gradual trend toward larger irrigated acreages and larger farms.

Silty Soils on Foot Slopes and Stream Terraces

One association, nearly level to gently sloping soils in the Elkhorn River Valley, is in this group.

6. *Hord-Cozad association*

Deep, nearly level to gently sloping, silty soils on foot slopes and stream terraces

This soil association consists mainly of nearly level soils on stream terraces of the Elkhorn River Valley and nearly level to gently sloping soils on foot slopes.

This soil association makes up about 2 percent of the county. It is about 58 percent Hord soils, 16 percent Cozad soils, and 26 percent minor soils.

The well drained Hord soils occupy the stream terraces and foot slopes. They have a surface layer of dark gray silt loam. The subsoil is a dark grayish brown, grayish brown, and brown silt loam. At a depth of 39 inches is the pale brown silt loam underlying material.

The well drained Cozad soils are on stream terraces. They have a surface layer of dark gray silt loam. The subsoil is grayish brown silt loam. At a depth of 20 inches is the grayish brown and light brownish gray silt loam underlying material.

Minor in this association are Hobbs, Ortello, and Thurman soils. Hobbs soils are on bottom land along drainageways that are occasionally or frequently flooded. Ortello and Thurman soils are on the stream terraces and foot slopes adjacent to the major soils in this association.

Farms on this association are mainly cash grain-livestock enterprises. Nearly all the acreage is in dryland or irrigated cultivated crops. Corn, grain sorghum, alfalfa, and soybeans are the main crops. Some livestock is fattened in feedlots and marketed.

Water erosion is the main hazard on this association. Occasional flooding is a hazard in some areas. Lack of adequate rainfall commonly limits the production of dryfarmed crops. Maintaining fertility is the main concern on these soils.

Farms on this association average about 320 acres in size. Wells on every farm provide sufficient water for domestic use. Gravel or improved dirt roads are on most section lines. Highways that cross the area are paved. Most of the cash grain crops are marketed within the county. Many of the cattle and swine are marketed outside the county. There is a gradual trend toward larger and fewer farms.

Sandy, Loamy, and Silty Soils on Bottom Land and Stream Terraces

Three associations of low lying areas that are mainly moderately wet or very wet are in this group.

7. *Elsmere-Loup association*

Deep, nearly level, sandy and loamy soils on bottom land and stream terraces

This soil association consists of nearly level areas between the sandhills and the bottom land along streams and rivers.

This soil association makes up about 2 percent of the county. It is about 38 percent Elsmere soils, 18 percent Loup soils, and 44 percent minor soils.

The somewhat poorly drained Elsmere soils are on stream terraces and bottom land. They have a surface layer of dark grayish brown fine sand and loamy fine sand. Below this is a transitional layer of grayish brown fine sand and loamy fine sand. At a depth of 18 inches is the very pale brown and light gray fine sand underlying material.

The poorly drained Loup soils are on bottom land. They have a surface layer of dark gray fine sandy loam. Below this is a transitional layer of gray loamy fine sand. At a depth of 14 inches is light gray and light brownish gray fine sand.

Minor in this association are Thurman, Valentine, Ovina, Ord, and Orwet soils. Thurman and Valentine soils are on the higher sandy knolls scattered among the major soils of this association. Ovina soils are on stream terraces and bottom land adjacent to Elsmere soils. Ord and Orwet soils are on the bottom land adjacent to Loup soils.

Farms on this association are mainly in native grass and are used for hay meadows or range. Some areas are cultivated; corn and alfalfa are the principal crops. A few livestock are fattened in feedlots and marketed.

Wetness is the main limitation on this association. Soil blowing and flooding are hazards in some areas.

Regulating the degree of use and improving grass condition are primary concerns on range. Maintaining fertility and organic matter content are concerns on the cultivated soils.

Farms on this association average about 400 acres in size. Most of the owners and operators reside outside the association. Many of these farms are part of cash grain-livestock enterprises; they are the part used to produce native hay and cattle. Wells or dugouts on most farms provide water for livestock. Gravel or improved dirt roads are on some section lines. Highways and a few county roads that cross the area are paved. Many of the cattle are delivered to markets outside the county. Cash grain crops are marketed locally. There is a gradual trend toward larger and fewer farms.

8. *Inavale-Elsmere-Ord association*

Deep, nearly level, sandy and loamy soils on bottom land

This soil association consists of nearly level soils along meandering streams. There are shallow, old stream channels and low, sandy hummocks throughout the area.

This soil association makes up about 2 percent of the county. It is about 38 percent Inavale soils, 25 percent Elsmere soils, 10 percent Ord soils, and 27 percent minor soils and Marsh areas.

The somewhat excessively drained Inavale soils occupy sandy flats and hummocks on bottom land. They have a surface layer of grayish brown fine sand. Below this is a transitional layer of light brownish gray fine sand. At a depth of 11 inches is the light gray, stratified fine sand and sand underlying material.

The somewhat poorly drained Elsmere soils occur on bottom land and in old stream channels. They have a surface layer of dark grayish brown fine sand and loamy fine sand. Below this is a transitional layer of grayish brown fine sand and loamy fine sand. At a depth of 18 inches is the very pale brown and light gray fine sand underlying material.

The somewhat poorly drained Ord soils occur on bottom land. They have a surface layer of dark gray loam and fine sandy loam. Below this is a transitional layer of gray fine sandy loam. At a depth of 21 inches is the white fine sand underlying material.

Minor in this association are Gibbon, Loup, and Lawet soils and areas of marsh. Gibbon, Loup, and Lawet soils are lower in elevation than the major soils. Marsh areas are in old oxbow stream channels at the lowest elevations.

Farms on this association are mostly in range and trees. They are used mainly for grazing cattle. A few areas are cultivated; corn and alfalfa are the main crops. A few livestock are fattened in feedlots and marketed.

Flooding is one of the main hazards on this association. Soil blowing is a serious hazard, particularly if the sandy soils are cultivated. Wetness, because of a high water table, and low fertility are limitations in many areas. Regulating the use and improving the grass cover are the main concerns on range.

Farms on this association average about 320 acres in size. Water for livestock is available from streams and other open water areas. A few gravel or paved roads parallel the streams or are on section lines. Many of the cattle and swine are delivered to markets outside the county. Cash grain crops are marketed locally. In a few areas in this association sand and gravel are mined. A few small cabins are adjacent to the streams.

9. *Lawet-Orwet-Gibbon association*

Deep, nearly level, silty and loamy soils on bottom land

This soil association consists of low lying areas along spring-fed drains and streams. This wet bottom land is nearly level except in the shallow meandering stream channels. Some soils have a boggy or mounded surface.

This soil association makes up about 2 percent of the county. It is about 43 percent Lawet soils, 16 percent Orwet soils, 13 percent Gibbon soils, and 28 percent minor soils.

The poorly drained Lawet soils are on bottom land. They have a surface layer of very dark gray and gray silt loam and loam. The subsoil is light brownish gray silty clay loam. At a depth of 32 inches is the gray loam and clay loam underlying material.

The poorly drained Orwet soils are on bottom land, commonly between Lawet soils and the sandy soils of adjacent soil associations 2 and 3. They have a surface layer of dark gray and gray loam. Below this is a transitional layer of gray fine sandy loam. At a depth of 24 inches is the light gray loamy fine sand underlying material.

The somewhat poorly drained Gibbon soils occupy the higher areas on the bottom land. They have a surface layer of dark gray and gray silt loam and light silty clay loam. At a depth of 23 inches is the light brownish gray and light gray silt loam or light silty clay loam underlying material.

Minor in this association are Thurman, Ortello, Elsmere, Ovina, and Ord soils. Thurman and Ortello soils are on the higher well drained knolls and are surrounded by the major soils of this association. Elsmere, Ovina, and Ord soils occupy some of the slightly higher areas.

Farms on this association are mainly in native grass and are used for hay meadow or range. A few areas are cultivated; corn and alfalfa are the main crops. A few livestock are fattened in feedlots.

Wetness is the main limitation on this association. Strong alkalinity is a limitation in a few areas. Flooding is a hazard on some soils. Regulating the use and improving the grass cover are the main concerns on range.

Farms on this association average about 320 acres in size. Most of the owners and operators live outside the association. Wells or dugouts on farms provide sufficient water for livestock. Gravel or improved dirt roads are on some section lines. Many of the cattle and swine sold are delivered to markets outside the county. Cash grain crops are marketed locally. There is a gradual trend toward larger farms.

Descriptions of the Soils

This section describes the soil series and map units in Antelope County. A soil series is described in detail, and then, briefly, each map unit in that series.

Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the map units in that series. Thus, to get full information about any one map unit, it is necessary to read both the description of the map unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. Reaction was determined by the calcium chloride method or by field indicators. The profile described in the series is representative for map units in that series. If the profile of a given map unit is different from the one described for the series, these differences are stated in describing the map unit, or they are differences that are apparent in the name of the map unit.

As mentioned in the section "How This Survey Was Made," not all map units are members of a soil series. Blownout land, for example, does not belong to a soil series but, nevertheless, is listed in alphabetic order along with the soil series.

Preceding the name of each map unit is a symbol. This symbol identifies the map unit on the detailed soil map. Listed at the end of each description of a map unit is the capability unit, range site, and windbreak suitability group in which the map unit has been placed. The page for the description of each capability unit, range site, windbreak suitability group, or other interpretative group can be found by referring to the "Guide to Map Units" at the back of this survey.

The acreage and proportionate extent of each map unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*8*).[1]

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Some soil boundaries may not match adjoining areas. Such differences result from changes in concepts of soil classification that have occurred since publication.

Bazile Series

The Bazile series consists of deep, well drained soils that formed in 20 to 40 inches of silty, loamy, or sandy material deposited over sand. The silty material is mainly wind deposited or material from glacial outwash. These are nearly level to strongly sloping soils, mainly on uplands. A few areas are on stream terraces.

In a representative profile the surface layer is friable, dark grayish brown loam 14 inches thick. The friable subsoil is about 17 inches thick. The upper part is grayish brown light silty clay loam, and the lower part is light brownish gray silt loam. The underlying material is pale brown fine sand in the upper 5 inches and very pale brown sand to a depth of 60 inches.

Bazile soils have moderately slow permeability in the upper part of the profile and rapid permeability in the lower part. The available water capacity is moderate. Organic matter content is moderate or moderately low, and natural fertility is high. These soils release moisture readily to plants.

Bazile soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees, wildlife habitat, and recreation.

Representative profile of Bazile loam, 0 to 2 percent slopes, in a cultivated field, 580 feet south and 375 feet west of the northeast corner of sec. 5, T. 28 N., R. 8 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; hard, friable; strongly acid; abrupt smooth boundary.

A12—7 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; slightly acid; clear smooth boundary.

B2t—14 to 26 inches; grayish brown (10YR 5/2) light silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; slightly acid; clear wavy boundary.

B3ca—26 to 31 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; violent effervescence; mildly alkaline; gradual wavy boundary.

IIC1—31 to 36 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; mildly alkaline; clear wavy boundary.

IIC2—36 to 60 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; single grained; loose; neutral.

The A horizon ranges from 7 to 18 inches in thickness and is medium acid or strongly acid. It is very dark grayish brown to dark grayish brown. It is typically loam, but is silt loam in places. Some areas have a deposit of moderately coarse and coarse material on the surface. The B horizon is grayish brown to brown or light brownish gray. It is typically silt loam and light silty clay loam but ranges to clay loam. It is 13 to 20 inches thick, and in many areas there is an accumulation of lime in the lower part. The upper part of the C horizon is loamy fine sand, fine sand, or sand, and the lower part is fine sand or sand.

Bazile soils are near Paka, Simeon, Thurman, and Valentine soils. They have more sand in the C horizon than Paka soils. They have more clay and silt in the upper part of the profile than Simeon, Thurman, or Valentine soils, and in contrast with those soils, they have a B horizon.

Bc—Bazile loam, 0 to 2 percent slopes. This deep,

[1] Italic numbers in parentheses refer to Literature Cited, p. 126.

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

Soil	Area	Extent
	Acres	*Percent*
Bazile loam, 0 to 2 percent slopes	6,600	1.2
Bazile loam, 2 to 6 percent slopes	1,650	.3
Bazile complex, 0 to 3 percent slopes	2,250	.4
Bazile complex, 3 to 6 percent slopes	3,750	.7
Bazile complex, 6 to 11 percent slopes	473	.1
Blendon fine sandy loam, 0 to 2 percent slopes	2,000	.4
Blendon fine sandy loam, 2 to 6 percent slopes	1,200	.2
Blownout land	328	.1
Boelus fine sand, 0 to 6 percent slopes	2,100	.4
Boelus loamy fine sand, 0 to 3 percent slopes	35,000	6.4
Boelus loamy fine sand, 3 to 6 percent slopes	4,200	.8
Brunswick-Paka complex, 11 to 30 percent slopes	12,800	2.3
Cass fine sandy loam, 0 to 2 percent slopes	283	.1
Cass loam, 0 to 2 percent slopes	760	.1
Cozad silt loam, 0 to 2 percent slopes	3,650	.7
Crofton silt loam, 6 to 15 percent slopes, eroded	2,650	.5
Crofton silt loam, 15 to 30 percent slopes, eroded	1,000	.2
Crofton soils, 30 to 60 percent slopes	690	.1
Crofton-Nora silt loams, 2 to 6 percent slopes, eroded	3,100	.6
Crofton-Nora silt loams, 6 to 11 percent slopes, eroded	30,250	5.5
Crofton-Nora silt loams, 11 to 15 percent slopes, eroded	9,600	1.7
Crofton-Nora silt loams, 15 to 30 percent slopes	12,400	2.3
Doger fine sand, 0 to 6 percent slopes	4,650	.9
Doger loamy fine sand, 0 to 3 percent slopes	9,500	1.7
Doger loamy fine sand, 3 to 6 percent slopes	1,850	.3
Elsmere fine sand, 0 to 2 percent slopes	4,450	.8
Elsmere loamy fine sand, 0 to 2 percent slopes	2,600	.5
Elsmere loamy fine sand, drained, 0 to 3 percent slopes	1,150	.2
Fillmore silt loam, 0 to 1 percent slopes	481	.1
Gibbon silt loam, 0 to 2 percent slopes	2,550	.5
Gibbon silt loam, saline-alkali, 0 to 2 percent slopes	630	.1
Hobbs silt loam, 0 to 2 percent slopes	6,200	1.1
Hobbs silt loam, channeled, 0 to 3 percent slopes	2,650	.5
Hord silt loam, 0 to 2 percent slopes	8,500	1.5
Hord silt loam, 2 to 6 percent slopes	11,700	2.1
Inavale fine sand, 0 to 2 percent slopes	1,450	.3
Inavale and Elsmere soils, 0 to 2 percent slopes	7,700	1.4
Lawet silt loam, 0 to 2 percent slopes	4,900	.9
Lawet soils, wet, 0 to 2 percent slopes	1,700	.3
Longford loam, 1 to 4 percent slopes	800	.2
Longford complex, 1 to 4 percent slopes	1,650	.3
Loretto sandy loam, 0 to 3 percent slopes	9,900	1.8
Loretto sandy loam, 3 to 6 percent slopes	940	.2
Loretto loam, 0 to 2 percent slopes	4,500	.8
Loretto loam, 2 to 6 percent slopes	3,500	.6
Loup fine sandy loam, 0 to 2 percent slopes	1,350	.3
Loup fine sandy loam, drained, 0 to 2 percent slopes	3,550	.7
Meadin sandy loam, 0 to 3 percent slopes	245	([1])
Meadin sandy loam, 3 to 30 percent slopes	2,400	.4
Moody silty clay loam, 0 to 2 percent slopes	2,800	.5
Moody silty clay loam, 2 to 6 percent slopes	16,000	2.9
Nora silt loam, 0 to 2 percent slopes	1,600	.3
Nora silt loam, 2 to 6 percent slopes	21,750	4.0
Nora silt loam, 2 to 6 percent slopes, eroded	6,100	1.1
Nora silt loam, 6 to 11 percent slopes	4,850	.9
Nora silt loam, 11 to 15 percent slopes	1,300	.2
O'Neill sandy loam, 0 to 2 percent slopes	970	.2
O'Neill sandy loam, 2 to 6 percent slopes	2,600	.5
O'Neill loam, 0 to 2 percent slopes	220	([1])
Ord fine sandy loam, 0 to 2 percent slopes	1,150	.2
Ord loam, 0 to 2 percent slopes	1,500	.3
Ortello fine sandy loam, 0 to 2 percent slopes	4,100	.8
Ortello fine sandy loam, 2 to 6 percent slopes	5,800	1.1
Ortello fine sandy loam, 6 to 11 percent slopes	690	.1
Ortello loam, 0 to 2 percent slopes	1,350	.3
Ortello loam, 2 to 6 percent slopes	630	.1
Orwet loam, 0 to 2 percent slopes	2,250	.4
Ovina loamy fine sand, 0 to 2 percent slopes	2,500	.5
Paka loam, 0 to 2 percent slopes	760	.1
Paka loam, 2 to 6 percent slopes	2,700	.5
Paka loam, 6 to 11 percent slopes	430	.1
Paka complex, 0 to 3 percent slopes	5,800	1.1
Paka complex, 3 to 6 percent slopes	3,400	.6
Paka complex, 6 to 11 percent slopes	1,100	.2
Thurman fine sand, 0 to 3 percent slopes	44,750	8.2
Thurman fine sand, 3 to 6 percent slopes	38,500	7.0
Thurman fine sand, 6 to 11 percent slopes	3,550	.7
Thurman loamy fine sand, 0 to 3 percent slopes	34,750	6.3
Thurman loamy fine sand, 3 to 6 percent slopes	21,250	3.9
Thurman-Crofton complex, 11 to 30 percent slopes	2,350	.4
Thurman-Valentine complex, 0 to 6 percent slopes	7,350	1.3
Trent silt loam, 0 to 2 percent slopes	2,150	.4
Valentine fine sand, 0 to 6 percent slopes	22,750	4.2
Valentine fine sand, rolling	30,250	5.5
Valentine-Simeon complex, 0 to 3 percent slopes	790	.2
Valentine-Simeon complex, 3 to 6 percent slopes	2,150	.4
Valentine-Simeon complex, 6 to 11 percent slopes	2,350	.4
Marsh	850	.2
Streams and water areas	1,350	.3
Gravel pits	200	([1])
Total	545,920	100.0

[1] Less than 0.1 percent.

nearly level soil is on the uplands. A few areas are on high stream terraces. Areas are irregular in shape and range from 5 to about 200 acres in size.

This soil has the profile described as representative of the series. Included in mapping were areas where the surface layer is loamy fine sand or fine sandy loam and areas where the sandy underlying material is at a depth of less than 20 inches. Also included were small areas of Thurman soils on the higher ridges, Trent soils in the lower pockets, and Paka soils at about the same elevations as the Bazile soil.

This soil is droughty during periods of low rainfall. Lack of adequate rainfall is the principal limitation in dryfarmed areas. Available water capacity is moderate. Runoff is slow. The organic matter content is moderate.

Most of the acreage is cultivated. Corn, soybeans, and alfalfa are the principal crops. A few areas are irrigated. The rest of the acreage is in native grass or seeded tame grass. Capability units IIs–5 dryland, I–7 irrigated; Silty range site; windbreak suitability group 4.

BcC—Bazile loam, 2 to 6 percent slopes. This gently sloping soil is on divides of the uplands. Areas are irregular in shape and range from 5 to about 300 acres in size.

Included with this soil in mapping were areas where the upper part of the surface layer or plow layer is loamy fine sand or a fine sandy loam. Also included were small areas of Thurman and Valentine soils on the higher ridges and areas of Paka soils at about the same general elevations as the Bazile soil.

Water erosion is the principal hazard. Lack of adequate rainfall limits crop production in some years. The moderate available water capacity is a limitation, especially in dryfarmed areas. The organic matter content is moderate. Runoff is medium.

Much of the acreage is cultivated. Corn, soybeans, and alfalfa are the principal crops. A few areas are irrigated. The rest of the acreage is in native grass or seeded tame grass. Capability units IIIe–1 dryland, IIIe–7 irrigated; Silty range site; windbreak suitability group 4.

BdB—Bazile complex, 0 to 3 percent slopes. This nearly level or very gently sloping map unit is mainly on uplands. In a few areas it is on high stream terraces. About 50 percent of each mapped area has a surface layer of fine sandy loam, loamy fine sand, or fine sand 8 to 18 inches thick. About 30 percent of each area has a surface layer of loamy fine sand or fine sand 18 to 32 inches thick. Areas are irregular in shape and range from 5 to about 300 acres in size.

The soils in this map unit have a profile similar to the one described as representative of the series, but have an overblow of sandy or loamy material on the surface.

Included in mapping were areas of Thurman soils on the higher ridges, areas of Paka and Loretto soils at the same general elevations, and areas of Bazile loam at the lower elevations. These included soils make up about 20 percent of this map unit.

Soil blowing is the principal hazard. The soils are droughty during periods of low rainfall. Available water capacity is moderate. Organic matter content is moderately low. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the principal irrigated crops. The rest of the acreage is in native grass or seeded tame grass. Capability units IIIe–6 dryland, IIe–10 irrigated; Sandy range site; windbreak suitability group 3.

BdC—Bazile complex, 3 to 6 percent slopes. This gently sloping map unit is on ridges and side slopes of the uplands. About 45 percent of each mapped area has a surface layer of fine sandy loam, loamy fine sand, or fine sand 8 to 18 inches thick. About 35 percent of each area has a surface layer of loamy fine sand or fine sand 18 to 32 inches thick. Areas are irregular in shape and range from 5 to about 100 acres in size.

The soils in this map unit have a profile similar to the one described as representative of the Bazile series, but have an overblow of sandy or loamy material on the surface.

Included in mapping were areas of Thurman soils on the higher ridges, areas of Paka and Loretto soils at about the same general elevations, and Bazile loam in the lower, concave areas. These included soils make up about 20 percent of this map unit.

Soil blowing is a severe hazard, and water erosion a moderate hazard unless the surface is protected. Inadequate rainfall is a limitation to cultivated crops in dryfarmed areas. Organic matter content is moderately low. Runoff is slow. Most of the rainfall is easily absorbed.

Much of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main crops. Corn, soybeans, and alfalfa are the principal irrigated crops. The rest of the acreage is in native grass or seeded tame grass. Capability units IIIe–6 dryland, IIIe–10 irrigated; Sandy range site; windbreak suitability group 3.

BdD—Bazile complex, 6 to 11 percent slopes. This strongly sloping map unit is on uplands. About 40 percent of each mapped area has a surface layer of fine sandy loam or loamy fine sand 8 to 18 inches thick. In about 35 percent of each area an 18 to 32 inch deposit of loamy fine sand or fine sand covers the surface. Areas are irregular or roughly oblong in shape and range from 5 to about 40 acres in size.

These soils have a profile similar to the one described as representative of the Bazile series, but have sandy or loamy material at the surface.

Included in mapping were areas where the surface layer is loam. Also included were areas of Thurman soils and Paka soils on the upper side slopes. These included soils make up about 25 percent of this map unit.

Soil blowing and water erosion are severe hazards unless the surface is protected. Lack of adequate rainfall, especially in summer, is also a limitation. Organic matter content is moderately low. Runoff is medium. Much of the rainfall is absorbed by the sandy surface layer.

Much of the acreage is in native grass. The rest is cultivated. Corn, rye, and alfalfa are the main crops. Capability units IVe–6 dryland, IVe–10 irrigated; Sandy range site; windbreak suitability group 3.

Blendon Series

The Blendon series consists of deep well drained soils that formed in a deposit of loamy material over sandy material. These are nearly level to gently sloping soils on uplands and foot slopes.

In a representative profile the very friable surface layer is very dark grayish brown and very dark gray fine sandy loam 12 inches thick. The subsoil is very dark gray and grayish brown, very friable fine sandy loam about 17 inches thick. The underlying material is pale brown fine sand to a depth of 60 inches.

Blendon soils have moderately rapid permeability and moderate water capacity. The organic matter content is moderate, and natural fertility is medium. These soils release moisture readily to plants.

Blendon soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees, wildlife habitat, and recreation.

Representative profile of Blendon fine sandy loam, 0 to 2 percent slopes, in a cultivated field, 1,060 feet west and 530 feet south of the northeast corner of sec. 12, T. 28 N., R. 5 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; medium acid; abrupt smooth boundary.

A12—7 to 12 inches; very dark gray (10YR 3/1) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; medium acid; clear smooth boundary.

B1—12 to 24 inches; very dark gray (10YR 3/1) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium and fine subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.

B2—24 to 29 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C—29 to 60 inches; pale brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose; neutral.

The A horizon ranges from 10 to 16 inches in thickness. It is slightly acid or medium acid. The B horizon is very dark gray to dark grayish brown or grayish brown fine sandy loam or sandy loam. It is 14 to 24 inches thick. The C horizon typically is brown or pale brown fine sand, but ranges to loamy fine sand. In some areas these soils have a loamy layer at a depth of 42 to 60 inches.

Blendon soils are near Doger, Loretto, Ortello, and Thurman soils. They have more silt and less sand between depths of 10 and 40 inches than Doger and Thurman soils. They have a thicker, darker colored B horizon than Ortello soils. Also they have more sand in the B and C horizons than Loretto soils.

Be—Blendon fine sandy loam, 0 to 2 percent slopes. This deep, nearly level soil is on uplands and foot slopes. Areas are irregular in shape and range from 5 to 50 acres in size.

This soil has the profile described as representative of the series. Included in mapping were small areas where the upper part of the surface layer is loam or loamy fine sand and small areas that have a subsoil of loamy fine sand. Also included were small areas of Doger and Thurman soils at the slightly higher elevations and areas of Ortello soils at about the same elevations.

Soil blowing is a moderate hazard unless the surface is protected. Lack of adequate rainfall is also a limitation in dryfarmed areas. The moderate available water capacity makes the soil droughty in seasons of low rainfall. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, rye, and alfalfa are the most commonly grown crops. A few cultivated areas are irrigated. The rest of the acreage is in native grass or seeded tame grass. Capability units IIe–3 dryland, IIe–8 irrigated; Sandy range site; windbreak suitability group 3.

BeC—Blendon fine sandy loam, 2 to 6 percent slopes. This deep, gently sloping soil is on the uplands and on foot slopes. Areas range from 5 to about 30 acres in size.

Included with this soil in mapping were small areas where the upper part of the surface layer is loam or loamy fine sand and small areas that have a subsoil of loamy fine sand. Also included were small areas of Doger and Thurman soils on the upper side slopes and areas of Ortello soils at about the same elevations as the Blendon soil.

Soil blowing and water erosion are the principal hazards unless the surface is protected. The moderate available water capacity makes the soil droughty in dryfarmed areas. Lack of adequate rainfall is a limitation. Runoff is medium after heavy rains but is slow if rainfall is slow or moderate.

Most of the acreage is cultivated. Corn, soybeans, rye, and alfalfa are the principal crops. A few areas are irrigated. The rest of the acreage is in native grass or seeded tame grass. Capability units IIIe–3 dryland, IIIe–8 irrigated; Sandy range site; windbreak suitability group 3.

Blownout Land

Bg—Blownout land, formerly Valentine fine sand, is in the sandy uplands. It generally has concave slopes and is bowl or saucer shaped. The wind has actively shifted the sand to form a depression, and in adjacent areas the vegetation has been covered by the sand blown from the depressions. Most areas are still actively eroding. The soil material is very pale brown fine sand. Areas range from 5 to 15 acres in size. Slopes are 6 to 30 percent.

Blownout land is excessively drained. Permeability is rapid, and the available water capacity is low. Runoff is slow. Natural fertility is low.

Vegetation is sparse. Soil blowing is a very severe hazard. Establishing an adequate plant cover is the main concern in management.

Blownout land is part of the rangeland of the sandhills. Vegetation can be reestablished by fencing the range and seeding suitable grasses. Capability unit

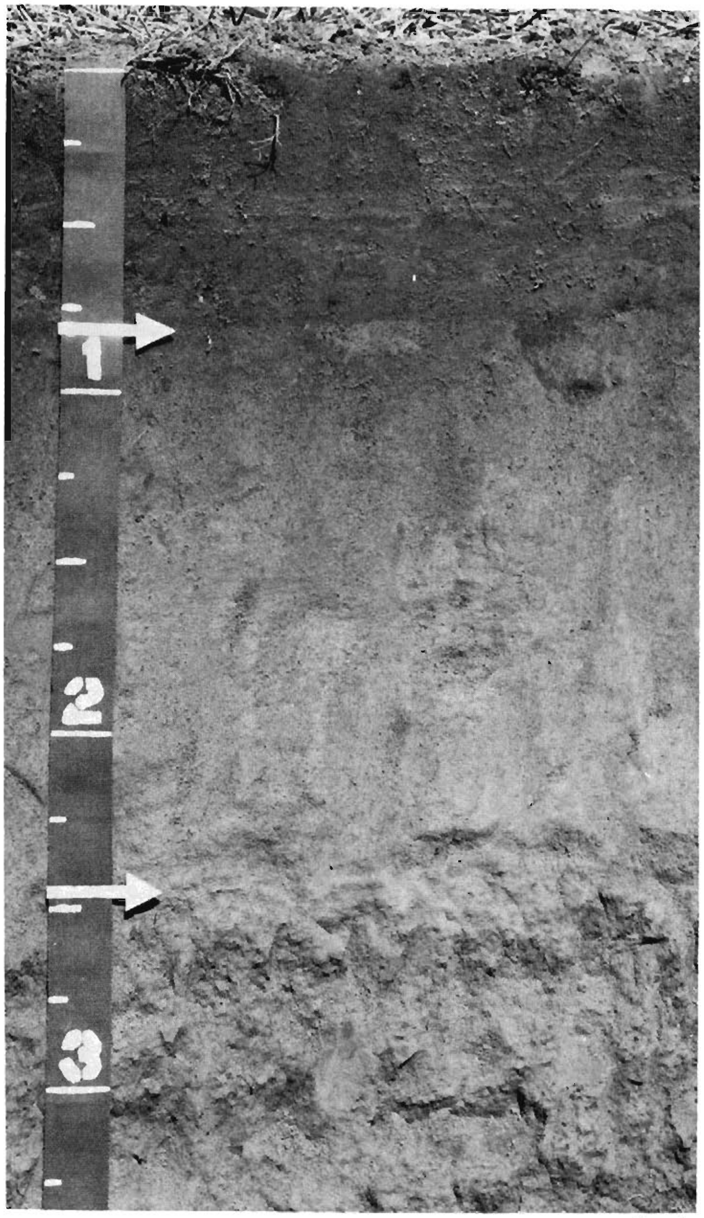

Figure 5.—**Profile of Boelus soil. The upper arrow marks the lower boundary of the darker, upper surface layer, and the lower arrow the upper boundary of the buried subsoil.**

VIIe-5 dryland; Sands range site; windbreak suitability group 10.

Boelus Series

The Boelus series consists of deep, well drained soils that formed in wind-deposited sandy material that overlies silty material. These are nearly level to gently sloping soils on uplands and stream terraces.

In a representative profile (fig. 5), the surface layer is very friable loamy fine sand 29 inches thick. The upper part is a gray and the lower part is a grayish brown. Below this is the subsoil of friable silt loam. The upper part is pale brown and the lower part is very pale brown. The underlying material is very pale brown silt loam to a depth of 60 inches.

Boelus soils have rapid permeability in the surface layer and moderate permeability in the subsoil and underlying material. The available water capacity is high, and natural fertility is medium. Organic matter content is moderately low. These soils release moisture readily to plants.

Boelus soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees, wildlife habitat, and recreation.

Representative profile of Boelus loamy fine sand, 0 to 3 percent slopes, in a cultivated field, 1,160 feet north and 790 feet east of the southwest corner of sec. 16, T. 24 N., R. 7 W.

Ap—0 to 10 inches; gray (10YR 5/1) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; medium acid; abrupt smooth boundary.

A12—10 to 29 inches; grayish brown (10YR 5/2) loamy fine sand, dark brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak very fine granular; soft, very friable; slightly acid; clear wavy boundary.

IIB2—29 to 42 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; slightly acid; gradual wavy boundary.

IIB3—42 to 48 inches; very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; slightly acid; clear wavy boundary.

IIC—48 to 60 inches; very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; strong effervescence; mildly alkaline.

The A horizon is 12 to 36 inches thick and is loamy fine sand or fine sand. The lower part of the A horizon is lower in organic matter than the upper part. The IIB horizon ranges from 14 to 32 inches in thickness. It typically is silt loam, but ranges to light silty clay loam. Depth to lime is 45 to 70 inches.

Boelus soils are near Doger, Loretto, Nora, and Thurman soils. They have more clay and silt in the C horizon than Doger and Thurman soils, and they have a silty B horizon that those soils lack. They have more sand in the A horizon than Loretto and Nora soils.

BoC—Boelus fine sand, 0 to 6 percent slopes. This deep nearly level to undulating soil is mainly on the uplands, although a few areas are on stream terraces. Areas are irregular in shape and range from 5 to about 80 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a surface layer of fine sand. In a few areas the upper part of the surface layer is slightly lighter colored than the one described in the representative profile.

Included with this soil in mapping were a few areas of Nora soils on the upper windward side slopes, areas of Thurman soils on the higher ridges, and areas of Boelus loamy fine sand in the lower concave areas.

Soil blowing is the principal hazard. Lack of adequate rainfall limits crop production in dryfarmed areas. Runoff is slow. Most of the rainfall is absorbed as rapidly as it falls.

Most of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the principal irrigated crops. The rest of the acreage is in native grass, seeded tame grass, and windbreaks. Capability units IVe-6 dryland, IVe-10 irrigated; Sandy range site; windbreak suitability group 3.

BpB—Boelus loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping soil is mainly on upland plains, but a few areas are on stream terraces. Areas are roughly irregular in shape and range from 5 to about 250 acres in size.

This soil has the profile described as representative of the series. In some areas the lower part of the surface layer and the upper part of the subsoil are darker colored than those described in the representative profile, and in some areas the lower part of the surface layer is fine sandy loam or fine sand.

Included with this soil in mapping were small areas where the plow layer is fine sand. Also included were small areas of Loretto and Nora soils on the higher windward side slopes, areas of Paka soils at the lower elevations and on side slopes, and areas of Thurman soils on higher ridges.

In cultivated areas soil blowing is a severe hazard. Lack of adequate rainfall is also a limitation in dryfarmed areas. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are principal dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. The rest of the acreage is in native grass, seeded tame grass, and windbreaks. Capability units IIIe-6 dryland, IIe-10 irrigated; Sandy range site; windbreak suitability group 3.

BpC—Boelus loamy fine sand, 3 to 6 percent slopes. This deep, gently sloping soil is on ridges and side slopes of the uplands. Areas are roughly irregular in shape and range from 5 to about 100 acres in size.

In some small areas the upper part of the surface layer is slightly lighter colored than the one described in the representative profile. In some areas the lower part of the surface layer and upper part of the subsoil are darker colored than is typical, and in some areas the lower part of the surface layer is a fine sandy loam or fine sand.

Included with this soil in mapping were areas where the upper part of the surface layer is fine sand. Also included were small areas of Doger soils on the lower side slopes, areas of Loretto and Nora soils on the windward hillsides, and areas of Thurman soils on the ridges.

Soil blowing is a severe hazard. Lack of adequate rainfall limits production in dryfarmed areas. Runoff is slow. The sandy surface absorbs most of the rainfall.

Much of the acreage is cultivated. The rest is in native grass, seeded tame grass, and windbreaks. Corn, soybeans, rye, vetch, and alfalfa are the principal dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. Capability unit IIIe-6 dryland, IIIe-10 irrigated; Sandy range site; windbreak suitability group 3.

Brunswick Series

The Brunswick series consists of moderately deep, well drained soils that formed in weakly cemented sandstone of the Ogallala Formation and in material reworked from Tertiary age materials. These are moderately steep to steep soils on uplands.

In a representative profile the surface layer is very friable, dark gray fine sandy loam 4 inches thick (fig. 6). The fine sandy loam subsoil is very friable and about 13 inches thick. The upper part is grayish brown, and the lower part is pale brown. The upper part of the underlying material is light brownish gray loamy fine sand. Below this, at a depth of 23 inches, is light gray weakly cemented soft sandstone.

Figure 6.—**Profile of Brunswick fine sandy loam. The arrow marks the lower boundary of the surface layer.**

Brunswick soils have moderately rapid permeability and moderate available water capacity. Organic matter content is low, and natural fertility is medium. These soils release moisture readily to plants.

Brunswick soils are suited to grass and trees. They are too steep and droughty for cultivated crops. They provide wildlife habitat and recreation areas.

The Brunswick soils in Antelope County are mapped only with Paka soils.

Representative profile of Brunswick fine sandy loam, in an area of Brunswick-Paka complex, 11 to 30 percent slopes, in native grass, 725 feet south and 200 feet west of the northeast corner of sec. 7, T. 28 N., R. 7 W.

A1—0 to 4 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak very fine granular structure; slightly hard, very friable; strongly acid; clear smooth boundary.

B2—4 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; strongly acid; clear smooth boundary.

B3—11 to 17 inches; pale brown (10YR 6/3) fine sandy loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; medium acid; clear smooth boundary.

C1—17 to 23 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; single grained; soft, very friable; slightly acid; gradual smooth boundary.

C2—23 to 60 inches; light gray (5Y 7/2) weakly cemented soft sandstone which crushes to loamy fine sand, light olive gray (5Y 6/2) moist; slightly hard, friable; neutral.

The A horizon is 2 to 7 inches thick and ranges from dark gray to dark grayish brown or grayish brown. It is strongly acid to slightly acid light loam, fine sandy loam, or heavy loamy fine sand.

The B horizon is 6 to 20 inches thick. It is typically fine sandy loam, but ranges to very fine sandy loam and loamy fine sand. It averages between 8 and 18 percent clay. It ranges from slightly acid to strongly acid.

The C1 horizon is typically loamy fine sand, but ranges to very fine sandy loam, fine sandy loam, and fine sand. In some places below a depth of 42 inches, there are layers of sandy clay loam. Lime is in the C horizon in some places.

Brunswick soils are near Bazile, Paka, Simeon, and Valentine soils. They have more sand in the B horizon than Bazile and Paka soils. They are not so deep as Simeon or Valentine soils, and in contrast with those soils, they have a B horizon. Also they have less sand and generally have more silt in the upper part of the profile than Simeon and Valentine soils.

BxF—Brunswick-Paka complex, 11 to 30 percent slopes. This map unit borders deeply entrenched, intermittent drainageways of the uplands. It is about 55 percent Brunswick fine sandy loam, 25 percent Paka loam, and 20 percent small areas of Bazile, Thurman, Simeon, and Valentine soils. The proportions vary from one area to another. Areas are irregular in shape and range from 5 to about 4,000 acres in size.

The Brunswick soil has the profile described as representative of the series. In some small areas the original surface layer has been removed by erosion. In other areas the surface layer is thicker than is typical.

Included in mapping were small areas of Bazile soils on the upper part of side slopes; areas of Thurman, Valentine, and Simeon soils on high, narrow ridges; and small gravelly areas of bedrock outcrop. Included within areas of the Paka soil were many places where a 12- to 24-inch deposit of loamy fine sand covers the surface.

Water erosion is a very severe hazard. The soils are highly erosible if cultivated or overgrazed. Inadequate rainfall limits plant growth in some years. Runoff is rapid.

Most of the acreage is in native grass and trees and is used for range or native hay. Part of the acreage provides recreation areas. The rest is cultivated. Alfalfa is the main crop. Capability unit VIe–3 dryland; Brunswick soil in Sandy range site, Paka soil in Silty range site; windbreak suitability group 10.

Cass Series

The Cass series consists of deep, well drained soils that formed in a deposit of loamy alluvium and the underlying sandy alluvium. These are nearly level soils on bottom land. In most years, the seasonal water table ranges from a high of 5 to 7 feet in spring to a low of 10 feet in summer.

In a representative profile the surface layer is friable, dark gray loam 11 inches thick. Below this is a transitional layer of very friable, gray fine sandy loam about 3 inches thick. The underlying material is grayish brown and brown fine sandy loam and loamy sand in the upper part and very pale brown fine sand to a depth of 60 inches.

Cass soils have moderately rapid permeability and moderate available water capacity. Organic matter content is moderate, and natural fertility is medium. These soils release moisture readily to plants.

Cass soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees, wildlife habitat, and recreation.

Representative profile of Cass loam, 0 to 2 percent slopes, in a cultivated field, 2,100 feet south and 200 feet west of the northeast corner of sec. 26, T. 26 N., R. 8 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak very fine granular structure; hard, friable; neutral; abrupt smooth boundary.

A12—6 to 11 inches; dark gray (10YR 4/1) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; slightly acid; clear smooth boundary.

AC—11 to 14 inches; gray (10YR 5/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; hard, very friable; neutral; clear smooth boundary.

C1—14 to 27 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

C2—27 to 31 inches; brown (10YR 5/3) loamy sand, dark grayish brown (10YR 4/2) moist; single grained; soft, very friable; neutral; gradual smooth boundary.

C3—31 to 41 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; neutral; clear smooth boundary.

C4—41 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; mildly alkaline.

The A horizon is 10 to 18 inches thick and is loam or fine sandy loam. It is dark gray or dark grayish brown. It is slightly acid or neutral. The AC horizon ranges from 3 to 8 inches in thickness. It is slightly acid or neutral. In some areas these soils have a thin loamy layer below a depth of 42 inches.

Cass soils are near Cozad, Hobbs, and Ord soils. They have more sand in the C horizon than Cozad and Hobbs soils. They are better drained and generally have less sand in the upper part of the C horizon than Ord soils.

Cb—Cass fine sandy loam, 0 to 2 percent slopes. This deep, nearly level soil is on bottom land along drainageways and streams. Areas are generally narrow and oblong in shape and range from 5 to about 30 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a surface layer of fine sandy loam. Included in mapping were areas where the plow layer is loamy fine sand. Also included were small areas of Hobbs soils at the slightly higher elevations, areas of Ord soils at the lower elevations, and areas of Cass loam at about the same elevations.

This soil is droughty in summer because the available water capacity is moderate, and this limits production. There is a moderate hazard of soil blowing unless fields are protected. Rare flooding during periods of heavy rainfall is a moderate hazard. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, and alfalfa are the principal dryland and irrigated crops. Most of the rest of the acreage is in native grass. Capability units IIs-6 dryland, IIs-8 irrigated; Sandy Lowland range site; windbreak suitability group 3.

Cc—Cass loam, 0 to 2 percent slopes. This deep, nearly level soil is on bottom land along drainageways and streams. Areas are generally oblong in shape and range from 5 to about 60 acres in size.

This soil has the profile described as representative of the series. In some small areas the surface layer is silt loam, and some areas have a thicker surface layer than the one described in the representative profile.

Included with this soil in mapping were areas that have a surface layer of fine sandy loam, areas of Cozad and Hobbs soils at the slightly higher elevations, and areas of Ord soils at the low elevations.

The main limitation is the moderate available water capacity. This causes the soil to be droughty in summer in dryfarmed areas. Rare flooding of short duration is a slight hazard during periods of heavy rainfall. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the principal dryland and irrigated crops. The rest of the acreage is mainly in native grass. Capability units I-1 dryland, I-8 irrigated; Sandy Lowland range site; windbreak suitability group 1.

Cozad Series

The Cozad series consists of deep, well drained soils that formed in silty alluvium, loess, or a mixture of these materials. These are nearly level soils on stream terraces.

In a representative profile the surface layer is a friable, dark gray silt loam 14 inches thick. The subsoil is friable, grayish brown silt loam about 6 inches thick. The silt loam underlying material is grayish brown in the upper part and light brownish gray in the lower part.

Cozad soils have moderate permeability and high available water capacity. Organic matter content is moderate, and natural fertility is high. These soils release moisture readily to plants.

Cozad soils are well suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees, wildlife habitat, and recreation.

Representative profile of Cozad silt loam, 0 to 2 percent slopes, in a cultivated field, 530 feet west and 630 feet south of the northeast corner of sec. 28, T. 25 N., R. 6 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak medium granular structure; hard, friable; medium acid; abrupt smooth boundary.

A12—6 to 14 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; medium acid; clear smooth boundary.

B2—14 to 20 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; hard, friable; slightly acid; clear smooth boundary.

C1—20 to 35 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; hard, friable; neutral; clear wavy boundary.

C2—35 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; hard, very friable; violent effervescence; moderately alkaline.

The A horizon is 10 to 16 inches thick and is dark gray to dark grayish brown or gray. The B horizon is 6 to 10 inches thick and is typically silt loam, but in many areas it is loam. It is grayish brown or brown and is slightly acid or neutral. Depth to lime ranges from 26 to 50 inches.

Cozad soils occur in the landscape near Hobbs, Hord, and Ortello soils. They have a thinner and lighter colored B horizon than Hord soils. They have more silt and clay in the B and C horizons than Ortello soils. They are not so stratified as Hobbs soils, and they have a B horizon that Hobbs soils lack.

Co—Cozad silt loam, 0 to 2 percent slopes. This deep, nearly level, silty soil is on stream terraces. Areas range from 5 to about 250 acres in size.

In some areas this soil has a subsoil of light silty clay loam and in some areas sandy material is below a depth of 40 inches.

Included with this soil in mapping were areas of sandy soils and alkali areas. Also included were small areas of Hobbs soils at the lowest elevations, areas of Ortello soils at slightly higher elevations, and areas of Hord soils at about the same elevations as the Cozad soil.

This is a good soil for farming. The principal limitation is inadequate rainfall in dryfarmed areas. In spring and early in summer this soil receives beneficial moisture as runoff from nearby uplands. Rare flooding of short duration follows periods of heavy rainfall. Runoff is slow.

Nearly all the acreage is cultivated. Corn, soybeans, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is mainly in native grass. Capability units I–1 dryland, I–6, irrigated. Silty Lowland range site; windbreak suitability group 1.

Crofton Series

The Crofton series consists of deep, well drained soils that formed in loess. These soils are gently sloping to very steep and are on uplands. They are weakly developed.

In a representative profile the surface layer is friable, dark grayish brown silt loam 5 inches thick. Below this is a transitional layer of friable, grayish brown silt loam about 4 inches thick. The underlying material is pale brown silt loam to a depth of 60 inches.

Crofton soils have moderate permeability and high available water capacity. Organic matter content is moderately low, and natural fertility is low. These soils release moisture readily to plants.

Where slope is less than 15 percent, Crofton soils are suited to cultivated crops and to windbreaks. These soils are suited to both dryland and irrigated crops. All Crofton soils are suited to grass, wildlife habitat, and recreation.

Representative profile of Crofton silt loam, 6 to 15 percent slopes, eroded, in seeded grass, 150 feet south and 2,490 feet east of the northwest corner of sec. 25, T. 25 N., R. 5 W.

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

AC—5 to 9 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C—9 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, friable; violent effervescence; moderately alkaline.

The A horizon ranges from 3 to 6 inches in thickness. It is dark grayish brown or grayish brown and is mildly alkaline or moderately alkaline. The AC horizon is 3 to 8 inches thick and is grayish brown or brown. Lime is at the surface or within a depth of 8 inches.

Crofton soils are near Hord, Moody, Nora, and Thurman soils. They have a thinner A horizon than Hord, Moody, and Nora soils and lack the B horizon characteristic of those soils. They have less sand, more silt, and more clay in the profile than Thurman soils.

CrE2—Crofton silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping to moderately steep silty soil is on ridges and hillsides of the loess uplands. Areas are roughly oblong in shape and range from 5 to about 200 acres in size.

This soil has the profile described as representative of the series. Many areas are severely eroded, and in these areas the underlying material is at the surface.

Included with this soil in mapping were small areas of Hord soils at the base of hillsides, Nora soils on the lower part of side slopes, and Thurman soils on ridges.

Water erosion is a very severe hazard. Lack of adequate rainfall limits production in dryfarmed areas. Low fertility is also a limitation. Runoff is medium to rapid, depending on the amount and kind of vegetation and the slope.

Most of the acreage is cultivated or has been cultivated in the past. Corn, grain sorghum, soybeans, small grain, and alfalfa are the main crops. Some areas have been seeded to tame or native grass. The rest of the acreage is in native grass. Capability unit IVe–9 dryland; Limy Upland range site; windbreak suitability group 5.

CrF2—Crofton silt loam, 15 to 30 percent slopes, eroded. This deep, steep silty soil is on the side slopes of intermittent drainageways in the loess uplands. Areas are long and narrow in shape and range from 5 to about 40 acres in size.

In many areas of this soil the original surface layer and the transitional layer have been removed through erosion, leaving the underlying material at the surface. Included in mapping were small areas of Hobbs soils in the bottom of narrow drainageways and Nora soils on the lower parts of the side slopes.

Water erosion is a very severe hazard unless fields are protected. Runoff is rapid.

Much of the acreage is cultivated or has been cultivated. It is not suited to the commonly grown tilled crops because the hazard of erosion is too severe. Many areas have been seeded to tame or native grass. The rest of the acreage is in native grass. Capability unit VIe–9 dryland; Limy Upland range site; windbreak suitability group 10.

CsG—Crofton soils, 30 to 60 percent slopes. These very steep soils are on side slopes of entrenched drainageways and canyons of the loess uplands. Slopes broken with catsteps are common. Areas are generally oblong in shape and range from 5 to about 100 acres in size.

Soils of this unit have a profile similar to the one described as representative of the series, but the combined surface layer and transitional layer is thicker near the base of the slope and thinner on the upper side slope.

Included with this unit in mapping were small areas of the sandy Valentine soils and the silty Nora soils. The Valentine soils are on the upper part of the side slopes, and the Nora soils are on the lower part of the side slopes. Also included were areas of loam or fine sandy loam.

Water erosion is a very severe hazard. Gullies are common. Runoff is very rapid.

All the acreage is in native grass and trees. It is too steep for cultivated crops. The areas are used for livestock, and they provide habitat for wildlife. A few areas are used for recreation. Capability unit VIIe–7 dryland; Thin Loess range site; windbreak suitability group 10.

CuC2—Crofton-Nora silt loams, 2 to 6 percent slopes, eroded. This map unit is on ridgetops and hillsides in the loess uplands. It is about 50 percent Crofton silt loam, 40 percent Nora silt loam, and 10 percent Moody soils. The proportions vary from one area to another. Areas are irregular in shape and range from 5 to about 300 acres in size.

The Crofton and Nora soils have profiles similar to the ones described as representative of their respective series, but the surface layer of each is slightly thinner and lighter colored.

Included in mapping were many areas that are severely eroded. In these areas most of the original, dark surface layer has been removed through erosion and the surface layer is pale brown. Also included were small areas of Moody silty clay loam, 2 to 6 percent slopes, on the lower parts of the hillsides.

Water erosion is a severe hazard unless fields are protected. Small rills form during heavy rains. Low fertility, mainly on the Crofton soil, is a limitation. Lack of adequate rainfall limits production during some seasons. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, small grain, and alfalfa are the principal crops. A small acreage is irrigated. Some cultivated areas have been seeded to tame or native grass. A few acres are in native grass. Capability units IIIe–9 dryland, IIIe–6 irrigated; Crofton soil in Limy Upland range site, Nora soil in Silty range site; windbreak suitability group 5.

CuD2—Crofton-Nora silt loams, 6 to 11 percent slopes, eroded. This map unit is on ridges and hillsides in the loess uplands. It is about 55 percent Crofton silt loam, 35 percent Nora silt loam, and 10 percent Hord soils. The proportions vary from one area to another. Areas are irregular in shape and range from 5 to about 1,200 acres in size.

The Crofton and Nora soils have profiles similar to the ones described as representative of their respective series, but the surface layer has been removed through erosion, and the lighter colored underlying material is exposed at the surface. Included in mapping were small areas of Hord silt loam, 2 to 6 percent slopes, on the lower parts of the hillsides.

Water erosion is a very severe hazard. Small rills and gullies are common in cultivated fields during heavy rains. Low fertility of the Crofton soils and of the severely eroded soil areas limits production. Conserving moisture is an important concern in management. Runoff is medium.

Most of the acreage is cultivated. Corn, grain sorghum, soybeans, small grain, and alfalfa are the principal crops. A few areas are irrigated. The rest of the acreage is in native grass. Some cultivated areas have been seeded to tame or native grass. Capability units IVe–9 dryland, IVe–6 irrigated; Crofton soil in Limy Upland range site, Nora soil in Silty range site; windbreak suitability group 5.

CuE2—Crofton-Nora silt loams, 11 to 15 percent slopes, eroded. This map unit is on ridges and side slopes adjacent to intermittent drainageways of the loess uplands. It is about 60 percent Crofton silt loam, 30 percent Nora silt loam, and 10 percent Hord soil. The proportions vary from one area to another.

The Crofton soil is on the ridgetops and upper side slopes, and the Nora soil is on the lower side slopes. Areas are irregular and roughly oblong in shape and range from 5 to about 200 acres in size.

The Crofton and Nora soils have profiles similar to the ones described as representative of their respective series, but the surface layer is thinner and lighter colored. In many areas the original, dark surface layer has been removed through erosion and the light colored underlying material is at the surface. Included in mapping were small areas of Hord silt loam, 2 to 6 percent slopes, at the lowest elevations.

Water erosion is a very severe hazard unless the surface is protected. Small gullies and rills are common in cultivated fields after heavy rains. Low fertility, particularly low nitrogen content, is a limitation. Inadequate rainfall, mainly in summer, is a hazard to crops. Conserving runoff water is an important concern in management. Runoff is rapid.

Most of the acreage is cultivated or has been cultivated in the past. Corn, grain sorghum, small grain, and alfalfa are the principal dryland crops. A small acreage is in native grass. A few areas that were formerly cultivated have been seeded to tame grass or native grass. Capability unit IVe–9 dryland; Crofton soil in Limy Upland range site, Nora soil in Silty range site; windbreak suitability group 5.

CuF—Crofton-Nora silt loams, 15 to 30 percent slopes. This map unit is on side slopes adjacent to intermittent drainageways of the loess uplands. It is about 65 percent Crofton silt loam, 25 percent Nora silt loam, and 10 percent Hobbs soil. The proportions vary from one area to another. Areas are generally narrow and long and range from 5 to about 500 acres in size.

The Crofton and Nora soils have profiles similar to the ones described as representative of their respective series, but the surface layer is thinner, and the subsoil of the Nora soil is thinner. A few severely eroded areas of Nora soil have the lighter colored subsoil exposed at the surface. Included in mapping were areas of Hobbs soils in narrow drainageways.

Water erosion is a very severe hazard. If a good cover of grass is not maintained, small gullies and rills commonly form. Runoff is rapid.

Most of the acreage is in native grass and is used for range. A few areas are cultivated, and some have been seeded to grass. The hazard of erosion is too severe for growing the common cultivated crops. Capability unit VIe–9 dryland; Crofton soil in Limy Upland range site, Nora soil in Silty range site; windbreak suitability group 10.

Doger Series

The Doger series consists of deep, well drained soils that formed mostly in wind-deposited sandy material. In a few areas the soils formed in material deposited by water. These are nearly level to gently sloping soils on uplands, foot slopes, and stream terraces.

In a representative profile the surface layer is very friable, dark grayish brown and very dark grayish brown loamy fine sand 25 inches thick. Below this is a transitional layer of very dark grayish brown very friable loamy fine sand about 6 inches thick. The underlying material is brown and pale brown fine sand to a depth of 60 inches.

Doger soils have rapid permeability and low available water capacity. Organic matter content is moderately low, and natural fertility is medium. These soils release moisture readily to plants.

Doger soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees, wildlife habitat, and recreation.

Representative profile of Doger loamy fine sand, 0 to 3 percent slopes, in a cultivated field, 900 feet south and 2,100 feet west of the northeast corner of sec. 6, T. 27 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; soft, very friable; strongly acid; abrupt smooth boundary.

A12—8 to 25 inches; very dark grayish brown (10YR 3/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak very fine granular; soft, very friable; medium acid; clear smooth boundary.

Ac—25 to 31 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; medium acid; clear smooth boundary.

C1—31 to 40 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grained; soft, loose; medium acid; clear smooth boundary.

C2—40 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; medium acid.

The A horizon is 15 to 30 inches thick. It ranges from very dark gray to very dark grayish brown or dark grayish brown loamy fine sand or fine sand. The AC horizon is a loamy fine sand or fine sand 6 to 20 inches thick. It is lower in content of organic matter than the A horizon. The C horizon is a loamy fine sand or fine sand.

Doger soils are near Blendon, Boelus, Thurman, and Valentine soils. They have more sand between depths of 10 and 40 inches than Blendon soils. They have more sand in the C horizon than Boelus soils, and they have a thicker and darker A horizon than Valentine soils. They have a thicker A horizon than Thurman soils.

DfC—Doger fine sand, 0 to 6 percent slopes. This deep, nearly level to gently sloping sandy soil is mainly on concave foot slopes of the uplands and on a few stream terraces. Areas are irregular in shape and range from 5 to about 200 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer and transitional layer are fine sand. In some areas the surface layer is lighter colored and in some areas it is thicker than the one described in the representative profile.

Included with this soil in mapping were small areas of Thurman soils on the higher convex ridges, Nora soils on the upper side slopes, and Boelus soils and Doger loamy fine sand in the lower concave pockets.

Soil blowing is a very severe hazard unless the fields are protected. This soil is droughty because of its low available water capacity. Maintenance of fertility is a concern. Runoff is slow.

Most of the acreage is in native grass and is used for range or native hay. Part of the acreage is in windbreaks. The rest is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the principal dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. Capability units IVe–5 dryland, IVe–12 irrigated; Sands range site; windbreak suitability group 3.

DhB—Doger loamy fine sand, 0 to 3 percent slopes. This deep, nearly level or very gently sloping sandy soil is on foot slopes and concave areas of the uplands and on stream terraces. Areas are irregular in shape and range from 5 to about 100 acres in size.

This soil has the profile described as representative of the series. In few areas the surface layer is thicker than is typical.

Included with this soil in mapping were areas where the surface layer is fine sand or fine sandy loam. Also included were small areas of Blendon and Boelus soils in the lower pockets and areas of Nora and Thurman soils on the higher ridges.

Soil blowing is a severe hazard. This soil is droughty because of its low available water capacity. Maintaining fertility is a concern of management in dryfarmed areas. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the principal irrigated crops. The rest of the acreage is in native grass used for range or native hay or is in windbreaks. Capability units IIIe–5 dryland, IIIe–11 irrigated; Sandy range site; windbreak suitability group 3.

DhC—Doger loamy fine sand, 3 to 6 percent slopes. This deep, gently sloping sandy soil is on foot slopes and side slopes of the uplands. Areas are irregular in shape and range from 5 to about 80 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thinner. In some small areas the plow layer is fine sand, and in a few areas the surface layer is fine sandy loam. Included in mapping were small areas of Blendon and Boelus soils at the lower elevations and areas of Thurman soils on the upper side slopes and ridges.

Soil blowing is a severe hazard. This soil is droughty in dryfarmed areas because the available water capacity is low. Runoff is slow.

Much of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the principal dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. The rest of the acreage is in native grass used for grazing or is in windbreaks. Capability units IVe-5 dryland, IVe-11 irrigated; Sandy range site; windbreak suitability group 3.

Elsmere Series

The Elsmere series consists of deep, somewhat poorly drained soils that formed in sandy material deposited by water or wind. These are nearly level soils on stream terraces and high bottom land. In most years the seasonal water table is at a depth of about 2 to 5 feet in spring and at a low of about 6 feet late in summer.

In a representative profile the surface layer is loose, dark grayish brown fine sand 10 inches thick. Below this is a transitional layer of grayish brown loose fine sand about 8 inches thick. The underlying material is very pale brown and light gray fine sand to a depth of 60 inches.

Elsmere soils have rapid permeability and low available water capacity. Organic matter content is moderately low, and natural fertility is low. These soils release moisture readily to plants.

Elsmere soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees, wildlife habitat, and recreation.

Representative profile of Elsmere fine sand, 0 to 2 percent slopes, in native grass, 2,430 feet north and 1,160 feet east of the southwest corner of sec. 20, T. 26 N., R. 5 W.

A—0 to 10 inches; dark grayish brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) moist; single grained; soft, loose; slightly acid; abrupt smooth boundary.

AC—10 to 18 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; soft, loose; slightly acid; clear smooth boundary.

C1—18 to 44 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; common medium distinct reddish yellow (7.5YR 6/6, moist) mottles; single grained; loose; neutral; gradual wavy boundary.

C2—44 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common medium distinct reddish yellow (7.5YR 6/6, moist) mottles; single grained; loose; free water at depth of 56 inches; neutral.

The A horizon is 10 to 20 inches thick and ranges from dark gray to dark grayish brown or grayish brown. It is medium acid or slightly acid loamy fine sand or fine sand. The AC horizon is 6 to 12 inches thick and is medium acid or slightly acid. It is gray to grayish brown or light brownish gray loamy fine sand or fine sand. In some areas the C horizon is stratified with loamy material below a depth of 48 inches.

Elsmere soils are near Loup, Ovina, Thurman, and Valentine soils. They are better drained than Loup soils. They have more sand in the C horizon than Ovina soils. They are more poorly drained than the Thurman and Valentine soils.

Ef—Elsmere fine sand, 0 to 2 percent slopes. This deep, sandy soil is on stream terraces and high bottom land along the edge of the sandhills and in sandhill basins. Areas range from 5 to about 250 acres in size.

This soil has the profile described as representative of the series. In some areas the surface layer is lighter colored and in some areas it is thinner than the one described in the representative profile. The seasonal high water table is at a depth of about 2 or 3 feet in the spring.

Included with this soil in mapping were small areas of Loup soils in low pockets and areas of Thurman and Valentine soils at the highest elevations.

The main limitation is wetness because of the fluctuating water table. Soil blowing is a very severe hazard. This soil is flooded for short periods during and after heavy rains. The low available water capacity makes the soil droughty in summer in cultivated areas. Fertility is not well balanced; available phosphate is low. Runoff is slow.

Most of the acreage is in native grass and is used for range or hay meadows. A small acreage is cultivated. Corn and alfalfa are the principal crops. Capability units IVw-5 dryland, IVw-12 irrigated; Subirrigated range site; windbreak suitability group 2.

Eh—Elsmere loamy fine sand, 0 to 2 percent slopes. This deep sandy soil is on stream terraces and high bottom land in basins of the sandhills and along the edge of the sandhills. Areas range from 5 to about 250 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer and transitional layer are loamy fine sand. In some areas the surface layer is 20 to 28 inches thick. The seasonal high water table is at a depth of about 2 or 3 feet in spring.

Included with this soil in mapping were areas where the surface layer is fine sand and other areas where the surface layer is fine sandy loam. Also included were small areas of Loup soils at the lower elevations, areas of Thurman soils at the high elevations, and areas of Ovina soils at about the same elevations as the Elsmere soil.

The main limitation is wetness because of the fluctuating water table. Flooding is a slight hazard during and after heavy rains. Soil blowing is a severe hazard.

In cultivated areas this soil is droughty in midsummer when rainfall is lowest. Available phosphate is low. Runoff is low.

Much of the acreage is in native grass and is used for range or mowed for hay. The rest of the acreage is cultivated. Corn and alfalfa are the principal crops. Capability units IIIw-5 dryland, IIIw-11 irrigated; Subirrigated range site; windbreak suitability group 2.

EmB—Elsmere loamy fine sand, drained, 0 to 3 percent slopes. This deep, nearly level or very gently sloping sandy soil is on high bottom land. Areas range from 5 to about 75 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer and transitional layer are loamy fine sand. In some areas the surface layer is 20 to 30 inches thick, and in others it is fine sand. The seasonal water table fluctuates from a high of 3 to 5 feet in spring to a depth of 8 feet late in summer.

Included with this soil in mapping were small areas of Ord and Loup soils in the lower concave pockets, Thurman soils at the slightly higher elevations, and Inavale soils at about the same general elevations as the Elsmere soil.

Soil blowing is a severe hazard. This soil is droughty in summer because of its low available water capacity and low water table. In spring, however, plants with deep roots receive beneficial moisture from the water table. Flooding of short duration is a minor hazard following heavy rains. Runoff is slow.

Most of the acreage is in native grass and is used for range. Some trees are on these areas. Corn and alfalfa are the principal cultivated crops. Capability units IIIe-5 dryland, IIIe-11 irrigated; Sandy Lowland range site; windbreak suitability group 3.

Fillmore Series

The Fillmore series consists of deep, poorly drained soils that formed in loess. These are nearly level soils in depressions in uplands.

In a representative profile the surface layer is friable, dark gray silt loam about 9 inches thick. Below this is a subsurface layer of friable gray silt loam 7 inches thick. The subsoil is about 34 inches thick. The upper part is firm, dark gray silty clay, and the lower part is firm gray silty clay loam. The underlying material is gray silty clay loam to a depth of 60 inches.

Fillmore soils have very slow permeability and high available water capacity. Organic matter content is moderate, and natural fertility is medium. These soils release moisture slowly to plants. They are occasionally flooded, mainly by runoff water from adjacent higher soils.

Fillmore soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees, and shrubs, and they provide wildlife habitat. They are not suitable as recreation areas.

Representative profile of Fillmore silt loam, 0 to 1 percent slopes, in native grass, 100 feet north and 1,850 feet east of the southwest corner of sec. 13, T. 23 N., R. 6 W.

A1—0 to 9 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A2—9 to 16 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak medium platy structure; soft, friable; slightly acid; abrupt smooth boundary.

B21t—16 to 28 inches; dark gray (10YR 4/1) silty clay, very dark brown (10YR 2/2) moist; strong medium and fine blocky structure; hard, firm; neutral; clear smooth boundary.

B22t—28 to 42 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong medium and fine angular blocky structure; hard, firm; neutral; clear smooth boundary.

B3—42 to 50 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; moderate medium and fine subangular blocky structure; hard, firm; neutral; gradual smooth boundary.

C—50 to 60 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; weak coarse prismatic structure; hard, friable; neutral.

The A1 horizon is 6 to 12 inches thick and ranges from very dark gray to gray. The B horizon ranges from 26 to 40 inches in thickness and is dark gray to dark grayish brown or gray. The C horizon is silt loam or silty clay loam and is neutral or mildly alkaline.

Fillmore soils occur in the landscape near Hord, Moody, and Nora soils. They have more clay in the B2 horizon and have an A2 horizon that Hord, Moody, and Nora soils lack. Also they are more poorly drained than those soils.

Fm—Fillmore silt loam, 0 to 1 percent slopes. This deep, nearly level soil is in depressions in uplands. Areas are roughly oblong or rounded in shape and range from 5 to about 50 acres in size.

In some areas this soil lacks the gray subsurface layer. Included in mapping were areas that are ponded most of the year. Also included were small areas of Moody and Hord soils at higher elevations.

Fillmore soils are occasionally flooded by runoff water from higher lying adjacent soils. This occurs mainly in spring, but can occur anytime following heavy rains. The soil is droughty at times because the claypan subsoil does not release water readily. Runoff is very slow.

Part of the acreage is cultivated. Corn, soybeans, grain sorghum, and small grain are the main crops. The rest of the acreage is in native or tame grass. Capability units IIIw-2 dryland, IIIw-2 irrigated; Clayey Overflow range site; windbreak suitability group 2.

Gibbon Series

The Gibbon series consists of deep, somewhat poorly drained soils that formed in silty alluvium. These are nearly level soils on bottom land. The seasonal water table ranges from a high of 2 or 3 feet early in spring to a low of about 6 feet late in summer.

In a representative profile the surface layer is 23 inches thick. The upper part is friable, dark gray silt loam, and the lower part is firm, gray light silty clay loam. The underlying material is light brownish gray light silty clay loam in the upper part and light gray silt loam to a depth of 60 inches.

Most areas of Gibbon soils have moderate permeability and high available water capacity. Organic matter content is moderate, and natural fertility is high. These soils release moisture readily to plants. The saline-alkali Gibbon soils have moderately slow permeability and moderate available water capacity. Their organic matter content is moderately low, and their natural fertility is medium.

Gibbon soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Gibbon silt loam, 0 to 2 percent slopes, in native grass, 2,350 feet west and 250 feet north of the southeast corner of sec. 2, T. 25 N., R. 7 W.

A11—0 to 8 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak very fine granular structure; slightly hard, friable; strong effervescence (4 percent calcium carbonate); moderately alkaline; clear smooth boundary.

A12—8 to 17 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; hard, friable; strong effervescence (8 percent calcium carbonate); moderately alkaline; clear smooth boundary.

A3ca—17 to 23 inches; gray (10YR 5/1) light silty clay loam, dark gray (10YR 4/1) moist; weak fine and medium subangular blocky structure; hard, firm; violent effervescence, lime disseminated throughout soil mass (15 percent calcium carbonate); moderately alkaline; clear smooth boundary.

C1ca—23 to 33 inches; light brownish gray (2.5Y 6/2) light silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm; violent effervescence, lime disseminated throughout soil mass (21 percent calcium carbonate); moderately alkaline; gradual smooth boundary.

C2—33 to 60 inches; light gray (2.5Y 7/2) silt loam, light brownish gray (2.5Y 6/2) moist; few fine distinct strong brown (7.5YR 5/6, moist) mottles; massive; slightly hard, friable; free water at depth of 47 inches; violent effervescence, lime disseminated throughout soil mass (15 percent calcium carbonate); moderately alkaline.

The A horizon is 12 to 28 inches thick. It ranges from very dark gray to light gray and is mildly alkaline or moderately alkaline. The C horizon is silt loam and light silty clay loam. In places the C horizon is sandy below a depth of 42 inches.

Gibbon soils occur in the landscape near Orwet, Lawet, Ord, and Loup soils. They are better drained than the Lawet, Orwet, and Loup soils. They have more silt and clay in the C horizon than Loup, Orwet, and Ord soils.

Gk—Gibbon silt loam, 0 to 2 percent slopes. This deep, silty soil is on bottom land of stream valleys. Areas range from 5 to about 200 acres in size.

This soil has the profile described as representative of the series. In some areas the lower part of the surface layer and the underlying material are heavy silty clay loam.

Included with this soil in mapping were areas where the upper part of the surface layer is fine sandy loam or loam and areas that have a thicker surface layer than is typical. Also included were small areas of Lawet soils at the lower elevations, Elsmere soils in slightly higher areas, areas of Ord soils, and small, strongly saline-alkali areas.

The main limitation is wetness. Wetness delays tillage in spring. Flooding is a slight hazard following heavy rains. Available phosphate is generally low. Runoff is slow.

Much of the acreage is cultivated. Corn, soybeans, and alfalfa are the main crops. The rest of the acreage is in native grass and is used for range or mowed for hay. Capability units IIw–4 dryland, IIw–6 irrigated; Subirrigated range site; windbreak suitability group 2.

Gs—Gibbon silt loam, saline-alkali, 0 to 2 percent slopes. This deep, nearly level soil is on bottom land of stream valleys. Cultivated areas have a scabby appearance. The affected areas are irregularly shaped microdepressions in rangeland or cloddy, light gray areas in cultivated fields. On rangeland the vegetation in the saline-alkali areas is alkali sacaton and inland saltgrass. Areas range from 5 to about 200 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer in about 30 percent of each area has high concentrations of excess salinity or alkalinity. The other 70 percent is not affected by excessive salinity or alkalinity.

Included with this soil in mapping were areas where the upper part of the surface layer is fine sandy loam and areas of sandy soils. Also included were small areas of Lawet soils at the low elevations and areas of Ord soils at about the same elevations as the Gibbon soil.

The main limitation is the excessively high saline-alkali condition of the scabby areas. The salinity and alkalinity restrict plant root growth and slow the intake of moisture by roots. Intake of moisture and permeability are moderately slow. Wetness from the moderately high water table delays tillage in spring. Flooding after rains is a slight hazard. Availability of plant nutrients, especially phosphate, is low. Organic matter content is moderately low. Runoff is slow.

Most of the acreage is in native grass and is used for range or mowed for hay. A small acreage is cultivated. Corn and alfalfa are the principal crops. Capability units IVs–1 dryland, IIIs–6 irrigated; Moderately alkaline part in Subirrigated range site, Strongly alkaline part in Saline Subirrigated range site; windbreak suitability group 8.

Hobbs Series

The Hobbs series consists of deep, well drained soils that formed in silty alluvium. These are nearly level or very gently sloping soils on bottom land. They are occasionally or frequently flooded.

In a representative profile the surface layer is very friable, grayish brown silt loam 7 inches thick. Below this is the underlying material. It is stratified, grayish brown and light brownish gray silt loam in the upper part and grayish brown and very dark grayish brown silt loam to a depth of 60 inches.

Hobbs soils have moderate permeability and high available water capacity. Organic matter content is moderate, and natural fertility is high. These soils release moisture readily to plants.

Except where they are frequently flooded, Hobbs soils are suited to cultivated crops and to trees and shrubs in windbreaks. These soils are also suited to grass, wildlife habitat, and recreation.

Representative profile of Hobbs silt loam, 0 to 2 percent slopes, in a cultivated field, 2,375 feet east and 100 feet south of the northwest corner of sec. 21, T. 23 N., R. 5 W.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) silt loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

C1—7 to 20 inches; finely stratified light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silt loam, dark brown (10YR 3/3) and dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

C2—20 to 48 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; hard, friable; mildly alkaline; gradual wavy boundary.

C3—48 to 60 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure; hard, friable; mildly alkaline.

The A horizon is 6 to 9 inches thick and ranges from grayish brown to dark grayish brown or very dark grayish brown. It is slightly acid to mildly alkaline silt loam. The C horizon ranges from light brownish gray to very dark grayish brown loam, light silty clay loam, or silt loam. It ranges from slightly acid to mildly alkaline. In some areas sandy layers are below a depth of 42 inches.

Hobbs soils occur in the landscape near Cozad, Hord, Nora, and Cass soils. They are more stratified than Cozad, Hord, and Nora soils, and in contrast with those soils, they lack a B horizon. They have more silt and clay between depths of 10 and 40 inches than Cass soils.

Hd—Hobbs silt loam, 0 to 2 percent slopes. This deep silty soil is on bottom land along drainageways and streams. It is occasionally flooded. Areas are narrow to moderately wide and are oblong in shape. They range from 5 to about 600 acres in size.

This soil has the profile described as representative of the series. In some areas the surface layer is lighter colored and in others it is thicker than the one described for the series. Included in mapping were small areas of Cozad and Hord soils at the higher elevations.

The main hazard is occasional flooding for short periods after heavy rain. The water comes from adjacent, higher soils, mainly uplands. Runoff is slow.

Much of the acreage is cultivated. Corn, soybeans, and grain sorghum are the principal dryland and irrigated crops. Most of the rest of the acreage is in native or tame grass. Capability units IIw–3 dryland, IIw–6 irrigated; Silty Overflow range site; windbreak suitability group 1.

HfB—Hobbs silt loam, channeled, 0 to 3 percent slopes. This nearly level to very gently sloping soil is on narrow bottom land along major creeks and drainageways. It is frequently flooded. Areas are deeply entrenched channels of meandering streams and the adjacent steep banks. They are long and narrow in shape and range from 5 to about 400 acres in size.

Included with this soil in mapping were areas of Hobbs silt loam, 0 to 2 percent slopes, at higher elevations that are not flooded so frequently.

The main hazard is frequent flooding. Flooding occurs with each heavy rainfall, mainly in spring, also at other times. Flooding generally lasts less than 2 days. When the water moves rapidly, some scouring occurs and the vegetation is commonly damaged. Each flood deposits sediment, and generally debris is also deposited. Water erosion in the stream channels and on the adjoining steep banks is a severe hazard. Runoff is slow.

Vegetation consists of native grass and trees. Cultivation is difficult or impossible because of the flooding hazard and the numerous, meandering, deep channels.

Most of the acreage is used for grazing and provides wildlife habitat. Capability unit VIw–7 dryland; Silty Overflow range site; windbreak suitability group 10.

Hord Series

The Hord series consists of deep, well drained soils that formed in silty alluvium and loess. These are nearly level to gently sloping soils on stream terraces, foot slopes, and concave areas of the uplands.

In a representative profile the surface layer is a friable, dark gray silt loam 14 inches thick. The subsoil is friable silt loam about 25 inches thick. In the upper part it is dark grayish brown, in the middle part it is grayish brown, and in the lower part it is brown. The underlying material is pale brown silt loam to a depth of 60 inches.

Hord soils have moderate permeability and high available water capacity. Organic matter content is moderate, and natural fertility is high. These soils release moisture readily to plants.

Hord soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Hord silt loam, 0 to 2 percent slopes, in a cultivated field, 80 feet west and 530 feet north of the southeast corner of sec. 31, T. 25 N., R. 5 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.

A12—6 to 14 inches, dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; hard, friable; slightly acid; clear smooth boundary.

B21—14 to 24 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear smooth boundary.

B22—24 to 30 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; mildly alkaline; clear smooth boundary.

B3—30 to 39 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, friable; mildly alkaline; abrupt smooth boundary.

C—39 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The A horizon ranges from 12 to 16 inches in thickness. It is dark gray to dark grayish brown or grayish brown. The B horizon is 25 to 36 inches thick. It is a silt loam or light silty clay loam and ranges from dark grayish brown to light brownish gray or brown. Depth to lime ranges from 36 to 56 inches.

Hord soils occur in the landscape near Cozad, Hobbs, Nora, and Ortello soils. They are thicker and darker colored in the upper part of the B horizon than Cozad and Nora soils. They have more clay and silt in the B and C horizons than Ortello soils. Hord soils are not so stratified as Hobbs soils, and in contrast with those soils, they have a B horizon.

HhA—Hord silt loam, 0 to 2 percent slopes. This silty soil is on stream terraces along drainageways, creeks, and rivers and also in concave areas of the uplands. Areas are roughly oblong in shape and range from 5 to about 500 acres in size.

This soil has the profile described as representative of the series. In some areas that have been leveled for irrigation the surface layer is extremely variable in thickness.

Included with this soil in mapping were areas that have a subsoil of heavy silty clay loam and areas that have a plow layer of fine sandy loam or loamy fine sand. Also included were small areas of Hobbs soils at the lowest elevations, Ortello and Thurman soils at slightly higher elevations, and Cozad soils at the same elevations as the Hord soils.

This soil has few limitations for farming. In spring and early summer it receives some beneficial moisture as runoff from the surrounding uplands. Runoff is slow.

Nearly all the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the principal dryland and irrigated crops. The rest of the acreage is in native grass. Capability units I-1 dryland, I-6 irrigated; Silty Lowland range site; windbreak suitability group 1.

HhC—Hord silt loam, 2 to 6 percent slopes. This silty soil is on foot slopes and concave areas of the loess uplands. Areas are irregular in shape and range from 5 to about 600 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer and subsoil are slightly thinner. Small areas are severely eroded. Included in mapping were small areas of Nora, Moody, Ortello, and Thurman soils, all at slightly higher elevations.

Water erosion is the main hazard. Rill erosion is common after heavy rains. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the principal dryland and irrigated crops. The rest of the acreage is in native or tame grass. Capability units IIe-1 dryland, IIIe-6 irrigated; Silty range site; windbreak suitability group 4.

Inavale Series

The Inavale series consists of deep, somewhat excessively drained soils that formed in sandy alluvium. These are nearly level soils on bottom land.

In a representative profile the surface layer is loose, grayish brown fine sand 7 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand 4 inches thick. The underlying material is light gray, stratified fine sand and sand to a depth of 60 inches.

Inavale soils have rapid permeability and low available water capacity. Organic matter content and natural fertility are low. These soils release moisture readily to plants.

Inavale soils are marginally suited to irrigated cultivated crops. They are too droughty for dryfarmed cultivated crops. These soils are suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Inavale fine sand, 0 to 2 percent slopes, in native grass, 2,450 feet east and 100 feet south of the northwest corner of sec. 35, T. 26 N., R. 8 W.

A1—0 to 7 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; medium acid; clear smooth boundary.

AC—7 to 11 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grained; loose; slightly acid; clear smooth boundary.

C—11 to 60 inches; light gray (10YR 7/2) stratified fine sand and sand, light brownish gray (10YR 6/2) moist; single grained; loose; neutral.

The A horizon is 4 to 14 inches thick and ranges from gray to grayish brown or light brownish gray. The AC horizon is 4 to 10 inches thick and ranges from grayish brown to light brownish gray or gray. Below a depth of 42 inches, the C horizon is commonly stratified with loam and gravel.

Inavale soils occur in the landscape with Ord, Elsmere, and Loup soils. They are better drained than Ord and Loup soils, and they have more sand in the A horizon and AC horizon than Ord soils. They have a

Figure 7.—**Typical landscape of Inavale and Elsmere soils, 0 to 2 percent slopes, along the Elkhorn River.**

lighter colored and thinner A horizon than Elsmere soils and are better drained.

If—Inavale fine sand, 0 to 2 percent slopes. This deep, sandy soil is on bottom land along streams and rivers. Areas are oblong or rounded in shape and range from 5 to about 100 acres in size.

This soil has the profile described as representative of the series. In some areas the surface layer and transitional layer are darker than the ones described. Included in mapping were small areas of Ord and Loup soils at lower elevations and Elsmere soils at about the same general elevations as the Inavale soil.

Soil blowing is a very severe hazard. Low fertility and low available water capacity limit production. In spring plants receive some beneficial moisture from a water table that fluctuates to a high of about 5 to 7 feet. Rare flooding during periods of high rainfall is a slight hazard. Runoff is slow. The soil is coarse and absorbs the precipitation about as rapidly as it falls.

Most of the acreage is in native grass and is used for range or native hay. A few areas are irrigated. In these areas alfalfa is the principal crop. The rest of the acreage is in trees and grass and is used for range or provides recreation areas. Capability units VIe–5 dryland, IVe–12 irrigated; Sandy Lowland range site; windbreak suitability group 7.

Ih—Inavale and Elsmere soils, 0 to 2 percent slopes. This nearly level map unit is on bottom land along the Elkhorn River and some of the major creeks and drainageways of the county. It consists of Inavale fine sand and Elsmere fine sand. The proportions vary from one area to another, and some areas only have one of these soils. The soils are crossed by many shallow old stream channels. Areas range from 5 to about 400 acres in size.

The Inavale soils are at the higher elevations. They have a seasonal water table that reaches a high of about 5 to 7 feet early in spring. The Elsmere soils are at the lower elevations in bottoms of old stream channels. The seasonal water table reaches a high of about 2 feet in spring.

In some areas of this map unit the surface layer is loam or silt loam and in others the underlying material is silt loam. Included in mapping were small areas of Ord and Loup soils at lower elevations and areas of marsh and open water in the lowest concave pockets.

Flooding is the main hazard. The fluctuating water table is a limitation in spring and early in summer. Areas of these soils are droughty in mid and late summer because of their low available water capacity. Low fertility is also a limitation. Runoff is slow. The soils are coarse and precipitation is readily absorbed.

The vegetation is mainly native grass and trees (fig. 7). Most of the acreage is used for grazing and provides habitat for rangeland wildlife. A small acreage is cultivated, but the soils are not suited to this use. A few areas are used for recreation. Capability unit VIw–7 dryland; Inavale soil in Sandy Lowland range site, Elsmere soil in Subirrigated range site; windbreak suitability group 10.

Lawet Series

The Lawet series consists of deep, poorly drained soils that formed in loamy alluvium. These are nearly level soils on bottom land. In most years, the seasonal water table ranges from a high of 0 to 3 feet in spring to a low of 5 feet in mid summer.

In a representative profile the surface layer is friable and is about 23 inches thick. The upper part is very dark gray silt loam, and the lower part is gray loam. The subsoil is about 9 inches thick. It is firm, light brownish gray silty clay loam. The underlying material is gray loam in the upper part and gray clay loam to a depth of 60 inches.

Lawet soils have moderately slow permeability and high available water capacity. The organic matter content is moderate, and natural fertility is high. These soils release moisture readily to plants.

Unless the water table is too high, Lawet soils are suited to cultivated crops. They are also suited to grass, trees, and shrubs, and they provide wildlife habitat. They have limited use as recreation areas because of the high water table.

Representative profile of Lawet silt loam, 0 to 2 percent slopes, in native grass, 550 feet south and 150 feet east of the center of sec. 11, T. 26 N., R. 5 W.

A11ca—0 to 15 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak very fine granular structure; hard, friable; free water at depth of 14 inches; violent effervescence (8 percent calcium carbonate); moderately alkaline; clear smooth boundary.

A12ca—15 to 23 inches; gray (10YR 5/1) loam, black (10YR 2/1) moist; weak fine and medium granular structure; hard, friable; violent effervescence (24 percent calcium carbonate); moderately alkaline; clear smooth boundary.

Bca—23 to 32 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm; violent effervescence (15 percent calcium carbonate); moderately alkaline; clear smooth boundary.

C1g—32 to 41 inches; gray (5Y 6/1) loam, dark gray (5Y 4/1) moist; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; hard, firm; violent effervescence, moderately alkaline; gradual smooth boundary.

C2g—41 to 60 inches; gray (5Y 5/1) clay loam, dark gray (5Y 4/1) moist; common fine distinct strong brown (7.5YR 5/6, moist) mottles; massive; very hard, firm; strong effervescence, moderately alkaline.

The A horizon ranges from 10 to 24 inches in thickness and is silt loam, loam, or silty clay loam. It ranges from very dark gray to gray and is high in lime. The B horizon is 6 to 10 inches thick. It is a gray or light brownish gray loam, silt loam, or silty clay loam. The C horizon is loam, clay loam, or light silty clay loam. In many areas, below a depth of 40 inches, the C horizon is stratified with sand.

Lawet soils are near Gibbon, Loup, Ord, and Orwet soils. They are more poorly drained than Gibbon soils and contain more lime and less silt. They are more poorly drained than Ord soils and contain more lime and more clay. They have more silt and clay between depths of 10 and 40 inches than Loup soils and contain more lime. They have more clay and less sand than Orwet soil.

Lb—Lawet silt loam, 0 to 2 percent slopes. This deep soil is on bottom land in stream valleys. Areas are irregular or oblong in shape and range from 5 to about 300 acres in size.

This soil has the profile described as representative of the series. In some areas the dark color typical of the surface layer extends to a depth of 24 to 30 inches. In some areas the underlying material is heavy silty clay loam or silty clay. The seasonal water table fluctuates from a high of about 1 to 3 feet in spring to a low of 5 feet late in summer.

Included with this soil in mapping were areas where the upper part of the surface layer is fine sandy loam, areas of deep sandy soils, and alkali areas. Also included were small areas of Gibbon soils at the slightly higher elevations and areas of Orwet soils.

The principal limitation is excessive wetness because of the high water table. Flooding is a hazard following periods of heavy rainfall. Runoff is slow.

Nearly all the acreage is in native grass and is used for grazing or hay. A few areas are cultivated. Corn is the main crop. Capability unit IVw–4 dryland; Subirrigated range site; windbreak suitability group 6.

Lc—Lawet soils, wet, 0 to 2 percent slopes. These deep soils are on bottom land in the Elkhorn River Valley and along a few of the major creeks. Areas range from 5 to about 75 acres in size.

The surface layer is silt loam or loam that extends to a depth of 24 to 36 inches. During most years, the water table is near the surface in spring and at a depth of about 3 feet late in summer.

Included with these soils in mapping were small areas of Gibbon soils and Lawet silt loam, 0 to 2 percent slopes, all at slightly higher elevations.

The very high water table is the main limitation. Flooding is common following periods of heavy rainfall. This soil becomes boggy if it is used as range in spring. Runoff is very slow.

The vegetation is mainly native grass species that can tolerate wetness. There are a few trees. Most of the acreage is used for range and native hay. Capability unit Vw–7 dryland; Wet Land range site; windbreak suitability group 10.

Longford Series

The Longford series consists of deep, well drained soils that formed in loess. These are nearly level to gently sloping soils on uplands.

In a representative profile the surface layer is friable, dark grayish brown loam 11 inches thick. The subsoil is firm and is about 30 inches thick. It is brown light silty clay in the upper part and light brown silty clay loam in the lower part. The underlying material is very pale brown silt loam to a depth of 60 inches.

Longford soils have moderately slow permeability and high available water capacity. Organic matter content is moderate or moderately low, and natural fertility is medium. These soils release moisture slowly to plants.

Longford soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Longford loam, 1 to 4 percent slopes, in a cultivated field, 690 feet east and 100 feet north of the southwest corner of sec. 29, T. 27 N., R. 6 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A12—7 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; medium acid; clear smooth boundary.

B2t—11 to 34 inches; brown (7.5YR 5/4) light silty clay, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, firm; neutral; gradual smooth boundary.

B3t—34 to 41 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; very hard, firm; neutral; gradual smooth boundary.

C—41 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; hard, friable; mildly alkaline.

The A horizon is 7 to 12 inches thick and ranges from very dark grayish brown to dark grayish brown or grayish brown. The B horizon is 24 to 36 inches thick and ranges from brown to light brown or gray. It is slightly acid or neutral. The B2 horizon is 35 to 45 percent clay. The C horizon is neutral or mildly alkaline silty clay loam or silt loam. Depth to lime ranges from 42 to more than 72 inches.

Longford soils occur in the landscape near Bazile, Loretto, Paka, and Thurman soils. They have more clay in the B2 horizon than Bazile, Loretto, and Paka soils. They have more clay and silt in the profile than Thurman soils.

LdC—Longford loam, 1 to 4 percent slopes. This deep soil is on ridges and side slopes of the uplands. Areas are irregular in shape and range from 5 to about 50 acres in size.

This soil has the profile described as representative of the series. Because of erosion, in some areas the surface layer is thinner and lighter colored than is typical. In some areas sandy material is below a depth of 48 inches.

Included with this soil in mapping were areas where the upper part of the surface layer is fine sandy loam. Also included were small areas of Bazile and Loretto soils and Longford complex, 1 to 4 percent slopes, at slightly higher elevations and areas of Paka soils at about the same elevations as the Longford soil.

Water erosion is the main hazard. Rill erosion is common following heavy rains. Some of the low lying areas dry slowly after rains. Organic matter content is moderate. Runoff is medium.

Much of the acreage is cultivated. Corn, soybeans, and alfalfa are the principal dryland and irrigated crops. Most of the rest of the acreage is in native or tame grass. Capability units IIIe–2 dryland, IIIe–2 irrigated; Clayey range site; windbreak suitability group 4.

LfC—Longford complex, 1 to 4 percent slopes. This mapping unit is on ridges and side slopes of the uplands. It is about 45 percent areas where the surface layer is dark grayish brown or grayish brown fine sandy loam, loamy fine sand, or fine sand 8 to 18 inches thick, and 35 percent areas where an 18- to 32-inch deposit of dark grayish brown or grayish brown loamy fine sand or fine sand is on the surface. Areas are irregular in shape and range from 5 to about 50 acres in size.

These soils have profiles similar to the one described as representative of the series, but they have an overblown sandy or loamy deposit on the surface. Included in mapping were areas of Thurman soils on the higher ridges, areas of Loretto and Paka soils at about the same general elevations, and Bazile soils at the slightly higher elevations. These included soils make up about 20 percent of this map unit.

Soil blowing is a severe hazard, and water erosion is a moderate hazard. Organic matter content is moderately low. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main dryland crops. The principal irrigated crops are corn, soybeans, and alfalfa. The rest of the acreage is in native grass or seeded tame grass. Capability units IIIe–6 dryland, IVe–10 irrigated; Sandy range site; windbreak suitability group 3.

Loretto Series

The Loretto series consists of deep, well drained soils that typically formed in loess on uplands, but a few areas formed in alluvium on stream terraces. These are nearly level to gently sloping soils.

In a representative profile the surface layer is friable, dark grayish brown loam 10 inches thick. The subsoil is friable loam about 40 inches thick. It is grayish brown in the upper part and brown in the lower part. The underlying material is pale brown loam to a depth of 60 inches.

Loretto soils have moderate permeability and high available water capacity. Organic matter content is moderate, and natural fertility is high. These soils release moisture readily to plants.

Loretto soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Loretto loam, 0 to 2 percent slopes, in a cultivated field, 2,000 feet north and 100 feet west of the southeast corner of sec. 1, T. 27 N., R. 6 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; hard, friable; strongly acid; abrupt smooth boundary.

A12—6 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; hard, friable; strongly acid; clear smooth boundary.

B2t—10 to 28 inches; grayish brown (10 YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; slightly acid; gradual smooth boundary.

B3—28 to 50 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; slightly acid; gradual wavy boundary.

C—50 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; mildly alkaline; strong effervescence on lime concretions.

The A horizon is 7 to 20 inches thick and is very dark grayish brown to dark grayish brown or grayish brown. It is strongly acid to slightly acid loam or sandy loam. The B horizon is 20 to 42 inches thick. It is grayish brown to light brownish gray or brown loam, silt loam, or clay loam. It averages between 20 and 30 percent clay. It is slightly acid or neutral. The C horizon is loam or silt loam and generally has lime below a depth of 42 inches. In some areas below a depth of 48 inches, the C horizon is sandy.

Loretto soils occur in the landscape near Bazile, Boelus, Nora, and Thurman soils. They have a loamy C horizon, whereas Bazile soils have a sandy C horizon. They have less sand in the A horizon than Boelus soils. They have more silt and clay in the profile than Thurman soils. They have more sand than Nora soils, and lime is leached deeper than in those soils.

LgB—Loretto sandy loam, 0 to 3 percent slopes. This nearly level to very gently sloping, deep soil is mainly on uplands. A few areas are on stream terraces. Areas are irregular in shape and range from 5 to about 300 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a surface layer of sandy loam. In some areas the surface layer is 20 to 28 inches thick, and in others the upper part of the subsoil is darker than is typical.

Included with this soil in mapping were areas that have a plow layer of loamy fine sand. Also included were small areas of Boelus, Ortello, and Thurman soils at slightly higher elevations and areas of Bazile soils at the same elevations as the Loretto soil.

Soil blowing is a moderate hazard. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, rye, and alfalfa are the principal dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. The rest of the acreage is mainly in native grass, seeded tame grass, and windbreaks. Capability units IIe-3 dryland, IIe-5 irrigated; Sandy range site; windbreak suitability group 3.

LgC—Loretto sandy loam, 3 to 6 percent slopes. This deep, gently sloping soil is on ridges and side slopes of the uplands. Areas are irregular in shape and range from 5 to about 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam. In small areas the plow layer is lighter colored than the one described and in others the surface layer is 20 to 28 inches thick.

Included with this soil in mapping were small areas where the surface layer is loamy fine sand and small areas of Boelus, Nora, Ortello, and Thurman soils. Boelus and Ortello soils are on the upper part of side slopes, Nora soils are on the windward upper side slopes, and Thurman soils are on the higher ridges.

Soil blowing and water erosion are severe hazards. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, rye, and alfalfa are the main dryland crops. The principal irrigated crops are corn, soybeans, and alfalfa. The rest of the acreage is mainly in native grass, tame grass, and windbreaks. Capability units IIIe-3 dryland, IIIe-5 irrigated; Sandy range site; windbreak suitability group 3.

Lh—Loretto loam, 0 to 2 percent slopes. This deep, nearly level soil is on uplands. Areas range from 5 to about 200 acres in size.

This soil has the profile described as representative of the series. In some areas the upper part of the surface layer is fine sandy loam, and in some areas sandy material is below a depth of 40 inches.

Included with this soil in mapping were small areas of Nora and Thurman soils at slightly higher elevations, Trent soils in slightly lower pockets, and Bazile soils at the same elevations as the Loretto soil. This soil has few serious hazards or limitations. Runoff is slow.

Nearly all the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland crops. The principal irrigated crops are corn, soybeans, and alfalfa. A small acreage is in native grass. Capability units I–1 dryland, I–4 irrigated; Silty range site; windbreak suitability group 4.

LhC—Loretto loam, 2 to 6 percent slopes. This deep, gently sloping soil is on ridgetops and side slopes of the uplands. Areas are irregular or oblong in shape and range from 5 to about 200 acres in size.

In some areas sandy material is below a depth of 40 inches. In some areas the dark color typical of the surface layer extends to a depth of 20 or 30 inches. In places there are small outcrops of reddish loess at the surface.

Included with this soil in mapping were areas where the upper part of the surface layer is fine sandy loam or sandy loam. Also included were small areas of Nora soils on the upper part of side slopes, Thurman soils on ridgetops, and areas of Bazile and Paka soils at the same general elevations as the Loretto soil.

Water erosion is the main hazard. Small rills are common after heavy rains. Lack of adequate rainfall is also a hazard in dryfarmed areas. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. A small acreage is still in native grass. Capability units IIe-1 dryland, IIIe-4 irrigated; Silty range site; windbreak suitability group 4.

Loup Series

The Loup series consists of deep, poorly drained soils (fig. 8) that formed in alluvium or a combination of alluvium and eolian sand. These are nearly level soils on bottom land. The seasonal water table in most years is at the surface or within a depth of 2 feet in spring and falls to a depth of about 3 to 5 feet late in summer. It is lowest in drained areas.

In a representative profile the surface layer is friable, dark gray fine sandy loam 10 inches thick. Below this is a transitional layer of gray, very friable loamy fine sand 4 inches thick. The underlying material is fine sand. It is light gray in the upper part and light brownish gray in the lower part.

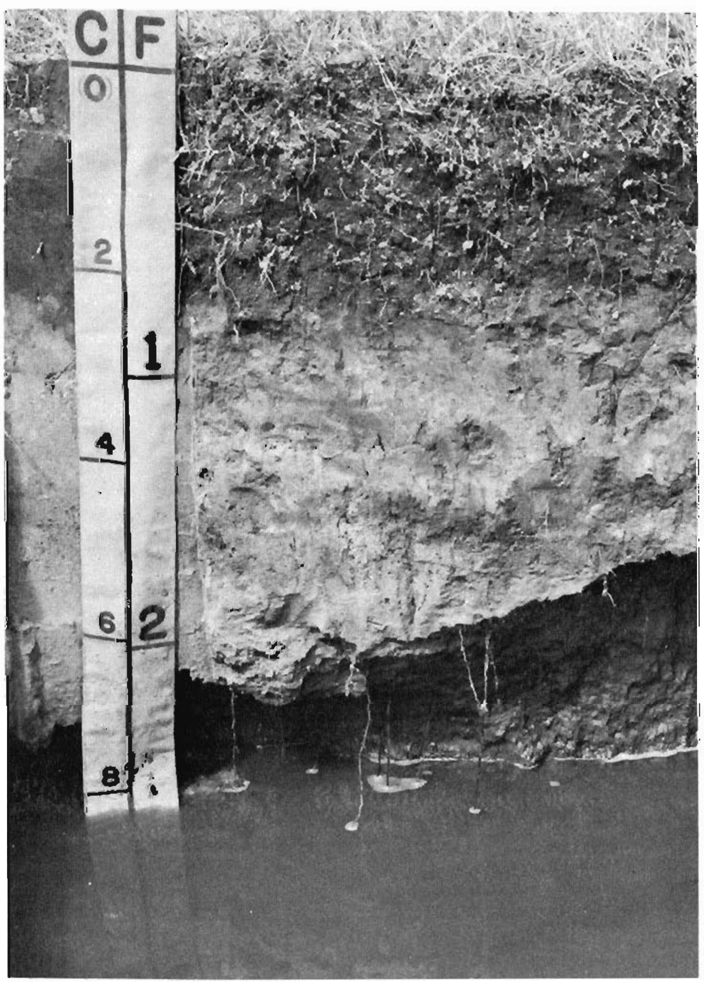

***Figure 8.*—Profile of Loup fine sandy loam, a poorly drained soil. The water table is at a depth of about 32 inches.**

Loup soils have rapid permeability and low available water capacity. Organic matter content is moderate, and natural fertility is medium. These soils release moisture readily to plants.

Loup soils are suited to native grass, trees, and shrubs, and they provide wildlife habitat. If properly managed, the better drained soils are suited to certain cultivated crops. These soils have limited use as recreation areas.

Representative profile of Loup fine sandy loam, drained, 0 to 2 percent slopes, in native grass, 1,550 feet south and 1,820 feet west of the northeast corner of sec. 11, T. 25 N., R. 7 W.

A—0 to 10 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

AC—10 to 14 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak very fine and fine granular structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C1—14 to 35 inches; light gray (10YR 7/1) fine sand, light brownish gray (10YR 6/2) moist; common medium distinct dark brown (7.5YR 4/4, moist) mottles; single grained; loose; moderately alkaline; gradual smooth boundary.

C2—35 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, grayish brown (2.5Y 5/2) moist; single grained; loose; free water at depth of 42 inches; mildly alkaline.

The surface layer is 10 to 16 inches thick. It is neutral to moderately alkaline and is very dark gray or dark gray. The A horizon is calcareous in most places. The AC horizon is fine sandy loam, loamy fine sand, or fine sand 0 to 4 inches thick. It is dark gray or gray and is neutral to moderately alkaline. In a few areas below a depth of 42 inches, the C horizon is stratified with loam.

Loup soils occur in the landscape near Ord, Elsmere, Ovina, and Thurman soils. They are more poorly drained than those soils. They have more sand in the C horizon than Ovina soils.

Lo—Loup fine sandy loam, 0 to 2 percent slopes. This deep, nearly level soil is on bottom land of stream valleys. Areas are oblong in shape and range from 5 to about 80 acres in size.

In this soil the water table is at the surface or within a depth of 1 foot in spring and ranges to a depth of 3 feet in summer.

Included with this soil in mapping were areas where the surface layer is loam or loamy fine sand. Also included were small areas of Ord and Inavale soils at the higher elevations and Orwet soils and Loup fine sandy loam, drained, at slightly higher elevations.

The principal limitation on this soil is wetness because of the very high water table. Flooding is a hazard following periods of heavy rainfall. This soil becomes boggy if it is used for grazing in spring when the water table is highest. Runoff is slow.

All the acreage is in native grass and is used for grazing or cut for hay. Capability unit Vw-7 dryland; Wet Land range site; windbreak suitability group 6.

Lp—Loup fine sandy loam, drained, 0 to 2 percent slopes. This deep, nearly level soil is on bottom land of stream valleys. Areas are irregular in shape and range from 5 to about 400 acres in size.

This soil has the profile described as representative of the series. In most years, the seasonal water table fluctuates from a high of about 1 to 2 feet early in spring to a low of 5 feet late in summer.

Included with this soil in mapping were areas where the surface layer is loamy fine sand or loam. Also included were small areas of Ord, Elsmere, Ovina, and Thurman soils at higher elevations.

The principal limitation is wetness because of the high water table. The low available water capacity limits production when the water table drops in mid summer. In some areas flooding is a slight hazard following heavy rains. Runoff is slow.

Nearly all the acreage is in native grass and is used for range or hay meadows. A small acreage is dryfarmed. Corn is the main crop. The soil is not suited to irrigation. Capability unit IVw-6 dryland; Subirrigated range site; windbreak suitability group 6.

Meadin Series

The Meadin series consists of excessively drained soils that are shallow over mixed sand and gravel (fig. 9). These are nearly level to steep soils on uplands.

In a representative profile the surface layer is very friable, dark gray sandy loam 6 inches thick. Below this is a transitional layer of dark grayish brown, loose gravelly loamy sand 4 inches thick. The underlying material is grayish brown and light gray mixed sand and gravel.

Meadin soils have very rapid permeability in the underlying material. The available water capacity is very low. Organic matter content and natural fertility are low. These soils release moisture readily to plants, but they are droughty because they can hold such a small amount of water.

Some areas of nearly level and very gently sloping Meadin soils can be used for cultivated crops. All Meadin soils are suited to grass, wildlife habitat, and recreation.

Representative profile of Meadin sandy loam, 3 to 30 percent slopes, in native grass, 790 feet west and 100 feet south of the northeast corner of sec. 2, T. 27 N., R. 7 W.

A—0 to 6 inches; dark gray (10YR 4/1) sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; strongly acid; abrupt smooth boundary.

AC—6 to 10 inches; dark grayish brown (10YR 4/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; loose; medium acid; clear smooth boundary.

IIC1—10 to 16 inches; grayish brown (10YR 5/2) mixed sand and gravel, dark grayish brown (10YR 4/2) moist; single grained; loose; medium acid; clear smooth boundary.

IIC2—16 to 60 inches; light gray (10YR 7/2) mixed sand and gravel, light brownish gray (10YR 6/2) moist; single grained; loose; medium acid.

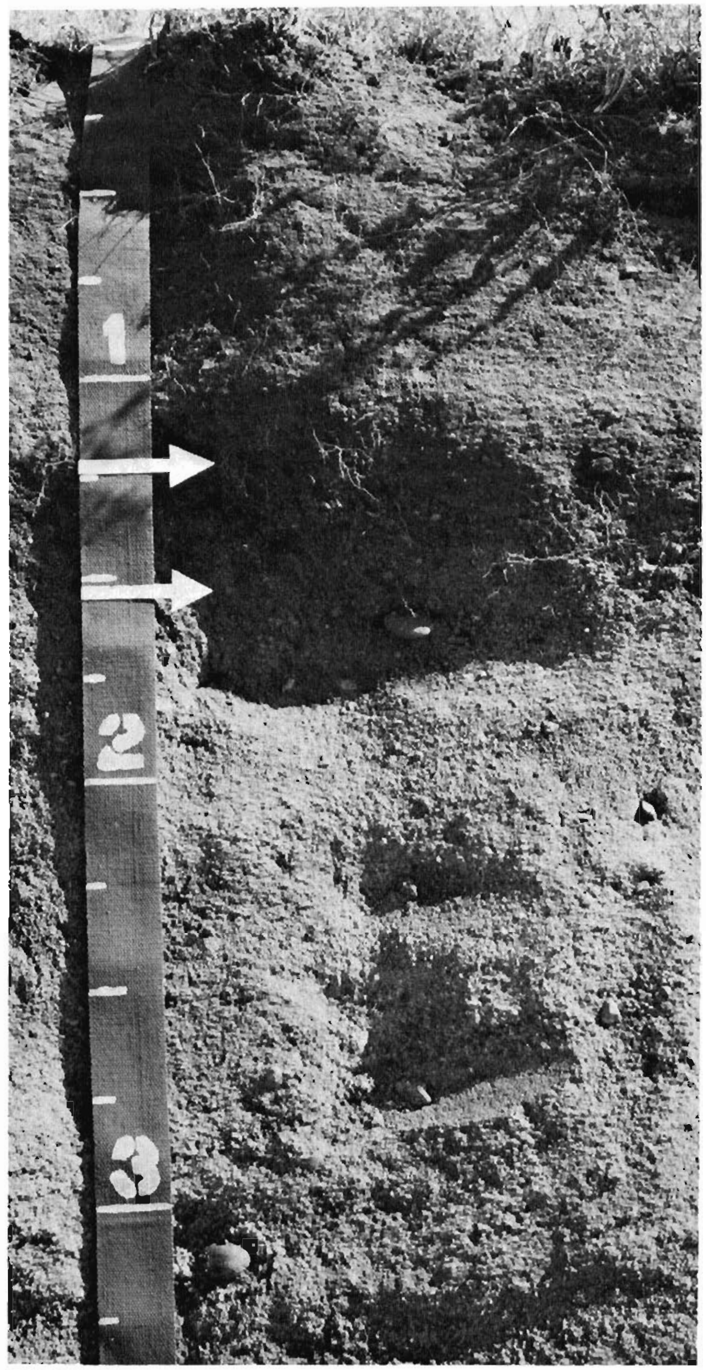

Figure 9.—**Profile of Meadin sandy loam. The upper arrow marks the lower boundary of the surface layer, and the lower arrow the upper boundary of the sand and gravel underlying material.**

The A horizon ranges from 6 to 15 inches in thickness. It is dark gray to dark grayish brown or grayish brown. The AC horizon is 2 to 4 inches thick and is gravelly sandy loam or gravelly loamy sand. In some places there is loamy material in the C horizon below a depth of 48 inches.

Meadin soils occur in the landscape near Bazile, O'Neill, Simeon, and Valentine soils. They have a thinner solum, and they have more gravel in the C horizon than Bazile soils. In contrast they lack the B horizon typical of those soils. They are shallower over the mixed sand and gravel than O'Neill soils. They have more gravel in the C horizon than Simeon or Valentine soils.

MeB—Meadin sandy loam, 0 to 3 percent slopes. This soil is shallow over mixed sand and gravel. It is on ridges of the uplands. Areas are narrow or irregular in shape and range from 5 to about 20 acres in size.

Small eroded areas have a lighter colored surface layer than the one described as representative of the series. In some areas there is a layer of loamy material below a depth of 36 inches. Included in mapping were small areas of Bazile, O'Neill, and Simeon soils at slightly higher elevations.

The main limitations are the mixed sand and gravel underlying material, which restricts root growth, the low natural fertility, and the very low available water capacity. Lack of adequate rainfall is a limitation in dryfarmed areas. Runoff is slow. Most of the precipitation is absorbed by the porous soil.

Most of the acreage is in native grass. A few areas are cultivated. Corn and alfalfa are the main crops. Capability units IVs-4 dryland, IVs-14 irrigated; Shallow to Gravel range site; windbreak suitability group 10.

MeF—Meadin sandy loam, 3 to 30 percent slopes. This soil is shallow over mixed sand and gravel. It is on narrow ridges and side slopes of the uplands. Areas range from 5 to about 100 acres in size.

This soil has the profile described as representative of the series. Some eroded areas have a lighter colored surface layer than is typical, and in some areas there is a loamy layer below a depth of 40 inches.

Included with this soil in mapping were small areas where the surface layer is loamy fine sand. Also included were areas of Valentine, Simeon, and Thurman soils at slightly higher elevations and Paka soils on the lower side slopes.

The main limitations are the sand and gravel underlying material, which restricts root growth, the very low available water capacity, and low fertility. Inadequate rainfall also limits production in dryfarmed areas. Runoff is medium or rapid, depending on the slope and the kind and amount of vegetation.

Nearly all the acreage is in native grass. A few areas are cultivated, but yields are generally very low. Capability unit VIs-4 dryland; Shallow to Gravel range site; windbreak suitability group 10.

Moody Series

The Moody series consists of deep, well drained soils (fig. 10) that formed in loess. These are nearly level to gently sloping soils on uplands.

In a representative profile the surface layer is friable, very dark grayish brown silty clay loam 8 inches thick. The subsoil is about 32 inches thick. The upper part is dark grayish brown, friable silty clay loam; the middle part is grayish brown and pale brown, firm or friable silty clay loam; and the lower part is pale brown, friable silt loam. The underlying material is very pale brown silt loam to a depth of 60 inches.

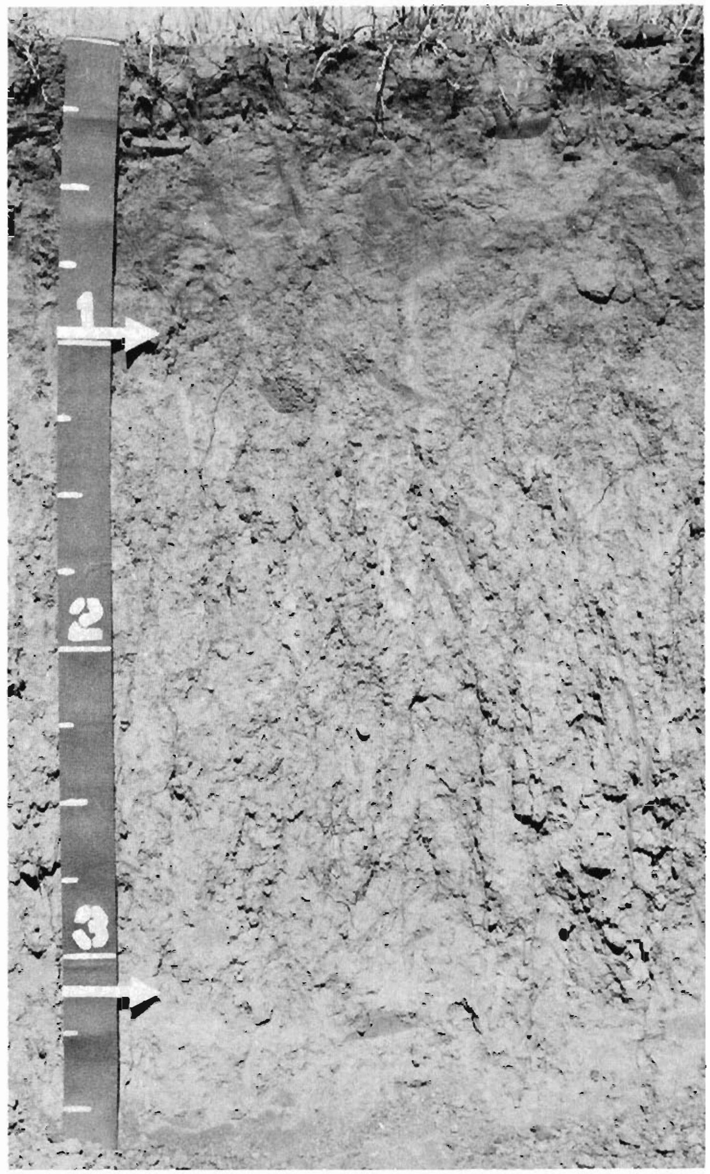

Figure 10.—Profile of Moody silty clay loam. The upper arrow marks the lower boundary of the surface layer, and the lower arrow the lower boundary of the subsoil.

Moody soils have moderately slow permeability and high available water capacity. Organic matter content is moderate, and natural fertility is high. These soils release moisture readily to plants.

Moody soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Moody silty clay loam, 2 to 6 percent slopes, in a cultivated field, 2,480 feet south and 530 feet west of the northeast corner of sec. 19, T. 23 N., R. 6 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable; slightly acid; abrupt smooth boundary.

B21—8 to 13 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; neutral; clear smooth boundary.

B22—13 to 23 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, firm; neutral; clear wavy boundary.

B23—23 to 34 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; gradual wavy boundary.

B3—34 to 40 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; mildly alkaline; clear wavy boundary.

C—40 to 60 inches; very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The A horizon is 6 to 10 inches thick and ranges from very dark grayish brown to dark grayish brown. It is medium acid or slightly acid. The B horizon is 25 to 40 inches thick. It ranges from slightly acid to mildly alkaline. Depth to lime ranges from 30 to 50 inches.

Moody soils occur in the landscape near Nora, Crofton, and Hord soils. They have a thicker, more clayey B2 horizon than Nora soils, and they have lime at a lower depth. They have a thicker A horizon than Crofton soils, and they have lime at a lower depth. Also they have a B horizon that Crofton soils lack. In both Moody and Hord soils the dark color of the A horizon extends into the B horizon, but it extends deeper in the Hord soils.

Mp—Moody silty clay loam, 0 to 2 percent slopes. This deep, nearly level silty soil is on low divides of the loess uplands. Areas are irregular or rounded in shape and range from 5 to about 900 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is generally slightly thicker. In a few eroded areas the surface layer is thinner than the one described as representative.

Included with this soil in mapping were small areas of Hord and Fillmore soils in the lower concave pockets and areas of Nora soils at slightly higher elevations.

This soil has few serious limitations for farming. Runoff is slow.

Nearly all the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is in native or tame grass. Capability units I–1 dryland, I–3 irrigated; Silty range site; windbreak suitability group 4.

MpC—Moody silty clay loam, 2 to 6 percent slopes. This deep, gently sloping soil is on ridges and side slopes of loess uplands. Areas are irregular or rounded in shape and range from 5 to about 1,200 acres in size.

This soil has the profile described as representative of the series. A few moderately eroded areas have a thinner surface layer and subsoil than those described in the representative profile. Included in mapping were small areas of Nora and Crofton soils on the higher upper side slopes and ridges and areas of Hord soils at the lowest elevations.

Water erosion is the main hazard unless the surface is protected. Small rills are common after heavy rains. Lack of adequate rainfall is commonly a hazard in dry-farmed areas. Runoff is medium.

Nearly all the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is in native or tame grass. Capability units IIe–1 dryland, IIIe–3 irrigated; Silty range site; windbreak suitability group 4.

Nora Series

The Nora series consists of deep, well drained soils that formed in loess (fig. 11). These are nearly level to steep soils on uplands.

In a representative profile the surface layer is friable, dark grayish brown silt loam 7 inches thick. The friable subsoil is about 25 inches thick. It is grayish brown silt loam in the upper part, pale brown light silty clay loam in the middle part, and light brownish gray silt loam in the lower part. The underlying material is light gray silt loam to a depth of 60 inches.

Nora soils have moderate permeability and high available water capacity. Organic matter content is generally moderate, but in eroded areas it is moderately low. Natural fertility is generally high, but in eroded areas it is medium. These soils release moisture readily to plants.

Where they are not too steep, Nora soils are suited to the commonly grown cultivated crops. Steep soils are better suited to less intensive uses. All Nora soils are suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Nora silt loam, 2 to 6 percent slopes, in a cultivated field, 2,000 feet west and 530 feet north of the southeast corner of sec. 13, T. 25 N., R. 6 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; medium acid; abrupt smooth boundary.

B21—7 to 12 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; slightly acid; clear wavy boundary.

B22—12 to 21 inches; pale brown (10YR 6/3) light silty clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear wavy boundary.

B3—21 to 32 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium subangular

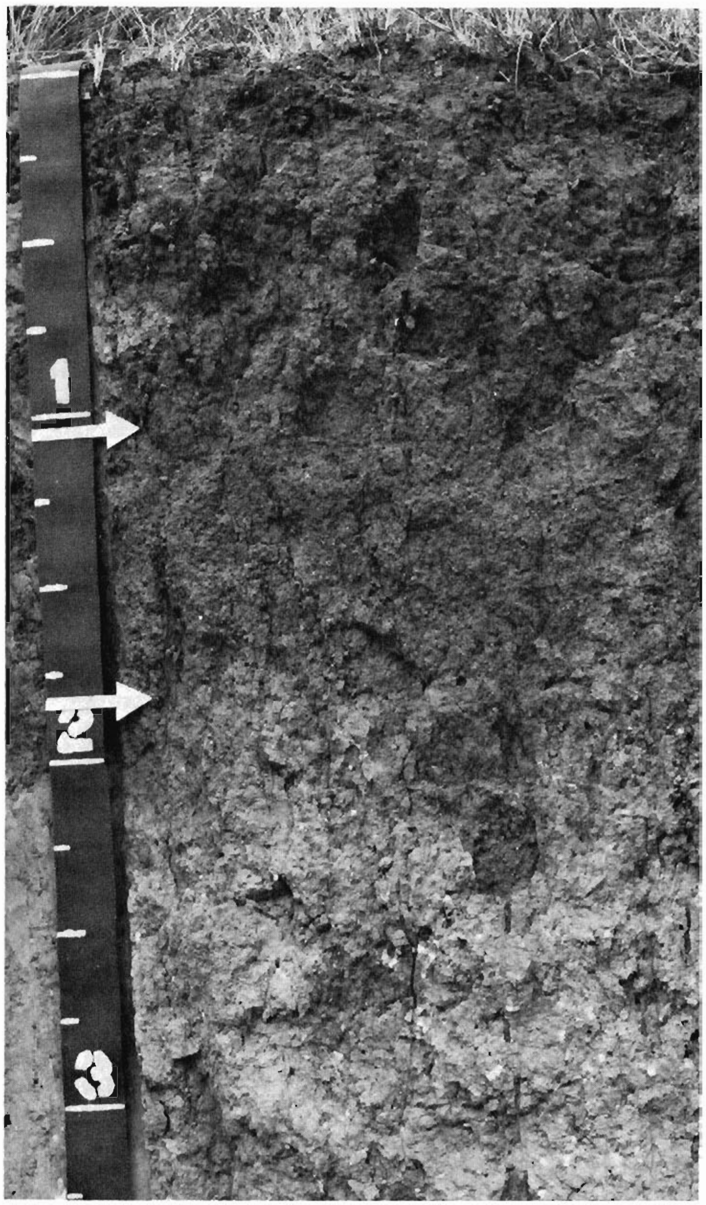

Figure 11.—Profile of Nora silt loam showing lime at a depth of about 21 inches and deep penetration of roots. The soil formed in loess.

blocky; hard, friable; violent effervescence; small soft masses of carbonates; moderately alkaline; gradual wavy boundary.

C—32 to 60 inches; light gray (2.5Y 7/2) silt loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline.

The A horizon is 4 to 7 inches thick and ranges from very dark grayish brown to dark grayish brown or grayish brown. The B21 horizon is nearly as dark as the A horizon in some places. The B horizon is 15 to 29 inches thick and ranges from dark grayish brown to light brownish gray or pale brown. Depth to lime ranges from 12 to 30 inches.

The soil in map unit NoC2 has a lighter colored A horizon than is defined in the range for the series, but this does not alter the use or management of the soil.

Nora soils are near Crofton, Hord, and Moody soils. They have a B horizon, which Crofton soils lack, and the lime is deeper in the profile than in those soils. They have a lighter colored B2 horizon than Hord soils. They have a thinner, less clayey B horizon than Moody soils, and the lime is higher in the profile.

No—Nora silt loam, 0 to 2 percent slopes. This deep, nearly level soil is on uplands. Areas range from 5 to about 80 acres in size.

This soil has a profile similar to the one described as representative of the series, but the subsoil is slightly thicker. In eroded areas the surface layer is thinner than the one described as representative, and in some areas the plow layer is fine sandy loam or loam. Included in mapping were small areas of Loretto and Thurman soils at slightly higher elevations and Moody soils at the same general elevations as the Nora soil.

This soil has few serious hazards or limitations for farming. Runoff is slow. Organic matter content is moderate.

Nearly all the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland and irrigated crops. A small acreage is in native or tame grass. Capability units I–1 dryland, I–6 irrigated; Silty range site; windbreak suitability group 4.

NoC—Nora silt loam, 2 to 6 percent slopes. This deep, gently sloping soil is on ridges and hillsides of uplands. Areas are irregular or oblong in shape and range from 5 to about 400 acres in size.

This soil has the profile described as representative of the series. In some small areas the plow layer is fine sandy loam or loam. In eroded areas the surface layer is thinner than the one described as representative.

Included with this soil in mapping were small areas of Loretto and Thurman soils on the ridges and upper side slopes, Hord soils at the lower elevations, and Nora silt loam, 2 to 6 percent slopes, eroded, on the upper part of hillsides.

Water erosion is the main hazard. Small rills are common following heavy rains unless fields are protected. Inadequate rainfall commonly limits production in dryfarmed areas. Runoff is medium. Organic matter content is moderate.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is in native or tame grass. Capability units IIe–1 dryland, IIIe–6 irrigated; Silty range site; windbreak suitability group 4.

NoC2—Nora silt loam, 2 to 6 percent slopes, eroded. This deep, gently sloping soil is on ridges and areas bordering drainageways in the uplands. Areas range from 5 to about 300 acres in size.

This soil has a profile similar to the one described as representative of the series, but mainly as a result of water erosion, less than 4 inches of the original surface layer is left. In many areas the lighter colored subsoil is exposed at the surface. In some areas the plow layer is fine sandy loam or loam.

Included with this soil in mapping were small areas of Crofton and Thurman soils on the upper side slopes and Loretto soils and Nora silt loam, 2 to 6 percent slopes, on the lower side slopes.

Water erosion is the principal hazard. Cultivated areas have small rills following heavy rains. Fertility is medium, and organic matter content is moderately low. Improving the fertility and organic matter content are important concerns in management. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the principal dryland and irrigated crops. The rest of the acreage is mainly in seeded tame grass. Capability units IIIe–8 dryland, IIIe–6 irrigated; Silty range site; windbreak suitability group 4.

NoD—Nora silt loam, 6 to 11 percent slopes. This deep, strongly sloping, silty soil is on ridges and hillsides of uplands. Areas range from 5 to about 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but the subsoil is slightly thinner. In a few eroded areas none of the original surface layer remains, and the lighter colored subsoil is exposed at the surface. Included in mapping were small areas of Crofton soils on ridgetops and areas of Loretto and Moody soils on lower hillsides.

Water erosion is a severe hazard unless fields are protected. Small rills and gullies form in cultivated fields during heavy rains. Inadequate rainfall limits production during some years. Conserving moisture by slowing runoff is an important concern in management. Runoff is medium. Organic matter content is moderate.

Much of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is mainly in native or tame grass. Capability units IIIe–1 dryland, IVe–6 irrigated; Silty range site; windbreak suitability group 4.

NoE—Nora silt loam, 11 to 15 percent slopes. This deep, moderately steep soil is on ridges and hillsides of uplands. Areas range from 5 to about 200 acres in size.

This soil has a profile similar to the one described as representative of the series but the subsoil is thinner. In eroded areas little of the original surface layer is left, and the subsoil is exposed at the surface. Included in mapping were small areas of Crofton soils on ridgetops and Hord soils at the base of the hillsides.

Water erosion is a very severe hazard. Small gullies and rills are common in cultivated areas following heavy rains. Reducing runoff is a concern in management. Organic matter content is moderate. Runoff is rapid.

Part of the acreage is cultivated. Corn, grain sorghum, and alfalfa are the main crops. Some areas that were formerly cultivated have been seeded to tame or native grass. The rest of the acreage is in native grass. Capability unit IVe–1 dryland; Silty range site; windbreak suitability group 4.

O'Neill Series

The O'Neill series consists of well drained soils that are moderately deep over mixed sand and gravel. These soils formed in 20 to 40 inches of loamy and sandy material overlying sand and gravel. They are nearly level to gently sloping soils on uplands and a few stream terraces.

In a representative profile the surface layer is friable, dark grayish brown sandy loam 19 inches thick. The subsoil is very friable, grayish brown loamy sand 6 inches thick. The underlying material is brown and light gray sand and gravel.

O'Neill soils have rapid permeability in the subsoil and very rapid permeability in the underlying material. The available water capacity is low. Organic matter content is moderately low, and natural fertility is medium. These soils release moisture readily to plants.

O'Neill soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of O'Neill sandy loam, 0 to 2 percent slopes, in a cultivated field, 100 feet east and 100 feet south of the northwest corner of sec. 35, T. 28 N., R. 5 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A12—8 to 19 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; medium acid; clear wavy boundary.

B2—19 to 25 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

IIC1—25 to 33 inches; brown (10YR 5/3) sand and gravel, dark brown (10YR 4/3) moist; single grained; loose; neutral; clear smooth boundary.

IIC2—33 to 54 inches; light gray (10YR 7/2) sand and gravel, light brownish gray (10YR 6/2) moist; single grained; loose; neutral.

The A horizon ranges from 6 to 20 inches in thickness. It is very dark gray to dark grayish brown or grayish brown loam or sandy loam. The B horizon is 6 to 16 inches thick. It is brown or grayish brown and is slightly acid or neutral. In many places below a depth of 48 inches, the C horizon is loamy.

These soils have more sand in the B horizon than is defined in the range for the series, but this difference does not alter the usefulness or behavior of the soils.

O'Neill soils occur in the landscape near Bazile, Meadin, Ortello, and Paka soils. They have more sand in the B horizon and more gravel in the IIC horizon than Bazile soils. They are deeper to mixed sand and gravel than Meadin soils. They have more sand and gravel in the C horizon than Ortello soils, and they have more sand in the B horizon and C horizon than Paka soils.

Oe—O'Neill sandy loam, 0 to 2 percent slopes. This nearly level soil is moderately deep over sand and gravel. It is on uplands and stream terraces. Areas range from 5 to about 40 acres in size.

This soil has the profile described as representative of the series. In some areas the upper part of the surface layer is lighter colored or the surface layer is thicker than is typical. In many areas there are pebbles in the surface layer.

Included with this soil in mapping were small areas where the surface layer is loamy fine sand. Also included were areas of Ortello and Simeon soils at slightly higher elevations, Meadin soils at slightly lower elevations, and Paka soils in the lower pockets.

The principal hazard is soil blowing unless the surface is protected. Lack of adequate rainfall is a serious limitation in dryfarmed areas. The main limitation is the low available water capacity, which causes the soil to be droughty. The sand and gravel in the underlying material restrict growth of plant roots. Runoff is slow.

Much of the acreage is cultivated. Corn, alfalfa, and rye are the main dryland crops. Corn, soybeans, and alfalfa are the principal irrigated crops. The rest of the acreage is in native or tame grass. Capability units IIIe-3 dryland, IIIe-9 irrigated; Sandy range site; windbreak suitability group 5.

OeC—O'Neill sandy loam, 2 to 6 percent slopes. This gently sloping soil is moderately deep over sand and gravel. It is on ridgetops and side slopes of uplands. Areas are irregular or oblong in shape and range from 5 to about 75 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thinner. In some areas the surface layer is thicker and in some areas the soil is lighter colored at the surface than is described in the representative profile. In most places there are pebbles in the surface layer and on the soil surface.

Included with this soil in mapping were areas where the surface layer is loamy fine sand or loam. Also included were small areas of Ortello and Simeon soils at the higher elevations and Meadin and Paka soils on the lower side slopes.

Soil blowing is the main hazard. Inadequate rainfall commonly limits production in dryfarmed areas. The soil is droughty because of the low available water capacity. The sand and gravel underlying material restricts root growth. Runoff is medium.

Most of the acreage is cultivated. Corn, rye, and alfalfa are the principal dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. The rest of the acreage is in native or tame grass. Capability units IVe-3 dryland, IVe-9 irrigated; Sandy range site; windbreak suitability group 5.

Of—O'Neill loam, 0 to 2 percent slopes. This nearly level soil is moderately deep over mixed sand and gravel. It is on uplands. Areas are irregular or somewhat rounded in shape and range from 5 to about 25 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is loam. In some areas the subsoil is loam.

Included with this soil in mapping were areas that have a plow layer of fine sandy loam. Also included were small areas of Ortello soils at slightly higher elevations, Paka soils at slightly lower elevations, and Bazile soils and O'Neill sandy loam, 0 to 2 percent slopes, at the same elevations.

The main limitation is droughtiness because of the low available water capacity. The underlying sand and gravel restrict root growth, and this commonly limits production. Lack of adequate rainfall in summer is a hazard, especially in dryfarmed areas. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, and alfalfa are the principal dryland and irrigated crops. The rest of the acreage is mainly in native grass. Capability units IIs-5 dryland, IIs-7 irrigated; Silty range site; windbreak suitability group 5.

Ord Series

The Ord series consists of deep, somewhat poorly drained soils that formed in loamy and sandy alluvium. These are nearly level soils on bottom land. In most years the seasonal water table is at a high of 2 or 3 feet early in spring and at a low of about 6 feet late in summer.

In a representative profile the surface layer is friable, dark gray loam 10 inches thick. Below this is a transitional layer of gray, friable fine sandy loam 11 inches thick. The underlying material is white fine sand to a depth of 60 inches.

Ord soils have moderately rapid permeability and moderate available water capacity. Organic matter content is moderate, and natural fertility is medium. These soils release moisture readily to plants.

Ord soils are suited to both dryland and irrigated crops and tame grass. They are also suited to native grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Ord loam, 0 to 2 percent slopes, in a cultivated field, 700 feet north and 80 feet feet west of the middle of sec. 7, T. 25 N., R. 7 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak very fine granular structure; slightly hard, friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A12—6 to 10 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

AC—10 to 21 inches; gray (10YR 6/1) fine sandy loam, dark gray (10YR 4/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

C—21 to 60 inches; white (2.5Y 8/2) fine sand, light gray (2.5Y 7/2) moist; common medium distinct strong brown (7.5YR 5/6, moist) mottles; single grained; loose; free water at depth of 48 inches; mildly alkaline.

The A horizon is 8 to 20 inches thick. It is dominantly loam or fine sandy loam, but in small areas it is silt loam. It ranges from dark gray to gray or dark grayish brown. The AC horizon ranges from 6 to 12 inches in thickness and is gray or grayish brown. The C horizon is typically fine sand, but ranges to loamy fine sand. It is light brownish gray to white. In many areas below a depth of 42 inches, the C horizon has thin layers of loamy material.

Ord soils in Antelope County have more sand between depths of 10 and 40 inches than is defined in the range for the series, but this does not alter the usefulness or behavior of the soils.

Ord soils are near Cass, Gibbon, and Orwet soils. They are more poorly drained than Cass soils and are coarser in the upper part of the C horizon. They have more sand, less silt, and less clay in the C horizon than Gibbon soils. They are better drained than Orwet soils.

Og—Ord fine sandy loam, 0 to 2 percent slopes. This nearly level, deep soil is on bottom land of stream valleys. Areas are elongated or irregular in shape and range from 5 to about 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam. In some areas there is a loam transitional layer and in other areas the surface layer extends to a depth of 20 to 26 inches.

Included with this soil in mapping were areas that have a plow layer of loamy fine sand. Also included were small areas of Loup soils at low elevations, Cass soils at higher elevations, and Ord loam, 0 to 2 percent slopes, at slightly lower elevations.

The main limitation is wetness in spring because of the fluctuating water level. Soil blowing, unless fields are protected, and rare flooding during periods of heavy rainfall are the main hazards. The available water capacity is only moderate, and this makes the soil droughty late in summer. Runoff is slow.

Much of the acreage is cultivated. Corn, soybeans, and alfalfa are the principal dryland and irrigated crops. The rest of the acreage is in native grass and is used for grazing or cut for hay. Capability units IIw-6 dryland, IIw-8 irrigated; Subirrigated range site; windbreak suitability group 2.

Oh—Ord loam, 0 to 2 percent slopes. This deep, nearly level soil is on bottom land of stream valleys. Areas are oblong in shape and range from 5 to about 300 acres in size.

This soil has the profile described as representative of the series. In some areas the surface layer is silt loam, and in some areas the surface layer extends to a depth of 20 to 28 inches.

Included with this soil in mapping were areas where the plow layer is fine sandy loam and areas that have a loam transitional layer. Also included were small areas of Elsmere soils and Ord fine sandy loam at slightly higher elevations and Gibbon silt loam, saline-alkali, at about the same elevations as the Ord soil.

The main limitation is wetness in spring because of the fluctuating water level. Rare flooding is a slight hazard following heavy rains. The soil is droughty, however, in midsummer when the water table is as low as 5 or 6 feet. Runoff is slow.

Much of the acreage is cultivated. Corn, soybeans, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is in native grass and is used for grazing or mowed for hay. Capability units IIw-4 dryland, IIw-8 irrigated; Subirrigated range site; windbreak suitability group 2.

Ortello Series

The Ortello series consists of deep, well drained soils that formed in eolian material deposited over eolian sand or sandy alluvium. These are nearly level to strongly sloping soils on uplands and stream terraces.

In a representative profile the surface layer is very friable, very dark grayish brown and dark grayish brown fine sandy loam 14 inches thick. The subsoil is very friable, grayish brown fine sandy loam 7 inches thick. The underlying material is brown fine sandy loam and pale brown loamy fine sand.

Ortello soils have moderately rapid permeability and moderate available water capacity. Natural fertility is medium, and organic matter content is moderately low. These soils release moisture readily to plants.

Ortello soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Ortello fine sandy loam, 2 to 6 percent slopes, in a cultivated field, 2,270 feet south and 200 feet east of the northwest corner of sec. 1, T. 27 N., R. 5 W.

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

A12—4 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak very fine and fine granular structure; slightly hard, very friable; strongly acid; clear smooth boundary.

A13—7 to 14 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak very fine granular; slightly hard, very friable; medium acid; clear smooth boundary.

B2—14 to 21 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; medium acid; clear smooth boundary.

C1—21 to 32 inches; brown (10YR 5/3) light fine sandy loam, dark brown (10YR 4/3) moist; weak very fine and fine granular structure; soft, very friable; medium acid; clear smooth boundary.

C2—32 to 40 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; soft, very friable; slightly acid; gradual smooth boundary.

C3—40 to 49 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; soft, very friable; slightly acid; clear smooth boundary.

C4—49 to 60 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; slightly acid.

The A horizon ranges from 10 to 20 inches in thickness. It is dominantly loam and fine sandy loam, but in small areas it is sandy loam. The B horizon is 6 to 12 inches thick and is grayish brown or brown. The C horizon is dominantly loamy fine sand and fine sandy loam, but ranges to fine sand in places. In some areas below a depth of 48 inches, the C horizon is loamy.

Ortello soils occur in the landscape near Blendon, Boelus, Loretto, and Thurman soils. They have a lighter colored, thinner B horizon than Blendon soils. They have more sand in the B horizon and C horizon than Boelus and Loretto soils. They have less sand between depths of 10 and 40 inches than Thurman soils, and they have a B horizon that those soils lack.

On—Ortello fine sandy loam, 0 to 2 percent slopes. This deep, nearly level soil is on uplands and stream terraces. Areas range from 5 to about 50 acres in size.

In some areas the surface layer is sandy loam and in some areas it is lighter colored than the one described in the representative profile. In some areas the subsoil is loamy fine sand.

Included with this soil in mapping were small areas that have loamy fine sand or loam at the surface. Also included were small areas of Blendon and Loretto soils at slightly lower elevations and Thurman soils at the highest elevations.

This soil is susceptible to soil blowing. The available water capacity is moderate. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, rye, and alfalfa are the main crops. The rest of the acreage is in native grass or has been reseeded to tame grass. Capability units IIe–3 dryland, IIe–8 irrigated; Sandy range site; windbreak suitability group 3.

OnC—Ortello fine sandy loam, 2 to 6 percent slopes. This deep, gently sloping soil is on ridges and hillsides of uplands. Areas range from 5 to about 100 acres in size.

This soil has the profile described as representative of the series. In some areas the surface layer is sandy loam, and in some areas the upper part of the surface layer is lighter colored than the one described in the representative profile.

Included with this soil in mapping were areas where the plow layer is loamy fine sand. Also included were small areas of Blendon and Boelus soils on the lower side slopes, Thurman soils on the higher ridges, and Ortello loam at the same elevations.

Wind and water erosion are hazards. The moderate available water capacity causes the soil to be droughty, especially in midsummer. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, rye, and alfalfa are the principal dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. The rest of the acreage is in native or tame grass. Capability units IIIe–3 dryland, IIIe–8 irrigated; Sandy range site; windbreak suitability group 3.

OnD—Ortello fine sandy loam, 6 to 11 percent slopes. This deep, strongly sloping soil is on hillsides that border drainageways of the uplands. Areas are irregular in shape and range from 5 to about 25 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. In a few areas the surface layer is sandy loam and in a few areas the upper part of the surface layer is lighter colored than the one described in the representative profile. Also, in some areas the underlying material is silt loam.

Included with this soil in mapping were areas where the upper part of the surface layer is loamy fine sand. Also included were small areas of Bazile soils at lower elevations and Thurman soils at the highest elevations.

Wind and water erosion are hazards unless the surface is protected. This soil is droughty in midsummer unless rainfall in timely. Runoff is medium.

Much of the acreage is cultivated. Corn and alfalfa are the main dryland and irrigated crops. The rest of the acreage is in native or tame grass. Capability units IVe–3 dryland, IVe–8 irrigated; Sandy range site; windbreak suitability group 3.

Or—Ortello loam, 0 to 2 percent slopes. This deep, nearly level soil is on stream terraces and uplands. Areas range from 5 to about 20 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is loam. In a few areas the surface layer is silt loam, and in a few areas there is loamy fine sand in the subsoil. In a few areas the dark color typical of the surface layer extends to a depth of 20 to 30 inches.

Included with this soil in mapping were small areas of Blendon soils at slightly lower elevations, Thurman soils at slightly higher elevations, and Loretto soils and Ortello fine sandy loam, 0 to 2 percent slopes, at the same general elevations.

In dry years this soil is droughty because a large amount of available water cannot be stored. Runoff is slow.

Nearly all the acreage is cultivated. Corn, soybeans, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is in native grass. Capability units I–1 dryland, I–8 irrigated; Silty range site; windbreak suitability group 4.

OrC—Ortello loam, 2 to 6 percent slopes. This deep, gently sloping soil is on ridgetops and side slopes of the uplands. Areas range from 5 to about 40 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is loam. In some areas the surface layer is silt loam, and in some areas the subsoil is loam or loamy fine sand. Also in some areas the surface layer is less than 6 inches thick, and in places the dark color typical of the surface layer extends to a depth of 20 to 30 inches.

Included with this soil in mapping were small areas of Blendon soils on the lower side slopes, Thurman soils on the higher ridges, and Loretto soils at about the same elevations.

Water erosion is the main hazard. Small rills are formed during heavy rains. This soil is droughty because the available water capacity is moderate. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is in native or tame grass. Capability units IIe–1 dryland, IIIe–8 irrigated; Silty range site; windbreak suitability group 4.

Orwet Series

The Orwet series consists of deep, poorly drained soils that formed in loamy and sandy alluvium. These are nearly level soils on bottom land. In most years the seasonal water table is at the surface or within a depth of 1 foot in spring and at a low of about 5 feet late in summer. These soils have a very high content of lime in the surface layer, in the transitional layer, and in the upper horizon of the underlying material.

In a representative profile the surface layer is very friable loam about 19 inches thick. The upper part is dark gray, and the lower part is gray. Below this is a transitional layer of gray, very friable fine sandy loam about 5 inches thick. The underlying material is light gray loamy fine sand in the upper part, dark gray fine sandy loam below that, and gray loamy fine sand to a depth of 60 inches.

Orwet soils have moderately rapid permeability and moderate available water capacity. Organic matter content is moderate, and natural fertility is medium. These soils release moisture readily to plants.

Orwet soils are marginally suited to the cultivated crops commonly grown. These soils are also suited to grass and trees, and they provide wildlife habitat. They are poorly suited as recreation areas.

Representative profile of Orwet loam, 0 to 2 percent slopes, in native grass, 1,370 feet west and 530 feet south of the northeast corner of sec. 22, T. 26 N., R. 5 W.

A11ca—0 to 11 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine and very fine granular structure; slightly hard, very friable; violent effervescence (17 percent calcium carbonate); moderately alkaline; clear smooth boundary.

A12ca—11 to 19 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to weak very fine granular; hard, very friable; violent effervescence (16 percent calcium carbonate); moderately alkaline; clear smooth boundary.

ACca—19 to 24 inches; gray (5Y 6/1) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct strong brown (7.5YR 5/6, moist) mottles; weak very fine and fine granular structure; slightly hard, very friable; violent effervescence (13 percent calcium carbonate); moderately alkaline; clear smooth boundary.

Cca—24 to 42 inches; light gray (2.5Y 7/2) loamy fine sand, light brownish gray (2.5Y 6/2) moist; single grained; soft, loose; violent effervescence (15 percent calcium carbonate); free water at depth of 40 inches; moderately alkaline; abrupt smooth boundary.

Ab—42 to 53 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; massive; hard, very friable; slight effervescence; mildly alkaline; gradual wavy boundary.

C—53 to 60 inches; gray (5Y 5/1) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; slightly hard, very friable; mildly alkaline.

The A horizon ranges from 12 to 20 inches in thickness. It is dominantly loam, but in small areas it is silt loam. The calcium carbonate equivalent ranges between 15 and 28 percent. The AC horizon is grayish brown or gray loamy fine sand or fine sandy loam. It is 0 to 10 inches thick and ranges from neutral to moderately alkaline. The upper part of the C horizon is a loamy fine sand or fine sand. In many areas below a depth of 40 inches, the lower part of the C horizon is stratified with loam.

Orwet soils in Antelope County have less sand between depths of 10 and 40 inches than is defined in the range for the series, but this does not alter the usefulness or behavior of the soils.

Orwet soils are near Gibbon, Lawet, Loup, and Ord soils. They have more lime in the A horizon than Gibbon soils, and they are more poorly drained and contain more sand. They lack the B horizon typical of Lawet soils, and they contain less silt and less clay in the C horizon than those soils. They have a higher content of lime in the A horizon and AC horizon than Loup soils, and they are more poorly drained and have more lime in the A horizon and AC horizon than Ord soils.

Ot—Orwet loam, 0 to 2 percent slopes. This deep, nearly level soil is on bottom land of stream valleys. Areas range from 5 to about 500 acres in size.

In small areas the upper part of the surface layer is fine sandy loam. In some areas the surface layer and transition layer are less than 15 percent calcium carbonate. Included in mapping were small areas of Loup soils at slightly lower elevations, Gibbon soils at the higher elevations, and Lawet soils at the same elevations as the Orwet soil.

The principal limitation is wetness because of the high water table. The wetness delays tillage in spring. Flooding is a slight hazard following periods of heavy rainfall. This soil becomes boggy if used for grazing in spring when the water table is highest. Much of the phosphate is unavailable. Runoff is slow.

Nearly all the acreage is in native grass and is used for grazing or mowed for hay. The small acreage left is cultivated. Corn is the main crop. Wet soil conditions limit the choice of adapted crops. Capability unit IVw-4 dryland; Subirrigated range site; windbreak suitability group 6.

Ovina Series

The Ovina series consists of deep, somewhat poorly drained soils that formed in eolian sandy material deposited over loamy alluvium. These are nearly level soils on stream terraces and high bottom land. In most years the seasonal water table is at a high of 2 or 3 feet early in spring and at a low of about 6 feet in mid summer.

In a representative profile the surface layer is very friable loamy fine sand about 13 inches thick. The upper part is dark gray, and the lower part is gray. Below this is a transitional layer of gray, very friable fine sandy loam about 5 inches thick. The underlying material is gray and light gray fine sandy loam and loam in the upper part, light gray loamy fine sand below that, and light brownish gray fine sand to a depth of 60 inches.

Ovina soils have rapid permeability in the surface layer and moderately rapid permeability in the transitional layer and upper part of the underlying material. The loam layer in the underlying material has moderate permeability. The available water capacity is moderate. Organic matter content is moderately low, and natural fertility is medium. These soils release moisture readily to plants.

Ovina soils are suited to both dryland and irrigated cultivated crops and tame grass. They are also suited to native grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Ovina loamy fine sand, 0 to 2 percent slopes, in a cultivated field, 75 feet east and 2,220 feet north of the southwest corner of sec. 26, T. 25 N., R. 7 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak very fine granular structure; soft, very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—9 to 13 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak very fine and fine granular structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

AC—13 to 18 inches; gray (10YR 6/1) fine sandy loam, dark gray (10YR 4/1) moist; few fine distinct dark brown (7.5YR 4/2, moist) mottles; weak fine and medium subangular blocky structure; slightly hard, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C1—18 to 24 inches; gray (10YR 6/1) fine sandy loam, dark grayish brown (10YR 4/2) moist; few fine distinct dark brown (7.5YR 4/2, moist) mottles; weak fine and medium subangular blocky structure; slightly hard, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C2—24 to 35 inches; light gray (10YR 7/1) loam, grayish brown (2.5Y 5/2) moist; few fine distinct dark brown (7.5YR 4/2, moist) mottles; massive; hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

IIC3—35 to 49 inches; light gray (2.5Y 7/2) loamy fine sand, light brownish gray (2.5Y 6/2) moist; few fine distinct strong brown (7.5YR 5/6, moist) mottles; single grained; slightly hard, very friable; free water at depth of 46 inches; violent effervescence; mildly alkaline; gradual wavy boundary.

IIC4—49 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, grayish brown (2.5Y 5/2) moist; single grained; slightly hard, very friable; mildly alkaline.

The A horizon is 10 to 16 inches thick and is dark gray to gray or dark grayish brown. It is dominantly loamy fine sand, but in small areas it is fine sandy loam. The AC horizon is 2 to 8 inches thick. It is gray to grayish brown or light brownish gray loamy fine sand or fine sandy loam. The upper part of the C horizon is fine sandy loam or loam, and the lower part is fine sandy loam, loamy fine sand, or fine sand. In some areas the upper part of the C horizon has thin strata of clay loam or sandy clay loam.

Ovina soils are near Elsmere, Loup, Thurman, and Valentine soils. They have less sand in the upper part of the C horizon than Elsmere soils. They have less sand between depths of 10 and 40 inches and are better drained than Loup soils. They are more poorly drained than Thurman soils and have less sand between depths of 10 and 40 inches. They are more poorly drained than Valentine soils, and they have a thicker A horizon and less sand between depths of 10 and 40 inches.

Ov—Ovina loamy fine sand, 0 to 2 percent slopes. This deep soil is on stream terraces and high bottom land that border the sandy uplands. Areas range from 5 to about 125 acres in size.

In some areas the surface layer is fine sandy loam. Also there are areas that have a plow layer of grayish brown or light brownish gray fine sand. In some areas the surface layer is 16 to 24 inches thick. In places, the transitional layer and underlying material are darker than those described in the representative profile.

Included with this soil in mapping were small areas of Loup soils at the lower elevations, Thurman and Valentine soils at the highest elevations, and Elsmere soils at the same elevations.

The main limitation is wetness because of the fluctuating water table. Wetness delays tillage in spring, and this soil warms up more slowly than better drained soils. Flooding is a slight hazard during and following heavy rains. Soil blowing is a hazard unless the surface is protected. Runoff is slow.

Much of the acreage is cultivated. Corn and alfalfa are the main crops. The rest of the acreage is in native grass and is used for grazing or mowed for hay. Capability units IIIw-5 dryland, IIIw-10 irrigated; Subirrigated range site; windbreak suitability group 2.

Paka Series

The Paka series consists of deep, well drained soils that formed in loamy material from siltstone. These are nearly level to steep soils on uplands.

In a representative profile the surface layer is friable, dark gray loam 7 inches thick. The firm subsoil is 28 inches thick. It is grayish brown light clay loam in the upper part and light brownish gray loam in the lower part. The underlying material is light gray loam to a depth of 47 inches. Below this is siltstone bedrock.

Paka soils have moderate permeability and high available water capacity. Organic matter content is moderate or moderately low, and natural fertility is medium. These soils release moisture readily to plants.

Except where the slope is more than 11 percent, Paka soils are suited to both dryland and irrigated cultivated crops. In steeper areas the hazard of erosion is too severe. All Paka soils are suited to grass. These soils are also suited to trees and shrubs, wildlife habitat, and recreation.

Representative profile of Paka loam, 2 to 6 percent slopes, in a cultivated field, 1,370 feet south and 275 feet east of the northwest corner of sec. 2, T. 27 N., R. 8 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable; medium acid; abrupt smooth boundary.

B21t—7 to 17 inches; grayish brown (2.5Y 5/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm; organic films on faces of peds; medium acid; clear smooth boundary.

B22t—17 to 35 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; hard, firm; organic films on faces of peds; slightly acid; clear smooth boundary.

C1—35 to 47 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

Cr2—47 to 60 inches; light gray (2.5Y 7/2) siltstone, light brownish gray (2.5Y 6/2) moist; massive; hard; violent effervescence.

The A horizon is 6 to 12 inches thick and ranges from very dark grayish brown to dark gray or dark grayish brown. It is dominantly loam, but many areas have an overblow of fine sandy loam, loamy fine sand, or fine sand on the surface. The B horizon is 16 to 30 inches thick and is brown, grayish brown, light gray, or light brownish gray. It is medium acid to mildly alkaline loam, clay loam, or sandy clay loam. The C horizon is loam or silt loam. Depth to lime ranges from 16 to 30 inches. In some areas below a depth of 42 inches, these soils have moderately coarse or coarse material.

Paka soils in Antelope County have a surface layer that is thinner than is defined in the range for the series. This difference, however, does not influence the usefulness or behavior of the soils.

Paka soils are near Bazile, Boelus, Loretto, and Thurman soils. They have more silt and clay in the C horizon than Bazile soils. They have more silt in the B horizon than Loretto and Boelus soils. They formed from weathered siltstone, whereas Boelus soils formed in wind deposited material. Paka soils have more clay and more silt in the profile than Thurman soils.

Ph—Paka loam, 0 to 2 percent slopes. This deep, nearly level soil is on the uplands. Areas range from 5 to about 60 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thicker. In small eroded areas less than 4 inches of the original surface layer is left.

Included with this soil in mapping were areas where the upper part of the surface layer or the plow layer is fine sandy loam or loamy fine sand. Also included were small areas of soils that are high in alkalinity, small areas of Loretto and Thurman soils at slightly higher elevations, and Longford and Bazile soils at the same relative elevations as the Paka soil.

This soil has few serious hazards or limitations. Organic matter content is moderate. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. The rest of the acreage is in native or tame grass. Capability units I–1 dryland, I–4 irrigated; Silty range site; windbreak suitability group 4.

PhC—Paka loam, 2 to 6 percent slopes. This deep, gently sloping soil is on the ridges and hillsides that slope to drainageways of the uplands. Areas range from 5 to about 200 acres in size.

This soil has the profile described as representative of the series. In small areas there is a plow layer of fine sandy loam or loamy fine sand, and in some areas gravel or sandstone fragments are on the surface. In many eroded areas the lighter colored subsoil is exposed at the surface.

Included with this soil in mapping were small areas of soils that are high in alkalinity. Also included were small areas of Loretto and Thurman soils on the upper side slopes and areas of Bazile and Longford soils at the same general elevations as the Paka soil.

Water erosion is the main hazard. Small rills form during heavy rains. Organic matter content is moderate. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, grain sorghum, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the principal irrigated crops. The rest of the acreage is in native or tame grass. Capability units IIe–1 dryland, IIIe–4 irrigated; Silty range site; windbreak suitability group 4.

PhD—Paka loam, 6 to 11 percent slopes. This deep, strongly sloping soil is on hillsides that slope to drainageways of the uplands. Areas range from 5 to about 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but the subsoil is slightly thinner. In some areas the surface layer is fine sandy loam or loamy fine sand. In some eroded areas the grayish brown subsoil is at the surface.

Included with this soil in mapping were small areas of gravelly soils and areas of soils that are high in alkalinity. Also included were small areas of Bazile and Loretto soils on the upper hillsides, Longford soils on the lower side slopes, and Brunswick soils at the same relative elevations.

Water erosion is the main hazard. Organic matter content is moderate. Runoff is medium.

Most of the acreage is cultivated. Corn, soybeans, and alfalfa are the principal dryland and irrigated crops. The rest of the acreage is in native grass and is used for grazing. Capability units IIIe–1 dryland, IVe–4 irrigated; Silty range site; windbreak suitability group 4.

PkB—Paka complex, 0 to 3 percent slopes. This nearly level or very gently sloping map unit is on uplands. These Paka soils have a profile similar to the one described as representative of the series, but have an overblow of dark grayish brown loamy or sandy material on the surface. On about 50 percent of each mapped area the surface layer is fine sandy loam, loamy fine sand, or fine sand 8 to 18 inches thick. On about 30 percent the surface layer is loamy fine sand or fine sand 18 to 32 inches thick. Areas are irregular in shape and range from 5 to about 300 acres in size.

About 20 percent of each mapped area is small included areas of Thurman and Boelus soils at slightly higher elevations and areas of Bazile and Longford soils at the same general elevations as the Paka soils.

Soil blowing is the main hazard. Runoff is slow. Organic matter content is moderately low.

Most of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the principal dryland crops. Corn, soybeans, and alfalfa are the main irrigated crops. The rest of the acreage is in native grass or seeded tame grass. Capability units IIIe–6 dryland, IIe–10 irrigated; Sandy range site; windbreak suitability group 3.

PkC—Paka complex, 3 to 6 percent slopes. This gently sloping map unit is on ridges and hillsides of uplands. These Paka soils have a profile similar to the one described as representative of the series, but have an overblow of dark grayish brown or grayish brown loamy or sandy material on the surface. On about 45 percent of each mapped area the surface layer is fine sandy loam, loamy fine sand, or fine sand 8 to 18 inches thick. On about 35 percent the surface layer is loamy fine sand or fine sand 18 to 32 inches thick. Areas range from 5 to about 150 acres in size.

About 20 percent of each mapped area is included areas of Thurman and Boelus soils on the ridges and upper side slopes and areas of Loretto and Bazile soils at the same relative elevations. Also included were areas where the surface layer is loam.

Soil blowing and water erosion are both severe hazards unless fields are protected. Organic matter content is moderately low. Runoff is slow.

Part of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main crops. The principal irrigated crops are corn, soybeans, and alfalfa. The rest of the acreage is in native grass, tame grass, or windbreaks. Capability units IIIe–6 dryland, IIIe–10 irrigated; Sandy range site; windbreak suitability group 3.

PkD—Paka complex, 6 to 11 percent slopes. This strongly sloping map unit is on hillsides of the uplands. These Paka soils have a profile similar to the one described as representative of the series, but have a dark grayish brown or grayish brown deposit of loamy or sandy material on the surface. On about 40 percent of each mapped area the surface layer is fine sandy loam or loamy fine sand 8 to 18 inches thick. On about 35 percent there is an 18- to 32-inch deposit of loamy fine sand or fine sand on the surface. Areas are irregular or roughly oblong in shape and range from 5 to about 50 acres in size.

About 25 percent of each mapped area is included areas of Bazile and Thurman soils on upper side slopes, Brunswick soils at the same relative elevations, and Paka soils that have a loam surface layer.

Soil blowing and water erosion are severe hazards unless the surface is protected. Organic matter content is moderately low. Runoff is medium.

Most of the acreage is in native grass and is used for range. The rest of the acreage is cultivated. Corn, rye, and alfalfa are the main crops. Capability units IVe–6 dryland, IVe–10 irrigated; Sandy range site; windbreak suitability group 3.

Simeon Series

The Simeon series consists of deep, excessively drained soils that formed in sandy material. These are nearly level to strongly sloping soils on uplands.

In a representative profile the surface layer is very friable, dark grayish brown loamy sand 7 inches thick. Below this is a transitional layer of pale brown loose sand 5 inches thick. The underlying material is very pale brown sand to a depth of 60 inches. A few pebbles are scattered throughout the soil.

Simeon soils have rapid permeability and low available water capacity. Organic matter content is moderately low, and natural fertility is low. These soils release moisture readily to plants.

Areas that are not too steep are suited to cultivated crops. The soils are marginal for this purpose, however, because they are so droughty. The soils are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Simeon soils in Antelope County are mapped only with Valentine soils.

Representative profile of Simeon loamy sand, in an area of Valentine-Simeon complex, 3 to 6 percent slopes, in native grass, 1,500 feet north and 1,500 feet east of the southwest corner of sec. 12, T. 28 N., R. 8 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, very friable; few fine pebbles; strongly acid; clear smooth boundary.

AC—7 to 12 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grained; loose; few fine pebbles; strongly acid; gradual smooth boundary.

C—12 to 60 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; single grained; loose; few fine pebbles; medium acid.

The A horizon ranges from 6 to 10 inches in thickness. It is loamy fine sand, loamy sand, or sand. It is very dark grayish brown, dark grayish brown or grayish brown. The AC horizon is 4 to 8 inches thick and ranges from dark grayish brown to light brownish gray or pale brown. It is loamy sand, fine sand, or sand. In some areas loamy material is between depths of 48 and 60 inches.

Simeon soils have less medium and coarse sand between depths of 10 and 40 inches than is defined in the range for the series. This difference, however, does not significantly alter the use or management of the soils.

Simeon soils are near Bazile, O'Neill, Paka, Thurman, and Valentine soils. They have a sandy C horizon, whereas O'Neill soils have sand and gravel in the C horizon. Simeon soils are coarser than Paka soils. They have more sand, less silt, and less clay in the solum than Bazile soils. They have more medium and coarse sand in the C horizon than Thurman and Valentine soils, and they have more pebbles throughout the profile.

Thurman Series

The Thurman series consists of deep, well drained soils (fig. 12) that formed in eolian sand or sandy alluvium. These are nearly level to steep soils on uplands and stream terraces.

In a representative profile the surface layer is very friable loamy fine sand 16 inches thick. It is dark gray in the upper part and dark grayish brown in the lower part. Below this is a transitional layer of grayish brown loose loamy fine sand 8 inches thick. The underlying material is pale brown fine sand to a depth of 60 inches.

Thurman soils have rapid permeability and low available water capacity. Organic matter content is moderately low, and natural fertility is medium. These soils release moisture readily to plants.

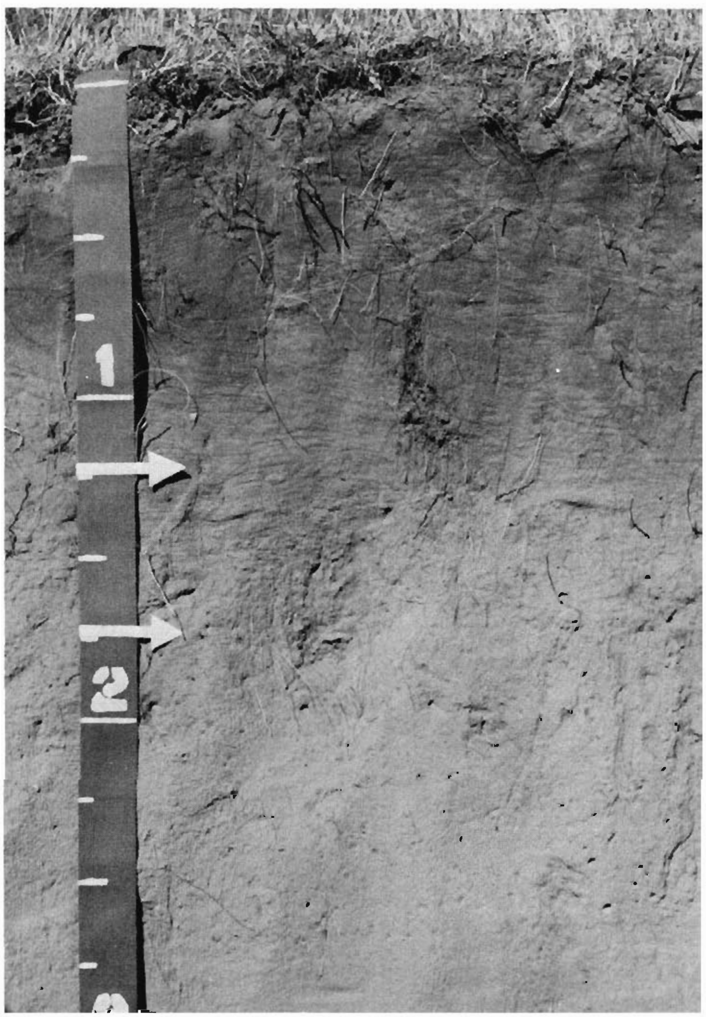

Figure 12.—Profile of Thurman loamy fine sand. The upper arrow marks the lower boundary of the surface layer, and the lower arrow marks the upper boundary of the fine sand underlying material.

Most areas of Thurman soils are suited to both dryland and irrigated cultivated crops. The strongly sloping to steep soils are not suited to cultivation. They are better suited to native grass and trees. All the Thurman soils provide wildlife habitat and recreation areas.

Representative profile of Thurman loamy fine sand, 0 to 3 percent slopes, in native grass, 1,850 feet east and 325 feet south of the northwest corner of sec. 26, T. 27 N., R. 8 W.

A11—0 to 10 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; strongly acid; clear smooth boundary.

A12—10 to 16 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; strongly acid; clear smooth boundary.

AC—16 to 24 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; medium acid; gradual wavy boundary.

C—24 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; medium acid.

The A horizon ranges from 10 to 18 inches in thickness. It is very dark grayish brown to grayish brown or dark gray. It is dominantly loamy fine sand or fine sand and is strongly acid or medium acid. The AC horizon is 5 to 8 inches thick and ranges from dark grayish brown to grayish brown or brown. It is medium acid or slightly acid loamy fine sand or fine sand. The C horizon is medium acid to neutral loamy fine sand or fine sand. In some areas, loamy material is below a depth of 42 inches.

Thurman soils are near Valentine, Doger, Boelus, and Loretto soils. They have a thicker and darker A horizon and AC horizon than Valentine soils. They have a thinner A horizon than Doger soils. In contrast with Boelus soils, they lack a B horizon and have more sand in the C horizon. They have less clay, less silt, and more sand in the profile than Loretto soils, and they lack the B horizon typical of those soils.

TfB—Thurman fine sand, 0 to 3 percent slopes. This deep, nearly level or gently undulating soil is on the low ridges and on flats of uplands and stream terraces. Areas are irregular in shape and range from 5 to about 700 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer and transitional layer are fine sand. In some areas the upper part of the surface layer is lighter colored than is typical, and in some areas the surface layer is loamy fine sand.

Included with this soil in mapping were small areas of Boelus and Doger soils in the lower concave pockets, Nora and Paka soils at slightly lower elevations, and Valentine soils at the highest elevations.

Soil blowing is a very severe hazard unless the surface is protected. Inadequate rainfall is commonly a limitation in dryfarmed areas. The soil is droughty because the available water capacity is low. Runoff is slow.

Much of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the principal irrigated crops. Most of the rest of the acreage is in native grass, tame grass, and windbreaks. A few small areas provide wildlife habitat. Capability units IVe–5 dryland, IVe–12 irrigated; Sandy range site; windbreak suitability group 3.

TfC—Thurman fine sand, 3 to 6 percent slopes. This deep, undulating soil is on ridges and hillsides of uplands. Areas range from 5 to about 600 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer and transitional layer are fine sand. In some areas the upper part of the surface layer is lighter colored than is typical. In some areas the surface layer is loamy fine sand.

Included with this soil in mapping were small areas of Boelus and Doger soils on the lower side slopes, Loretto and Nora soils on the upper windward hillsides, and Valentine soils on the ridges.

Soil blowing is a very severe hazard unless the surface is protected. Inadequate rainfall is a limitation in dryfarmed areas. This soil is droughty because of its low available water capacity. Runoff is slow.

A large part of the acreage is in native grass and is used for range or hay. Most of the rest is in crops, tame grass, and windbreaks. Corn, rye, vetch, soybeans, and alfalfa are the principal dryland crops. Corn and alfalfa are the main irrigated crops. A few small areas provide wildlife habitat. Capability units IVe–5 dryland, IVe–12 irrigated; Sands range site; windbreak suitability group 3.

TfD—Thurman fine sand, 6 to 11 percent slopes. This deep, rolling soil is on ridges and hillsides of uplands. Areas range from 5 to about 40 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer and transitional layer are fine sand. In small areas the surface layer and transitional layer are loamy fine sand and in some areas the upper part of the surface layer is lighter colored than is typical.

Included with this soil in mapping were small areas of Doger, Nora, and Valentine soils. The Doger soils are on side slopes, the Nora soils are on upper windward side slopes, and the Valentine soils on the ridges.

Soil blowing is a very severe hazard unless the surface is protected. This soil is droughty because it has such a low available water capacity. Runoff is slow or medium, depending on the amount of vegetation.

Most of the acreage is in native grass and is used for range or hay. The rest is in cultivated crops and windbreaks. This soil is not suited to the commonly grown crops because of the erosion hazard. Capability unit VIe–5 dryland; Sands range site; windbreak suitability group 7.

ThB—Thurman loamy fine sand, 0 to 3 percent slopes. This deep, nearly level or gently undulating soil is on low ridges and on flats of uplands and stream terraces. Areas range from 5 to about 400 acres in size.

This soil has the profile described as representative of the series. In some areas the surface layer is fine sandy loam or fine sand and in some areas the upper part of the surface layer is lighter colored than is typical.

Included with this soil in mapping were small areas of Boelus and Doger soils in the lower concave pockets and areas of Nora, Paka, and Loretto soils at slightly lower elevations than this Thurman soil.

Soil blowing is a severe hazard unless fields are protected. This soil is droughty because it has such a low available water capacity. Runoff is slow.

Most of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the principal irrigated crops. Nearly all the rest of the acreage is in native grass, tame grass, and windbreaks. A few small areas provide wildlife habitat. Capability units IIIe–5 dryland, IIIe–11 irrigated; Sandy range site; windbreak suitability group 3.

ThC—Thurman loamy fine sand, 3 to 6 percent slopes. This deep, undulating soil is on ridges and hillsides of the uplands. Areas range from 5 to about 500 acres in size.

In some areas the upper part of the surface layer is lighter colored than is typical, and in some areas there is a plow layer of fine sand. Included in mapping were small areas of Valentine soils on higher ridges, areas of Nora and Loretto soils on the upper windward side slopes, and areas of Doger and Boelus soils at the lower elevations.

Soil blowing is a severe hazard unless the surface is protected. This soil is droughty because of its low available water capacity. Runoff is slow.

Much of the acreage is cultivated. Corn, soybeans, rye, vetch, and alfalfa are the main dryland crops. Corn, soybeans, and alfalfa are the principal irrigated crops. Most of the rest of the acreage is in native grass, tame grass, or trees. A few small areas provide wildlife habitat. Capability units IVe–5 dryland, IVe–11 irrigated; Sandy range site; windbreak suitability group 3.

TnF—Thurman-Crofton complex, 11 to 30 percent slopes. This moderately steep and steep map unit borders drainageways of the uplands. It is about 50 percent Thurman loamy fine sand and 40 percent Crofton silt loam. The proportions vary from one area to another. The Thurman soil is on the upper side slopes and on the leeward slopes, and the Crofton soil is on the steeper windward slopes. Areas are narrow or irregular in shape and range from 5 to about 200 acres in size.

The Thurman and Crofton soils have profiles similar to those described as representative of their respective series, but in some areas the original surface layer has been removed through erosion and the lighter colored underlying material is at the surface.

Included with this unit in mapping were small areas of Boelus, Doger, Hobbs, and Nora soils. The Boelus and Doger soils are on the lower side slopes, the Hobbs soils are in the bottoms of narrow drainageways, and the Nora soils are in a few moderately steep areas.

Soil blowing and water erosion are very severe hazards unless the surface is protected or the grass cover is maintained. Runoff is rapid. Reducing runoff is a concern in management.

Nearly all the acreage is in native grass or trees. A small acreage is cultivated, but the slope is too steep and the erosion hazard too severe for economical production of the commonly grown cultivated crops. Capability unit VIe–5 dryland; Thurman soil in Sands range site, Crofton soil in Limy Upland range site; windbreak suitability group 10.

ToC—Thurman-Valentine complex, 0 to 6 percent slopes. This nearly level to undulating map unit is on uplands. It is about 65 percent Thurman fine sand and Thurman loamy fine sand and about 30 percent Valentine fine sand. The Valentine soil is on the ridges and upper windward side slopes and the Thurman soils are on the rest of the landscape. The proportions vary from one area to another. Areas range from 5 to about 250 acres in size.

The Thurman and Valentine soils have profiles similar to those described as representative of their respective series, but in many areas the Thurman soils have a fine sand texture. Included with this unit in mapping were small areas of Doger and Boelus soils at the lower elevations.

Soil blowing is a very severe hazard unless the surface is protected. The soils are droughty because of their low available water capacity. Runoff is slow.

A large part of the acreage is in native grass and is used for grazing or hay. Most of the rest is in crops, tame grass, and field windbreaks. A small acreage is dryfarmed, but the soils are not suited to dryland cultivated crops because they are too droughty and blow too easily. Corn and alfalfa are the main irrigated crops. Center pivot systems can be used on these soils. A few small areas provide wildlife habitat. Capability units VIe–5 dryland, IVe–12 irrigated; Sandy range site; windbreak suitability group 3.

Trent Series

The Trent series consists of deep, moderately well drained soils that formed in loess or silty outwash material. These are nearly level soils on uplands.

In a representative profile the surface layer is friable, very dark grayish brown silt loam 18 inches thick. The subsoil is about 27 inches thick. The upper part is friable, dark grayish brown silt loam, and the lower part is firm, grayish brown light silty clay loam. The underlying material is pale brown silt loam.

Trent soils have moderate permeability and high available water capacity. Organic matter content is moderate, and natural fertility is high. These soils release moisture readily to plants.

Trent soils are suited to both dryland and irrigated cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Trent silt loam, 0 to 2 percent slopes, in a cultivated field, 2,560 feet east and 75 feet north of the southwest corner of sec. 17, T. 28 N., R. 8 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable; medium acid; abrupt smooth boundary.

A12—6 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; hard, friable; medium acid; gradual wavy boundary.

B21—18 to 27 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak very fine granular; hard, friable; slightly acid; gradual wavy boundary.

B22—27 to 39 inches; grayish brown (2.5Y 5/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; slightly acid; gradual wavy boundary.

B23—39 to 45 inches; grayish brown (2.5Y 5/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; slightly acid; gradual wavy boundary.

C1—45 to 52 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure; hard, friable; slightly acid; clear smooth boundary.

IIC2—52 to 60 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; single grained; loose; slightly acid.

The A horizon is 10 to 20 inches thick. The B horizon is 20 to 36 inches thick. It is mainly silty clay loam, but silt loam is common in the upper and lower parts. It is slightly acid or neutral and ranges from dark gray to grayish brown or pale brown. Depth to lime is more than 48 inches. In many areas sandy underlying material is below a depth of 42 inches.

Trent soils occur in the landscape with Bazile, Loretto, Paka, and Thurman soils. They have a thicker solum and less sand in the C horizon than Bazile soils. They have thicker A and B horizons than Loretto and Paka soils, and they have more clay, more silt, and less sand in the profile than Thurman soils. They are similar to Moody and Nora soils, but the upper part of the subsoil is darker and lime is leached deeper than in those soils.

Tr—Trent silt loam, 0 to 2 percent slopes. This deep, nearly level silty soil is in slight depressions or on low ridges of the uplands. Areas range from 5 to about 100 acres in size.

In some areas this soil has a plow layer of fine sandy loam or loam. Included in mapping were small areas of Bazile, Paka, Loretto, and Thurman soils. The Bazile and Thurman soils are on the higher convex areas and the Loretto and Paka soils are at the same relative elevations as this Trent soil.

This soil has few serious limitations for farming. Some areas receive runoff from adjacent higher areas during heavy rains and are subject to rare flooding. Runoff is slow.

Nearly all the acreage is cultivated. Corn, soybeans, and alfalfa are the main dryland and irrigated crops. The rest of the acreage is in native or tame grass. Capability units I–1 dryland, I–6 irrigated; Silty range site; windbreak suitability group 4.

Valentine Series

The Valentine series consists of deep, excessively drained soils that formed in eolian sand. These are nearly level to moderately steep soils on uplands and a few stream terraces.

In a representative profile the surface layer is loose, grayish brown fine sand 5 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand 6 inches thick. The underlying material is fine sand that is pale brown in the upper part and very pale brown in the lower part.

Valentine soils have rapid permeability and low available water capacity. Organic matter content and natural fertility are low. These soils release moisture readily to plants.

The nearly level Valentine soils are suited to both dryland and irrigated crops. The gently sloping soils are suited to cultivated crops only under irrigation. All Valentine soils are suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Valentine fine sand, rolling, in native grass, 1,850 feet north and 400 feet east of the southwest corner of sec. 33, T. 25 N., R. 6 W.

A—0 to 5 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; loose; strongly acid; abrupt wavy boundary.

AC—5 to 11 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; loose; strongly acid; clear wavy boundary.

C1—11 to 17 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; medium acid; gradual wavy boundary.

C2—17 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; medium acid.

The A horizon ranges from 3 to 8 inches in thickness and is dark grayish brown or grayish brown. It is strongly acid or medium acid. The AC horizon is 3 to 7 inches thick and ranges from brown to grayish brown or light brownish gray. It is strongly acid or medium acid. The C horizon ranges from medium acid to neutral. In some areas below a depth of 42 inches, there is a thin loamy horizon.

Valentine soils occur in the landscape with Thurman, Doger, Boelus, and Elsmere soils. They have a thinner, lighter colored A horizon than Thurman and Doger soils. They lack a B horizon and have more sand, less clay, and less silt in the C horizon than Boelus soils. Valentine soils are better drained and have a thinner A horizon than Elsmere soils.

VaC—Valentine fine sand, 0 to 6 percent slopes. This deep, nearly level to undulating sandy soil is on ridges and low dunes of uplands and stream terraces. Areas range from 5 to about 2,000 acres in size.

In some small areas the surface layer is lighter colored than the one described in the representative profile. Included in mapping were small areas of Doger and Boelus soils, mainly at the lower elevations, Elsmere soils in shallow depressions, and areas of Thurman soils.

Soil blowing is a very severe hazard. This soil is droughty because the available water capacity is low. It dries out quickly during hot weather. Runoff is slow.

Most of the acreage is in native grass that is used for range or mowed for hay. The rest is mostly in crops, tame grass, and field windbreaks. The soil is not suited to the commonly grown dryland crops because it is too droughty and the danger of soil blowing is too severe. Corn and alfalfa are the main irrigated crops. A few small areas provide wildlife habitat. Capability units VIe–5 dryland, IVe–12 irrigated; Sands range site; windbreak suitability group 7.

VaE—Valentine fine sand, rolling. This deep sandy soil is on ridges and dunes of the uplands. Areas range from 5 to about 4,000 acres in size. Slopes are 6 to 15 percent.

This soil has the profile described as representative of the series. In some areas the surface layer is light brownish gray or pale brown.

Included with this soil in mapping were small areas of Doger and Boelus soils at low elevations. Also included were small areas of Thurman soils and Blownout land.

Soil blowing is a very severe hazard unless the vegetation is well established. This soil is droughty because the available water capacity is low. Runoff is slow or medium, depending on the amount of vegetation and the intensity of the rainfall.

Nearly all the acreage is in native grass and is used for range. A small acreage is used for hay. The rest is in crops or windbreaks. This soil is not economically suited to the commonly grown cultivated crops because it is too droughty and the erosion hazard is too severe if the grass cover is destroyed. Capability unit VIe–5 dryland; Sands range site; windbreak suitability group 7.

VsB—Valentine-Simeon complex, 0 to 3 percent slopes. This nearly level or gently undulating, deep sandy map unit is on uplands. It is about 55 to 65 percent Valentine soil and 30 to 45 percent Simeon soil. The Valentine soil is in the higher convex areas. The Simeon soil is at the lower elevations. Areas range from 5 to about 25 acres in size.

The Valentine soil has a profile similar to the one described as representative of the series, but in some areas the surface layer is loamy fine sand, loamy sand, or sand. The Simeon soil has a profile similar to the one described as representative of the series, but in some areas the surface layer is loamy fine sand, fine sand, or sand.

Included with this unit in mapping were small areas of Paka soils at the lower elevations and areas of O'Neill and Thurman soils.

Soil blowing is a very severe hazard unless the surface is protected. These soils are droughty because of their low available water capacity. Maintaining fertility is an important concern of management, particularly in areas under irrigation. Runoff is slow.

Part of the acreage is in native grass. The rest is cultivated. Corn, rye, vetch, and alfalfa are the main dryland crops. Corn and alfalfa are the principal irrigated crops. Capability units IVe–5 dryland, IVe–11 irrigated; Valentine soil in Sandy range site, Simeon soil in Sands range site; windbreak suitability group 7.

VsC—Valentine-Simeon complex, 3 to 6 percent slopes. This undulating, deep sandy map unit is on ridges and side slopes of uplands. It is about 50 to 60 percent Valentine soil and 35 to 50 percent Simeon soil. The Valentine soil is on the ridges. The Simeon soil is on the lower side slopes. Areas range from 5 to about 50 acres in size.

The Valentine and Simeon soils have profiles similar to those described as representative of their respective series, but in some areas the surface layer is loamy fine sand, loamy sand, or sand.

Included with this unit in mapping were areas where the surface layer is light brownish gray and pale brown. Also included were small areas of Bazile and Paka soils in the lower areas and areas of O'Neill and Thurman soils.

Soil blowing is a very severe hazard. Inadequate rainfall is a common limitation in midsummer when temperatures are high. The low available water capacity makes the soil droughty. Runoff is slow. Nearly all the moisture is absorbed as quickly as it falls.

Most of the acreage is in native grass. The rest is cultivated or in tame grass. The soils are not suited to dryland cultivation because they are too droughty and the erosion hazard is too severe if the grass cover is destroyed. Corn and alfalfa are the principal irrigated crops. Capability units VIe–5 dryland, IVe–11 irrigated; Sands range site; windbreak suitability group 7.

VsD—Valentine-Simeon complex, 6 to 11 percent slopes. This deep sandy map unit has complex rolling slopes. It is on ridges and side slopes of drainageways of the uplands. It is about 40 to 60 percent Valentine soil and 35 to 50 percent Simeon soil. Other soils make up 0 to 10 percent of the unit. The Valentine soil is on the ridges and upper side slopes. Areas are irregular or oblong in shape and range from 5 to about 300 acres in size.

The Valentine and Simeon soils have profiles similar to those described as representative of their respective series, but in some areas the surface layer is loamy fine sand, loamy sand, or sand. In places the surface layer is light brownish gray or pale brown.

Included with this unit in mapping were small areas of Bazile and Paka soils in the lower areas and areas of Meadin, Brunswick, and Thurman soils.

Soil blowing is a very severe hazard unless the surface is adequately protected. The low available water capacity makes the soils droughty. Inadequate rainfall in some years limits production of grasses. Runoff is slow or medium, depending on the intensity of rainfall and the amount of vegetation.

Most of the acreage is in native grass. Only a small acreage is cultivated. The soils are not well suited to the commonly grown cultivated crops because they are too droughty. Capability unit VIe–5 dryland; Sands range site; windbreak suitability group 7.

Use and Management of the Soils

This section provides information on the use and capabilities of the soils for irrigated and dryland crops and gives predicted yields of the principal crops. It suggests use and management of the soils for range, for woodland and windbreaks, and for wildlife habitat and recreation. It also discusses use of the soils in engineering.

Crops and Pasture

Most soils of Antelope County are fertile and well suited to farming. The principal problems and hazards are water erosion, flooding adjacent to streams, damage to the soil and to crops from soil blowing, and loss of fertility through erosion and leaching. Under good management, many of the soils are well suited to cultivated crops.

Less than 10 percent of the soils of Antelope County have slopes of more than 11 percent. Some of the steep soils were previously cultivated, but are now in grass for pasture or hay. Water erosion, mostly on the uplands, has occurred in many places. In the steeper areas excessive runoff after heavy rains floods the bottom land and also reduces soil fertility.

The major cultivated crops in Antelope County are corn, grain sorghum, and soybeans. Rye and vetch are also important where soil blowing is a hazard, for example, in areas of Thurman, Boelus, and Doger soils. On the bottom land, an extensive acreage of such soils as Cass, Hobbs, and Gibbon soils is in row crops. In some years flooding on these soils is a hazard. A sizeable acreage in the uplands, in areas of Crofton, Nora, and Moody soils, is also in row crops. Alfalfa for hay is an important crop throughout the county. A minor acreage is in oats and wheat.

Pastures are mainly bromegrass or, in some cases, a mixture of bromegrass and alfalfa and other cool-season grasses. Most pastureland is part of a long-time cropping system. Eroded soils and areas that are frequently or occasionally flooded are particularly well suited to pasture.

The acreage of cropland under irrigation in Antelope County is increasing. In 1973, about 65,000 acres was irrigated. Water for irrigation comes mostly from about 500 wells. Irrigation water is used primarily to supplement natural rainfall in dry years. During normal years less irrigation water is used. Soils that are level or very gently sloping are best suited to irrigation. Where the slope is more than 4 percent, irrigation creates serious problems, such as erosion and loss of water through excessive runoff. Soils that have slopes of more than 9 percent are not suited to irrigation.

Where suitable quantities of underground water are available, there is a potential for increasing the amount of irrigated land. A potential also exists for increasing the acreage of pasture and range and for using more conservation practices, particularly on the strongly sloping soils.

Dryfarmed soils

Such soils as the gently sloping and strongly sloping Moody, Nora, and Crofton soils are suited to conservation practices. Terraces and contour farming, grassed waterways, and a cropping system that includes conservation tillage and limited use of row crops keep soil losses to a minimum. Crops grown on such bottom land soils as Cass, Hobbs, and Gibbon soils commonly benefit by protection from flooding. Using diversions above the flooded areas and applying good water conservation practices on the adjacent areas and throughout the watershed help to reduce flooding.

The steeper, more erodible soils, such as Crofton-Nora silt loams, 11 to 15 percent slopes, eroded, are best suited to a management system that includes pasture and hayland crops. These soils do not always produce an abundance of crop residue. Therefore, in these areas grass or hay crops help control erosion.

Soils in Antelope County should be tested to determine nutrient content before commercial fertilizer is used. Receiving the most benefit from fertilizer depends on providing enough plant nutrients, thus making the best use of the available moisture in the soil. In dryfarmed areas fertilizer should be applied at a lower rate than in areas where the supply of moisture is unlimited. Nearly all soils respond to nitrogen fertilizer. Soils that have lost the surface horizon through erosion, land leveling, or terrace construction commonly respond to additions of phosphorus and zinc.

To reach maximum production, insects, plant diseases, and weeds must be controlled. Timely application of insecticides and herbicides is extremely important. Plant diseases can be controlled by planting disease-free seed or by using appropriate sprays. Some insects and plant diseases can be controlled by a cropping sequence.

Diversions can divert large quantities of water from certain areas. Diversions are channels that have a supporting ridge on the lower side constructed across the slope. They are generally planted to grass, and grassed waterways are provided to carry away excess runoff.

In the sloping areas, contour farming helps control water erosion (fig. 13). In areas that are farmed on the contour, terraces serve as guidelines for tilling and planting across the slope. In this way the furrows, rows, ridges, and wheel tracks are nearly level. Terraces and contour farming supplement each other.

Grassed waterways are natural drainageways that have been smoothed, leveled, and seeded to grass to protect them from erosion. The grass cover must be maintained to help control erosion. Grassed waterways also produce hay or grass seed and furnish cover for upland game birds.

Crop residue left on the surface of the soil during tillage reduces soil blowing and water erosion. Keeping the crop residue on the surface during seedbed preparation reduces runoff and sediment losses. In conservation tillage, all tillage is limited to the amount essential

Figure 13.—**Planting row crops on the contour reduces the hazard of water erosion on silty soils.**

to produce a crop and prevent damage to the soil. In a conservation tillage system, a large part of the residue from the previous crop remains on the soil surface while the next crop is growing. Conservation tillage includes stubble mulch tillage, for example, the till-plant system, strip-tillage, slot planting, chisel plowing and planting, and discing and planting.

Both level and gradient terraces are used in Antelope County. Level terraces are used mainly on soils that have more rapid permeability than the soils where gradient terraces are used. The level terrace is an earth embankment or a ridge and channel constructed across the slope at suitable spacing and at no grade. The ends of the level terrace are closed so that as much water as possible is held in the soil. Examples of soils suited to level terraces are Hord silt loams and Nora silt loams.

The gradient terrace is an earth embankment or a ridge and channel constructed across the slope at suitable spacing and at an acceptable grade. This terrace is built so that one end is slightly lower than the other. Water drains to a lower area, preferably a grassed waterway. Moody soils are suited to gradient terraces.

Irrigated soils

Deep wells yield water for irrigation throughout most of Antelope County except in some areas in the northern part. Most irrigation is on the nearly level to gently sloping soils of the sandy and loamy uplands. A smaller acreage of the nearly level to strongly sloping soils on the silty uplands is also under irrigation. Soils on bottom land and stream terraces are irrigated with water pumped from shallow wells or flowing streams.

Different methods of irrigation are commonly needed for different kinds of crops. For example, the method used to irrigate a row crop generally differs from that used to irrigate a close-sown crop. Changing the method of irrigation is difficult where the slope is more than 1½ percent. Bench leveling the irrigated fields so that the slope is less than 1 percent in all areas can be considered.

Furrow irrigation is the most common method of surface irrigating row crops. Water is applied to furrows between the plant rows by gated pipe or by siphon tubes. Furrows on such nearly level soils as Hord silt loam generally are straight and follow field boundaries. On such gently sloping soils as Moody silty clay loam, 2 to 6 percent slopes, contour furrows can carry irrigation water across the slope rather than down the slope. In places terraces are needed to supplement contour furrows.

In corrugation irrigation, water is applied in small furrows by gated pipe or by siphon tubes. From the small furrows, water moves laterally through the soil and wets the entire field. This method is suitable for close growing crops like alfalfa.

In border irrigation, flooding is controlled by borders or small dikes along the sides of narrow cultivated fields. Irrigation water flows in a thin, uniform sheet and is absorbed by the soil as it advances through the field. For this method to work well, the strips need to be well leveled and of uniform grade. The dikes between the strips should be low and rounded so that they can also be planted to the crop. Hord silt loam is well suited to border irrigation.

In contour ditch irrigation, applied water flows down the slope between field ditches that are closely spaced. Frequent openings in the ditches permit uniform distribution of water over the field. This method is suitable only for close-grown crops or hay crops. It is well suited to the steeper irrigated soils.

Sprinkler irrigation is a method of applying water as a spray through small nozzles at a rate that the soil can absorb without runoff. Sprinklers can be used on the more sloping soils as well as the nearly level ones. Some soils, such as Nora silt loam, 6 to 11 percent slopes, can be irrigated by sprinklers if they are protected by conservation practices. Because the water can be carefully controlled, sprinklers have special uses in a farming operation, such as establishing seedlings and irrigating sloping fields. In summer, however, some water is lost through evaporation. Wind drift can cause uneven application of water under some sprinkler irrigation systems.

There are two kinds of sprinkler systems. The first type operates in sets, which means sprinklers are set at a certain location and operate there until a specified amount of water is applied. The second type is the center-pivot type. It is a moving sprinkler system that revolves about a certain pivot point.

Soil holds a limited amount of water. Irrigation water, therefore, is applied at regular intervals to keep the soil profile wet at all times. The interval varies according to the crop and to the time of year. The water should be applied only as fast as the soil can absorb it.

Silty irrigation soils in Antelope County hold about 2 inches of available water per foot of soil depth. A soil that is 4 feet deep and planted to a crop that sends its roots to that depth can hold about 8 inches of available water for that crop.

Irrigation is most efficient if the irrigation process is started when about one-half of the stored water has been used by the plants. Thus, if a soil holds 8 inches of available water, irrigation should be started when about 4 inches has been removed by the crop.

Good management controls the application of irrigation water so that crops grow well without wasting water as runoff and without eroding the soil. The size of the stream in the furrow or the sprinkler irrigation rate should be adjusted so that the soil is uniformly moistened without excessive runoff or erosion. In a furrow system, water can be applied most efficiently by using a fairly good size stream down the row until the water nearly reaches the lower end. Then the stream size is reduced to about one-half of the original rate and allowed to flow until the soil is irrigated. A water collecting system at the lower end of irrigated fields collects runoff water, and it is then possible to recycle this runoff water back into the system to irrigate the same field or other fields nearby.

Irrigated soils generally produce higher yields than dryfarmed soils. Consequently, more plant nutrients, particularly nitrogen and phosphorus, are removed when the crop is harvested. Returning crop residue to the soil and adding barnyard manure and commercial fertilizers help maintain needed plant nutrients. Most grain and grass crops in Antelope County respond to additions of nitrogen fertilizer. Soils disturbed during land leveling, particularly if the topsoil has been removed, commonly respond to nitrogen, phosphorus, zinc, and iron. Some sandy soils respond to sulphur. The kinds and amounts of fertilizer needed for specific crops can be determined by soil tests. The University of Nebraska, in Lincoln, maintains a soil testing service for Nebraska farm owners and operators. Private laboratories also provide similar services.

The two principal irrigated crops in Antelope County are corn and alfalfa. Corn is grown in rows spaced 30 to 40 inches apart. Irrigation water is applied by sprinklers or furrows between the rows. Alfalfa is irrigated by flooding or by sprinklers.

The cropping sequence on soils well suited to irrigation consists mostly of row crops. Changing from corn to grain sorghum or soybeans and an alfalfa or grass crop helps to control the cycle of disease and insects that is commonly present when the same crop is grown year after year. Such gently sloping soils as Nora silt loam, 2 to 6 percent slopes, are subject to water erosion if they are irrigated. These soils are better suited to a cropping sequence that includes several years of row crops followed by 3 to 5 years of hay that is mostly alfalfa or a mixture of alfalfa and grass. Such soils as Crofton-Nora silt loams, 6 to 11 percent slopes, eroded, are better suited to irrigated hay or pasture crops than to irrigated row crops.

Assistance in planning and laying out an irrigation system is available through the local office of the Soil Conservation Service or the county extension agent. Estimates concerning cost of equipment can be obtained from the local dealers and manufacturers of irrigation equipment.

Management of an irrigated soil generally differs from management of the same soil if it is dryfarmed. In the paragraphs that follow, soils that have similar management requirements are grouped in capability units. Soil limitations are mentioned and management needs for irrigation are defined. The capability unit to which each soil in the county is assigned can be found in the Guide to Map Units at the back of the survey. All soil series represented in Nebraska are assigned to irrigation design groups. These design groups are described in the Nebraska Irrigation Guide, which is a part of the technical specifications for conservation in Nebraska. The Arabic numbers in the symbol identifying the irrigation capability unit indicate the irrigation design group.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; it does not take into consideration possible but unlikely major reclamation projects; and it does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for the more detailed interpretations provided in the sections on range, woodland and windbreaks, and engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, 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*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use.

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–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The names of the soil series and land types represented are mentioned in the description of each unit, but this does not mean that all the soils of a given series are in that unit. The capability unit to which each soil in the county has been assigned can be found in the "Guide to Map Units."

On the following pages the capability units in Antelope County are described and the use and management of the soils is suggested.

CAPABILITY UNIT I–1 DRYLAND

In this unit are deep, nearly level soils on uplands, stream terraces, and bottom land. They are well drained and moderately well drained. They have a surface layer of loam, silt loam, or silty clay loam. The subsoil or transition layer ranges from fine sandy loam to silty clay loam. The underlying material ranges widely from silt loam to fine sand.

These soils have moderately rapid, moderate, or moderately slow permeability. Available water capacity is moderate or high. The organic-matter content is moderately low to moderate, and natural fertility is medium or high. The soils absorb moisture easily and release it readily to plants. They are easy to work. Runoff is slow.

The main concerns in management are maintaining the organic-matter content and the fertility. Rare flooding occurs on the bottom lands and low terraces in spring. Rainfall in summer is commonly inadequate to meet crop needs.

These soils are suited to all crops commonly grown in the county and are especially suited to corn, grain sorghum, soybeans, and alfalfa. Row crops can be grown year after year if the proper amount of fertilizer is added.

Grassed waterways are useful in carrying runoff. In places, diversion terraces prevent damage of runoff from adjacent higher areas. Seeding grass in the turn rows controls weeds along field borders.

CAPABILITY UNIT IIe–1 DRYLAND

In this unit are deep, gently sloping soils on uplands, foot slopes, and stream terraces. They are well drained. They have a surface layer of loam, silt loam, or silty clay loam. The subsoil ranges from fine sandy loam to silty clay loam. The underlying material ranges widely from silt loam to fine sand.

These soils have moderately rapid, moderate, or moderately slow permeability. Available water capacity is moderate or high. The organic-matter content is moderately low to moderate, and natural fertility is medium or high. The soils absorb moisture easily and release it readily to plants. They are friable and easy to work. Runoff is medium.

Water erosion is the principal hazard because of the slope and the silty surface layer. Conserving moisture is a concern in management because rainfall in summer is commonly inadequate to meet crop needs. Maintaining the organic-matter content and the fertility are also concerns in management.

These soils are suited to all crops commonly grown in the county. Corn, grain sorghum, soybeans, and alfalfa are the main crops. Some small grain is also grown.

Terraces, contour cultivation, and grassed waterways help control erosion and conserve water. Keeping crop residue on the surface and using commercial fertilizer help maintain fertility. A cropping system that includes grasses and legumes helps control erosion, maintains the supply of organic matter, maintains fertility, and improves tilth.

CAPABILITY UNIT IIe–3 DRYLAND

In this unit are deep, nearly level to very gently sloping soils on uplands, foot slopes, and stream terraces. They are well drained. They have a surface layer of fine sandy loam or sandy loam. The subsoil ranges from sandy loam to clay loam. The underlying material ranges widely from silt loam to fine sand.

These soils have moderately rapid or moderate permeability. The available water capacity is moderate or high. The organic-matter content is moderate to moderately low, and natural fertility is medium or high. The soils absorb moisture easily and release it readily to plants. They are easy to work. Runoff is slow.

Soil blowing is the principal hazard because of the moderately coarse textured surface layer. Maintaining the organic-matter content and the fertility are concerns in management. Some fertility can be lost through leaching, particularly on soils that have sandy underlying material. Conserving moisture is also a concern in management because rainfall in summer is commonly inadequate to meet crop needs.

These soils are suited to crops commonly grown in the county. Corn, soybeans, rye, and alfalfa are the crops most commonly grown. Oats, wheat, and grain sorghum are also suitable.

Growing legumes or grasses or a mixture of grasses and legumes in the cropping system replenishes the supply of organic matter, maintains fertility, and helps control soil blowing. The hazard of soil blowing can also be reduced by stripcropping and field windbreaks and by leaving crop residue on the surface. Using fertilizer and lime helps maintain fertility.

CAPABILITY UNIT IIw–3 DRYLAND

Hobbs silt loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, well drained, nearly level soil on bottom land and in narrow drainageways. It is occasionally flooded by runoff from the adjacent uplands. The surface layer is silt loam. The underlying material is loam, silt loam, or light silty clay loam.

This soil has moderate permeability and high available water capacity. The organic-matter content is moderate, and natural fertility is high. The soil absorbs moisture easily and releases it readily to plants. It is easy to work. Runoff is slow.

The main concern in management is the occasional flooding, which is generally for short periods after heavy spring rains. Flooding frequently delays planting, and the young crop is sometimes damaged by silt deposits. Damage to crops is seldom severe. Maintaining the fertility and the organic-matter content are also concerns in management.

This soil is suited to most crops commonly grown in the county. Corn, soybeans, and grain sorghum are the main crops. Small grain and alfalfa can be grown, but they are sometimes damaged by floodwater. If properly managed, row crops can be grown year after year.

Terracing the adjacent uplands and using diversions help prevent flooding. Incorporating crop residue into the soil, adding barnyard manure, and applying fertilizer maintain good tilth and high fertility.

CAPABILITY UNIT IIw-4 DRYLAND

In this unit are deep, nearly level soils on bottom land. They are somewhat poorly drained. The water table fluctuates between depths of 2 and 6 feet. The surface layer is light silty clay loam, loam, or silt loam. The transition layer is fine sandy loam. The underlying material ranges widely from fine sand to silty clay loam.

These soils have moderately rapid or moderate permeability. Available water capacity is high or moderate. The organic-matter content is moderate, and natural fertility is high or medium. The soils absorb moisture easily and release it readily to plants. They are easy to work. Runoff is slow.

The main limitation is wetness caused by the moderately high water table. The water table is highest early in spring and lowest late in summer. When the water table is highest, these soils are commonly too wet to till. In dry years the water table can be beneficial to crops. In some years the soils are flooded for short periods. Maintaining a fertility balance is also a concern in management. These soils are generally high in calcium. Improvement in phosphate content is needed.

Corn, soybeans, and alfalfa are the principal crops. Some areas of these soils are in native grass. Spring-sown small grain generally is not grown because of excessive wetness early in spring. In most years, growth of alfalfa is improved by the subirrigation.

If suitable outlets are available, tile drains can be used to lower the water table and control wetness. Incorporating all crop residue into the soil and applying fertilizer help maintain fertility. Diversions and land treatment of the drainage areas above these soils help reduce flood damage.

CAPABILITY UNIT IIw-6 DRYLAND

Ord fine sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, somewhat poorly drained soil on bottom land. The water table fluctuates between depths of 2 and 6 feet. The surface layer is fine sandy loam. The transition layer is fine sandy loam. The underlying material is fine sand or loamy fine sand.

This soil has moderately rapid permeability and moderate available water capacity. The organic-matter content is moderate, and natural fertility is medium. The soil absorbs moisture easily and releases it readily to plants. It is friable and easy to work. Runoff is slow.

The major limitation is wetness caused by the moderately high water table. The water table is highest in spring and lowest late in summer. When the water table is highest, the soil is too wet to till. In dry years the water table can be beneficial to crops. Late in summer when the water table is lowest crops may show the effects of drought. Maintaining fertility and the organic-matter content are also concerns in management.

This soil is suited to all crops commonly grown in the county. It is well suited to grasses. Corn, soybeans, and alfalfa are the main crops. Spring-sown small grain generally is not grown because of excessive wetness early in spring. Alfalfa growth varies because in some years the water table restricts roots.

The hazard of soil blowing can be reduced by crop residue on the surface and minimum tillage. Applying fertilizer helps maintain fertility. Diversions and terraces built in the drainage area above this soil help reduce potential flood damage.

CAPABILITY UNIT IIs-5 DRYLAND

In this unit are deep and moderately deep, nearly level soils, mainly on uplands but also on a few stream terraces. They are well drained. The surface layer is loam. The subsoil is light silty clay loam, silt loam, or loamy sand. The underlying material is fine sand, sand, or mixed sand and gravel.

These soils have moderately slow or moderately rapid permeability in the upper part and rapid or very rapid permeability in the lower part. Available water capacity is moderate or low. The organic-matter content is moderate to moderately low, and natural fertility is high or medium. The soils absorb moisture easily and release it readily to plants. They are friable and easy to work. Runoff is slow.

The main limitations are the moderate and low available water capacity and the rapid to very rapid permeability of the underlying material. These cause the soils to be droughty. Plant roots are not restricted except where the sand and gravel is coarse. Maintaining the organic-matter content and the fertility are further concerns in management. Some fertility may be lost through leaching because of the coarse or very coarse underlying material. Rainfall in summer is commonly inadequate to meet crop needs.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and alfalfa are the main crops.

Incorporating crop residue into the soil and applying fertilizer help maintain fertility.

CAPABILITY UNIT IIs-6 DRYLAND

Cass fine sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, well drained soil on bottom land. The surface layer and transition layer are fine sandy loam. The underlying material ranges from fine sandy loam in the upper part to fine sand in the lower part.

This soil has moderately rapid permeability and moderate available water capacity. The organic-matter content is moderate, and natural fertility is medium. The soil absorbs moisture easily and releases it readily to plants. It is easy to work. Runoff is slow.

The main limitations are the moderate available water capacity and the rapid permeability in the lower part of the underlying material. They cause the soils to be droughty, especially in summer when rainfall is commonly inadequate. The surface layer is susceptible to soil blowing unless it is protected. Maintaining the organic-matter content and the fertility are other concerns in management. Some fertility can be lost through leaching because of the sandy underlying material.

This soil is suited to all crops commonly grown in the county. Corn, soybeans, and alfalfa are the main crops.

Incorporating crop residue into the surface layer and applying fertilizer help to prevent soil blowing and maintain fertility. The hazard of soil blowing can also be reduced by stripcropping. Growing grasses and legumes in the cropping system maintains fertility and replenishes the supply of organic matter.

CAPABILITY UNIT IIIe-1 DRYLAND

In this unit are deep, gently sloping to strongly sloping soils on uplands. They are well drained. The surface layer is loam or silt loam. The subsoil is silt loam, silty clay loam, or clay loam. The underlying material ranges widely from silt loam to sand.

These soils have moderate or moderately slow permeability. In a few areas where the underlying material is sand, permeability is rapid. Available water capacity is moderate or high. The organic-matter content is moderate, and natural fertility is medium or high. The soils absorb moisture easily and release it readily to plants. They are friable and easy to work. Runoff is medium.

Water erosion is the principal hazard, particularly on the strongly sloping soils. The moderate available water capacity and the rapid permeability of the underlying material in some areas are also limitations. Conserving moisture is a concern in management because rainfall in summer is commonly inadequate to meet crop needs. Maintaining the organic-matter content and the fertility are also concerns in management.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and alfalfa are the main crops. The hazard of erosion is more severe if soybeans are grown than if other row crops are planted.

Erosion can be controlled by terraces, contour farming, and grassed waterways. Leaving crop residue on the surface and applying fertilizer help maintain the organic-matter content and the fertility. The hazard of erosion can also be reduced by minimum tillage.

CAPABILITY UNIT IIIe-2 DRYLAND

Longford loam, 1 to 4 percent slopes, is the only soil in this unit. It is a deep, well drained, nearly level to gently sloping soil on uplands. The surface layer is loam. The subsoil is silty clay and silty clay loam. The underlying material is silt loam or silty clay loam.

This soil has moderately slow permeability and high available water capacity. The organic-matter content is moderate, and natural fertility is medium. This soil absorbs moisture readily until the surface layer is saturated. Moisture is released slowly to plants. The soil is easy to work. Runoff is medium.

Water erosion, because of the moderately slow rate of moisture intake, is the principal hazard. Conserving water is an important concern in management because rainfall in summer is commonly inadequate to meet crop needs. Maintaining the organic-matter content and the fertility are also concerns.

This soil is suited to all crops commonly grown in the county. Corn, soybeans, and alfalfa are the main crops.

Terraces, contour farming, grassed waterways, and crop residue on the surface help control erosion and conserve water. Applying commercial fertilizer helps maintain fertility.

CAPABILITY UNIT IIIe-3 DRYLAND

In this unit are deep and moderately deep, nearly level to gently sloping soils on uplands, foot slopes, and stream terraces. They are well drained. The surface layer is sandy loam or fine sandy loam. The subsoil ranges from clay loam to loamy sand. The underlying material ranges widely from silt loam to mixed sand and gravel.

Permeability is generally moderate or moderately rapid. In areas that have mixed sand and gravel at a depth of 20 inches, permeability is very rapid. Available water capacity ranges from low to high. The organic-matter content is moderately low or moderate, and natural fertility is medium or high. The soils absorb moisture easily and release it readily to plants. They are easy to work. Runoff is medium or slow.

Soil blowing is the principal hazard because of the moderately coarse textured surface layer. Water erosion is also a hazard in some gently sloping areas. The moderate and low available water capacity and the very rapid permeability of the underlying material are limitations in some areas. Conserving water and maintaining the organic-matter content and the fertility are important concerns in management. Some fertility can be lost through leaching on most of these soils during periods of high rainfall. Rainfall in summer is generally inadequate to meet crop needs.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, rye, and alfalfa are the main crops. The soils are more susceptible to erosion if soybeans are grown than if other row crops are planted.

Terracing, contour farming, grassed waterways, and minimum tillage help reduce water erosion. Stripcropping and field windbreaks help control soil blowing. Growing a mixture of grasses and legumes in the cropping sequence helps maintain the organic-matter content and the fertility and also helps control erosion. Additions of lime are needed on some soils to correct soil acidity. Applying commercial fertilizer improves and maintains the fertility.

CAPABILITY UNIT IIIe-5 DRYLAND

In this unit are deep, nearly level and very gently sloping, well drained soils on stream terraces, foot slopes, and uplands and a few moderately well drained soils on bottom land. The surface layer is loamy fine sand. The transition layer is loamy fine sand. The underlying material is fine sand or loamy fine sand.

These soils have rapid permeability and low available water capacity. The organic-matter content is moderately low, and natural fertility is medium or low. The soils absorb moisture easily and release it readily to plants. They are very friable and easy to work. Runoff is slow.

These soils are susceptible to soil blowing unless they are protected by a cover of vegetation. They are droughty because of the low available water capacity. Rainfall is commonly inadequate to meet crop needs. Improving the fertility, particularly the nitrogen and calcium content, and maintaining the organic-matter content are also concerns in management. Fertility can be lost through leaching during periods of high rainfall.

Corn, soybeans, rye, vetch, and alfalfa are the main crops grown. The hazard of soil blowing can be reduced by stripcropping, field windbreaks, incorporating crop residue into the soil, and conservation tillage. Using rye and vetch as a cover crop helps control soil blowing and maintains the organic-matter content. Crops respond well to adequate fertilization. Lime is needed in many areas to correct soil acidity.

CAPABILITY UNIT IIIe-6 DRYLAND

In this unit are deep, nearly level to gently sloping soils on uplands and stream terraces. They are well drained. The surface layer ranges from fine sandy loam to fine sand. The subsoil ranges from loam to silty clay. The underlying material ranges from silty clay loam to sand.

These soils have moderately rapid or rapid permeability in the surface layer and moderate or moderately slow permeability in the subsoil. The available water capacity is moderate or high. The organic-matter content is moderately low, and natural fertility is medium or high. The soils absorb water easily and release it readily to plants. They are easy to work. Runoff is slow.

The hazard of soil blowing is moderate to severe if the vegetation cover is destroyed. Water erosion is also a hazard on gently sloping soils that have a subsoil of silty clay. Maintaining the fertility and the organic-matter content are important concerns in management. Rainfall in summer is commonly inadequate to meet crop needs.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and alfalfa are the principal crops. Rye and vetch are commonly grown as a cover crop to control soil blowing.

Terraces, grassed waterways, and contour farming help control water erosion. Field windbreaks, stubble mulch tillage, stripcropping, and conservation tillage help control soil blowing and maintain the organic-matter content. Fertility can be maintained by adding fertilizer and lime.

CAPABILITY UNIT IIIe-8 DRYLAND

Nora silt loam, 2 to 6 percent slopes, eroded, is the only soil in this unit. It is a deep, gently sloping, eroded soil on uplands. It is well drained. The surface layer is silt loam. The subsoil is light silty clay loam and silt loam. The underlying material is silt loam.

This soil has moderate permeability and high available water capacity. The organic-matter content is moderately low, and natural fertility is medium. The soil absorbs moisture somewhat slowly and releases it readily to plants. It is easy to work. Runoff is medium.

Water erosion is the principal hazard. Improving the organic-matter content increases intake of moisture. Improving fertility, particularly the nitrogen content, is a concern in management. Conserving all available moisture is important because rainfall, especially in summer, is commonly inadequate to meet crop needs.

This soil is suited to most crops grown in the county. It is poorly suited to soybeans because of the hazard of erosion. Growing any row crop makes this soil highly erodible.

Growing such soil building crops as grasses and legumes and incorporating crop residue into the soil improve the organic-matter content and the fertility. Contour farming, conservation tillage, grassed waterways, and grassed field borders help prevent water erosion, conserve moisture, restore fertility, and control runoff. Zinc and phosphate fertilizers are needed for good crop growth.

CAPABILITY UNIT IIIe-9 DRYLAND

Crofton-Nora silt loams, 2 to 6 percent slopes, eroded, is the only map unit in this unit. These are deep, well drained, gently sloping soils on uplands. The surface layer and transition layer are silt loam. The subsoil is silt loam or light silty clay loam. The underlying material is silt loam.

These soils have moderate permeability and high available water capacity. The organic-matter content is moderately low or low, and natural fertility is low. The soils are eroded. They absorb moisture somewhat slowly and release it readily to plants. They are easy to work. Runoff is medium.

Water erosion is the principal hazard. The nitrogen content is low; improvement is needed. These soils are friable, but increased organic-matter content is needed to increase surface intake of moisture and to improve fertility. Many areas are calcareous at the surface, and the excess lime causes the phosphate to be unavailable. Fertility should be balanced to provide needed nutrients to the crops. Unless there is a good moisture supply in the subsoil and underlying material at the start of summer, rainfall in summer is commonly inadequate to meet crop needs.

These soils are suited to most crops commonly grown in the county except soybeans. The soils are highly erodible when planted to such row crops as soybeans.

Terraces, conservation tillage, grassed waterways, and contour farming help prevent erosion, conserve moisture, restore fertility, and control runoff. Growing such soil-building crops as grasses and legumes and incorporating crop residue into the soil improve soil structure and replenish the supply of organic matter. Zinc and phosphate fertilizers are needed in the most eroded areas.

CAPABILITY UNIT IIIw-2 DRYLAND

Fillmore silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, nearly level, poorly drained soil in depressions of the uplands. It is occasionally flooded. The surface layer is silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silty clay loam or silt loam.

This soil has very slow permeability and high available water capacity. The organic-matter content is moderate, and natural fertility is medium. This soil absorbs moisture slowly and releases it slowly to plants. Runoff is very slow.

The main limitation is the clay subsoil, which restricts water movement and root development. In years of above-average rainfall the soil is too wet to cultivate until mid summer. Crops are sometimes lost because of water that ponds on the surface during heavy spring rains. Maintaining fertility and the organic-matter content are also concerns in management.

This soil is fairly well suited to crops commonly grown in the county, especially during years of below average rainfall. It is best suited to corn and grain sorghum. It is commonly too wet for alfalfa unless good surface drainage is provided.

Removal of excess water is needed for consistent crop production. Terraces, waterways, and diversions can be built at the higher elevations to prevent excess runoff from damaging crops. Fertility can be maintained by adding commercial fertilizers and barnyard manure.

CAPABILITY UNIT IIIw-5 DRYLAND

In this unit are deep, nearly level, somewhat poorly drained soils on the stream terraces and high bottom land. The water table fluctuates between depths of 2 and 6 feet. The surface layer is loamy fine sand. The transition layer is fine sandy loam or loamy fine sand. The underlying material ranges widely from loam to fine sand.

In these soils the permeability is rapid in the upper part and rapid to moderate in the lower part. Available water capacity is low or moderate. The organic-matter content is moderately low, and natural fertility is low or medium. The soils absorb moisture easily and release it readily to plants. They are easy to work. Runoff is slow.

The main limitation is wetness caused by a moderately high water table. Tillage is commonly delayed early in spring. The low or moderate available water capacity causes the soils to be droughty in the summer when the surface is dry and the water table has dropped below the root zone. Soil blowing is also a hazard unless fields are protected. Improvement of fertility, particularly nitrogen content, is needed. Maintaining or improving the organic-matter content is also a concern in management.

Corn and alfalfa are the main cultivated crops. The soils are not well suited to spring-sown small grain.

The hazard of soil blowing can be reduced by field windbreaks, conservation tillage, stripcropping, and incorporating crop residue into the soil. Conservation tillage helps improve the organic-matter content. Applying commercial fertilizer helps maintain fertility.

CAPABILITY UNIT IVe-1 DRYLAND

Nora silt loam, 11 to 15 percent slopes, is the only soil in this unit. It is a deep, well drained, moderately steep soil on uplands. The surface layer is silt loam. The subsoil is light silty clay loam and silt loam. The underlying material is silt loam.

This soil has moderate permeability and high available water capacity. The organic-matter content is moderate, and natural fertility is high. The soil absorbs moisture easily, but, because of the slope, much of the rainfall runs off. The soil releases moisture to plants readily. These slopes are somewhat difficult to work. Runoff is rapid.

Water erosion because of soil slope is the principal hazard. Conserving moisture is a primary concern in management. Rainfall is commonly inadequate to meet crop needs because much of the moisture runs off and is lost. Maintaining the fertility and the organic-matter content are also important concerns in management.

This soil is marginal as cropland because of the slope. It is suited to most crops commonly grown in the county except soybeans. Row crops are not commonly grown continuously because of the high risk of erosion. Growing legumes and grasses about three-fourths of the time, incorporating crop residue into the surface, and adding barnyard manure help control erosion and maintain high fertility and good tilth. The hazard of water erosion can also be reduced by using grassed waterways, contour farming, and grass turn rows. Conservation tillage helps prevent runoff and increases water intake.

CAPABILITY UNIT IVe-3 DRYLAND

In this unit are deep and moderately deep, gently sloping to strongly sloping soils on uplands. They are well drained. The surface layer is sandy loam or fine sandy loam. The subsoil is fine sandy loam or loamy sand. The underlying material ranges from fine sandy loam to mixed sand and gravel.

These soils generally have moderately rapid or rapid permeability, but in areas where mixed sand and gravel is as shallow as 20 inches, permeability is very rapid. Available water capacity is low or moderate. The organic-matter content is moderately low, and natural fertility is medium. The soils absorb moisture easily and release it readily to plants. They are very friable and fairly easy to work. Runoff is medium.

Soil blowing is the principal hazard because of the moderately coarse textured surface layer. Water erosion is also a hazard in the strongly sloping areas. Where the underlying material is mixed sand and gravel, the soil is droughty. Conserving moisture is an important concern in management because rainfall is commonly inadequate to meet crop needs, particularly in summer when temperatures are highest. Maintaining the fertility and the organic-matter content are other concerns in management. In some of these soils fertility is lost through leaching during periods of high rainfall.

These soils are suited to most crops commonly grown in the county. They are better suited to pasture and forage crops than to row crops because of the slope and risk of erosion. The hazard of soil blowing can be reduced by stripcropping, by leaving crop residue on the surface, and by using conservation tillage. Terraces, grassed waterways, and contour farming help control water erosion. However, grassed waterways are difficult to maintain in areas where the underlying material is sand and gravel. In the more sandy areas, additions of lime are needed for legume crops.

CAPABILITY UNIT IVe-5 DRYLAND

In this unit are deep, nearly level to gently sloping soils on stream terraces, foot slopes, and uplands. They are well drained or excessively drained. The surface layer, transition layer, and underlying material are loamy fine sand, loamy sand, fine sand, or sand.

These soils have rapid permeability and low available water capacity. The organic-matter content is moderately low or low, and natural fertility is medium or low. The soils absorb moisture easily and release it readily to plants. They are fairly easy to work. Runoff is slow.

These soils are highly susceptible to soil blowing if the vegetative cover is destroyed. They are droughty because of the low available water capacity. Rainfall in summer is commonly inadequate to meet crop needs. Improving the fertility and maintaining or improving the organic-matter content are concerns in management. Fertility can be lost through leaching during periods of above-average rainfall.

Soils in this unit are better suited to range and pasture than to cultivated crops because of the severe hazard of soil blowing. Where cultivated, such close-growing crops as alfalfa, rye, vetch, and grass are best. These crops are more dependable than row crops because their best growth is early in spring when rainfall is the highest. If corn and other row crops are planted, it is best to plant in narrow strips alternated with strips of rye and vetch.

Stripcropping, conservation tillage, and field windbreaks can be used to control soil blowing. Leaving crop residue on the soil surface is also beneficial. Crops on these soils respond well to fertilization. Lime may be needed in most areas.

CAPABILITY UNIT IVe-6 DRYLAND

In this unit are deep, nearly level to strongly sloping soils on uplands and a few stream terraces. They are well drained. The surface layer ranges from fine sandy loam to fine sand. The subsoil ranges from light silty clay loam to loam. The underlying material ranges from sand to silt loam.

The permeability is rapid or moderately rapid in the surface layer and moderate or moderately slow in the subsoil. Available water capacity is moderate or high. The organic-matter content is moderately low, and natural fertility is medium or high. The soils absorb moisture easily and release it readily to plants. They are somewhat difficult to work in the strongly sloping areas. Runoff is slow or medium.

The hazard of soil blowing is moderate to severe if the vegetative cover is destroyed. Where the slope is steepest, water erosion is also a hazard. Maintaining the fertility and the organic-matter content are concerns in management. Rainfall in summer is commonly inadequate to meet crop needs, particularly on the soils that have sand underlying material.

Most crops commonly grown in the county can be grown. The soils are better suited to such close-growing crops as grass and legumes than to row crops.

Terraces, grassed waterways, and contour farming can be used to control water erosion. Crop residue on the surface and conservation tillage help control soil blowing. A cropping system that provides for a limited number of years of a row crop followed by close growing crops or hay and pasture crops reduces soil losses. Applying commercial fertilizer helps maintain fertility.

CAPABILITY UNIT IVe-9 DRYLAND

In this unit are deep, strongly sloping or moderately steep soils on uplands. They are well drained. The surface layer is silt loam. The transition layer or subsoil is silt loam or light silty clay loam. The underlying material is silt loam. These soils are eroded.

Permeability is moderate, and available water capacity is high. The organic-matter content is low or moderately low, and natural fertility is low. The soils absorb moisture easily, but much of the rainfall is lost as runoff. The soils release moisture readily to plants. They are somewhat difficult to work because of slope. Runoff is medium or rapid.

Water erosion is a severe hazard. Increasing the organic-matter content to increase surface intake of moisture and improve fertility is a concern in management. Nitrogen and available phosphate are needed to improve fertility. Rainfall is commonly inadequate to meet crop needs because much of the moisture is lost as runoff.

These soils are suited to corn, sorghum, small grain, and alfalfa. They are not suited to soybeans.

Terraces, grassed waterways, conservation tillage, and contour farming can be used to conserve moisture and control water erosion. Seeding grasses or a mixture of grasses and legumes improves the fertility and the organic-matter content. A cropping system that limits the use of row crops and provides for close growing crops or grasses and legumes is beneficial. A permanent cover of grass is suggested. Crops generally respond to zinc and phosphate fertilizers.

CAPABILITY UNIT IVw-4 DRYLAND

In this unit are deep, nearly level, poorly drained soils on bottom land. The water table fluctuates between depths of 1 and 5 feet. The surface layer is loam, silty clay loam, or silt loam. The transition layer or subsoil ranges from silty clay loam to loamy fine sand. The underlying material ranges widely from light silty clay loam to fine sand.

Permeability is moderately slow or rapid, and available water capacity is moderate or high. The organic-matter content is moderate, and natural fertility is high or medium. The soils absorb moisture easily and release it readily to plants. They are easy to work when the water table is low. Runoff is slow.

The main limitation is wetness caused by a high water table. The water table is highest in spring and late in fall and lowest in summer. These soils are commonly too wet to be cultivated in the spring. In most years planting is delayed in spring. Plant roots can die if the water table is too high. Maintaining the organic-matter content and the fertility balance is essential because the calcium content is generally high and the available phosphate is low.

These soils are best suited to native meadow or pasture. The native grasses benefit from the high water table, which subirrigates the land. These soils have limited use for crops. Tiling is beneficial in preparing the soils for crops, but locating suitable drainage outlets is a problem in places. Corn is the most suitable crop. It can be planted late in spring after the water table recedes. Leveling is sometimes needed to reduce the flood hazard.

CAPABILITY UNIT IVw-5 DRYLAND

Elsmere fine sand, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained, nearly level soil on bottom land and stream terraces. The profile is fine sand. The water table fluctuates between depths of 2 and 6 feet most of the year.

Permeability is rapid, and available water capacity is low. The organic-matter content is moderately low, and natural fertility is low. This soil absorbs moisture easily and releases it readily to plants. It is easy to work. Runoff is slow.

The main limitation is wetness caused by the moderately high water table. Wetness commonly delays planting in spring. When the water table is lowest late in summer, this soil is droughty. Soil blowing is a hazard if the vegetative cover is destroyed. Improving fertility, particularly the nitrogen and calcium content, and maintaining the organic-matter content are other concerns in management.

This soil is used for cultivated crops, range, and native hay. It is suited to most cultivated crops grown in the county, but corn and alfalfa are the main crops. Spring-sown small grain is not suitable because of soil wetness.

In cultivated areas, stripcropping, field windbreaks, conservation tillage, and incorporating crop residue into the soil help control soil blowing and maintain fertility. Applying commercial fertilizer also helps maintain fertility. Tiling is generally not desirable because it lowers the water table to a level that leaves the soil droughty.

CAPABILITY UNIT IVw-6 DRYLAND

Loup fine sandy loam, drained, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, poorly drained, nearly level soil on bottom land. The water table fluctuates between depths of 1 and 5 feet. The surface layer is fine sandy loam. The underlying material is fine sand. This soil is subject to occasional flooding along drainageways and streams.

Permeability is rapid, and available water capacity is low. The organic-matter content is moderate, and natural fertility is medium. The soil absorbs moisture easily and releases it readily to plants. It is easy to work except when the water table is highest. Runoff is slow.

The main limitation is wetness caused by a high water table in spring and early in summer. Wetness in spring commonly delays or prevents planting. Some crops die when the water table gets too high. Maintaining the organic-matter content and the fertility are also concerns in management.

This soil is suitable for crops only where the high water table can be controlled. It is best suited to native hay meadow. Suitable outlets for tile drains are difficult to find. Thus, lowering the water table is difficult. Where the water table can be lowered and controlled, this soil is suited to corn. The warm-season meadow grasses obtain moisture from the high water table in summer. Leaving crop residue on the surface and applying commercial fertilizer help maintain the organic-matter content and the fertility.

CAPABILITY UNIT IVs-1 DRYLAND

Gibbon silt loam, saline-alkali, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, somewhat poorly drained soil on bottom land. It is affected by strong salinity and alkalinity. The water table fluctuates between depths of 2 and 6 feet. The surface layer and underlying material are silt loam or light silty clay loam.

Permeability is moderately slow in the strongly saline and alkali areas and moderate in the unaffected areas. Available water capacity is high or moderate. The organic-matter content is moderate or moderately low, and natural fertility is medium or high. In the saline-alkali areas, the soil absorbs moisture slowly and releases it slowly to plants. These areas are hard to cultivate. In the unaffected areas, the soil absorbs moisture easily and releases it readily to plants. Runoff is slow.

The main limitation is the strong alkalinity. Improving the fertility balance and soil tilth are important concerns in management in cultivated areas. Soil tilth is difficult to improve. The surface puddles because of poor soil structure. Wetness caused by the moderately high water table is also a limitation. Wetness in spring commonly delays planting.

This soil is suited to most crops grown in the county. It is best suited to crops that tolerate high alkalinity. Corn and alfalfa are the main crops.

Incorporating crop residue into the soil, applying barnyard manure, and growing legumes improve fertility and tilth. Applying sulfur and gypsum lowers alkalinity, but is generally too costly to be profitable. Tile drains can be used to lower the water table if suitable outlets are available. Crops generally respond to fertilization.

CAPABILITY UNIT IVs-4 DRYLAND

Meadin sandy loam, 0 to 3 percent slopes, is the only soil in this unit. It is a shallow, excessively drained, nearly level to very gently sloping soil on uplands. The surface layer is sandy loam. The transition layer is gravelly loamy coarse sand or gravelly sandy loam. The underlying material is sand and gravel.

Permeability is rapid in the upper part of this soil and very rapid in the underlying material. Available water capacity is very low. The organic-matter content is low, and natural fertility is low. The soil absorbs moisture easily and releases it readily to plants. Runoff is slow.

This soil is droughty because of the very low available water capacity. The mixed sand and gravel underlying material restricts root growth. Improving the fertility, particularly the nitrogen and calcium content, and improving the organic-matter content are further concerns in management. Fertility can be lost through leaching during periods of above-average rainfall. Soil blowing is a serious hazard unless the soils are protected by a cover of vegetation. Rainfall is commonly inadequate to meet crop needs.

The soil in this unit is marginal for cultivated crops. It is better suited to range or pasture because of the very low available water capacity. Where used for cultivated crops, stripcropping, crop residue on the surface, and conservation tillage help control soil blowing. Crops generally respond to commercial fertilizer. Lime is needed in most areas.

CAPABILITY UNIT Vw-7 DRYLAND

In this unit are deep, poorly drained, nearly level soils on bottom land. The water table fluctuates between the surface and a depth of 3 feet. The surface layer ranges from silty clay loam to fine sandy loam. The transition layer, subsoil, and underlying material range widely from silty clay loam to fine sand.

Permeability ranges from moderately slow to rapid, and available water capacity is high or low. The organic-matter content is moderate, and natural fertility is medium or high. Runoff is very slow to slow.

Because of the high water table in spring and early in summer, these soils are too wet for cultivation. The available water capacity has little effect on plants because the water table is always high enough for plant roots to reach. Drainage is generally not feasible because suitable outlets are not available. These soils can become boggy if they are used as range when the water table is highest.

Vegetation consists of plants that tolerate a high degree of wetness. The soils are used mainly for grass, which is mowed for hay and grazed in summer when the water table is lowest. These soils also provide wildlife habitat.

CAPABILITY UNIT VIe-3 DRYLAND

Brunswick-Paka complex, 11 to 30 percent slopes, is the only map unit in this unit. These are deep and moderately deep, well drained, moderately steep to steep soils on uplands. The surface layer is fine sandy loam, heavy loamy fine sand, or loam. The subsoil and underlying material ranges widely from sandy clay loam to fine sand.

Permeability is moderate or moderately rapid. Available water capacity is moderate or high. The organic-matter content is moderate or low, and natural fertility is medium. The soils absorb moisture easily because of the texture of the surface layer, but, because of the slope, much of the rainfall runs off. Runoff is rapid.

These soils are not suited to cultivated crops because of the moderately steep and steep slopes. Water erosion is a very severe hazard if the vegetative cover is destroyed. Unless the soil is protected, soil blowing is also a hazard, particularly in areas that have a surface layer of fine sandy loam.

Soils of this unit are best suited to range, pasture, recreation areas, or wildlife habitat. Areas now in cultivation can be reseeded to native grass. Regulating the use of range and planning the grazing system help preserve the desired grasses, control water erosion, and prevent soil blowing.

CAPABILITY UNIT VIe-5 DRYLAND

In this unit are deep, nearly level to steep soils on uplands, stream terraces, and bottom land. They are well drained to excessively drained. In most places they have a loamy fine sand, loamy sand, fine sand, or sand surface layer, transition layer, and underlying material. In a few they are silt loam throughout.

The silt loams have moderate permeability and high available water capacity. The rest have rapid permeability and low available water capacity. The organic-matter content is low or moderately low, and natural fertility is low or medium. These soils absorb moisture easily, but in some of the steepest areas, particularly where the soils are silty, rainfall is lost as runoff. Runoff is slow to rapid.

These soils are not suited to farming. They are either too sandy or too steep, or both, for successful cultivation. Soil blowing is a very severe hazard if the vegetative cover is destroyed. Water erosion is a hazard in the steeper areas, especially on the silt loams. All but the deep silty soils are droughty because of their low available water capacity.

These soils are best suited to grass, trees, and wildlife habitat. Areas now under cultivation can be reseeded to native grass. Most areas are used for range. A planned grazing system helps control erosion, maintains the desired grasses, and improves range condition. If necessary, weeds and undesirable plants can be controlled by spraying.

CAPABILITY UNIT VIe-9 DRYLAND

In this unit are deep, steep soils on uplands. They are well drained. Most of these soils have a thin silt loam surface layer. The transition layer or subsoil is silt loam or light silty clay loam. The underlying material is silt loam. In many areas these soils are eroded.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderate to low, and natural fertility is low or high. These soils absorb moisture easily, but because of the steep slopes much of the rainfall is lost as runoff. Runoff is rapid.

These soils are not suited to cultivated crops because of the steep slopes and the very severe hazard of water erosion where the vegetation is destroyed. Improving the organic-matter content and the fertility are concerns in management. The principal fertility needs are nitrogen and available phosphate.

These soils are best suited to native grass. Areas now under cultivation can be reseeded to native grass. When reseeding, a cover should be maintained on the surface during preparation of the seedbed and during planting. These soils can also be used for woodland, wildlife habitat, and recreation areas.

Increasing the organic-matter content in the eroded areas improves the fertility and intake of moisture. The use of range should be regulated. Only one-half of the current year's growth of desired grasses can be safely removed. If necessary, weeds and other undesirable plants can be controlled by spraying. Good sites for dams are along some drainageways.

CAPABILITY UNIT VIw-7 DRYLAND

In this unit are deep, nearly level to very gently sloping soils on bottom land. They are somewhat excessively drained to somewhat poorly drained. The water table in the bottom land of large stream valleys is at a depth of 2 to 6 feet in the spring. In the upland drainageways it is below a depth of 6 feet throughout the year. In the broad valleys the surface layer and underlying material are fine sand. In the narrow upland drainageways the soil is loam, silt loam, and silty clay loam. Most areas are frequently flooded.

In the broad valleys permeability is rapid, available water capacity is low, organic-matter content is moderately low or low, and natural fertility is low. On narrow bottoms of the upland drainageways, permeability is moderate, and fertility is high. The soils absorb moisture easily and release it readily to plants. Runoff is slow.

These soils are not suited to cultivated crops because flooding is too frequent for tillage or for crops to grow and mature. Many areas also have a dense growth of trees, and removing them would be unprofitable. During dry periods soil blowing is a very severe hazard in the sandy areas unless the surface is protected by a vegetative cover.

These soils are suited to grass, trees, wildlife habitat, and recreation areas. Most areas are used for pasture or range. A planned grazing system allows the desired grasses to increase. Flooded areas can be reseeded to native grasses. In places, structures are needed to reduce gully formation. Weeds and undesirable plants can be controlled by spraying.

CAPABILITY UNIT VIs-4 DRYLAND

Meadin sandy loam, 3 to 30 percent slopes, is the only soil in this unit. It is a shallow, excessively drained, gently sloping to steep soil on uplands. The surface layer is sandy loam. The transition layer is gravelly loamy coarse sand or gravelly sandy loam. The underlying material is sand and gravel.

Permeability is rapid in the upper part of this soil and very rapid in the underlying material. Available water capacity is very low. The organic-matter content is low, and natural fertility is low. This soil absorbs moisture easily, but in steep areas some rainfall is lost as runoff. Runoff is medium or rapid.

The main limitation is the very low available water capacity, which makes the soil droughty. Soil blowing is a very severe hazard if the vegetative cover is destroyed. Improving fertility, particularly the nitrogen and calcium content, and increasing the organic-matter content are further concerns in management. Fertility is lost through leaching in periods of above-average rainfall.

This soil is best suited to grass. It is also suited to woodland, wildlife habitat, and recreational areas. It is used mainly for range or pasture. Regulating and planning grazing encourages growth of the desired grasses.

CAPABILITY UNIT VIIe-5 DRYLAND

Only Blownout land is in this unit. This land type consists of deep, excessively drained, strongly sloping to steep soil material on uplands. The profile is fine sand throughout. The material is severely eroded.

Permeability is rapid, and available water capacity is low. The organic-matter content is low, and natural fertility is low. Runoff is slow.

Soil blowing is a very severe hazard. This unit is not suited to farming. The material is too sandy, too steep, and too droughty for successful cultivation. Establishing a vegetative cover is the main concern in management.

These areas are suited mainly to grass. Until the grasses have been reestablished, the land has limited use for grazing. Grasses can be reestablished by smoothing and reducing the steep slopes and then drilling to a mixture of native grasses. Mulching with plant residue helps control soil blowing until the grasses are established. Until grasses are established, the areas should be fenced to keep livestock away.

CAPABILITY UNIT VIIe-7 DRYLAND

Crofton soils, 30 to 60 percent slopes, are the only soils in this unit. They are deep, well drained, very steep soils on uplands. The profile is silt loam.

These soils have moderate permeability and high available water capacity. The organic-matter content is moderately low, and natural fertility is low. Runoff is very rapid.

This unit is too steep and erodible for successful cultivation. Water erosion is a severe hazard. Maintaining a good vegetative cover is an important concern in management.

These soils are suited to grass. They also provide wildlife habitat and recreation areas. Most of the acreage has a cover of mid grasses and trees and is used as range.

CAPABILITY UNIT I-3 IRRIGATED

Moody silty clay loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, well drained soil on uplands. The surface layer and subsoil are silty clay loam. The underlying material is silt loam.

This soil has moderately slow permeability and high available water capacity. It has moderate organic-matter content and high natural fertility. It has a low intake rate, but releases moisture readily to plants. It is easy to work. Runoff is slow.

The low intake rate is one of the few restrictions in irrigated areas. Maintaining the organic-matter content and improving fertility are the principal management concerns. Keeping good tilth by working the soil at the proper moisture content is also important.

This soil is suited to most irrigated crops commonly grown in Antelope County. Corn, soybeans, grain sorghum, and alfalfa are the principal crops.

Borders, furrows, and sprinklers are suitable irrigation systems. Some land leveling is generally needed for satisfactory border and furrow irrigation. Wheel track ruts can be a problem if this soil is irrigated by center-pivot sprinklers. Water should be applied at a rate that does not exceed the low intake rate of this soil.

CAPABILITY UNIT I-4 IRRIGATED

This unit consists of deep, nearly level, well drained soils on uplands. The surface layer is loam and the subsoil ranges from loam to sandy clay loam. The underlying material is silt loam or loam.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderate, and natural fertility is high or medium. The soils have a moderately low intake rate and release moisture readily to plants. They are easy to work. Runoff is slow.

These soils have few restrictions in irrigated areas. Maintaining good tilth is a concern in management. In places small areas of alkali soil make cultivation difficult. Keeping the fertility at a high level and maintaining the organic-matter content are particularly important under irrigation.

These soils are suited to all irrigated crops commonly grown in the county. Corn, soybeans, and alfalfa are the main crops.

Borders, furrows, and sprinklers are suitable irrigation systems. Land leveling is needed for satisfactory border and furrow irrigation. Wheel track ruts are a moderate problem if these soils are irrigated by center-pivot sprinklers. Water should be applied at a rate that does not exceed the moderately low intake rate of these soils.

CAPABILITY UNIT I-6 IRRIGATED

This unit consists of deep, well drained and moderately well drained, nearly level soils on stream terraces and uplands. The surface layer is silt loam. The subsoil is silt loam or light silty clay loam. The underlying material is silt loam.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderate, and natural fertility is high. These soils have a moderate intake rate and release moisture readily to plants. They are easy to work. Runoff is slow. Tilth is good.

These soils have few restrictions in irrigated areas. Maintaining the organic-matter content and the high level of fertility are important concerns in management. Minor, infrequent flooding occurs on the low stream terraces.

These soils are suited to all the irrigated crops commonly grown in the county. Corn, soybeans, and alfalfa are the main crops.

Borders, furrows, and sprinklers are suitable irrigation systems. Land leveling is generally needed for even distribution of irrigation water and uniform drainage in border and furrow irrigation. Wheel track ruts are a slight problem if these soils are irrigated by center-pivot sprinklers. Water should be applied at a rate that does not exceed the moderate intake rate of these soils. Dikes or diversions can be constructed to protect adjacent lands from flooding.

CAPABILITY UNIT I-7 IRRIGATED

Bazile loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, well drained soil on uplands and a few stream terraces. The surface layer is loam or silt loam. The subsoil is light silty clay loam, clay loam, and silt loam. The underlying material is loamy fine sand, fine sand, and sand.

Permeability is moderately slow in the surface layer and subsoil and rapid in the sand underlying material. Available water capacity is moderate. The organic-matter content is moderate, and natural fertility is high. This soil has a moderate intake rate and releases moisture readily to plants. It is easy to work. Runoff is slow.

The main concerns in management are associated with the rapid permeability of the underlying material. The soil is somewhat droughty. The sand underlying material does not restrict plant roots, but it has large pore spaces through which water can move rapidly. The soil has good tilth. Keeping the fertility level high is also important.

This soil is well suited to most irrigated crops grown in the county. Corn, soybeans, and alfalfa are the principal crops.

Borders, furrows, or sprinklers are suitable irrigation systems. Land leveling is needed for border and furrow irrigation. Short irrigation runs are needed to prevent deep leaching into the sand underlying material. Wheel track ruts are a slight problem if this soil is irrigated by center-pivot sprinklers. Water should be applied at a rate that does not exceed the moderate intake rate of this soil.

CAPABILITY UNIT I-8 IRRIGATED

This unit consists of deep, well drained, nearly level soils on bottom land, stream terraces, and uplands. The surface layer is loam. The transition layer or subsoil is fine sandy loam. The underlying material ranges from fine sandy loam to fine sand.

Permeability is moderately rapid, and available water capacity is moderate. The organic-matter content is moderately low or moderate, and natural fertility is medium. These soils have a moderately high intake rate and release moisture readily to plants. They are easy to work. Runoff is slow.

Many of these soils are susceptible to minor flooding in spring. The soils are somewhat droughty because of the moderate available water capacity. Improving or maintaining the organic-matter content is essential. The soil tilth is good and should be maintained. Keeping fertility at a high level is important because in these moderately coarse soils plant nutrients can be leached out by excessive amounts of irrigation water.

These soils are suited to all irrigated crops commonly grown in Antelope County. Corn is the principal crop.

Borders, furrows, and sprinklers are suitable irrigation systems. Some land leveling is generally needed for efficient border or furrow irrigation. Fairly short irrigation runs are needed to prevent leaching into the sandy underlying material. Flooding from streams or runoff from adjacent lands can be controlled by dikes or diversions.

CAPABILITY UNIT IIe-5 IRRIGATED

Loretto sandy loam, 0 to 3 percent slopes, is the only soil in this unit. It is a deep, well drained, nearly level to very gently sloping soil on uplands and stream terraces. The surface layer is sandy loam. The subsoil is loam, silt loam, or clay loam. The underlying material is silt loam or loam.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderate, and natural fertility is high. This soil has a moderate intake rate and releases moisture readily to plants. It is easy to work and has good tilth. Runoff is slow.

Soil blowing is a hazard if the vegetative cover is destroyed. Water erosion is only a slight hazard. Maintaining the organic-matter content and keeping the fertility at a high level are important in management. This soil is suited to most of the irrigated crops commonly grown in the county. Corn, soybeans, and alfalfa are the principal crops.

Borders, furrows, and sprinklers are suitable irrigation systems. Some land leveling is needed for satisfactory border and furrow irrigation. Crop residue, conservation tillage, and windbreaks help control soil blowing.

CAPABILITY UNIT IIe-8 IRRIGATED

This unit consists of deep, nearly level, well drained soils on stream terraces, foot slopes, and uplands. The surface layer and subsoil are fine sandy loam. The underlying material ranges from fine sandy loam to fine sand.

Permeability is moderately rapid, and available water capacity is moderate. The organic-matter content is moderately low or moderate, and natural fertility is medium. These soils have a moderately high intake rate and release moisture readily to plants. They are easy to work and have good tilth. Runoff is slow.

Soil blowing is a moderate hazard. The soils are moderately coarse, and they can be droughty unless irrigation is timely. The chief concerns in management are increasing the organic-matter content and increasing and maintaining the fertility level. The soils are generally low in nitrogen. Fertility can be lost through leaching if an excessive amount of irrigation water is applied.

These soils are suited to most irrigated crops commonly grown in Antelope County. Corn is the principal crop.

Borders, furrows, and sprinklers are suitable irrigation systems. Land leveling is needed for satisfactory border and furrow irrigation. Because of the sandy underlying material, short irrigation runs are needed to minimize water loss. Crop residue, conservation tillage, and windbreaks help control soil blowing.

CAPABILITY UNIT IIe-10 IRRIGATED

This unit consists of deep, well drained, nearly level to very gently sloping soils on stream terraces and uplands. These soils have a surface layer of fine sandy loam to fine sand. The subsoil ranges from loam to light silty clay loam. The underlying material ranges widely from silt loam to sand.

Permeability is rapid or moderately rapid in the surface layer and moderate or moderately slow in the subsoil. Available water capacity is moderate or high. The organic-matter content is moderately low, and natural fertility is medium or high. These soils have a high intake rate and release moisture readily to plants. All but the soils that have a fine sand surface layer are easy to work when dry. Runoff is slow.

Soil blowing is a severe hazard where there is no vegetative cover. The sandier surface layers tend to dry out rapidly because of large pore spaces. Leaching of nutrients can occur on soils with coarse textured underlying material. The chief management need is to improve the organic-matter content and keep fertility at a high level.

Corn, alfalfa, and soybeans are the main crops. Grain, hay, and pasture crops commonly grown in the county are also suited.

Borders, furrows, and sprinklers are suitable irrigation systems. Sprinklers are the most suitable because of the high intake rate of the soils. Land leveling or land shaping is needed for satisfactory border or furrow irrigation. Short irrigation runs are needed. Crop residue, stripcropping, conservation tillage, and field windbreaks help control soil blowing.

CAPABILITY UNIT IIw-6 IRRIGATED

This unit consists of deep, nearly level, somewhat poorly drained and well drained soils on bottom land. The surface layer is silt loam or light silty clay loam. The underlying material is loam, silt loam, or light silty clay loam. In some areas the water table is at a depth of 2 to 6 feet. It is highest in spring and lowest in summer. In other areas there are occasional floods caused by runoff from adjacent uplands.

These soils have moderate permeability and high available water capacity. The organic-matter content is moderate, and natural fertility is high. These soils have a moderate intake rate and release moisture readily to plants. They are easy to work. Runoff is slow.

The main limitation is wetness caused either by a moderately high water table or by flooding in spring. Planting is generally delayed until late in May or early in June. Flood damage to row crops is seldom severe.

These soils are best suited to corn, soybeans, or cool-season grasses. Small acreages of alfalfa and grain sorghum are also irrigated.

Borders, furrows, and sprinklers are suitable irrigation systems. Land leveling is generally needed in border and furrow irrigation for even distribution of irrigation water and uniform surface drainage. Where outlets are available, open drains or tile drains can be constructed to provide drainage and improve soil workability. In some places stream flooding can be controlled by dikes. Good tilth can be maintained by working these soils at the proper moisture content.

CAPABILITY UNIT IIw-8 IRRIGATED

This unit consists of deep, somewhat poorly drained, nearly level soils on bottom land. The water table fluctuates between depths of 2 and 6 feet. The surface layer is fine sandy loam or loam. The transition layer is fine sandy loam. The underlying material is fine sand or loamy fine sand.

Permeability is moderately rapid, and available water capacity is moderate. The organic-matter content is moderate, and natural fertility is medium. These soils have a moderately high intake rate and release moisture readily to plants. They are easy to work and have good tilth. Runoff is slow.

The principal concern in management is wetness caused by the fluctuating water table. These soils are commonly too wet to cultivate early in spring and planting is commonly delayed. Unless irrigation is timely, the moderate available water capacity causes the soils to be droughty in mid summer after the water table has dropped. The sandy underlying material does not restrict root growth, but unless kept moist, plant roots will die. Maintaining fertility at a high level is important in management. Plant nutrients can be leached out if too much water is added.

These soils are suited to the most common crops grown in the county. Corn, alfalfa, and soybeans are the principal irrigated crops.

Borders, furrows, and sprinklers are suitable irrigation systems. Land leveling is needed for satisfactory border and furrow irrigation. Because of rapid permeability in the sandy underlying material, fairly short irrigation runs are needed to reduce water loss. Crop residue, conservation tillage, and windbreaks help control soil blowing. Where outlets are available, tile drains can be installed to provide drainage. In some places stream flooding can be controlled by dikes.

CAPABILITY UNIT IIs-7 IRRIGATED

O'Neill loam, 0 to 2 percent slopes, is the only soil in this unit. It is a moderately deep, well drained, nearly level soil on uplands. The surface layer is loam. The subsoil is loamy sand. The underlying material is mixed sand and gravel.

Permeability is moderately rapid to rapid in the upper 2 feet of the profile and very rapid below. Available water capacity is low. The organic-matter content is moderately low, and natural fertility is medium. This soil has a moderate intake rate and releases moisture readily to plants. It is easy to work because the surface layer is friable. Runoff is slow.

The principal limitation is droughtiness because of the large pore spaces in the sand and gravel underlying material between depths of 20 and 40 inches. This restricts root growth. Improving organic-matter content is essential. Leaching is a hazard. For this reason it is important to keep fertility at a high level in order to supply the crop with needed nutrients.

This soil is suited to most irrigated crops commonly grown in the county. Corn is the principal crop.

Borders, furrows, and sprinklers are suitable irrigation systems. Land leveling is needed for satisfactory border and furrow irrigation. Few deep cuts should be made because of the moderate depth to gravel. Because of the very rapid permeability of the underlying material, short irrigation runs reduce water loss. Center-pivot sprinklers are well suited to this soil because frequent irrigation is needed.

CAPABILITY UNIT IIs-8 IRRIGATED

Cass fine sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, well drained, nearly level soil on bottom land. The surface layer and transition layer are fine sandy loam. The underlying material ranges from fine sandy loam to fine sand.

Permeability is moderately rapid, and available water capacity is moderate. The organic-matter content is moderate, and natural fertility is medium. This soil has a moderately high intake rate and releases moisture readily to plants. It is easy to work because the surface layer is friable. Runoff is slow.

This soil can be droughty. It has a moderately coarse or coarse texture and dries out quickly because of large pore spaces. Maintaining or improving the organic-matter content is essential. Leaching can occur throughout the profile. For this reason it is important to keep the fertility level high.

This soil is suited to most crops commonly grown in the county. Corn is the principal irrigated crop.

Borders, furrows, or sprinklers are suitable irrigation systems. Some land leveling is generally required for satisfactory border and furrow irrigation. In gravity irrigation, runs must be designed so that excessive amounts of water are not lost in the sandy underlying material. Short irrigation runs at frequent intervals are needed. Stripcropping and using crop residue as surface mulch help control soil blowing. Stream flooding can be controlled in some places by dikes or diversions.

CAPABILITY UNIT IIIe-2 IRRIGATED

Longford loam, 1 to 4 percent slopes, is the only soil in this unit. It is a deep, well drained, very gently sloping and gently sloping soil on uplands. The surface layer is loam. The subsoil is light silty clay or silty clay loam. The underlying material is silt loam or silty clay loam.

Permeability is moderately slow, and available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. This soil has a low intake rate and releases moisture slowly to plants. It is easy to work except in areas where tillage has mixed part of the subsoil into the surface layer. Runoff is medium.

Water erosion is the main hazard. The silty clay subsoil slows the movement of roots and water, which influences irrigation management. Wetness because of the low intake rate makes the small depressions and flatter side slopes in this soil difficult to till.

This soil is suited to most irrigated crops grown in the county. Corn, soybeans, and alfalfa are the principal crops.

Under gravity irrigation water erosion can be controlled by contour furrows. In some places, terraces are needed to supplement contour furrows. Land leveling is generally needed for proper irrigation water distribution. Sprinkler irrigation is suitable if water is applied at a rate that does not exceed the low intake rate. Wheel track ruts are a problem if this soil is irrigated by center-pivot sprinklers. Conservation tillage in planting row crops helps control water erosion under sprinkler irrigation.

CAPABILITY UNIT IIIe-3 IRRIGATED

Moody silty clay loam, 2 to 6 percent slopes, is the only soil in this unit. It is a deep, well drained, gently sloping soil on uplands. The surface layer is light silty clay loam. The subsoil is silty clay loam. The underlying material is silt loam.

Permeability is moderately slow, and available water capacity is high. The organic-matter content is moderate, and natural fertility is high. This soil has a low intake rate, but it releases moisture readily to plants. It is easy to work if tillage is in the surface layer where the soil is most friable. Runoff is medium.

Water erosion is the principal hazard. Small gullies can form during hard rains and during irrigation, but they are plowed in with later tillage. Controlling runoff is important in management.

This soil is suited to most of the crops commonly grown in the county. Corn, soybeans, and alfalfa are the main irrigated crops.

Under gravity irrigation, bench leveling or contour furrows with terraces can be used to control water erosion. Sprinklers are also suitable if water is applied at a rate that does not exceed the low intake rate. Terraces, conservation tillage, contour farming, and grassed waterways are needed in some places to control water erosion. Wheel track ruts are a problem if this soil is irrigated by center-pivot sprinklers.

CAPABILITY UNIT IIIe-4 IRRIGATED

This unit consists of deep, gently sloping, well drained soils on uplands. The surface layer is loam.

The subsoil is clay loam, sandy clay loam, silt loam, or loam. The underlying material is silt loam or loam.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderate, and natural fertility is medium or high. These soils have a moderately low intake rate and release moisture readily to plants. They are generally easy to work except where gullies form or where tillage is in the subsoil. Runoff is medium.

Water erosion is the principal hazard. Small gullies form during heavy rains and during irrigation. Managing irrigation water properly is important. In some areas on the lower side slopes are alkali soils, which make cultivation difficult.

These soils are suited to all irrigated crops commonly grown in the county. Corn, soybeans, and alfalfa are the principal crops.

Under gravity irrigation contour furrows supplemented with terraces are suitable. Bench leveling allows all types of gravity irrigation. Sprinklers are also suitable. Water should be applied at a rate that does not exceed the moderately low intake rate of the soils. Terraces, conservation tillage, and contour farming help to control water erosion. Wheel track ruts are a moderate problem if these soils are irrigated by center-pivot sprinklers.

CAPABILITY UNIT IIIe-5 IRRIGATED

Loretto sandy loam, 3 to 6 percent slopes, is the only soil in this unit. It is a deep, well drained, gently sloping soil on uplands. The surface layer is sandy loam. The subsoil is loam, silt loam, or clay loam. The underlying material is silt loam or loam.

Permeability is moderate. Available water capacity is high. The organic-matter content is moderate, and natural fertility is high. This soil has a moderate intake rate and releases moisture readily to plants. It is very friable and easy to work. Runoff is medium.

Soil blowing and water erosion on unprotected slopes are the main hazards. Managing irrigation water properly keeps small rills from forming on these slopes during irrigation.

This soil is suited to most irrigated crops commonly grown in the county. Corn and alfalfa are the principal crops.

Contour furrows or borders on the lower slopes are suitable irrigation systems, but sprinklers are the most suitable. Water erosion can be controlled by terraces, contour farming, and conservation tillage. Grassed waterways dispose of excess water. Incorporating crop residue into the soil and using conservation tillage help control soil blowing.

CAPABILITY UNIT IIIe-6 IRRIGATED

This unit consists of deep, well drained, gently sloping soils on foot slopes and uplands. The surface layer is silt loam. The subsoil or transition layer is light silty clay loam or silt loam. The underlying material is silt loam. In some areas these soils are eroded.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderately low or moderate. Natural fertility is generally high, but in eroded areas and in areas of weakly developed soils, it is medium or low. These soils have a moderate intake rate and release moisture readily to plants. They are easy to work, but in places small gullies form after heavy rains. Runoff is medium.

Water erosion is the principal hazard. It has removed the original surface layer in some areas, and in these areas fertility is lowest. In most light colored areas the soil is calcareous at the surface and the phosphate is commonly not available. In such areas increasing the organic-matter content and keeping the fertility in balance are concerns. Managing irrigation water to prevent the formation of small gullies and rills is also important in management.

These soils are suited to most irrigated crops grown in the county. Corn, soybeans, grain sorghum, and alfalfa are the principal crops.

Bench leveling allows all types of gravity irrigation. Contour furrows supplemented with conservation tillage and terraces are suitable for irrigating row crops. Sprinklers also are suited to these soils. Water should be applied at a rate that does not exceed the moderate intake rate of the soil. Conservation tillage, terraces, and grassed waterways help control water erosion. Wheel track ruts are a slight problem if these soils are irrigated by center-pivot sprinklers.

CAPABILITY UNIT IIIe-7 IRRIGATED

Bazile loam, 2 to 6 percent slopes, is the only soil in this unit. It is a deep, gently sloping, well drained soil on uplands. The surface layer is loam or silt loam. The subsoil is light silty clay loam, clay loam, or silt loam. The underlying material is loamy fine sand, fine sand, and sand.

Permeability is moderately slow in the upper part of this soil and rapid in the lower part. Available water capacity is moderate. The organic-matter content is moderate, and natural fertility is high. This soil has a moderate intake rate and releases moisture readily to plants. It is easy to work. Runoff is medium.

Water erosion is the principal hazard. Regulating the application of irrigation water to prevent the forming of rills and gullies is important in management. The soil is somewhat droughty because the sand underlying material has large pore spaces and dries out rapidly. Plant nutrients are leached out because of the coarse underlying material. For this reason it is important to maintain fertility at a high level. In some areas improving the organic-matter content is also a concern.

This soil is suited to most crops grown in the county. Corn, soybeans, and alfalfa are the principal irrigated crops.

Contour furrows, supplemented by conservation tillage and terraces, are suitable for gravity irrigation. Deep cuts should be avoided during construction because of the moderate depth to sand. Short irrigation runs are needed to prevent water loss in the rapidly permeable underlying material. Sprinklers are also suitable on this soil. Water should be applied at a rate that does not exceed the moderate intake rate of this soil. Wheel track ruts are a slight problem if the soil is irrigated by center-pivot sprinklers. Erosion can be controlled by conservation tillage, terraces, and grassed waterways.

CAPABILITY UNIT IIIe-8 IRRIGATED

This unit consists of deep, well drained, gently sloping soils on uplands and foot slopes. The surface layer is loam or fine sandy loam. The subsoil is fine sandy loam. The underlying material is fine sand, loamy fine sand, or fine sandy loam.

Permeability is moderately rapid, and available water capacity is moderate. The organic-matter content is moderately low or moderate, and natural fertility is medium. These soils have a moderately high intake rate and release moisture readily to plants. They are very friable and easy to work. Runoff is medium.

Soil blowing and water erosion are the principal hazards unless fields are protected. These soils can be droughty unless irrigation water is applied at timely intervals. Plant nutrients can also be leached beyond the reach of plant roots. In most areas increasing the organic-matter content is a concern in management. Keeping the fertility at a high level is also important.

These soils are suited to most crops commonly grown in the county. Corn, soybeans, and alfalfa are the principal irrigated crops.

These soils are best suited to sprinkler irrigation. Borders and furrows are also suitable. Land leveling and short irrigation runs are needed for satisfactory gravity irrigation. Using crop residue as surface mulch, stripcropping, terraces, and grassed waterways help control erosion.

CAPABILITY UNIT IIIe–9 IRRIGATED

O'Neill sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is a moderately deep, well drained, nearly level soil on stream terraces and uplands. The surface layer is sandy loam. The subsoil is loamy sand. The underlying material is mixed sand and gravel.

Permeability is moderately rapid in the surface layer and very rapid in the mixed sand and gravel underlying material. Available water capacity is low. The organic-matter content is moderately low, and natural fertility is medium. This soil has a moderately high intake rate and releases moisture readily to plants. The surface layer is friable, and the soil is easy to work. Runoff is slow.

Soil blowing is the principal hazard unless fields are protected. This soil has a limited root zone. It is droughty unless water application is timely and adequate. Plant nutrients and moisture are commonly leached out because of the very coarse underlying material. For this reason it is important to keep fertility at a high level and to increase the organic-matter content.

This soil is suited to most irrigated crops grown in the county. Corn is the principal crop.

This soil is best suited to irrigation by sprinkler. Borders and furrows can be used, but some land leveling is generally needed. Cuts in leveling must be minimal so that the mixed sand and gravel is not exposed. Short irrigation runs are needed because of the very rapid permeability of the underlying material. Frequent irrigation is needed because of the low available water capacity. Stripcropping, incorporating crop residue into the soil, and conservation tillage help control soil blowing.

CAPABILITY UNIT IIIe–10 IRRIGATED

This unit consists of deep, well drained, gently sloping soils on uplands. The surface layer is fine sandy loam to fine sand. The subsoil ranges from loam to light silty clay loam. The underlying material ranges widely from silt loam to sand.

Permeability is rapid or moderately rapid in the surface layer and moderate or moderately slow in the subsoil. Available water capacity is moderate or high. The organic-matter content is moderately low, and natural fertility is medium or high. These soils have a high intake rate and release moisture readily to plants. All but the soils that have a loose, dry fine sand surface layer are easy to work. Runoff is slow.

Soil blowing is a severe hazard and water erosion is a slight hazard unless the surface has a protective cover. The surface layer tends to dry out rapidly because of the large pore spaces. Leaching of plant nutrients in areas that have coarse textured underlying material is a hazard. Increasing the organic-matter content and maintaining fertility at a high level are concerns in management.

Corn and alfalfa are the main irrigated crops. These soils are also suited to the other grain, hay, and pasture crops commonly grown in the county.

These soils are better suited to sprinkler irrigation than to a gravity system such as furrows or borders because of their high intake rate. Land shaping or land leveling is generally needed for gravity irrigation. Soil blowing can be controlled by stripcropping and conservation tillage, which keeps most of the crop residue on the surface. Terraces and grassed waterways are needed in some places to control water erosion.

CAPABILITY UNIT IIIe–11 IRRIGATED

This unit consists of deep, nearly level or very gently sloping, well drained and moderately well drained soils on stream terraces, foot slopes, bottom land, and uplands. The surface layer and transition layer are loamy fine sand. The underlying material is loamy fine sand or fine sand.

Permeability is rapid, and available water capacity is low. The organic-matter content is moderately low, and natural fertility is medium or low. These soils have a very high intake rate and release moisture readily to plants. They are very friable and easy to work. Runoff is slow.

The principal hazard is soil blowing unless fields are protected. The soils are droughty and crops show moisture stress unless irrigation is timely. Improving the organic-matter content is a concern in management. The soils are susceptible to leaching. For this reason it is important to keep fertility at a high level.

Corn and alfalfa are the main irrigated crops. The soils are also suited to the other grain, hay, and pasture crops grown in the county. They are not so well suited to such crops as soybeans, which produce little residue.

These soils are best suited to sprinkler irrigation because of their very high intake rate. Frequent irrigation is required because of the low available water capacity. Soil blowing can be controlled by leaving maximum amounts of crop residue as a mulch on the surface, by stripcropping, and by planting field windbreaks.

CAPABILITY UNIT IIIw-2 IRRIGATED

Fillmore silt loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, poorly drained, nearly level soil in depressions in uplands. It has a surface layer of silt loam. The subsoil is silty clay and silty clay loam. The underlying material is silty clay loam or silt loam.

Permeability is very slow, and available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. This soil has a low intake rate and releases moisture slowly to plants. Unless wet, it is easy to work. Runoff is very slow. Water ponds on the surface for short periods following heavy rains.

Excess water that accumulates as runoff from higher lying soils is the main limitation. Most of the ponding occurs in spring and commonly delays planting. Sometimes following heavy summer rains crops are drowned out. Keeping the fertility level high and maintaining good soil tilth by working the soil at the proper moisture content are important in management.

Corn is the main irrigated crop. Minor acreages of soybeans, grain sorghum, and cool-season grasses are also irrigated.

Flooding can be controlled by dikes, diversions, open ditches, or dugouts, all of which prevent excess runoff water from ponding. Gravity irrigation and sprinklers are suitable. Some land leveling is generally needed for satisfactory border or furrow irrigation. Water should be applied at a rate that does not exceed the low intake rate of the soil. A system can be installed to recycle excess irrigation runoff back to the irrigated fields.

CAPABILITY UNIT IIIw-10 IRRIGATED

Ovina loamy fine sand, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained, nearly level soil on stream terraces and high bottom land. The surface layer is loamy fine sand. The transition layer is fine sandy loam or loamy fine sand. The underlying material ranges from loam to fine sand. The water table fluctuates between depths of 2 and 6 feet. It is highest in spring and fall and lowest in summer.

Permeability is rapid in the surface layer and moderate in the lower underlying material. Available water capacity is moderate. The organic-matter content is moderately low, and natural fertility is medium. This soil has a high intake rate and releases moisture readily to plants. Unless wet, it is easy to work. Runoff is slow.

The main limitation is wetness caused by the moderately high water table. The soil is commonly too wet early in spring for timely planting. Soil blowing is a slight hazard if the surface layer is dry and is not protected. Keeping fertility at a high level and improving the organic-matter content are important concerns in management.

This soil is suited to most irrigated crops commonly grown in the county. Corn and alfalfa are the principal crops.

Sprinklers or furrows are suitable irrigation systems. Land leveling is generally needed for efficient furrow irrigation. Short irrigation runs are needed because of the sandy surface layer. Because of the high intake rate, this soil is well suited to sprinkler irrigation. Soil blowing can be controlled by stripcropping and conservation tillage. If suitable outlets are available, wetness can be controlled by tile drains.

CAPABILITY UNIT IIIw-11 IRRIGATED

Elsmere loamy fine sand, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained, nearly level soil on stream terraces and bottom land. The surface layer and transition layer are loamy fine sand. The underlying material is fine sand. The water table fluctuates between depths of 2 and 6 feet. It is highest in spring and in fall and lowest in summer.

Permeability is rapid, and available water capacity is low. The organic-matter content is moderately low, and natural fertility is low. This soil has a very high intake rate and releases moisture readily to plants. Unless wet, it is easy to work. Runoff is slow.

The main limitations are wetness from the water table in spring and soil blowing when the soil is cultivated. Seed bed preparation and planting are commonly delayed by wetness. This soil is droughty in summer after the water table has dropped. Improving the organic-matter content and increasing the fertility are important concerns in management.

Corn and alfalfa are the main irrigated crops. The soil is also suited to cool-season grasses.

This soil is best suited to sprinkler irrigation because of the very high intake rate. In summer, frequent irrigation is needed to keep the plant roots alive in the fine sand underlying material. Stripcropping, planting field windbreaks, and conservation tillage, which leaves maximum amounts of crop residue as a mulch on the surface, help control soil blowing. The use of perforated tile helps control wetness in this soil. Because the soil occupies low-lying areas on the landscape, drainage outlets are not always available.

CAPABILITY UNIT IIIs-6 IRRIGATED

Gibbon silt loam, saline-alkali, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, nearly level, somewhat poorly drained soil on bottom land. The water table fluctuates between depths of 2 and 6 feet. The surface layer and underlying material are silt loam or light silty clay loam. This soil is affected by strong salinity and alkalinity.

Permeability is moderately slow in the strongly saline and alkali areas and moderate in the unaffected areas. Available water capacity is high or moderate. The organic-matter content is moderate or moderately low, and natural fertility is medium or high. The saline-alkali areas have a very low intake rate and release moisture slowly to plants. The unaffected areas have a moderate intake rate and release moisture readily to plants. This soil is difficult to till because the saline-alkali areas are very sticky when wet and hard when dry.

The main limitation is the strong alkalinity. The alkali in the soil is toxic and inhibits the growth of most crops. Wetness because of the moderately high water table delays seedbed preparation and planting. The saline-alkali areas are low in nitrogen and available phosphorus. Balancing the fertility and improving the organic-matter content are important concerns in management. Improving the poor soil tilth is also a concern.

This soil is suited to irrigated corn, grain sorghum, or alfalfa. Grasses are also suited. Such alkali-tolerant crops as tall wheatgrass can be planted for forage in the more strongly alkaline areas.

Gravity irrigation and sprinklers are suited to this soil. Land leveling provides uniform surface drainage and, in places, covers the saline-alkali areas with more fertile topsoil. Where tile drains can be installed, the affected areas can generally be improved. Alkali salts can be leached out by applying sulfur and large quantities of irrigation water. Tilth in the saline-alkali areas can be improved by adding corncobs, manure, and other organic material.

CAPABILITY UNIT IVe-4 IRRIGATED

Paka loam, 6 to 11 percent slopes, is the only soil in this unit. It is a deep, well drained, strongly sloping soil on uplands. The surface layer is loam. The subsoil is clay loam, loam, or sandy clay loam. The underlying material is silt loam and loam.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. This soil has a moderately low intake rate and releases moisture readily to plants. It is easy to work, but in places small gullies form after heavy rains. Runoff is medium.

Water erosion is a very severe hazard. Maintaining and improving the organic-matter content and increasing the fertility level are important in management.

Under irrigation, this soil is better suited to close-growing crops than to cultivated crops because of the strong slope and the hazard of further erosion. Alfalfa, small grain, and cool-season grasses are best suited.

This soil is best suited to sprinkler irrigation. To prevent excessive water loss and soil erosion, water should be applied at a rate that does not exceed the moderately low intake rate of the soil. Terraces, grassed waterways, and conservation tillage, which leaves a maximum amount of crop residue as a mulch on the surface, help control erosion. Wheel track ruts are a moderate problem if this soil is irrigated by center-pivot sprinklers.

CAPABILITY UNIT IVe-6 IRRIGATED

This unit consists of deep, well drained, strongly sloping soils on uplands. The surface layer is silt loam. The subsoil or transition layer is silt loam or light silty clay loam. The underlying material is silt loam. In many areas erosion has left lime at or near the surface.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderately low or moderate, and natural fertility is low or high. These soils have a moderate intake rate and release moisture readily to plants. Except in areas where small gullies have formed; they are easy to work. Runoff is medium.

Water erosion is a very severe hazard. It has removed the original surface layer in many areas, and in these areas the fertility is low. In eroded areas the nitrogen content is low and phosphate is commonly unavailable. Improving the organic-matter content and the fertility in the lighter colored areas is a concern in management.

Under irrigation these soils are better suited to close growing crops than to cultivated crops because of the hazard of further water erosion. Alfalfa and small grain are best suited. Bromegrass, orchardgrass, and intermediate wheatgrass are the main cool-season grasses sown for irrigated pasture.

These soils are suited only to sprinkler irrigation. Other methods are too difficult to manage, and the cost of land preparation is high. Water should be applied at a rate that does not exceed the moderate intake rate of these soils in order to prevent excessive water loss and soil erosion. Terraces, grassed waterways, and conservation tillage, which leaves a maximum amount of crop residue as a mulch on the surface, help control erosion. Wheel track ruts are a problem if these soils are irrigated by center-pivot sprinklers.

CAPABILITY UNIT IVe-8 IRRIGATED

Ortello fine sandy loam, 6 to 11 percent slopes, is the only soil in this unit. It is a deep, well drained, strongly sloping soil on uplands. The surface layer and subsoil are fine sandy loam. The underlying material ranges from fine sandy loam to fine sand.

Permeability is moderately rapid, and available water capacity is moderate. The organic-matter content is moderately low, and natural fertility is medium. This soil has a moderately high intake rate and releases moisture readily to plants. It is very friable and easy to work. Runoff is medium.

Water erosion and soil blowing are hazards unless the soil is adequately protected. This soil can be droughty unless irrigation water is applied at timely intervals. Improving the organic-matter content is a concern in management. Plant nutrients are leached out. For this reason it is important to keep fertility at a high level. Applying excessive amounts of irrigation water causes rillets to form.

This soil is best suited to close-sown crops. Alfalfa, cool-season grasses, and small grain are suitable.

This soil is suited only to sprinkler irrigation. Conservation tillage and terraces can be used to control water erosion, and grassed waterways can be used to carry away excess water. Maintaining organic residue on the surface helps control soil blowing and reduces water erosion. Wheel track ruts are a slight problem in some places if this soil is irrigated by center-pivot sprinklers.

CAPABILITY UNIT IVe-9 IRRIGATED

Only O'Neill sandy loam, 2 to 6 percent slopes, is in this unit. It is a moderately deep, well drained, gently sloping soil on uplands. The surface layer is sandy loam. The subsoil is loamy sand. The underlying material is mixed sand and gravel.

Permeability is moderately rapid in the surface layer and very rapid in the underlying material. Available water capacity is low. The organic-matter content is moderately low, and natural fertility is medium. This soil has a moderately high intake rate and releases moisture readily to plants. It is friable and easy to work. Runoff is medium.

The principal hazards are soil blowing and water erosion. This soil has a limited root zone. Because it is droughty, timely and adequate applications of water are needed. Improving the organic-matter content is essential. Because irrigation water can move through this soil so readily, plant nutrients are commonly leached out below rooting depth. For this reason, it is important to keep the fertility level high.

This soil is suited to most irrigated crops grown in the county. Corn, soybeans, and alfalfa are the principal crops.

This soil is best suited to sprinkler irrigation. Border irrigation can be used in some places. Cuts in leveling must be minimal so that the mixed sand and gravel is not exposed. Short irrigation runs are needed because of the very rapid permeability of the underlying material. Frequent irrigation is needed because of the low available water capacity. Terraces and grassed waterways help control water erosion. Stripcropping, incorporating crop residue into the soil, and conservation tillage of row crops help control soil blowing.

CAPABILITY UNIT IVe-10 IRRIGATED

This unit consists of deep, well drained, nearly level to strongly sloping soils on uplands and a few stream terraces. The surface layer ranges from fine sandy loam to fine sand. The subsoil ranges from loam to silty clay. The underlying material ranges widely from silty clay loam to sand.

Permeability is rapid or moderately rapid in the upper part of these soils and moderate or moderately slow in the subsoil. Available water capacity is moderate or high. The organic-matter content is moderately low, and natural fertility is medium or high. These soils have a high intake rate and release moisture readily to plants. All but the soils that have a loose fine sand surface layer are easy to work. Runoff is slow or medium.

Soil blowing is a severe hazard if the vegetative cover is destroyed. Water erosion is a very serious hazard in the strongly sloping areas. Improving the organic-matter content is essential. Maintaining good soil tilth and keeping the fertility level high are important in management. If irrigation water is applied too rapidly, rillets can form on slopes.

These soils are suited to most irrigated crops grown in the county. Corn and alfalfa are the principal crops.

Because of their high intake rate, these soils are best suited to sprinkler irrigation. Gravity irrigation can be used in the nearly level areas. Soil blowing can be controlled by stripcropping and conservation tillage, which keeps most of the crop residue on the surface. In the gently sloping to strongly sloping areas, terraces and grassed waterways are needed to control water erosion.

CAPABILITY UNIT IVe-11 IRRIGATED

This unit consists of deep, well drained or excessively drained, nearly level to gently sloping soils on foot slopes and uplands. The surface layer, transition layer, and underlying material are loamy fine sand, loamy sand, fine sand, or sand.

Permeability is rapid, and available water capacity is low. The organic-matter content is moderately low or low, and natural fertility is medium or low. These soils have a very high intake rate and release moisture readily to plants. Runoff is slow. All but the soils that have a loose dry, fine sand surface layer are easy to work.

Soil blowing is the main hazard if the vegetative cover is destroyed. The soils are droughty and crops show moisture stress unless irrigation is timely. Improving the organic-matter content and the fertility is essential. The soils are generally low in such plant nutrients as nitrogen and calcium. Fertility can be lost through leaching.

These soils are suited to most of the crops commonly grown in the sandy part of Antelope County. Corn, soybeans, and alfalfa are the principal irrigated crops.

These soils are suited only to sprinkler irrigation because of their very high intake rate and rapid permeability. Frequent irrigation is needed because of the low available water capacity. Center-pivot sprinklers are particularly suitable. Stripcropping and conservation tillage, which maintains a high amount of crop residue on the surface, help control soil blowing.

CAPABILITY UNIT IVe-12 IRRIGATED

This unit consists of deep, nearly level to gently sloping, well drained to excessively drained soils on bottom land, stream terraces, foot slopes, and uplands. The surface layer and transition layer are fine sand or loamy fine sand. The underlying material is fine sand or sand.

Permeability is rapid, and available water capacity is low. The organic-matter content is low or moderately low, and natural fertility is low or medium. These soils have a very high intake rate and release moisture readily to plants. They are somewhat difficult to work when dry because of the loose consistence. The soils are coarse, and runoff is slow.

The principal hazard is the severe risk of soil blowing if the vegetative cover is destroyed. These soils are droughty because they have large pore spaces and dry out rapidly. Improving fertility, organic-matter content, and soil tilth is essential. The soils are generally low in such plant nutrients as nitrogen, calcium, phosphate, and sulfur. They are susceptible to leaching.

These soils are better suited to irrigated crops than to dryfarmed crops. Corn and alfalfa are the principal irrigated crops.

These soils are suited only to sprinkler irrigation, particularly to center-pivot sprinklers, because of the very high intake rate and rapid permeability. Frequent irrigation is needed because of the low available water capacity. Stripcropping and conservation tillage, which maintains a high amount of crop residue on the surface, are necessary to control soil blowing. Soil blowing is controlled in cornfields after harvest by planting rye as a cover crop to protect the soil late in fall, in winter, and in spring. A few small knolls and higher parts of hummocks may need additional manure, straw, or other organic matter to control soil blowing in spring. Where planting is feasible, field windbreaks are effective in controlling soil blowing.

CAPABILITY UNIT IVw-12 IRRIGATED

Elsmere fine sand, 0 to 2 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained, nearly level soil on stream terraces and bottom land. The surface layer, transition layer, and underlying material are fine sand. The water table fluctuates between depths of 2 and 6 feet. It is highest in spring and lowest in summer.

Permeability is rapid, and available water capacity is low. The organic-matter content is moderately low, and natural fertility is low. This soil has a very high intake rate and releases moisture readily to plants. It is somewhat difficult to work when dry because of its loose consistence. Runoff is slow.

The main limitation is wetness caused by the moderately high water table. Seedbed preparation is commonly delayed in the spring. Soil blowing is a severe hazard if the vegetative cover is destroyed. In summer after the water table has dropped this soil becomes droughty because of its large pore spaces. Improving fertility, organic-matter content, and soil tilth are essential. If irrigated, this soil is susceptible to leaching. For this reason it is important to keep fertility at a high level.

This soil is suited to corn, small grain, alfalfa, red clover, and grasses. Rye or a mixture of rye and vetch is commonly grown as a cover crop.

This soil is best suited to sprinkler irrigation. Frequent irrigation is needed in summer because of the low available water capacity. Where outlets are available, tile drains can be installed to lower the water table and thus correct the problem of wetness in spring. Stripcropping and conservation tillage, which maintains a large amount of residue on the surface, are needed to control soil blowing. Where planting is feasible, field windbreaks help in controlling soil blowing.

CAPABILITY UNIT IV$_{s}$-14 IRRIGATED

Meadin sandy loam, 0 to 3 percent slopes, is the only soil in this unit. It is a shallow, excessively drained, nearly level or very gently sloping soil on uplands. The surface layer is sandy loam. The transition layer is gravelly loamy coarse sand or gravelly sandy loam. The underlying material is mixed sand and gravel.

Permeability is rapid in the upper part of the soil and very rapid in the mixed sand and gravel. Available water capacity is very low. The organic-matter content is low, and natural fertility is low. This soil has a moderately high or higher intake rate, and it releases moisture readily to plants. It is not easy to work when dry because of its loose consistence. Runoff is slow.

The main limitation is droughtiness. Roots are restricted and the soil dries rapidly because the pore spaces are so large. The surface layer is susceptible to soil blowing unless protected by a vegetative cover. Improving the organic-matter content is essential. This soil is commonly low in nitrogen, calcium, and phosphate. Plant nutrients are leached out. For this reason, it is important to improve and maintain the fertility level.

Under irrigation, this soil is better suited to close-sown crops than row crops. Rye, or a mixture of rye and vetch, and cool-season grasses, such as bromegrass and orchardgrass, are best suited.

This soil is suited only to sprinkler irrigation, particularly to center-pivot sprinklers. Frequent irrigation is needed because of the very low available water capacity. Stripcropping and conservation tillage, which maintains a high amount of crop residue on the surface, help control soil blowing.

Predicted yields

Crop yield predictions are an important interpretation that can be made from a soil survey. The predicted acre yields for the principal crops grown on soils of Antelope County are listed in table 2. These predictions are based on average yields of seeded acres over the most recent 5-year period. They do not represent possible future yields under new and possibly different technology.

Yields for various crops were estimated from information obtained in interviews with farmers, directors of the Natural Resource Districts, representatives of the Soil Conservation Service and Agricultural Extension Service, and others familiar with soils and farming in the county. Yield information from the Agriculture Stabilization and Conservation Service and research data from Agricultural Experiment Stations was also used. Yield records, trends, research, and experience were taken into consideration.

Crop yields are influenced by many factors. Some of the soil features that affect yields most are depth, texture, slope, and drainage. Also important are erosion hazard, available water capacity, permeability, and fertility. Managing the cropping pattern, the timeliness of fieldwork, the plant population, and the crop variety affect crop yields. Weather is a significant influence, both day to day and in its longer seasonal or yearly fluctuations. All of these factors were taken into account in preparing table 2.

The yields listed are those predicted under a high level of management. This management represents those practices used by the best farmers in the county. Under this level of management, fertility is maintained and fertilizer or lime is applied at rates indicated by soil tests and field experiments. Crop residue is incorporated into the soil to improve tilth and maintain or increase organic-matter content. Adapted varieties of seed are used and plant populations are optimum. Weeds, insects, and diseases are well controlled. Under irrigation, water is applied in a timely manner and in the proper amounts. Water erosion and soil blowing are controlled. If necessary, the soil is drained. Tillage and seeding are done at the proper time and are adequate. The soil is protected from deterioration and used in accordance with its capacity.

Using table 2, productivity of the soils within the county can be compared. The table does not recommend, and the yields listed do not apply to specific farms or farmers.

Yields vary considerably from year to year because of weather, sudden infestations of diseases and insects or other unpredictable hazards. By using long-time averages, it is possible to consider such hazards in predicting crop yields.

Improved technology may make predictions in the table obsolete in a few years, and yield data will have to be updated.

TABLE 2.—*Predicted average yields per acre of principal crops*

[The yields listed are those predicted under high management. Absence of figure indicates that the crop is not suited to the soil, is not commonly grown, or irrigation is not practical. Only arable soils are listed]

Mapping unit	Corn		Soybeans		Grain sorghum		Rye	Alfalfa hay	
	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated	Dryland	Dryland	Irrigated
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Bazile loam, 0 to 2 percent slopes	60	135	28	48	65	130		3.0	5.5
Bazile loam, 2 to 6 percent slopes	55	125	25	45	60	120		2.8	5.3
Bazile complex, 0 to 3 percent slopes	55	125	25	43	58	120	25	3.1	5.5
Bazile complex, 3 to 6 percent slopes	50	115	22	40	53	110	23	2.9	5.3
Bazile complex, 6 to 11 percent slopes	45	110	19	36	48	105	18	2.7	4.9
Blendon fine sandy loam, 0 to 2 percent slopes	60	130	26	43	62	120	23	2.8	5.4
Blendon fine sandy loam, 2 to 6 percent slopes	55	120	23	40	57	110	20	2.6	5.1
Boelus fine sand, 0 to 6 percent slopes	50	120	20	35	55	110	20	3.1	5.4
Boelus loamy fine sand, 0 to 3 percent slopes	55	130	28	45	58	120	24	3.4	5.6
Boelus loamy fine sand, 3 to 6 percent slopes	50	120	25	42	54	110	22	3.2	5.4
Cass fine sandy loam, 0 to 2 percent slopes	60	130	28	45	63	120	23	3.2	5.6
Cass loam, 0 to 2 percent slopes	65	135	30	50	68	125		3.6	5.8
Cozad silt loam, 0 to 2 percent slopes	65	145	35	55	70	125		4.0	6.2
Crofton silt loam, 6 to 15 percent slopes, eroded	45		18		45			2.4	
Crofton-Nora silt loams, 2 to 6 percent slopes, eroded	55	120	25	45	60	115		3.0	5.3
Crofton-Nora silt loams, 6 to 11 percent slopes, eroded	50	110	20	35	55	105		2.6	4.7
Crofton-Nora silt loams, 11 to 15 percent slopes, eroded	40		15		45			2.2	
Doger fine sand, 0 to 6 percent slopes	45	110	15	35	50	100	16	2.0	4.5
Doger loamy fine sand, 0 to 3 percent slopes	50	120	20	40	56	105	20	2.3	4.8
Doger loamy fine sand, 3 to 6 percent slopes	45	100	15	35	50	95	18	2.1	4.6
Elsmere fine sand, 0 to 2 percent slopes	40	100	17	35	40	90	18	2.5	4.5

TABLE 2.—*Predicted average yields per acre of principal crops*—Continued

Mapping unit	Corn		Soybeans		Grain sorghum		Rye	Alfalfa hay	
	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated	Dryland	Dryland	Irrigated
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Elsmere loamy fine sand, 0 to 2 percent slopes	45	105	23	40	45	100	20	2.8	4.8
Elsmere loamy fine sand, drained, 0 to 3 percent slopes	55	120	20	40	56	110	20	2.8	5.0
Fillmore silt loam, 0 to 1 percent slopes [1]	35	115	18	40	45	110	----------	2.0	3.8
Gibbon silt loam, 0 to 2 percent slopes	75	125	35	52	70	120	----------	4.3	6.0
Gibbon silt loam, saline-alkali, 0 to 2 percent slopes	40	100	24	36	40	95	----------	2.7	4.5
Hobbs silt loam, 0 to 2 percent slopes	62	135	30	52	67	125	----------	3.6	5.8
Hord silt loam, 0 to 2 percent slopes	70	145	36	55	75	125	----------	4.0	6.3
Hord silt loam, 2 to 6 percent slopes	65	135	32	50	70	120	----------	3.7	6.0
Lawet silt loam, 0 to 2 percent slopes [1]	50	----------	30	----------	55	----------	----------	3.0	----------
Longford loam, 1 to 4 percent slopes	45	115	25	43	50	110	----------	2.6	5.0
Longford complex, 1 to 4 percent slopes	50	110	23	40	53	105	21	2.8	5.2
Loretto sandy loam, 0 to 3 percent slopes	65	135	32	52	68	125	25	3.4	5.8
Loretto sandy loam, 3 to 6 percent slopes	60	130	30	46	63	115	23	3.2	5.6
Loretto loam, 0 to 2 percent slopes	70	145	35	55	75	125	----------	3.5	6.0
Loretto loam, 2 to 6 percent slopes	65	135	32	50	70	120	----------	3.3	5.8
Loup fine sandy loam, drained, 0 to 2 percent slopes [1]	45	----------	25	----------	45	----------	20	2.6	----------
Meadin sandy loam, 0 to 3 percent slopes	15	85	----------	25	18	80	10	----------	2.5
Moody silty clay loam, 0 to 2 percent slopes	70	140	35	55	75	125	----------	3.6	6.0
Moody silty clay loam, 2 to 6 percent slopes	65	125	32	50	70	120	----------	3.4	5.8
Nora silt loam, 0 to 2 percent slopes	70	140	35	55	75	125	----------	3.6	6.0
Nora silt loam, 2 to 6 percent slopes	65	125	32	50	70	120	----------	3.4	5.8
Nora silt loam, 2 to 6 percent slopes, eroded	60	120	30	48	65	115	----------	3.2	5.6

TABLE 2.—*Predicted average yields per acre of principal crops*—Continued

Mapping unit	Corn		Soybeans		Grain sorghum		Rye	Alfalfa hay	
	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated	Dryland	Dryland	Irrigated
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Nora silt loam, 6 to 11 percent slopes	55	110	25	40	60	105	----------	3.0	5.0
Nora silt loam, 11 to 15 percent slopes	45	----------	20	----------	50	----------	----------	2.5	----------
O'Neill sandy loam, 0 to 2 percent slopes	30	120	15	35	35	110	20	1.8	4.4
O'Neill sandy loam, 2 to 6 percent slopes	25	110	12	30	30	100	17	1.5	4.2
O'Neill loam, 0 to 2 percent slopes	35	130	22	45	40	120	----------	2.3	5.0
Ord fine sandy loam, 0 to 2 percent slopes	55	120	30	45	60	110	22	3.6	5.5
Ord loam, 0 to 2 percent slopes	60	125	32	50	65	115	----------	3.8	5.7
Ortello fine sandy loam, 0 to 2 percent slopes	60	130	26	43	62	120	23	2.8	5.4
Ortello fine sandy loam, 2 to 6 percent slopes	55	120	23	40	57	110	20	2.6	5.1
Ortello fine sandy loam, 6 to 11 percent slopes	45	110	20	35	47	100	16	2.2	4.5
Ortello loam, 0 to 2 percent slopes	60	135	28	48	65	125	----------	3.0	5.5
Ortello loam, 2 to 6 percent slopes	55	125	25	45	60	115	----------	2.8	5.2
Orwet loam, 0 to 2 percent slopes [1]	50	----------	30	----------	50	----------	----------	2.8	----------
Ovina loamy fine sand, 0 to 2 percent slopes	45	110	27	42	45	105	20	3.2	5.0
Paka loam, 0 to 2 percent slopes	60	135	32	50	65	130	----------	3.4	5.8
Paka loam, 2 to 6 percent slopes	55	125	28	47	60	120	----------	3.3	5.6
Paka loam, 6 to 11 percent slopes	50	115	23	40	55	110	----------	2.9	5.0
Paka complex, 0 to 3 percent slopes	60	130	27	45	63	125	24	3.3	5.6
Paka complex, 3 to 6 percent slopes	55	120	25	42	58	115	22	3.2	5.4
Paka complex, 6 to 11 percent slopes	50	110	20	37	53	105	17	2.8	5.0
Thurman fine sand, 0 to 3 percent slopes	45	120	17	37	50	105	18	2.2	4.6
Thurman fine sand, 3 to 6 percent slopes	40	100	15	35	45	95	16	2.0	4.5
Thurman loamy fine sand, 0 to 3 percent slopes	50	120	20	40	56	105	20	2.3	4.8

TABLE 2.—*Predicted average yields per acre of principal crops*—Continued

Mapping unit	Corn		Soybeans		Grain sorghum		Rye	Alfalfa hay	
	Dryland	Irrigated	Dryland	Irrigated	Dryland	Irrigated	Dryland	Dryland	Irrigated
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Thurman loamy fine sand, 3 to 6 percent slopes	45	100	15	35	51	95	18	2.1	4.6
Thurman-Valentine complex, 0 to 6 percent slopes		110		30		90			4.2
Trent silt loam, 0 to 2 percent slopes	70	140	35	55	75	125		3.7	6.0
Valentine fine sand, 0 to 6 percent slopes		100		28		80			3.7
Valentine-Simeon complex, 0 to 3 percent slopes	35	110	15	35	36	100	18	1.8	4.3
Valentine-Simeon complex, 3 to 6 percent slopes		105		32		90			4.0

[1] When drainage is established, yields can be expected to increase 30 to 50 percent.

Range [2]

Approximately 30 percent of the total agricultural acreage in Antelope County is range. It is scattered throughout the county, but it is most common on the sandy soils, the subirrigated bottom land, and the dissected, deeply entrenched uplands in the northwest part of the county. The major areas in range are the Valentine-Thurman soil association, the Brunswick-Paka-Valentine soil association, the Elsmere-Loup soil association, and the Inavale-Elsmere-Ord soil association.

Raising livestock, mainly cow and calf herds, and selling calves in the fall as feeders is the second largest agricultural industry in the county. Range is generally grazed from late spring to early fall. In fall and early in winter livestock graze grain sorghum or corn crop residue and the rest of the winter they are fed hay or silage or both.

Management to maintain or improve range condition is needed on all rangeland, regardless of other practices used. Such management means proper grazing use, deferred grazing, and planned grazing systems. The distribution of livestock in a pasture can be improved by properly locating fences, livestock water developments, and salting facilities.

Practices that improve the range condition include range seeding, which means establishing, by seeding or reseeding, native grasses, either wild harvest or improved strains, on land suitable for use as range. Some soils, such as Crofton silt loam, 15 to 30 percent slopes, eroded, and Crofton-Nora silt loams, 15 to 30 percent slopes, are still being used for crops, but they should be seeded to range. The most important grasses used in the seed mixtures are big bluestem, little bluestem, indiangrass, switchgrass, and sideoats grama. Little care other than managing grazing is needed to maintain forage production.

[2] Prepared by PETER N. JENSEN, range conservationist, Soil Conservation Service.

Range sites and condition classes

Different kinds of rangeland produce different kinds and amounts of native grass. To manage range properly, an operator should know the different kinds of land or range sites in his holding and the native plants each site can grow. Management can then be used to favor the growth of the best forage plants on each kind of land.

Range sites are distinctive kinds of rangeland that differ significantly in the kinds and amounts of vegetation they produce. A significant difference is one great enough to require some variation in management, such as a different stocking rate. Climax vegetation is the combination of plants that originally grew on a given site. The most productive combination of range plants on a site is generally the climax vegetation.

Range condition is classified according to the percent of vegetation on the site that is climax vegetation. This classification is used for comparing the kinds and amounts of present vegetation with that which the site can produce. Changes in range condition are caused primarily by grazing and by drought.

Climax vegetation may be altered by intensive grazing. Livestock graze selectively. They constantly seek the more palatable and nutritious plants, and as a result plants either decrease, increase, or invade. Decreaser and increaser plants are climax plants. Generally, *decreasers* are the most heavily grazed and, consequently, the first to be injured by overgrazing. *Increasers* withstand grazing better because they are less palatable to livestock. They increase under grazing and replace the decreasers. *Invaders* are weeds that become established after the climax vegetation has been reduced by grazing.

Range condition is expressed by four condition classes, which show the present condition of the vegetation on a range site in relation to the climax plant community. The condition is *excellent* if 76 to 100 percent of the vegetation is climax vegetation; *good* if 51 to 75 percent is climax; *fair* if 26 to 50 percent is climax; and *poor* if 0 to 25 percent is climax.

Descriptions of range sites

The range sites in Antelope County are Wet Land, Subirrigated, Saline Subirrigated, Silty Overflow, Clayey Overflow, Sandy Lowland, Silty Lowland, Sands, Sandy, Silty, Clayey, Limy Upland, Shallow to Gravel, and Thin Loess.

These range sites are discussed in this section. The topography of each site is described, a brief description of the map units in each site is given, the dominant vegetation on the site when it is in excellent condition is described, the dominant vegetation when the site is in poor condition is given, and the total annual production of air-dry herbage when the site is in excellent condition is estimated.

To find the names of all the soils in any given range site, refer to the "Guide to Map Units" at the back of this survey.

WET LAND RANGE SITE

This site is on bottom land. The soils are nearly level, deep, and poorly drained. During the growing season they are occasionally under water for short periods. The surface layer and underlying material range widely from silty clay loam to fine sand.

These soils have rapid to moderately slow permeability and low to high available water capacity. The high water table, which fluctuates primarily between the surface and a depth of 3 feet, determines the kind of vegetation. These soils become boggy if grazed in spring. Bogs are small mounds that form at the surface.

The climax plant community is a mixture of such decreaser grasses as prairie cordgrass and reed grasses. These grasses make up at least 75 percent of the total plant volume. Other perennial grasslike plants and forbs account for the rest. Sedges are the principal increasers. When the site is in poor condition, the plant community is Kentucky bluegrass, redtop, red clover, foxtail barley, dandelion, common ragweed, and small amounts of prairie cordgrass and sedges.

When the site is in excellent condition, the total annual production of air-dry herbage is 5,500 pounds per acre in unfavorable years and 6,500 pounds per acre in favorable years (fig. 14).

Figure 14.—Native hay on Loup fine sandy loam, 0 to 2 percent slopes. The hay is fed to cattle in winter.

SUBIRRIGATED RANGE SITE

This site is on bottom land and stream terraces. The soils are deep, nearly level, and somewhat poorly drained to poorly drained. The surface layer and underlying material range widely from fine sand to silty clay loam.

These soils have moderately slow to rapid permeability and low to high available water capacity. The water table, which fluctuates primarily between depths of 1 and 6 feet, determines the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as big bluestem, indiangrass, switchgrass, slender wheatgrass, prairie cordgrass, and Canada wildrye. These grasses make up 75 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Kentucky bluegrass, green muhly, and sedges are the principal increasers. When the site is in poor condition, the plant community is Kentucky bluegrass, foxtail barley, timothy, redtop, dandelion, common ragweed, and sedges.

When the site is in excellent range condition, the total annual production of air-dry herbage is 5,000 pounds per acre in unfavorable years and 6,000 pounds per acre in favorable years.

SALINE SUBIRRIGATED RANGE SITE

This site is the strongly alkaline part of Gibbon silt loam, saline-alkali, 0 to 2 percent slopes. This deep, somewhat poorly drained, nearly level soil is on bottom land. The surface layer and underlying material are silt loam or silty clay loam.

The material is typically strongly alkaline, but is very strongly alkaline in places. It has moderately slow permeability and moderate available water capacity. The water table, which fluctuates between depths of 2 and 6 feet, and the strong alkalinity primarily determine the kind of vegetation. Alkalinity inhibits the growth of some grasses.

The climax plant community is a mixture of such decreaser grasses as switchgrass, indiangrass, western wheatgrass, and Canada wildrye. These grasses make up at least 65 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Inland saltgrass and sedges are the principal increasers. When the site is in poor condition, the plant community is inland saltgrass, Kentucky bluegrass, dandelion, blue grama, buffalograss, and various sedges.

When the site is in excellent condition, the total annual production of air-dry herbage is 4,000 pounds per acre in unfavorable years and 5,500 pounds per acre in favorable years.

SILTY OVERFLOW RANGE SITE

This site is on bottom land. The soils are nearly level or very gently sloping, deep, and well drained. They are occasionally or frequently flooded. The surface layer and the underlying material are silt loam. The additional water from periodic overflow or runoff water from higher areas, the high available water capacity, and the moderate permeability of the silty soils primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as big bluestem, little bluestem, indiangrass, switchgrass, and Canada wildrye. These grasses make up at least 70 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Western wheatgrass, side-oats grama, Kentucky bluegrass, and sedges are the principal increasers. When the site is in poor condition, the plant community is Kentucky bluegrass, western wheatgrass, Baldwin ironweed, common ragweed, and sedges.

When the site is in excellent condition, the total annual production of air-dry herbage is 4,000 pounds per acre in unfavorable years and 5,000 pounds per acre in favorable years.

CLAYEY OVERFLOW RANGE SITE

This site is Fillmore silt loam, 0 to 1 percent slopes. This deep, poorly drained, nearly level soil is in depressions in the uplands. The surface layer is silt loam and the subsoil is silty clay and silty clay loam. Flooding, caused by runoff from higher areas, and the very slow permeability of the clayey subsoil primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as big bluestem, switchgrass, indiangrass, little bluestem, and Canada wildrye. These soils make up at least 50 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Western wheatgrass, blue grama, buffalograss, and sedges are the principal increasers. When the site is in poor condition, the plant community is Kentucky bluegrass, western wheatgrass, common ragweed, and sedges.

When the site is in excellent condition, the total annual production of air-dry herbage is 3,000 pounds per acre in unfavorable years and 4,500 pounds per acre in favorable years.

SANDY LOWLAND RANGE SITE

This site is on bottom land. The soils are nearly level or very gently sloping, deep, and moderately well drained to somewhat excessively drained. The surface layer and underlying material range from loam to sand.

These soils have moderately rapid or rapid permeability and moderate or low available water capacity. The additional beneficial moisture from a moderately deep water table, which is at a depth of 4 to 10 feet in spring, and periodic overflow from streams and adjacent uplands primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as sand bluestem, little bluestem, switchgrass, and Canada wildrye. These grasses make up at least 60 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Prairie sandreed, blue grama, Scribner panicum, sand dropseed, needleandthread, and sedges are the principal increasers. When the site is in poor condition, the plant community is sand dropseed, blue grama, Scribner panicum, and common ragweed.

When the site is in excellent condition, the total annual production of air-dry herbage is 3,500 pounds per acre in unfavorable years and 4,500 pounds per acre in favorable years.

SILTY LOWLAND RANGE SITE

This site is on stream terraces and some uplands.

The soils are nearly level, deep, and well drained. The surface layer is silt loam, and the subsoil ranges from loam to light silty clay loam. The additional moisture from runoff from higher elevations, the moderate permeability, and the high available water capacity primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as big bluestem, indiangrass, switchgrass, little bluestem, and Canada wildrye. These grasses make up at least 70 percent of the total plant volume. Other grasses and forbs account for the rest. Western wheatgrass, blue grama, side-oats grama, and sedges are the principal increasers. When the site is in poor condition, the plant community is Kentucky bluegrass, western wheatgrass, common ragweed, and various sedges.

When the site is in excellent condition, the total annual production of air-dry herbage is 3,500 pounds per acre in unfavorable years and 4,500 pounds per acre in favorable years.

SANDS RANGE SITE

This site is on uplands and stream terraces. The soils are nearly level to steep, deep, and well drained to excessively drained. The surface layer and underlying material range from sand to loamy fine sand.

These soils have rapid permeability and low available water capacity. Deep storage of moisture, which is readily released to plants, primarily determines the kind of vegetation.

The climax plant community is a mixture of such decreaser plants as sand bluestem, switchgrass, indiangrass, porcupinegrass, prairie junegrass, and leadplant. These grasses make up at least 65 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Little bluestem, prairie sandreed, blue grama, hairy grama, Scribner panicum, sand dropseed, and sand paspalum are the principal increasers. When the site is in poor condition, the plant community is blue grama, hairy grama, sand dropseed, Scribner panicum, sand paspalum, and western ragweed.

When the site is in excellent condition, the total annual production of air-dry herbage is 2,000 pounds per acre in unfavorable years and 3,500 pounds per acre in favorable years.

SANDY RANGE SITE

This site is on uplands, stream terraces, and foot slopes. The soils are nearly level to steep, deep or moderately deep, and well drained to excessively drained. The surface layer ranges from fine sandy loam to fine sand. The subsoil and underlying material range widely from silty clay to sand.

These soils have low to high available water capacity. The well drained to excessively drained soils and the moderately rapid to rapid permeability in the surface layer primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser plants as sand bluestem, little bluestem, switchgrass, indiangrass, side-oats grama, prairie junegrass, and leadplant. These grasses make up at least 65 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Needleandthread, blue grama, prairie sandreed, hairy grama, and sand dropseed are the principal increasers. When the site is in poor condition the plant community is blue grama, Kentucky bluegrass, sand dropseed, and western ragweed.

When the site is in excellent condition, the total annual production of air-dry herbage is 2,000 pounds per acre in unfavorable years and 3,500 pounds per acre in favorable years.

SILTY RANGE SITE

This site is on uplands, stream terraces, and foot slopes. The soils are nearly level to steep, deep or moderately deep, and well drained or moderately well drained. The surface layer ranges from loam to silty clay loam, and the subsoil ranges from loamy sand to silty clay loam. The silty and loamy texture primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser plants as big bluestem, little bluestem, switchgrass, prairie dropseed, indiangrass, and leadplant. These grasses make up at least 70 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Side-oats grama, blue grama, Scribner panicum, Kentucky bluegrass, and sedges are the principal increasers. When the site is in poor condition, the plant community is blue grama, Kentucky bluegrass, Scribner panicum, western ragweed, blue verbena, and sedges.

When the site is in excellent condition, the total annual production of air-dry herbage is 3,000 pounds per acre in unfavorable years and 4,000 pounds per acre in favorable years.

CLAYEY RANGE SITE

This site is Longford loam, 1 to 4 percent slopes. This very gently sloping and gently sloping, deep, well drained soil is on uplands. The surface layer is loam and the subsoil is silty clay and silty clay loam. The moderately slow permeability and the high available water capacity primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as big bluestem, little bluestem, switchgrass, indiangrass, and prairie dropseed. These grasses make up at least 55 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Western wheatgrass, blue grama, side-oats grama, Kentucky bluegrass, and tall dropseed are the principal increasers. When the site is in poor condition, the plant community is blue grama, western wheatgrass, Kentucky bluegrass, western ragweed, and blue verbena.

When the site is in excellent condition, the total annual production of air-dry herbage is 2,500 pounds per acre in unfavorable years and 4,000 pounds per acre in favorable years.

LIMY UPLAND RANGE SITE

This site is on uplands. The soils are gently sloping to steep, deep, and well drained. The surface layer and underlying material are silt loam. Lime is at or near the surface.

These soils have moderate permeability and high available water capacity. The good water relationship and the limy condition of these silty soils primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as little bluestem, big bluestem, indiangrass, switchgrass, and porcupinegrass. These grasses make up at least 65 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Side-oats grama, blue grama, Scribner panicum, western wheatgrass, and Kentucky bluegrass are the principal increasers. When the site is in poor condition the plant community is blue grama, Kentucky bluegrass, Scribner panicum, blue verbena, and western ragweed.

When the site is in excellent condition, the total annual production of air-dry herbage is 2,000 pounds per acre in unfavorable years and 3,500 pounds per acre in favorable years.

SHALLOW TO GRAVEL RANGE SITE

This site is on uplands. The soils are nearly level to steep, shallow to mixed sand and gravel, and excessively drained. The surface layer is sandy loam and the underlying material is mixed sand and gravel.

These soils have rapid permeability in the upper part and very rapid permeability in the coarse underlying material. The very low available water capacity and the shallow depth to the sand and gravel primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These grasses make up at least 60 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Blue grama, sand dropseed, Scribner panicum, and clubmoss are the principal increasers. When the site is in poor condition, the plant community is clubmoss, sand dropseed, blue grama, western wheatgrass, and brittle pricklypear.

When the site is in excellent condition, the total annual production of air-dry herbage is 1,500 pounds per acre in unfavorable years and 2,500 pounds per acre in favorable years.

THIN LOESS RANGE SITE

This site is Crofton soils, 30 to 60 percent slopes. These deep, well drained, very steep soils are on uplands. The surface layer and underlying material are silt loam.

The soils have moderate permeability and high available water capacity. The very steep slopes, the excessive runoff, and the weakly developed soil material primarily determine the kind of vegetation.

The climax plant community is a mixture of such decreaser grasses as little bluestem, big bluestem, indiangrass, switchgrass, and side-oats grama. These grasses make up at least 80 percent of the total plant volume. Other perennial grasses and forbs account for the rest. Western wheatgrass, blue grama, sand dropseed, and sedges are the principal increasers. Because this site is generally inaccessible to livestock, it is rarely found in poor condition.

When the site is in excellent condition, the total annual production of air-dry herbage is 1,500 pounds per acre in unfavorable years and 2,500 pounds per acre in favorable years.

The following list provides the common name and respective scientific name for those plants named in the range section:

Common Name	*Scientific Name*
Baldwin ironweed	Vernonia baldwini Torr.
Big bluestem	Andropogon gerardi Vitman.
Blue grama	Bouteloua gracilis (H.B.K.) Lag. ex Steud.
Brittle pricklypear	Opuntia fragilis (Nutt.) Haw.
Buffalograss	Buchloe dactyloides (Nutt.) Engelm.
Canada wildrye	Elymus canadensis L.
Clubmoss	Lycopodium spp. L.
Common ragweed	Ambrosia artemisifolia L.
Dandelion	Taraxacum officinale Weber in Wiggers
Foxtail barley	Hordeum jubatum L.
Green muhly	Muhlenbergia racemosa (Michx.) B.S.P.
Hairy grama	Bouteloua hirsuta Lag.
Indiangrass	Sorghastrum nutans (L.) Nash.
Inland saltgrass	Distichlis stricta (Torr.) Rydb.
Kentucky bluegrass	Poa pratensis L.
Leadplant	Amorpha canescens Pursh
Little bluestem	Andropogon scoparius Michx.
Needleandthread	Stipa comata Trin. and Rupr.
Porcupinegrass	Stipa spartea Trin.
Prairie cordgrass	Spartina pectinata Link
Prairie dropseed	Sporobolus heterolepis (A. Gray) A. Gray
Prairie junegrass	Koeleria cristata (L.) Pers.
Prairie sandreed	Calamovilfa longifolia (Hook) Scribn.
Red clover	Trifolium pratense L.
Redtop	Agrostis alba L.
Reed grasses	Calamagrostis spp. Adans.
Sand bluestem	Andropogon hallii Hack.
Sand dropseed	Sporobolus cryptandrus (Torr.) A. Gray
Sand paspalum	Paspalum stramineum Nash.
Scribner panicum	Panicum scribnerianum Nash.
Sedges	Carex spp. L.
Side-oats grama	Bouteloua curtipendula (Michx.) Torr.
Slender wheatgrass	Agropyron trachycaulum (Link) Malte
Switchgrass	Panicum virgatum L.
Timothy	Phleum pratense L.
Western ragweed	Ambrosia psilostachya DC.
Western wheatgrass	Agropyron smithii Rydb.

Native Woodland and Windbreaks[3]

Native woodland in Antelope County is limited to relatively narrow strips along the Elkhorn River and its tributaries. Areas of native woodland are also in the northern part of the county along the south branch and east branch of the Verdigris Creek. Much of this acreage is suitable for producing commercial quantities of wood, but its value for esthetics, wildlife habitat, and watershed protection is even greater.

Eastern cottonwood, green ash, bur oak, American elm, boxelder, and willows are the principal trees in the flood plains. The understory is American plum, common chokecherry, Missouri gooseberry, eastern redcedar, Russian-olive, sandbar willow, and dogwoods. Scattered stands of bur oak, boxelder, hackberry, and eastern redcedar are on the steep slopes and in canyons adjacent to Verdigris Creek. Primary understory plants in these stands are American plum, coralberry, and smooth sumac.

Early settlers in Antelope County planted trees for protection, shade, and fenceposts. Throughout the years, landowners have continued to plant trees to protect their cropland, buildings, and livestock. These trees and shrubs contribute a great deal to the natural beauty of the landscape. They also provide food and cover for wildlife.

[3] Prepared by JAMES W. CARR, JR., forester, Soil Conservation Service.

Figure 15.—Well established windbreak planting designed to protect livestock during winter storms.

Kinds of windbreaks

Because of the scarcity of native trees and the severe extremes of weather that prevail, windbreaks are needed to protect farmsteads and livestock. Windbreaks are used to reduce soil blowing on sandy soils of the Thurman-Boelus-Nora association. They help reduce home heating costs, control snow drifting, reduce soil erosion, provide shelter for livestock, improve wildlife habitat, and beautify the home and countryside (fig. 15).

Narrow windbreaks or screen plantings are also useful in urban areas. They slow windspeed, settle dust, and help reduce noise.

Although trees are not easily established every year in Antelope County, observing basic rules of tree culture can result in a high degree of tree survival. Healthy seedlings of adapted species, properly planted in a well prepared soil site and well maintained, can survive and grow well. Care is needed after planting if the seedlings are to continue to survive.

Growth of trees

Table 3 gives the expected height at 20 years of age of trees suitable for windbreaks in this county. Detailed measurements were taken for most tree and shrub species listed in this table; however, some tree heights and ratings of vigor are estimated. The soils were grouped into nine different windbreak suitability groups. The soils in each group are similar in characteristics that affect the growth of trees.

The ratings of vigor given in table 3 are based on observations of relative vigor and general condition of the trees. Those species that have a rating of *good* are best suited for windbreaks on soils of that group. A rating of good indicates that one or more of the following conditions generally apply: leaves or needles are normal in color and growth; small amounts of deadwood (top, branches, and twigs) occur in the live crown of the tree; damage because of disease, insects, and climate is limited. A rating of *fair* indicates one or more of the following conditions generally apply: leaves or needles are obviously abnormal in color and growth; substantial amounts of deadwood (top, branches, and twigs) occur in the live crown; damage because of disease, insects, and climate is moderate; current year's growth is obviously less than normal. A rating of *poor* indicates one or more of the following conditions apply: leaves or needles are very abnormal in color and growth; very large amounts of deadwood (top, branches, and twigs) occur within the live crown; damage because of disease, insects, and climate is extensive.

The conifers cedar and pine are best suited to windbreaks in Antelope County. Measurements show that eastern redcedar, ponderosa pine, Austrian pine, and Scotch pine are the most reliable species; they were

TABLE 3.—*Windbreak plantings*

[No height is listed if species is poorly suited. The soils in group 10 are generally not suited to windbreaks]

Windbreak group	Conifer trees			Broadleaf trees			Shrubs		
	Species	Relative vigor	Height in 20 years	Species	Relative vigor	Height in 20 years	Species	Relative vigor	Height in 20 years
			Feet			*Feet*			*Feet*
Group 1	Austrian pine	Good	32	Black walnut	Good	28	American plum	Good	8
	Black Hills spruce	Good	24	Bur oak	Good	26	Amur honeysuckle	Good	10
	Blue spruce	Good	24	Eastern cottonwood	Fair	60	Amur maple	Good	12
	Eastern redcedar	Good	24	Golden willow	Good	30	Autumn-olive	Good	14
	Ponderosa pine	Good	32	Green ash	Good	28	Common chokecherry.	Good	12
	Scotch pine	Good	32	Hackberry	Good	28	Lilac	Good	8
				Honeylocust	Good	32	Peking cotoneaster	Good	8
				Midwest Manchurian crabapple.	Good	16	Red-osier dogwood	Good	6
				Russian mulberry	Good	22	Silver buffaloberry.	Good	8
				Silver maple	Good	32	Skunkbush sumac	Good	8
Group 2	Austrian pine	Good	24	Black walnut	Poor		American plum	Fair	6
	Black Hills spruce	Fair	16	Bur oak	Poor		Amur honeysuckle	Fair	8
	Blue spruce	Poor		Eastern cottonwood	Fair	55	Amur maple	Fair	10
	Eastern redcedar	Good	20	Golden willow	Good	28	Autumn-olive	Fair	10
	Ponderosa pine	Poor		Green ash	Fair	24	Common chokecherry.	Good	10
	Scotch pine	Good	24	Hackberry	Fair	20	Lilac	Poor	
				Honeylocust	Fair	26	Peking cotoneaster	Poor	
				Midwest Manchurian crabapple.	Poor		Red-osier dogwood	Good	8
				Russian mulberry	Good	22	Silver buffaloberry.	Fair	8
				Silver maple	Good	32	Skunkbush sumac	Poor	
Group 3	Austrian pine	Good	28	Black walnut	Fair	20	American plum	Good	6
	Black Hills spruce	Poor		Bur oak	Fair	20	Amur honeysuckle	Fair	6
	Blue spruce	Fair	18	Eastern cottonwood	Fair	52	Amur maple	Fair	10
	Eastern redcedar	Good	23	Golden willow	Poor		Autumn-olive	Good	12
	Ponderosa pine	Good	30	Green ash	Fair	26	Common chokecherry.	Good	8
	Scotch pine	Good	30	Hackberry	Fair	22	Lilac	Good	6
				Honeylocust	Good	28	Peking cotoneaster	Fair	6
				Midwest Manchurian crabapple.	Fair	12	Red-osier dogwood	Poor	
				Russian mulberry	Fair	20	Silver buffaloberry.	Fair	6
				Silver maple	Fair	24	Skunkbush sumac	Good	8

Group 4	Austrian pine	Good	26	Black walnut	Good	22	American plum	Fair	6
	Black Hills spruce	Fair	16	Bur oak	Good	22	Amur honeysuckle	Good	8
	Blue spruce	Fair	18	Eastern cottonwood	Poor		Amur maple	Good	12
	Eastern redcedar	Good	24	Golden willow	Poor		Autumn-olive	Good	12
	Ponderosa pine	Good	28	Green ash	Good	24	Common chokecherry.	Good	10
	Scotch pine	Good	28	Hackberry	Good	22	Lilac	Good	8
				Honeylocust	Good	26	Peking cotoneaster	Good	6
				Midwest Manchurian crabapple.	Fair	14	Red-osier dogwood	Poor	
				Russian mulberry	Good	22	Silver buffaloberry.	Fair	6
				Silver maple	Fair	22	Skunkbush sumac	Good	8
Group 5	Austrian pine	Good	20	Black walnut	Poor		American plum	Poor	
	Black Hills spruce	Poor		Bur oak	Good	16	Amur honeysuckle	Poor	
	Blue spruce	Poor		Eastern cottonwood	Poor		Amur maple	Poor	
	Eastern redcedar	Good	16	Golden willow	Poor		Autumn-olive	Fair	8
	Ponderosa pine	Good	20	Green ash	Fair	16	Common chokecherry.	Poor	
	Scotch pine	Good	18	Hackberry	Fair	16	Lilac	Fair	6
				Honeylocust	Fair	18	Peking cotoneaster	Fair	6
				Midwest Manchurian crabapple.	Poor		Red-osier dogwood	Poor	
				Russian mulberry	Poor		Silver buffaloberry.	Poor	
				Silver maple	Poor		Skunkbush sumac	Good	6
Group 6	Austrian pine	Poor		Black walnut	Poor		American plum	Poor	
	Black Hills spruce	Poor		Bur oak	Poor		Amur honeysuckle	Poor	
	Blue spruce	Poor		Eastern cottonwood	Fair	50	Amur maple	Poor	
	Eastern redcedar	Poor		Golden willow	Good	26	Autumn-olive	Poor	
	Ponderosa pine	Poor		Green ash	Poor		Common chokecherry.	Poor	
	Scotch pine	Poor		Hackberry	Poor		Lilac	Poor	
				Honeylocust	Poor		Peking cotoneaster	Poor	
				Midwest Manchurian crabapple.	Poor		Red-osier dogwood	Fair	6
				Russian mulberry	Poor		Silver buffaloberry.	Poor	
				Silver maple	Poor		Skunkbush sumac	Poor	
Group 7	Austrian pine	Good	24	Black walnut	Poor		American plum	Fair	5
	Black Hills spruce	Poor		Bur oak	Poor		Amur honeysuckle	Poor	
	Blue spruce	Poor		Eastern cottonwood	Fair	40	Amur maple	Poor	
	Eastern redcedar	Good	16	Golden willow	Poor		Autumn-olive	Fair	8
	Ponderosa pine	Good	24	Green ash	Poor		Common chokecherry.	Poor	
	Scotch pine	Good	24	Hackberry	Poor		Lilac	Poor	
				Honeylocust	Fair	20	Peking cotoneaster	Poor	
				Midwest Manchurian crabapple.	Poor		Red-osier dogwood	Poor	
				Russian mulberry	Poor		Silver buffaloberry.	Poor	
				Silver maple	Poor		Skunkbush sumac	Poor	

TABLE 3.—*Windbreak plantings*—Continued

Windbreak group	Conifer trees			Broadleaf trees			Shrubs		
	Species	Relative vigor	Height in 20 years	Species	Relative vigor	Height in 20 years	Species	Relative vigor	Height in 20 years
			Feet			*Feet*			*Feet*
Group 8	Austrian pine	Poor		Black walnut	Poor		American plum	Poor	
	Black Hills spruce	Poor		Bur oak	Poor		Amur honeysuckle	Poor	
	Blue spruce	Poor		Eastern cottonwood	Fair	42	Amur maple	Poor	
	Eastern redcedar	Good	12	Golden willow	Fair	22	Autumn-olive	Poor	
	Ponderosa pine	Fair	18	Green ash	Fair	16	Common chokecherry.	Poor	
	Scotch pine	Poor		Hackberry	Poor		Lilac	Poor	
				Honeylocust	Fair	18	Peking cotoneaster	Poor	
				Midwest Manchurian crabapple.	Poor		Red-osier dogwood	Poor	
				Russian mulberry	Poor		Silver buffaloberry.	Fair	5
				Silver maple	Poor		Skunkbush sumac	Fair	5

all given high ratings for survival and vigor. These species keep their leaves in winter and thus give maximum protection when it is most needed. Table 3 also indicates several broadleaf tree species that are well suited to windbreaks in Antelope County.

Eastern redcedar can reach a height of 25 to 35 feet at maturity, depending upon the kind of soil on which it is grown. Ponderosa pine, Austrian pine, and Scotch pine grow slightly faster and are somewhat taller at maturity than eastern redcedar. If grown in suitable soils, broadleaf trees are also taller at maturity than eastern redcedar.

The rate at which a windbreak grows varies widely, depending on soil moisture conditions and soil fertility. Exposure and arrangements of trees within a planting also have a marked effect on tree growth. Some kinds of trees, especially eastern cottonwood, tend to grow fast but die young. Siberian elm and Russian-olive also grow rapidly and are often short lived. Furthermore, they are likely to spread where they are not wanted. Boxelder and Russian mulberry commonly freeze back in severe winters. Green ash is susceptible to damage by borers.

Windbreak design, planting, and care

A good windbreak must be designed to fit the soil in which it is to grow. The intended purpose of the planting should be considered. Specific information on designing, establishing, and caring for windbreaks is available from the Soil Conservation Service and the extension forester serving Antelope County.

The soils of Antelope County are assigned to windbreak suitability groups according to characteristics that affect tree growth. Soils in a particular group produce trees that have similar growth and survival under similar conditions of weather and care. The windbreak group for each soil in the county is listed in the "Guide to Map Units" at the back of the survey.

Not all groups in the system that is used statewide are represented in Antelope County. Following is a brief description of the windbreak suitability groups in Antelope County.

WINDBREAK SUITABILITY GROUP 1

In this group are deep, nearly level soils on bottom land and stream terraces. They are well drained. The surface layer is medium textured, and the subsoil ranges from moderately coarse textured to moderately fine textured. The underlying material is coarse textured to moderately fine textured.

These soils generally provide good tree planting sites. Capability for survival and growth of adapted species are good. Competition for moisture from weeds and grass is the principal hazard.

WINDBREAK SUITABILITY GROUP 2

In this group are deep, nearly level soils in depressions in uplands, on bottom land, and on stream terraces. All but the soils in upland depressions are somewhat poorly drained and have a water table at a depth of 2 to 6 feet; the soils in upland depressions are occasionally flooded and are poorly drained. The surface layer and underlying material range widely from coarse textured to moderately fine textured.

These soils generally provide good tree planting sites. Capability for survival and growth are good if species are selected that tolerate occasional excessive wetness. Establishing seedlings can be a problem in wet years. The abundant and persistent herbaceous vegetation that grows on these sites is a concern in establishing and maintaining trees.

WINDBREAK SUITABILITY GROUP 3

In this group are deep, nearly level to strongly sloping soils on uplands, foot slopes, bottom land, and stream terraces. Most of these soils are well drained. A few areas are moderately well drained or excessively drained. The surface layer is coarse textured or moderately coarse textured, and the subsoil or transitional layer ranges widely from coarse textured to fine textured. The underlying material ranges from coarse textured to moderately fine textured.

These soils generally provide good tree planting sites. Capability for survival and growth of adapted species are fair. Lack of adequate moisture and the risk of soil blowing are the principal hazards. Soil blowing can be prevented by maintaining strips of sod or other vegetation between the rows. Generally, restricting cultivation to the tree rows is needed.

WINDBREAK SUITABILITY GROUP 4

In this group are deep, nearly level to moderately steep soils on uplands, stream terraces, and foot slopes. These soils are well drained to moderately well drained. The surface layer is medium textured or moderately fine textured, and the subsoil ranges widely from moderately coarse textured to fine textured. The underlying material is coarse textured to moderately fine textured.

These soils generally provide good tree planting sites. Capability for survival of adapted species is good, and capability for growth is fair. Drought and competition for moisture from weeds and grasses are the principal hazards. Water erosion is a hazard in the gently sloping to moderately steep areas. On the steeper slopes runoff is rapid and lack of sufficient moisture reduces growth of trees.

WINDBREAK SUITABILITY GROUP 5

In this group are deep soils and soils that are moderately deep over mixed sand and gravel. They are nearly level to moderately steep soils on uplands and stream terraces. These soils are well drained. The surface layer is moderately coarse textured to medium textured, and the subsoil ranges widely from coarse textured to moderately fine textured. The underlying material is coarse to medium textured.

These soils provide fair to poor tree planting sites. Survival and growth of adapted species are fair. In some areas lack of adequate moisture restricts rooting depth. In other areas the soil is calcareous. These are the principal hazards on this site.

WINDBREAK SUITABILITY GROUP 6

In this group are deep, nearly level soils on bottom land. These soils are poorly drained and have a water table at the surface or within a depth of 5 feet. The surface layer ranges from moderately coarse textured to moderately fine textured. The subsoil and underlying material range widely from coarse textured to moderately fine textured.

These soils generally provide poor tree planting sites, but survival and growth of adapted species are fair. Excessive wetness is the principal hazard and concern in management. Only those trees and shrubs that are tolerant of flooding are suited.

WINDBREAK SUITABILITY GROUP 7

In this group are deep, nearly level to moderately steep soils on uplands, on stream terraces, and in a few areas on bottom land. These soils are well drained to excessively drained. The surface layer and underlying material are coarse textured.

These soils generally provide fair tree planting sites. Capability for survival and growth of adapted species are fair. The soil is so loose that trees must be planted in a shallow furrow and not cultivated; otherwise, during periods of high wind, young trees can suffer damage caused by drifting sand. Only conifers are suitable for planting on these soils.

WINDBREAK SUITABILITY GROUP 8

Gibbon silt loam, saline-alkali, 0 to 2 percent slopes, is the only soil in this group. It is a deep, nearly level, somewhat poorly drained soil on bottom land. It is moderately to strongly affected by soluble salts and alkali. The most strongly affected areas are in the lowest parts of the landscape. The surface layer and the underlying material are moderately fine textured and medium textured.

This soil generally provides poor tree planting sites. Capability for survival and growth of adapted species are poor to fair. Establishing seedlings can be a problem in wet years. Root growth is impeded by the alkali layer.

WINDBREAK SUITABILITY GROUP 10

In this group are nearly level to very steep soils on uplands and bottom land. Most of these soils are deep or moderately deep. A few are shallow over mixed sand and gravel. The soils on bottom land are frequently flooded or have a water table at the surface or within a depth of 6 feet. The soils on uplands are well drained or excessively drained. The surface layer and underlying material range from coarse textured to moderately fine textured.

Soils of this group are generally not suited to windbreak plantings of any kind because of their unfavorable qualities and characteristics. Some areas can be used for recreation, forestation, and wildlife plantings of tolerant tree and shrub species, if the trees are hand planted or if special approved practices are used.

Wildlife[4]

Wildlife populations in Antelope County are determined largely by the quality and quantity of vegetation which the land is capable of producing. Cover, food, and water, in proper combination, are the three essential elements to wildlife.

Topography plays a major role in determining wildlife numbers, as do such soil characteristics as fertility. Fertile soils produce more and better quality wildlife, both game and nongame species. Primarily game species are discussed here, although nongame species are becoming increasingly important. Improving the living conditions for the game species also benefits nongame species.

Outdoor interpretation and an appreciation of the natural environment by persons other than hunters and fishermen now has greater importance. People learn to understand the relationship between plants, animals, and man and how all are dependent upon the soil.

Wildlife species can be used to evaluate the quality of the environment. It has been said that "a livable environment for wildlife is generally a quality environment for man."

In many cases the soils that have been given the highest ratings as potential wildlife habitat do not have the highest wildlife populations. This is not caused by the inability of soils to produce elements of wildlife habitat; many other factors influence wildlife populations, for example, hunting pressure, clean tillage, and improved harvesting methods. The soil's potential still remains, and its value for wildlife can be enhanced with little cost and effort. Wildlife has a place in both rural and urban settings; when planning the use of these areas wildlife should be considered.

Fish ponds that are filled by runoff from fertile fields generally produce more fish than average. Zooplankton are microscopic animals and phytoplankton are miscroscopic plants produced in fertile ponds. They provide food for larger aquatic animals such as frogs which, in turn, are used by fish. Wetness, permeability, and available water capacity are important in selecting pond sites for wildlife and recreation.

Steep slopes and rough, irregular topography present hazards to livestock and are poorly suited to crop production. In such areas, the natural undisturbed landscape can become escape cover for wildlife and can provide a source of food. In many instances flowering and fruiting trees and shrubs can be planted where vegetation is lacking.

The potential for producing wildlife habitat is evaluated for the principal soil associations in the county. Table 4 rates the potential for each of the habitat elements listed.

Grain and seed crops are domestic grain or other seed-producing annuals planted to produce food for wildlife. Examples are corn, sorghum, wheat, oats, barley, millet, soybeans, and sunflowers.

Domestic grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife cover and food. Examples are fescue, bluegrass, bromegrass, timothy, orchardgrass, clover, alfalfa, trefoil, and crownvetch.

Wild herbaceous plants are native or naturally established dryland herbaceous grasses and forbs (including weeds) that provide food and cover for wildlife. Examples are bluestem, indiangrass, goldenrod, beggarweed, partridgepea, pokeweed, wheatgrasses, fescues, and gramas.

Hardwood trees and shrubs include nonconiferous trees and associated wood understory plants that pro-

[4] Prepared by ROBERT O. KOERNER, biologist, Soil Conservation Service.

TABLE 4.—*Wildlife habitat*

Soil association	Potential for producing—							Potential as habitat for—		
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees and shrubs	Coniferous plants	Wetland food and cover	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Valentine-Thurman:										
Valentine	Fair	Fair	Fair	Poor	Poor	Very poor	Very poor	Fair	Very poor	Fair.
Thurman	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Thurman-Boelus-Nora:										
Thurman	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Boelus	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Nora	Fair to good.	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bazile-Paka-Thurman:										
Bazile	Fair to good.	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Paka	Fair to good.	Good	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Thurman	Fair	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Good.
Brunswick-Paka-Valentine:										
Brunswick	Poor	Poor	Good	Fair	Good	Very poor	Very poor	Poor	Very poor	Good.
Paka	Fair to good.	Good	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Good.
Valentine	Poor	Fair	Fair		Poor	Very poor	Very poor	Poor	Very poor	Fair.
Nora-Crofton-Moody:										
Nora	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Crofton	Fair	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Good.
Moody	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Hord-Cozad:										
Hord	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Cozad	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Elsmere-Loup:										
Elsmere	Fair	Fair	Good	Poor	Fair	Good	Fair	Fair	Fair	Good.
Loup	Fair to poor.	Fair	Poor	Poor	Poor	Good	Good	Fair	Good	Poor.
Inavale-Elsmere-Ord:										
Inavale	Poor	Poor	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Fair.
Elsmere	Poor	Poor	Poor	Fair	Fair	Fair	Good	Poor	Good	Poor.
Ord	Good	Good	Good	Fair	Fair	Fair	Good	Good	Good	Good.
Lawet-Orwet-Gibbon:										
Lawet	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Good	Fair.
Orwet	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Good	Fair.
Gibbon	Good	Good	Good	Good	Fair	Fair	Fair	Good	Fair	Good.

vide cover for wildlife or that produce nuts, buds, catkins, twigs, bark, or foliage used as food for wildlife. Shrubby plants are shrubs that produce buds, twigs, bark, or foliage used as food by wildlife, or that provide cover and shade for some wildlife species. Examples are snowberry, honeysuckle, and Russian-olive.

Coniferous plants include cone-bearing trees, shrubs, or ground cover that furnish wildlife cover or supply food in the form of browse, seeds, or fruitlike cones. Commonly established through natural processes, they may be planted or transplanted. Examples are pine, spruce, fir, cedar, and juniper.

Wetland food and cover consists of annual and perennial wild herbaceous plants of moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover used extensively by wetland forms of wildlife. Examples are smartweed, wild millet, rushes, sedges, reeds, cordgrass, and cattail.

Shallow water areas are areas of surface water, generally averaging less than 5 feet in depth, that are useful to wildlife. They may be naturally wet areas or those created by dams or levees or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, wildlife ponds, and beaver ponds.

Ratings for kinds of wildlife habitat

Soils are rated as to their suitability for producing openland, wetland, and rangeland wildlife habitat. The three types of habitat are directly related to the three broad classes of wildlife.

Openland wildlife are birds and mammals of cropland, pastures, meadows, lawns, and areas overgrown with grasses, herbs, shrubs, and vines. Examples are bobwhite quail, pheasant, meadowlark, killdeer, cottontail rabbit, red fox, and woodchuck.

Wetland wildlife are birds and mammals of swampy, marshy, or open-water areas. Examples are ducks, geese, herons, shorebirds, rails, kingfishers, muskrat, mink, and beaver.

Rangeland wildlife are birds and mammals of natural rangelands. Examples are antelope, white-tailed deer, mule deer, prairie grouse, lark bunting, and prairie dog.

The levels of suitability are expressed by an adjective rating as follows:

A rating of *good* means habitats are easily improved, maintained, or created. There are few or no soil limitations in habitat management, and satisfactory results can be expected. *Fair* means habitats can be improved, maintained, or created on these soils, but moderate soil limitations affect habitat management or development. A moderate intensity of management and fairly frequent attention may be required to ensure satisfactory results. A rating of *poor* indicates that habitats can be improved, maintained, or created on these soils, but the soil limitations are severe. Habitat management may be difficult and expensive and require intensive effort. Results are questionable.

Very poor means that under the prevailing soil conditions it is impractical to attempt to improve, maintain, or create habitats. Unsatisfactory results are probable.

Developing good habitat for wildlife requires the proper location and distribution of vegetation. Technical assistance in planning wildlife developments and determining which species of vegetation to use can be obtained at the local office of the Soil Conservation Service in Nebraska. The Soil Conservation Service also provides technical assistance in the planning and application of conservation practices for developing outdoor recreation facilities.

For additional information and assistance contact the Nebraska Game and Parks Commission, the Fish and Wildlife Service, or the Federal Extension Service.

The Valentine-Thurman association is an area of nearly level to hilly uplands. Tracts of native range are common. A few prairie grouse are in this association. Range grasses provide good cover and nesting habitat for upland game birds. Populations of pheasant and bobwhite quail are low and numbers of white cottontail rabbit and fox squirrel are in the medium to high range.

The Thurman-Boelus-Nora association is an area of low, rolling hills that alternate with side slopes to drainageways. Single-row windbreaks of redcedar, planted to control soil blowing, are common. The trees and shrubs in these field windbreaks also provide good cover for many species of wildlife. Rye planted in corn rows in September provides winter cover. Many of the field windbreaks are being removed so that center-pivot sprinklers can be used in irrigation. Similar numbers of trees and shrubs can be planted in the odd corners of fields and around farmsteads to replace habitat. The supply of surface water is scarce in this association except during the irrigation season.

The Bazile-Paka-Thurman association is nearly level to rolling. Thickets of native plum and common chokecherry are in the natural drainageways. Redcedar and Russian-olive are in the narrow bottoms. The principal wildlife species are bobwhite quail, pheasant, and cottontail rabbit.

The Brunswick-Paka-Valentine association is mainly grassland. Oak, ash, redcedar, native plum, common chokecherry, and sumac grow in the deep drainageways. The native plum thickets provide good food and cover for pheasant and quail. Squirrel, white-tailed deer, raccoon, fox, coyote, and songbirds are common in the wooded draws. Some drainageways are spring fed and provide needed water for wildlife (fig. 16). The Grove Trout Recreation Area, which is 30 acres of land and 2 acres of water, is on this association.

The Nora-Crofton-Moody association has a landscape of ridgetops, divides, and side slopes to drainageways. Redcedar, ash, elm, eastern cottonwood, and native plum grow in the drainageways. Oak is common along Cedar Creek. The 70 percent of this association in crops provides good habitat for pheasant and food and cover for deer, fox, coyote, raccoon, and squirrel.

The Hord-Cozad association is mainly on the nearly level to gently sloping stream terraces of the Elkhorn River Valley. It offers a wide variety of cover and produces an abundance of food for many species of wildlife.

The Elsmere-Loup association, at the edge of the sandhills, is nearly level. The water table is high. Waterfowl and shorebirds find this area attractive during spring migrations because the water table is com-

Figure 16.—**Wooded drainageways in Brunswick-Paka-Valentine association provide excellent cover and produce food for wildlife.**

monly at the surface during this period and provides desirable habitat. This association has many wet hay meadows where water ponds in spring.

The Inavale-Elsmere-Ord association is on nearly level bottom land. It supports a woody cover of ash, oak, elm, buckbrush, native plum, common chokecherry, and many species of grass. The area near the Elkhorn River supports the most types of cover as well as the greatest variety of wildlife species in the county. Squirrel, raccoon, white-tailed deer, hawks, owls, eagles, and songbirds are common. Wetland areas on bottom land contain muskrat, mink, and beaver. Corn and alfalfa provide food for many species of wildlife. This association provides all the elements of food, cover, and water that are needed for wildlife.

The Lawet-Orwet-Gibbon association is nearly level and on bottom land. The water table is within a few feet of the surface. The soils produce food and provide nesting cover for waterfowl. Muskrat and mink are common in years when rainfall is highest. Cottontail rabbits are common. In winter prairie grouse commonly congregate in this association. Native stands of reed canarygrass, phragmites, and cattails are common in the lowest areas. They provide habitat for some forms of wetland wildlife.

Recreational Resources

Antelope County offers several kinds of recreational resources and has potential for much more. Hunting and fishing are two of the most important types of recreation available in the county. Wild game is common in all parts of the county. The numbers are influenced by different farming operations. The main animals hunted are pheasant, bobwhite quail, sharp-tailed grouse, cottontail rabbit, squirrel, waterfowl, and white-tailed deer.

Waters for fishing are scattered throughout the county. They include the Elkhorn River and other perennial rivers and creeks as well as stocked ponds (fig. 17) and lakes. Catfish, bluegill, bass, bullheads, carp, and trout are the main fish species in Antelope County.

Other types of recreation in the county are boating, camping, picnicking, golfing, and scenic drives. The main boating, camping, and picnic area is the Grove Lake Special Use Area near Royal. It is operated by the Nebraska Game and Parks Commission. Its 1,565 acres offer fishing, camping, and picnicking facilities. Picnic and camping facilities are also available at some city parks. There are two golf courses that have excellent facilities and grass greens. The northwest part of the county is the main natural scenic area. It consists of moderately deep canyons, ridgetops, and wooded valleys of creeks. The large number of shelterbelts throughout the county provide beautiful fall colors for scenic drives.

Antelope County has potential for developing more

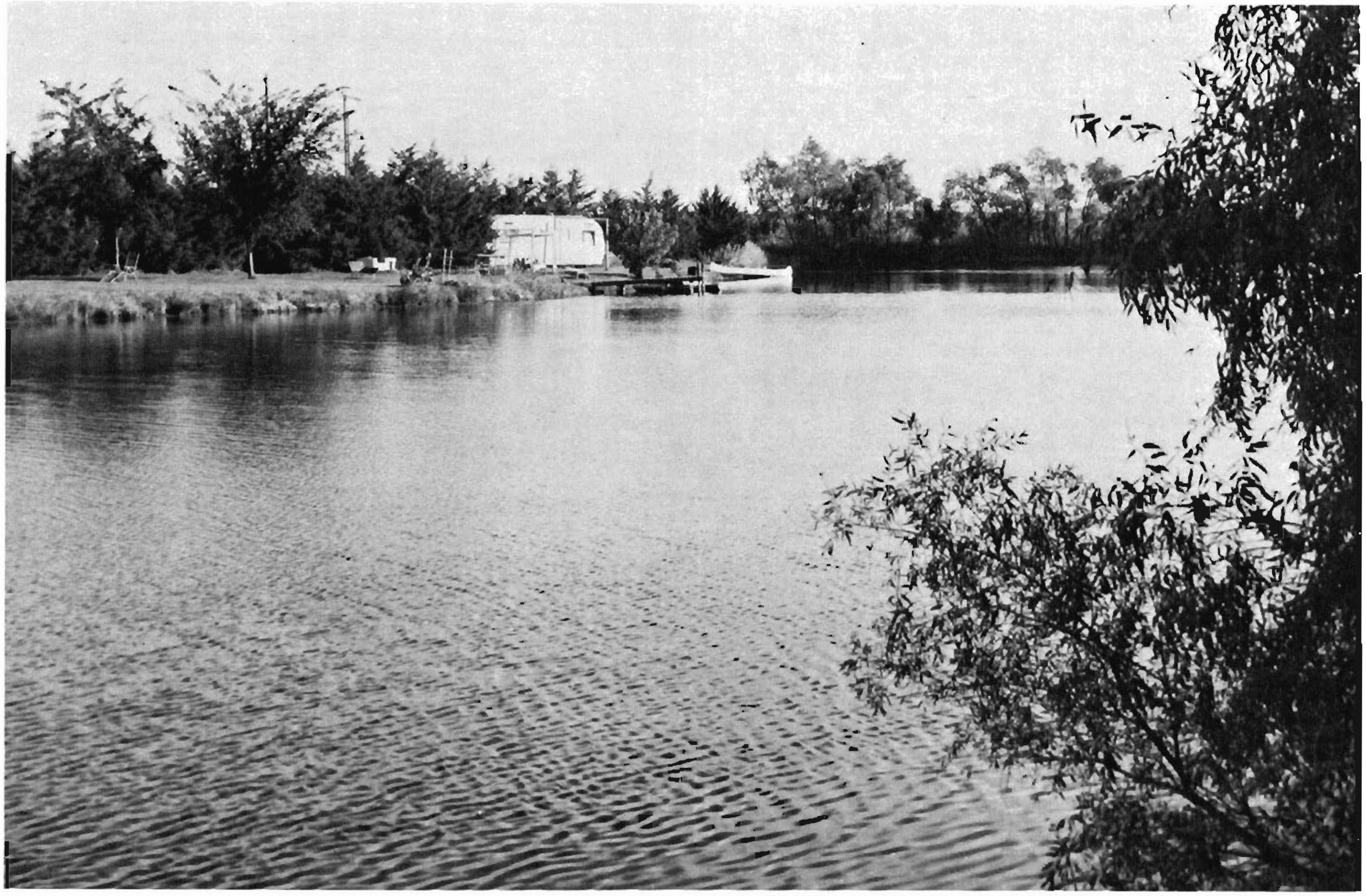

Figure 17.—Farm pond provides recreation.

recreation as the demand rises (fig. 18). Shooting preserves and vacation farms and ranches are possible developments for recreation in the future.

Engineering[5]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Planning commissions, town and city managers, land developers, engineers, contractors, and farmers can benefit from information in this section.

Properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this survey, can be used to make interpreta-

[5] SYDNEY H. HAAKENSTAD, engineer, Soil Conservation Service, helped prepare this section.

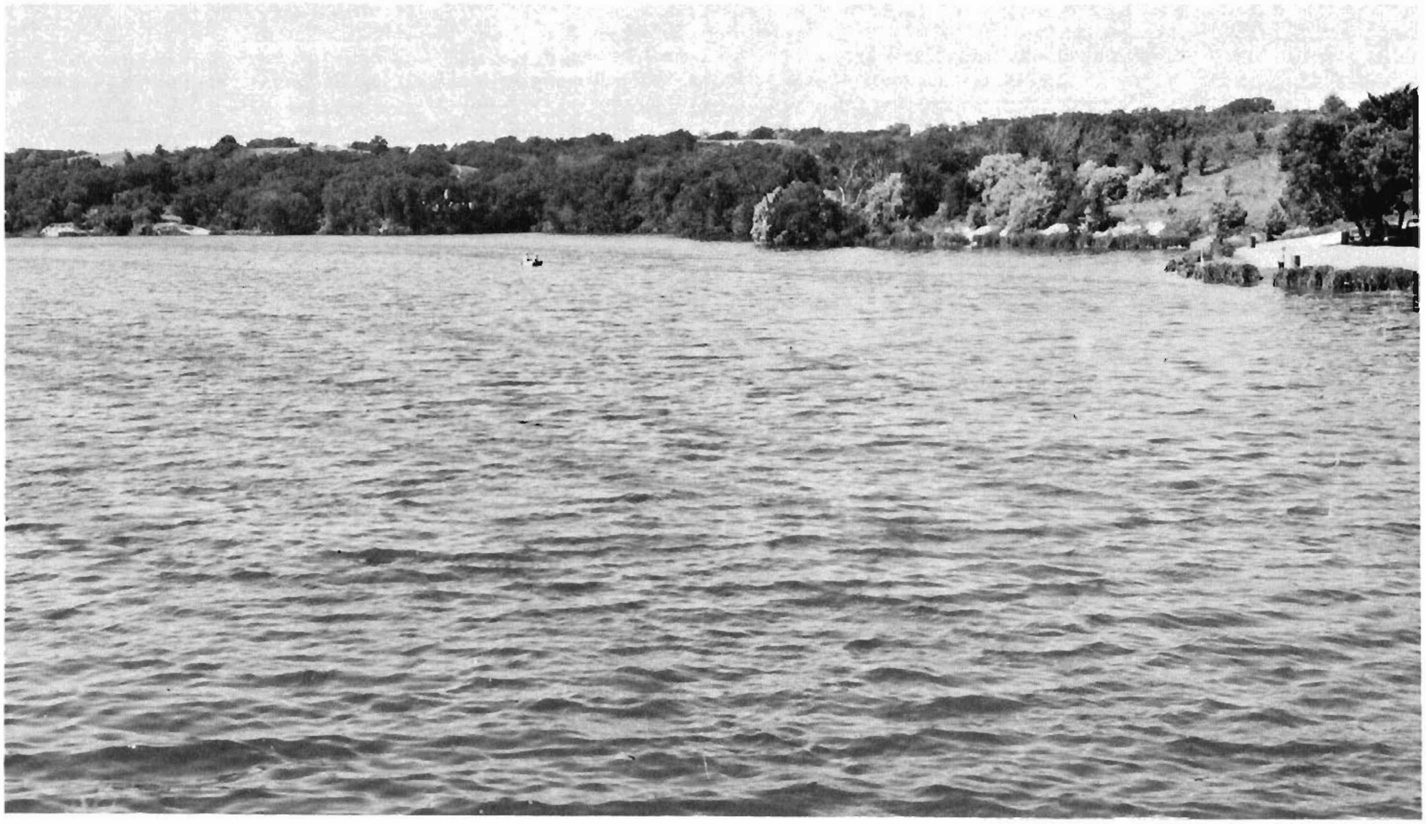

Figure 18.—Grove Lake provides fishing, camping, and picnicking facilities.

tions in addition to those given in tables 5 and 6, and it also can be used to make other useful maps.

This information, however, is not intended for use in design and does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many mapped areas of a given soil contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning in soil science that may not be familiar to engineers. The Glossary defines many terms commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*2*) used by the SCS engineers, Department of Defense, and others, and the AASHTO system (*1*) adopted by the American Association of State Highway and Transportation Officials.

The Unified system is used to classify soils according to engineering uses for building material. Soils are classified according to particle size, size distribution, liquid limit, plasticity index, and organic-matter content. Soils are divided into coarse-grained or fine-grained groups. The coarse-grained group is further divided into sands or gravels according to grain size distribution. Sands are divided into four principal classes on the basis of gradation or classification of the fines they contain. These are identified by the symbols SW, SP, SM and SC. Gravels are also divided into four principal classes by gradation or classification of the fines they contain. These are identified by the symbols GW, GP, GM, and GC. Coarse grained soils that are 5 to 12 percent fines are considered to be between two classes and are given dual symbols such as GW-GM or SW-SC. The fine grained group is divided into six principal classes on the basis of liquid limit, plasticity index, and organic-matter content. Nonplastic classes are ML, MH, OL, and OH; plastic classes are CL and CH. One transitional class is identified by the dual symbol CL-ML. The system has one class of highly organic soils, Pt.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is classified in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils, which have high bearing strength and are the best soils for subgrade, or foundation. At the other extreme, in group A–7, are clay soils, which have low strength when wet and are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7

TABLE 5.—*Estimates of soi...*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. ...fully the instructions for referring to other series that appear in the first column

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification	
				Unified	AASHTO
	Ft	*In*			
Bazile:					
Bc, BcC	>10	0–14	Loam	CL	A–4 or A–6
		14–26	Light silty clay loam	CL	A–6 or A–7
		26–31	Silt loam	CL	A–4 or A–6
		31–60	Fine sand and sand	SP, SP–SM or SM	A–3 or A–2
BdB, BdC, BdD	>10	0–16	Fine sandy loam, loamy fine sand, and fine sand.	SM or SP–SM	A–4, A–3 or A–2
		16–26	Light silty clay loam	CL	A–6 or A–7
		26–31	Silt loam	CL	A–4 or A–6
		31–60	Fine sand and sand	SP, SP–SM, or SM	A–3 or A–2
Blendon: Be, BeC	>10	0–29	Fine sandy loam	SM	A–2 or A–4
		29–60	Fine sand	SP–SM or SM	A–3 or A–2
Blownout land: Bg	>10	0–60	Fine sand	SP or SP–SM	A–3 or A–2
Boelus:					
BoC	>10	0–18	Fine sand	SM or SP–SM	A–2 or A–3
		18–60	Silt loam	CL	A–6
BpB, BpC	>10	0–10	Loamy fine sand	SM	A–2
		10–29	Loamy fine sand	SM	A–4 or A–2
		29–60	Silt loam	CL	A–6
*Brunswick: BxF For Paka part see Paka series.	>10	0–4	Fine sandy loam	SM	A–4 or A–2
		4–17	Fine sandy loam	SM	A–2 or A–4
		17–23	Loamy fine sand	SM	A–4 or A–2
		23–60	Soft sandstone.		
Cass:					
Cb	5–7	0–27	Fine sandy loam	SM	A–4 or A–2
		27–34	Loamy fine sand	SM	A–2
		34–60	Fine sand	SP–SM or SM	A–3 or A–2
Cc	5–7	0–11	Loam	ML or CL	A–4
		11–27	Fine sandy loam	SM	A–4 or A–2
		27–31	Loamy sand	SM	A–2
		31–41	Fine sandy loam	SM	A–4 or A–2
		41–60	Fine sand	SP–SM or SM	A–3 or A–2
Cozad: Co	>10	0–14	Silt loam	CL–ML, CL or ML	A–4 or A–6
		14–20	Silt loam	CL	A–6
		20–60	Silt loam	CL or CL–ML	A–6 or A–4
*Crofton: CrE2, CrF2, CsG, CuC2, CuD2, CuE2, CuF. For Nora part of CuC2, CuD2, CuE2 and CuF, see Nora series.	>10	0–60	Silt loam	ML or CL	A–6
Doger;					
DfC	>10	0–32	Fine sand	SP–SM or SM	A–3 or A–2
		32–60	Fine sand	SP–SM or SM	A–3 or A–2
DhB, DhC	>10	0–31	Loamy fine sand	SM	A–2
		31–60	Fine sand	SP–SM or SM	A–3 or A–2

properties significant in engineering

The soils in such mapping units may have different properties and limitations, and for this reason, it is necessary to follow care-
of this table. The symbol > means more than; the symbol < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permea-bility	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						
				Pct		*In/hr*	*In/in of soil*	*pH*	
	100	90–100	65–90	20–35	8–20	0.6–2.0	0.20–0.22	5.1–6.5	Low.
	100	90–100	85–95	35–45	13–25	0.2–0.6	0.18–0.20	6.1–6.5	Moderate.
	100	90–100	75–95	20–35	8–20	0.6–2.0	0.20–0.22	7.4–7.8	Low.
	100	60–90	5–15	-----------	[1] NP	6.0–20.0	0.05–0.07	6.6–7.8	Low.
	100	80–100	10–49	-----------	NP	2.0–20.0	0.06–0.18	5.1–6.5	Low.
	100	90–100	85–95	35–45	13–25	0.2–0.6	0.18–0.20	6.1–6.5	Moderate.
	100	90–100	75–95	20–35	8–20	0.6–2.0	0.20–0.22	7.4–7.8	Low.
	100	60–90	5–15	-----------	NP	6.0–20.0	0.05–0.07	6.6–7.8	Low.
	100	90–100	30–49	<20	NP	2.0–6.0	0.15–0.18	5.6–7.3	Low.
	100	75–95	10–15	-----------	NP	6.0–20.0	0.05–0.07	6.6–7.3	Low.
	100	75–95	3–12	-----------	NP	6.0–20.0	0.05–0.07	5.1–6.0	Low.
	100	75–95	8–20	-----------	NP	6.0–20.0	0.06–0.09	5.6–6.0	Low.
	-----------	100	90–100	30–40	11–18	0.6–2.0	0.20–0.22	6.1–7.8	Moderate.
	100	90–100	15–30	NP	NP	6.0–20.0	0.10–0.12	5.6–6.0	Low.
	100	90–100	20–40	<20	<5	6.0–20.0	0.09–0.11	6.1–6.5	Low.
	-----------	100	90–100	30–40	11–18	0.6–2.0	0.20–0.22	6.1–7.8	Moderate.
	100	90–100	30–49	-----------	NP	2.0–6.0	0.16–0.18	5.1–5.5	Low.
	100	90–100	25–40	-----------	NP	2.0–6.0	0.15–0.17	5.1–6.0	Low.
	100	90–100	20–45	-----------	NP	6.0–20.0	0.09–0.11	6.1–6.5	Low.
	100	85–95	25–40	-----------	NP	2.0–6.0	0.16–0.18	6.1–7.3	Low.
	100	70–95	15–30	-----------	NP	6.0–20.0	0.09–0.11	6.6–7.3	Low.
	100	51–95	5–15	-----------	NP	6.0–20.0	0.05–0.07	7.4–7.8	Low.
	100	85–95	60–75	25–35	5–15	0.6–2.0	0.20–0.22	6.1–7.3	Low.
	100	85–95	30–40	-----------	NP	2.0–6.0	0.15–0.17	6.6–7.8	Low.
	100	70–95	15–30	-----------	NP	6.0–20.0	0.09–0.11	6.6–7.3	Low.
	100	85–95	30–40	-----------	NP	2.0–6.0	0.14–0.16	6.6–7.3	Low.
	100	51–95	5–15	-----------	NP	6.0–20.0	0.05–0.07	7.4–7.8	Low.
	-----------	100	80–100	25–40	5–15	0.6–2.0	0.22–0.24	5.6–6.0	Low.
	100	95–100	85–100	30–40	11–20	0.6–2.0	0.20–0.22	6.1–6.5	Low to moderate.
	100	95–100	85–100	25–35	7–20	0.6–2.0	0.20–0.22	6.6–8.4	Low.
	100	95–100	95–100	35–40	11–20	0.6–2.0	0.20–0.24	7.4–8.4	Low.
	100	75–95	8–20	-----------	NP	6.0–20.0	0.06–0.09	5.1–6.0	Low.
	100	75–95	5–15	-----------	NP	6.0–20.0	0.05–0.07	5.6–6.0	Low.
	100	80–96	20–40	-----------	NP	6.0–20.0	0.10–0.12	5.1–6.0	Low.
	100	75–95	5–15	-----------	NP	6.0–20.0	0.05–0.07	5.6–6.0	Low.

TABLE 5.—*Estimates of the soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification	
				Unified	AASHTO
	Ft	*In*			
Elsmere:					
Ef	2–3	0–44 44–60	Fine sand Fine sand	SP–SM or SM SP–SM or SM	A–3 or A–2 A–3 or A–2
Eh, EmB	2–3 (3–5 in unit EmB)	0–18 18–60	Loamy fine sand Fine sand	SM SP–SM or SM	A–2 A–3 or A–2
Fillmore: Fm	>10	0–9 9–16 16–42 42–60	Silt loam Silt loam Silty clay Silty clay loam	ML or CL ML or CL CH CL	A–4 or A–6 A–4 or A–6 A–7 A–6
Gibbon: Gk, Gs	2–3	0–17 17–33 33–60	Silt loam Light silty clay loam Silt loam	CL CL CL or ML	A–6 or A–4 A–6 or A–7 A–6 or A–4
Hobbs: Hd, HfB	>10	0–60	Silt loam	ML or CL	A–4 or A–6
Hord: HhA, HhC	>10	0–14 14–39 39–60	Silt loam Silt loam Silt loam	CL CL CL	A–6 or A–4 A–6 A–6
*Inavale: If, Ih For Elsmere part of Ih, see Elsmere series, unit Ef.	5–7	0–11 11–60	Fine sand Fine sand and sand	SP–SM or SM SP–SM or SM	A–3 or A–2 A–3 or A–2
Lawet: Lb, Lc	1–3 (0–2 in unit Lc)	0–23 23–32 32–60	Silt loam and loam Silty clay loam Loam and clay loam	CL CL CL or CL–ML	A–6 A–6 or A–7 A–6 or A–4
Longford:					
LdC	>10	0–11 11–34 34–41 41–60	Loam Light silty clay Silty clay loam Silt loam	CL CH or CL CL or ML CL or ML	A–6 or A–4 A–7 A–7 or A–6 A–6 or A–4
LfC	>10	0–18 18–34 34–41 41–60	Fine sandy loam, loamy fine sand, and fine sand. Light silty clay Silty clay loam Silt loam	SM or SP–SM CH or CL CL or ML CL or ML	A–4 or A–3, A–2 A–7 A–7 or A–6 A–6 or A–4
Loretto:					
LgB, LgC	>10	0–16 16–19 19–60	Sandy loam Loam Silt loam	SM CL CL	A–2 or A–4 A–6 or A–4 A–6 or A–7
Lh, LhC	>10	0–10 10–60	Loam Loam	CL or CL–ML CL	A–6 or A–4 A–6 or A–7
Loup: Lo, Lp	0–1 (1–2 in unit Lp)	0–10 10–14 14–60	Fine sandy loam Loamy fine sand Fine sand	SM SM SP–SM or SM	A–4 or A–2 A–2 A–3 or A–2
Meadin: MeB, MeF	>10	0–6 6–10 10–60	Sandy loam Gravelly loamy sand Sand and gravel	SM SM or SP–SM SP–SM, SP, or GP–GM	A–2 A–2 or A–3 A–1
Moody: Mp, MpC	>10	0–8 8–34 34–40 40–60	Silty clay loam Silty clay loam Silt loam Silt loam	CL CL or CH CL CL	A–7 or A–6 A–7 A–6 or A–7 A–6

significant in engineering—Continued

Percentage less than 3 inches passing sieve— No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Liquid limit	Plasticity index	Permea-bility	Available water capacity	Reaction	Shrink-swell potential
				Pct		*In/hr*	*In/in of soil*	*pH*	
	100	80–95	8–20	----------	NP	6.0–20.0	0.06–0.09	6.1–7.3	Low.
	100	80–95	5–15	----------	NP	6.0–20.0	0.05–0.07	6.6–7.3	Low.
	100	80–95	15–35	----------	NP	6.0–20.0	0.10–0.12	6.1–6.5	Low.
	100	80–95	8–20	----------	NP	6.0–20.0	0.05–0.07	6.6–7.3	Low.
	----------	100	95–100	25–35	4–15	0.6–2.0	0.22–0.24	5.6–6.0	Moderate.
	----------	100	95–100	20–35	4–15	0.6–2.0	0.20–0.22	6.1–6.5	Low.
	----------	100	95–100	50–70	30–45	<0.06	0.11–0.13	6.6–7.3	High.
	----------	100	95–100	25–40	11–20	0.2–0.6	0.18–0.20	6.6–7.3	Moderate.
	100	95–100	85–100	30–40	8–20	0.6–2.0	0.22–0.24	7.9–8.4	Moderate.
	100	95–100	80–95	30–45	15–25	0.6–2.0	0.18–0.20	7.9–8.4	Moderate or high.
	100	95–100	75–95	20–40	10–20	0.6–2.0	0.20–0.22	7.9–8.4	Moderate.
	100	95–100	90–100	30–40	8–20	0.6–2.0	0.20–0.24	7.4–7.8	Low.
	----------	100	90–100	25–35	8–18	0.6–2.0	0.22–0.24	6.1–6.5	Low.
	----------	100	95–100	30–40	11–25	0.6–2.0	0.20–0.22	6.6–7.8	Moderate.
	----------	100	95–100	24–35	8–18	0.6–2.0	0.20–0.22	7.9–8.4	Low.
	100	85–95	5–20	----------	NP	6.0–20.0	0.06–0.09	5.6–6.5	Low.
	100	70–90	5–20	----------	NP	6.0–20.0	0.05–0.07	6.6–7.3	Low.
	100	95–100	75–95	20–35	11–20	0.6–2.0	0.20–0.24	7.9–8.4	Moderate.
	100	95–100	85–100	30–45	11–20	0.2–0.6	0.18–0.20	7.9–8.4	Moderate.
	100	90–100	70–100	20–35	6–20	0.2–0.6	0.14–0.19	7.9–8.4	Moderate.
	100	85–100	75–95	25–35	8–20	0.6–2.0	0.20–0.22	5.6–6.0	Moderate.
	100	95–100	85–100	45–60	20–35	0.2–0.6	0.11–0.13	6.6–7.3	High.
	100	95–100	75–95	35–50	11–25	0.2–0.6	0.18–0.20	6.6–7.3	Moderate.
	100	95–100	70–95	30–40	8–20	0.6–2.0	0.20–0.22	7.4–7.8	Moderate.
	100	80–100	10–49	----------	NP	2.0–20.0	0.06–0.18	5.6–6.0	Low.
	100	95–100	85–100	45–60	20–35	0.2–0.6	0.11–0.13	6.6–7.3	High.
	100	95–100	75–95	35–50	11–25	0.2–0.6	0.18–0.20	6.6–7.3	Moderate.
	100	95–100	70–95	30–40	8–20	0.6–2.0	0.20–0.22	7.4–7.8	Moderate.
	100	85–100	25–40	----------	NP	2.0–6.0	0.13–0.15	5.1–5.5	Low.
	100	90–100	70–95	20–30	8–20	0.6–2.0	0.17–0.19	6.1–6.5	Low.
	100	95–100	90–100	30–45	11–25	0.6–2.0	0.20–0.22	6.1–7.8	Low to moderate.
	100	85–100	60–85	25–40	5–15	0.6–2.0	0.20–0.22	5.1–5.5	Low.
	100	90–100	70–95	30–45	11–20	0.6–2.0	0.17–0.19	6.1–7.8	Moderate.
	100	80–100	30–49	<20	NP–6	2.0–6.0	0.16–0.18	7.9–8.4	Low.
	100	75–95	15–30	----------	NP	6.0–20.0	0.09–0.11	7.9–8.4	Low.
	100	70–95	5–20	----------	NP	6.0–20.0	0.05–0.07	7.4–8.4	Low.
95–100	93–100	60–95	36–50	----------	NP	2.0–6.0	0.13–0.15	5.1–5.5	Low.
50–90	45–85	35–65	5–30	----------	NP	6.0–20.0	0.09–0.11	5.6–6.0	Low.
40–80	30–60	11–35	2–10	----------	NP	>20.0	0.02–0.04	5.6–6.0	Low.
	----------	100	90–100	30–49	11–25	0.2–0.6	0.21–0.23	6.1–6.5	Moderate.
	----------	100	95–100	40–55	20–35	0.2–0.6	0.18–0.20	6.6–7.3	Moderate to high.
	----------	100	95–100	30–45	11–22	0.6–2.0	0.20–0.22	7.4–7.8	Moderate.
	----------	100	95–100	30–40	11–20	0.6–2.0	0.20–0.22	7.9–8.4	Moderate.

TABLE 5.—*Estimates of the soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification	
				Unified	AASHTO
	Ft	*In*			
Nora: No, NoC, NoC2, NoD, NoE.	>10	0–12	Silt loam	CL	A–6
		12–21	Light silty clay loam	CL	A–6 or A–7
		21–60	Silt loam	CL	A–6 or A–7
O'Neill: Oe, OeC	>10	0–19	Sandy loam	SM	A–2 or A–4
		19–25	Loamy sand	SM	A–2
		25–60	Sand and gravel	SP–SM or SP	A–1
Of	>10	0–19	Loam	SM or ML	A–4
		19–25	Loamy fine sand	SM	A–2
		25–60	Sand and gravel	SP–SM or SP	A–1
Ord: Og	2–3	0–21	Fine sandy loam	SM	A–2 or A–4
		21–60	Fine sand	SM or SP–SM	A–2 or A–3
Oh	2–3	0–10	Loam	ML	A–4
		10–21	Fine sandy loam	SM	A–2 or A–4
		21–60	Fine sand	SM or SP–SM	A–2 or A–3
Orthello: On, OnC, OnD	>10	0–32	Fine sandy loam	SM or ML	A–4
		32–49	Loamy fine sand	SM	A–2
		49–60	Fine sandy loam	SM or ML	A–4
Or, OrC	>10	0–14	Loam	ML	A–4
		14–32	Fine sandy loam	SM or ML	A–4
		32–49	Loamy fine sand	SM	A–2
		49–60	Fine sandy loam	SM or ML	A–4
Orwet: Ot	0–1	0–19	Loam	ML	A–4
		19–24	Fine sandy loam	SM	A–4 or A–2
		24–42	Loamy fine sand	SM	A–2
		42–53	Fine sandy loam	SM	A–4 or A–2
		53–60	Loamy fine sand	SM	A–2
Ovina: Ov	2–3	0–13	Loamy fine sand	SM	A–2
		13–24	Fine sandy loam	SM or ML	A–4
		24–35	Loam	CL or ML	A–4 or A–6
		35–60	Loamy fine sand and fine sand.	SP–SM, SM	A–2 or A–3
Paka: Ph, PhC, PhD	>10	0–7	Loam	CL	A–6 or A–4
		7–17	Light clay loam	CL	A–6
		17–35	Loam	CL	A–6
		35–47	Loam	CL or ML	A–6 or A–4
		47–60	Siltstone.		
PkB, PkC, PkD	>10	0–17	Fine sandy loam, loamy fine sand and fine sand.	SM or SP–SM	A–4 or A–3, A–2
		17–35	Loam	CL	A–6
		35–60	Loam	CL or ML	A–6 or A–4
Simeon: Mapped only with Valentine series.	>10	0–7	Loamy sand	SM	A–2
		7–60	Sand	SP–SM or SM	A–3 or A–2
*Thurman: TfB, TfC, TfD	>10	0–60	Fine sand	SP–SM or SM	A–3 or A–2
ThB, ThC, TnF, ToC. For Crofton part of TnF, see Crofton series; for Valentine part of ToC, see Valentine series.	>10	0–16	Loamy fine sand	SM	A–2
		16–60	Loamy fine sand and fine sand.	SP–SM or SM	A–2 or A–3

significant in engineering—Continued

Percentage less than 3 inches passing sieve— No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential
				Pct		*In/hr*	*In/in of soil*	*pH*	
	100	95–100	70–100	30–40	11–20	0.6–2.0	0.22–0.24	5.6–6.5	Moderate.
	100	100	90–100	30–49	11–27	0.6–2.0	0.18–0.20	6.6–7.3	Moderate.
	-----------	100	95–100	30–45	11–24	0.6–2.0	0.20–0.22	7.9–8.4	Moderate.
95–100	95–100	70–85	30–49	-----------	NP	2.0–6.0	0.13–0.15	5.6–6.0	Low.
95–100	95–100	60–85	15–35	-----------	NP	6.0–20.0	0.09–0.11	6.6–7.3	Low.
50–80	30–50	25–35	0–5	-----------	NP	>20.0	0.02–0.04	6.6–7.3	Low.
95–100	95–100	85–95	60–75	20–35	NP–10	0.6–2.0	0.20–0.22	5.6–6.0	Low.
95–100	95–100	60–85	15–35	-----------	NP	6.0–20.0	0.09–0.11	6.6–7.3	Low.
50–80	30–50	25–35	0–5	-----------	NP	>20.0	0.02–0.04	6.6–7.3	Low.
	100	80–100	30–49	-----------	NP	2.0–6.0	0.16–0.18	7.4–8.4	Low.
	100	70–95	5–20	-----------	NP	6.0–20.0	0.05–0.07	7.4–7.8	Low.
	100	85–100	60–90	20–35	4–10	0.6–2.0	0.20–0.22	7.9–8.4	Low.
	100	80–100	30–49	<20	NP	2.0–6.0	0.15–0.17	7.4–7.8	Low.
	100	70–95	5–20	-----------	NP	6.0–20.0	0.05–0.07	7.4–7.8	Low.
	100	70–85	40–55	<20	NP	2.0–6.0	0.16–0.18	5.1–6.0	Low.
	100	70–95	15–35	-----------	NP	6.0–20.0	0.09–0.11	5.6–6.5	Low.
	100	70–85	40–55	-----------	NP	2.0–6.0	0.14–0.16	6.1–6.5	Low.
	100	90–100	60–85	20–35	2–10	0.6–2.0	0.20–0.22	5.1–6.0	Low.
	100	75–90	40–55	<20	NP	2.0–6.0	0.15–0.17	5.1–6.0	Low.
	100	70–95	15–35	-----------	NP	6.0–20.0	0.09–0.11	5.6–6.5	Low.
	100	75–90	40–55	-----------	NP	2.0–6.0	0.14–0.16	6.1–6.5	Low.
	100	85–100	60–90	22–35	3–10	0.6–2.0	0.20–0.22	7.9–8.4	Low.
	100	80–95	40–55	-----------	NP	2.0–6.0	0.15–0.17	7.9–8.4	Low.
	100	70–95	15–30	-----------	NP	6.0–20.0	0.09–0.11	7.9–8.4	Low.
	100	80–95	40–55	-----------	NP	2.0–6.0	0.14–0.16	7.4–7.8	Low.
	100	70–95	15–30	-----------	NP	6.0–20.0	0.08–0.10	7.4–7.8	Low.
	100	85–100	15–30	-----------	NP	6.0–20.0	0.10–0.12	7.4–8.4	Low.
	100	90–100	35–55	-----------	NP	2.0–6.0	0.15–0.17	7.9–8.4	Low.
	100	90–100	65–85	20–35	2–15	0.6–2.0	0.17–0.19	7.9–8.4	Low.
	100	80–100	5–30	-----------	NP	6.0–20.0	0.05–0.10	7.4–7.8	Low.
	100	95–100	60–80	30–35	8–15	0.6–2.0	0.20–0.22	5.6–6.0	Moderate.
	100	95–100	70–95	30–40	15–25	0.6–2.0	0.15–0.17	5.6–6.0	Moderate.
	100	95–100	70–90	25–35	11–25	0.6–2.0	0.17–0.19	6.1–6.5	Moderate.
	100	95–100	70–90	20–35	8–20	0.6–2.0	0.17–0.19	7.9–8.4	Moderate.
	100	80–100	10–50	-----------	NP	6.0–20.0	0.06–0.18	5.6–6.0	Low.
	100	95–100	65–85	25–40	11–25	0.6–2.0	0.17–0.19	6.1–6.5	Moderate.
	100	95–100	70–90	20–40	8–20	0.6–2.0	0.17–0.19	7.9–8.4	Moderate.
100	90–100	65–90	10–30	-----------	NP	6.0–20.0	0.10–0.12	5.1–5.5	Low.
100	90–100	60–80	2–15	-----------	NP	6.0–20.0	0.05–0.07	5.1–6.0	Low.
	100	90–100	8–20	-----------	NP	6.0–20.0	0.05–0.09	5.1–6.0	Low.
	100	90–100	15–35	-----------	NP	6.0–20.0	0.10–0.12	5.1–5.5	Low.
100	95–100	90–100	8–30	-----------	NP	6.0–20.0	0.05–0.11	5.6–6.0	Low.

TABLE 5.—*Estimates of the soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification	
				Unified	AASHTO
	Ft	*In*			
Trent: Tr	>10	0–27	Silt loam	CL or ML	A–6 or A–4
		27–45	Light silty clay loam	CL	A–6 or A–7
		45–52	Silt loam	CL	A–7 or A–6
		52–60	Sand	SP–SM or SM	A–3 or A–2
*Valentine: VaC, VaE, VsB, VsC, VsD. For Simeon part of VsB, VsC, and VsD, see Simeon series.	>10	0–60	Fine sand	SP–SM or SM	A–3 or A–2

[1] NP means nonplastic.

groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 7; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

Soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made by layers of representative soil profiles having significantly different soil properties. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms are based on the percentages of sand, silt, and clay in the less than 2 millimeter fraction of the soil. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and plasticity index are water contents obtained by specified operations. As the water content of a clayey soil, from which the particles coarser than 0.42 millimeter have been removed, is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of water content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5, but in table 7 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability, as used here, is an estimate of the rate at which saturated soil would transmit water in a vertical direction under a unit head of pressure. It is estimated on basis of those soil characteristics observed in the field, particularly structure, porosity, and texture. Lateral seepage or such transient soil features as plowpans and surface crusts are not considered.

Available water capacity is an estimate of the capacity of soils to hold water for use by most plants. It is defined here as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most plants.

Reaction refers to the acidity or alkalinity of a soil, expressed in pH values for a stated soil-solution mixture. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks when dry or swells when wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils may damage building foundations, roads, and other structures. Soils having a *high* shrink-swell potential are the most hazardous. Shrink-swell potential is not indicated for organic soils or certain soils which shrink markedly on drying but do not swell quickly when rewetted.

Engineering interpretations

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engi-

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permea-bility	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						
				Pct		*In/hr*	*In/in of soil*	*pH*	
	100	90–100	70–95	30–40	11–25	0.6–2.0	0.22–0.24	5.6–6.5	Moderate.
	100	95–100	85–95	30–45	11–30	0.6–2.0	0.18–0.20	6.1–6.5	Moderate.
	100	95–100	85–100	35–55	20–35	0.6–2.0	0.20–0.22	6.1–6.5	Moderate.
	100	60–90	5–15	-----------	NP	6.0–20.0	0.05–0.07	6.1–6.5	Low.
	100	90–100	5–15	-----------	NP	6.0–20.0	0.05–0.09	5.1–6.0	Low.

neers and soil scientists with the soils of Antelope County. In table 6 ratings are used to summarize limitation or suitability of the soils for all purposes listed except drainage of cropland and pasture, irrigation, ponds and reservoirs, embankments, and terraces and diversions. For these particular uses, table 6 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are expressed as slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the rated use, or in other words, limitations are minor and are easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* indicates soil properties so unfavorable and so difficult to correct or overcome that major soil reclamation, special designs, or intensive maintenance is required. For some uses, the rating of severe is divided to obtain ratings of severe and very severe.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe. Following are explanations of some of the columns in table 6.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system. Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated. Soils having a hazard of inadequate filtration are indicated by footnotes in table 6. In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

Sewage lagoons are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce its capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the location of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, and open ditches. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 6, are no more than

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. fully the instructions for referring to other series

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill [1]	Local roads and streets
Bazile: Bc, BcC, BdB, BdC, BdD	Slight [3]	Severe: rapid permeability below a depth of about 28 inches.	Severe: cutbanks subject to caving; sand below depth of about 28 inches.	Slight	Trench type. Severe: rapid permeability below depth of 28 inches. Area type. Severe: rapid permeability below depth of 28 inches.	Severe: subject to frost action.
Blendon: Be, BeC	Slight [3]	Severe: moderately rapid permeability.	Slight	Moderate: susceptible to frost action.	Trench type. Severe: moderately rapid permeability. Area type. Severe: moderately rapid permeability.	Slight
Blownout land: Bg	Slight [3]	Severe: rapid permeability.	Severe: cutbanks may cave; sandy texture and loose consistence.	Slight	Trench type. Severe: rapid permeability. Area type. Severe: rapid permeability.	Moderate: slope.
Boelus: BoC, BpB, BpC	Moderate: moderate permeability below depth of about 1.5 feet.	Moderate: moderate permeability.	Slight	Moderate: moderate shrink-swell potential; subject to frost action.	Trench type. Slight. Area type. Slight on slopes less than 6 percent.	Moderate: subject to frost action; moderate shrink-swell potential below depth of 19 inches.

interpretations

The soils in such mapping units may have different properties and limitations, and for this reason, it is necessary to follow care-
that appear in the first column of this table]

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Good: fine sand and sand below a depth of 28 inches.	Fair: excess fines; check below a depth of 28 inches.	Fair: 8 to 16 inches of suitable material.	Fair: thin layer.	Seepage below depth of 28 inches.	Medium to low shear strength in subsoil; high permeability of compacted material; medium to high susceptibility to piping in foundation area.	Well drained; all features favorable.	Moderate available water capacity; moderate permeability of subsoil; rapid permeability below a depth of 28 inches; subject to erosion.	Nearly level to gently sloping; hazard of water erosion on slopes; sand below a depth of 28 inches.
Good	Fair: excessive fines.	Good	Good	High seepage; moderately rapid permeability.	High permeability of compacted material; medium to high susceptibility to piping.	Well drained; all features favorable.	Moderate available water capacity; moderate intake rate; moderately rapid permeability; subject to erosion by wind and water.	Nearly level to gently sloping; hazard of water erosion; fine sand below a depth of 29 inches.
Good	Fair: too many fines.	Poor: fine sand texture; susceptible to blowing.	Poor: fine sand texture.	High seepage; rapid permeability.	High permeability of compacted material; moderate to high susceptibility to piping.[3]	Excessively drained; all features favorable.[3]	Low available water capacity; subject to severe soil blowing.[3]	Sand texture; rapid permeability; loose consistence.[3]
Fair: subject to frost action; moderate shrink-swell potential.	Unsuited: no sand below depth of 19 inches.	Poor: loamy fine sand texture.	Fair: loamy sand texture.	Moderate permeability.	Susceptibility to piping; fair compaction characteristics.	Well drained; all features favorable.	High available water capacity; rapid surface intake rate; moderate permeability; subject to erosion by wind and water.	Gently undulating; subject to soil blowing; hazard of water erosion; loamy fine sand surface layer.[3]

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill[1]	Local roads and streets
*Brunswick: BxF. For Paka part, see Paka series.	Severe: soft sandstone at depth of less than 40 inches.	Severe: moderately rapid permeability; soft sandstone at depth of less than 40 inches.	Severe: cutbanks may cave; soft sandstone at depth of less than 40 inches.	Moderate for dwellings without basements where slope is less than 15 percent; severe where slope is more than 15 percent. Severe for dwellings with basements; soft sandstone at depth of less than 40 inches.	Trench type. Severe: moderately rapid permeability; soft bedrock at depth of less than 40 inches. Area type. Severe: moderately rapid permeability.	Moderate where slopes are less than 15 percent; soft sandstone at depth of less than 40 inches. Severe where slopes are more than 15 percent.
Cass: Cb, Cc	Moderate: rare flooding.[2]	Severe: moderately rapid permeability; subject to rare flooding.	Severe: sand underlying material; subject to caving for vertical cuts.	Severe: rare flooding.	Trench type. Severe: moderately rapid permeability. Area type. Moderate: moderately rapid permeability.	Moderate: rare flooding.
Cozad: Co	Moderate: rare flooding.	Severe: rare flooding.	Moderate: rare flooding.	Severe: rare flooding.	Trench type. Moderate: rare flooding. Area type. Moderate: rare flooding.	Moderate: rare flooding; subject to frost action.
*Crofton: CrE2, CrF2, CsG, CuC2, CuD2, CuE2, CuF. For Nora part of CuC2, CuD2, CuE2, and CuF, see Nora series.	Slight where slopes are less than 7 percent; moderate where slopes are 7 to 15 percent; moderate permeability; severe where slopes are more than 30 percent.	Moderate: moderate permeability; slopes less than 7 percent; severe where slopes are more than 7 percent.	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Moderate: moderate shrink-swell potential; slopes less than 15 percent; severe where slopes are more than 15 percent.	Trench type. Slight: slopes less than 15 percent; moderate; slopes 15 to 25 percent; severe: slopes more than 25 percent. Area type. Slight: slopes less than 8 percent; moderate: slopes 8 to 15 percent; severe: slopes more than 15 percent.	Moderate where slopes are less than 15 percent; severe where slopes are more than 15 percent.

interpretations—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Good where slopes are less than 15 percent; fair where slopes are 15 to 25 percent; poor where slopes are more than 25 percent.	Unsuited: too many fines.	Fair where slopes are less than 15 percent; poor where slopes are more than 15 percent.	Fair where slopes are less than 15 percent; poor where slopes are more than 15 percent.	Moderate to high seepage; slopes 11 to 30 percent.	Medium to high susceptibility to piping; fair to good compaction; erodes easily.	Well drained; all features favorable.	Slopes 11 to 30 percent.[3]	Slopes 11 to 30 percent.[3]
Good	Poor: check below depth of 3 feet; limited uses; fines and poor gradation.	Good in upper 2 feet; poor below depth of 2 feet; coarse texture.	Good	High seepage; susceptible to piping.	Medium to low shear strength; high permeability of compacted soil.	Well drained; all features favorable.	Moderate available water capacity; moderately high intake rate; moderately rapid permeability in upper part; rapid permeability in lower part.	Nearly level.[3]
Fair: moderate shrink-swell potential.	Unsuited: no sand available.	Good	Good	Moderate seepage potential.	Medium to low shear strength; low permeability of compacted soil; fair to good compaction.	Well drained; all features favorable.	High available water capacity; moderate intake rate; moderate permeability.	Nearly level.[3]
Fair where slopes are less than 25 percent; poor where slopes are more than 25 percent.	Unsuited: sand not available.	Good where slopes are less than 8 percent; fair where slopes are 8 to 15 percent; poor where slopes are more than 15 percent.	Good where slopes are less than 8 percent; fair where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Moderate seepage; moderate permeability.	Slopes subject to erosion; subject to piping; low to medium permeability of compacted soil.	Well drained; slopes subject to erosion.[3]	Suited only where slopes are less than 9 percent; high available water capacity; moderate intake rate; moderate permeability; subject to erosion by water.	Gently sloping to very steep; hazard of water erosion; not applicable on very steep slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill [1]	Local roads and streets
Doger: DfC, DhB, DhC	Slight [2]	Severe: rapid permeability.	Severe: loamy sand texture; cutbanks may cave.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.	Trench type. Severe: rapid permeability. Area type. Severe: rapid permeability.	Slight
Elsmere: Ef, Eh, EmB	Severe: seasonal high water table at depth of 2 or 3 feet.[2]	Severe: seasonal high water table at depth of 2 or 3 feet; rapid permeability.	Severe: somewhat poorly drained; fine sand and loamy fine sand texture; cutbanks cave; seasonal high water table at depth of 2 or 3 feet.	Moderate: seasonal high water table at depth of 2 or 3 feet; cutbanks subject to caving; subject to frost action.	Trench type. Moderate: seasonal high water table at depth of 2 or 3 feet. Area type. Severe: rapid permeability.	Moderate: seasonal high water table at depth of 2 or 3 feet; subject to frost action.
Fillmore: Fm	Severe: slow permeability; subject to ponding.	Severe: subject to ponding; slight if protected from flooding.	Severe: subject to ponding; clayey texture in subsoil.	Severe: poorly drained; subject to ponding; high shrink-swell potential.	Trench type. Severe: poorly drained; subject to ponding. Area type. Severe: poorly drained; subject to ponding.	Severe: poorly drained; high shrink-swell potential.
*Gibbon: Gk, Gs	Severe: seasonal high water table at depth of 2 or 3 feet.	Severe: seasonal high water table at depth of 2 or 3 feet; rare flooding.	Severe: seasonal high water table at depth of 2 or 3 feet.	Moderate: somewhat poorly drained; seasonal high water table at depth of 2 or 3 feet; rare flooding.	Trench type. Moderate: somewhat poorly drained. Area type. Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; subject to frost action; rare flooding.
Saline-akali part of Gs.	Severe: moderately high water table; slow permeability; flooding.	Severe: moderately high water table; flooding.	Severe: moderately high water table; flooding.	Severe: moderately high water table; flooding.	Trench type. Severe: flooding; moderately high water table. Area type. Severe: flooding; somewhat poorly drained and poorly drained.	Severe: flooding; subject to frost action; high shrink-swell potential.

interpretations—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Good	Poor: too many fines; poor gradation.	Poor: too sandy.	Fair: too sandy.	High seepage.	Subject to piping; high permeability of compacted material.	Well drained.[3]	Complex slopes; low available water capacity; rapid intake rate; rapid permeability; subject to soil blowing.	Sandy soil.[3]
Fair: somewhat poorly drained; subject to frost action.	Poor: excess fines; poor gradation.	Poor: fine sand and loamy fine sand texture.	Fair for loamy sand texture; poor for sand.	Seasonal high water table at depth of 2 or 3 feet; high seepage.	Low to medium compressibility; high susceptibility to piping; fair to good compaction.	Seasonal high water table at depth of 2 or 3 feet; outlets may not be readily available.	Low available water capacity; rapid intake rate; rapid permeability; subject to soil blowing; moderately high water table.	Nearly level.[3]
Poor: high shrink-swell potential; poorly drained; subject to frost action.	Unsuited: no sand available.	Fair in upper one foot of depth, poor below; clayey texture and very firm consistence.	Poor: poorly drained; clayey material in subsoil is very sticky when wet.	Low seepage; depressions may be used for ponds.	High compressibility; fair to poor compaction; high shrink-swell potential.	Poorly drained; surface ponding; very slow permeability; poor outlets.	High available water capacity; moderate intake rate; very slow permeability; may need leveling or draining.	Nearly level.[3]
Fair: somewhat poorly drained; subject to frost action.	Unsuited: no sand available.	Fair: silty clay loam and silt loam texture.	Good	Seasonal high water table at depth of 2 to 3 feet; nearly level.	High susceptibility to piping; fair to poor compaction.	Somewhat poorly drained; outlets may not be available; rare flooding.	High available water capacity; moderate intake rate; moderate permeability; somewhat poorly drained.	Nearly level.[3]
Poor: subject to frost action; high shrink-swell potential.	Unsuited: sand not available.	Poor: high alkalinity.	Nearly level; slow permeability.	Medium to low permeability of compacted soil; fair to poor compaction.	Medium to low permeability of compacted soil; fair to poor compaction.	Moderately high water table; flooding; affected by salinity and high alkalinity.	Saline-alkali soil.[3]	Nearly level.[3]

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill [1]	Local roads and streets
Hobbs:						
Hd	Severe: occasional flooding.	Severe: occasional flooding.	Severe: occasional flooding.	Severe: occasional flooding.	Trench type. Severe: occasional flooding. Area type. Severe: occasional flooding.	Severe: subject to occasional flooding; susceptible to frost action.
HfB	Severe: frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding.	Trench type. Severe: frequent flooding. Area type. Severe: frequent flooding.	Severe: frequent flooding.
Hord: HhA, HhC	Slight	Moderate: moderate permeability.	Slight	Moderate: moderate shrink-swell potential.	Trench type. Slight. Area type. Slight.	Moderate: moderate shrink-swell potential.
Inavale: If, Ih	Severe: subject to flooding.[2]	Severe: rapid permeability; subject to flooding.	Severe: sandy texture; rapid permeability; subject to flooding; cutbanks may cave.	Severe: subject to flooding.	Trench type. Severe: rapid permeability; subject to flooding. Area type. Severe: rapid permeability; subject to flooding.	Severe: subject to flooding.
Lawet:						
Lb	Severe: seasonal high water table at depth of 1 to 3 feet.	Severe: seasonal high water table at depth of 1 to 3 feet.	Severe: seasonal high water table at depth of 1 to 3 feet.	Severe: seasonal high water table at depth of 1 to 3 feet.	Area type. Severe: seasonal high water table at depth of 1 to 3 feet.	Severe: poorly drained; subject to flooding; subject to frost action.
Lc	Severe: seasonal high water table at depth of 0 to 2 feet.	Severe: seasonal high water table at depth of 0 to 2 feet; subject to flooding.	Severe: seasonal high water table at depth of 0 to 2 feet.	Severe: rare flooding; seasonal high water table at depth of 0 to 2 feet.	Trench type. Severe: seasonal high water table at depth of 0 to 2 feet. Area type. Severe: seasonal high water table at depth of 0 to 2 feet.	Severe: poorly drained; subject to flooding; subject to frost action.

interpretations—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: susceptible to frost action; occasional flooding.	Unsuited: sand not available.	Good	Good	Nearly level: moderate seepage; occasional flooding; subject to frost action.	Low to high susceptibility to piping; fair to good compaction.	Subject to occasional flooding.	High available water capacity; moderate intake rate; moderate permeability; needs protection from flooding.	Nearly level.[3]
Poor: susceptible to frost action; frequent flooding.	Unsuited: sand not available.	Good when area is not wet.	Good when area is dry.	Moderate seepage; frequently flooded.	Fair to good compaction; susceptible to piping.	Frequently flooded.	Frequently flooded.[3]	([3]).
Fair: moderate shrink-swell potential.	Unsuited: sand not available.	Good	Good	Low to moderate seepage.	Low to medium susceptibility to piping; fair to good compaction.	Well drained; all features favorable.	High available water capacity; moderate intake rate; moderate permeability.	Nearly level to gently sloping; generally not needed on nearly level soils.
Good	Fair: excess fines; poor gradation.	Poor: fine sand texture.	Poor: fine sand texture.	High seepage potential; subject to flooding; nearly level.	High permeability of compacted material; medium to high susceptibility to piping.	Excessively drained.[3]	Low available water capacity; rapid intake rate; rapid permeability; subject to soil blowing.	Nearly level.[3]
Poor: wetness; subject to frost action.	Unsuited: sand not available.	Poor: wetness; poorly drained.	Poor: poorly drained.	Low seepage; subject to flooding; seasonal water table at depth of 1 to 3 feet.	Poorly drained; low to medium susceptibility to piping; good to fair compaction.	Seasonal water table at depth of 1 to 3 feet; nearly level; outlets may not be available.	Seasonal water table at depth of 1 to 3 feet; high available water capacity; moderately slow permeability.	Poorly drained; nearly level.[3]
Poor: poorly drained; moderate shrink-swell potential; subject to frost action.	Unsuited: sand not available.	Poor: poorly drained.	Poor: poorly drained.	Low seepage; seasonal water table at depth of 0 to 2 feet; subject to flooding.	Low to medium susceptibility to piping; fair to good compaction; poorly drained.	Poorly drained; seasonal water table at depth of 0 to 2 feet; outlets may not be available.	Too wet[3]	Poorly drained; nearly level.[3]

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill[1]	Local roads and streets
Longford: LdC, LfC.	Severe: moderately slow permeability.	Slight where slopes are less than 2 percent; moderate where slopes are more than 2 percent.	Slight	Severe: high shrink-swell potential.	Trench type. Moderate: moderately slow permeability. Area type. Slight.	Severe: high shrink-swell potential.
Loretto: LgB, LgC, Lh, LhC.	Slight	Slight	Slight	Slight	Trench type. Slight. Area type. Slight.	Moderate: low strength.
Loup: Lo, Lp	Severe: seasonal high water table at a depth of 0 to 2 feet.[2]	Severe: seasonal high water table at a depth of 0 to 2 feet.	Severe: poorly drained; fine sand texture; seasonal high water table at depth of 0 to 2 feet; cutbanks may cave.	Severe: frequently ponded; seasonal high water table at depth of 0 to 2 feet.	Trench type. Severe: poorly drained; seasonal high water table at depth of 0 to 2 feet. Area type. Severe: poorly drained; seasonal high water table at depth of 0 to 2 feet.	Severe: poorly drained; subject to frost action.
Meadin: MeB, MeF	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 perment; severe where slopes are more than 15 percent.[3]	Severe: very rapid permeability.	Severe: sand and gravel texture; cutbanks cave.	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Trench type. Severe: mixed sand and gravel in underlying material; very rapid permeability. Area type. Severe: very rapid permeability.	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.

interpretations—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: high shrink-swell potential.	Unsuited: sand not available.	Fair: thin layer.	Fair: too clayey.	Low seepage; moderately slow permeability; slopes are 0 to 4 percent.	Fair to good compaction; low permeability of compacted material.	Well drained.	High available water capacity; moderately slow permeability; sandy type is subject to soil blowing; slopes are 0 to 4 percent.	Very gently sloping to gently sloping; soil blowing hazard where surface layer is sandy.
Fair: low strength.	Unsuited: sand not available.	Good	Good	Moderate seepage.	Medium to high susceptibility to piping; fair to good compaction.	Well drained.	High available water capacity; moderate or moderately low intake rate; moderate permeability; subject to erosion by wind and water.	Very gently sloping or gently sloping; subject to erosion by water and wind; sandy loam and loam surface layer.
Poor: poorly drained; subject to frost action.	Fair: excess fines; poor gradation.	Poor: poorly drained; too sandy below surface layer.	Poor: fine sand texture; wetness.	High seepage; seasonal high water table at depth of 0 to 2 feet; frequently ponded.	High permeability of compacted material; medium to high susceptibility to piping.	Poorly drained; outlets may not be available; rapid permeability; nearly level.	Poorly drained.[3]	Poorly drained.[3]
Good where slopes are less than 15 percent; fair where slopes are 15 to 25 percent; poor where slopes are more than 25 percent.	Fair: sand and gravel below depth of 10 inches.	Poor: thin layer; sand and gravel below depth of 10 inches.	Poor: sand and gravel in underlying material.	High seepage; very rapid permeability; mixed sand and gravel below depth of 10 inches.	High permeability of compacted soil; fair to poor compaction; medium susceptibility to piping.	Excessively drained.[3]	Slopes of 0 to 3 percent are suitable; shallow soil over mixed sand and gravel; very rapid permeability.[3]	Nearly level to steep slopes; shallow soil over mixed sand and gravel.[3]

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill [1]	Local roads and streets
Moody: Mp, MpC	Moderate: moderately slow permeability.	Slight	Slight	Moderate: moderate to high shrink-swell potential.	Trench type. Moderate: moderately slow permeability. Area type. Slight.	Moderate: moderate to high shrink swell potential; subject to frost action.
Nora: No, NoC, NoC2, NoD, NoE.	Moderate: moderate permeability; severe where slopes are more than 15 percent.	Moderate: moderate permeability; severe where slopes are more than 7 percent.	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Moderate: moderate shrink-swell potential; severe where slopes are more than 15 percent.	Trench type. Slight where slopes are less than 15 percent; moderate where slopes are 15 to 25 percent; severe where slopes are more than 25 percent. Area type. Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Moderate: where slopes are less than 15 percent; moderate shrink-swell potential; subject to frost action; severe where slopes are more than 15 percent.
O'Neill: Oe, OeC, Of.	Slight [2]	Severe: very rapid permeability in mixed sand and gravel.	Severe: mixed sand and gravel at depth of 20 to 40 inches; cutbanks cave.	Slight for dwellings with basements; moderate for dwellings without basements; cutbanks cave.	Trench type. Severe: sand and gravel underlying material has very rapid permeability. Area type. Severe: very rapid permeability in mixed sand and gravel.	Moderate: subject to frost action.

interpretations—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Fair: moderate to high shrink-swell potential.	Unsuited: sand not available.	Fair: thin layer.	Fair: silty clay loam texture.	Low seepage potential; moderately slow permeability; nearly level to gently sloping.	Low susceptibility to piping; fair to poor compaction; medium to high compressibility.	Well drained.[3]	High available water capacity; low intake rate; modeartely slow permeability; slopes subject to erosion.	Nearly level to gently sloping; moderate hazard of erosion; silty clay loam texture.
Fair: moderate shrink-swell potential; subject to frost action.	Unsuited: sand not available.	Fair: moderately thick material; slopes less than 15 percent; severe where slopes are more than 15 percent.	Good where slopes are less than 8 percent; fair where slopes are 8 to 15 percent; poor where slopes are more than 15 percent.	Moderate seepage; slope ranges from 0 to 30 percent.	Medium to low permeability of compacted material; fair to good compaction; slopes subject to erosion; subject to consolidation on wetting and drying.	Well drained.[3]	Suitable where slopes are 0 to 9 percent; high available water capacity; moderate permeability; hazard of water erosion.	Moderately sloping; hazard of water erosion; silt loam texture; steep slopes not suited to terraces.
Fair: subject to frost action.	Fair: may lack good gradation.	Poor: thin layer; may be difficult to reclaim borrow area.	Poor: thin layer; may be difficult to reclaim borrow area.	High seepage; mixed sand and gravel between depth of 20 and 40 inches.	High susceptibility to piping; high permeability of compacted soil.	Well drained.[3]	Low available water capacity; moderately rapid permeability in upper part; very rapid permeability below depth of about 25 inches; moderately rapid intake rate; droughty.	Nearly level to very gently sloping; subject to soil blowing; mixed sand and gravel at depth of 20 to 40 inches.

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill [1]	Local roads and streets
Ord: Og, Oh	Severe: seasonal high water table at depth of 2 or 3 feet.[2]	Severe: seasonal high water table at depth of 2 or 3 feet.	Severe: somewhat poorly drained; seasonal high water table at depth of 2 or 3 feet.	Severe: rare flooding; seasonal high water table at depth of 2 or 3 feet.	Trench type. Severe: moderately rapid permeability. Area type. Severe: moderately rapid permeability.	Severe: subject to flooding; subject to frost action.
Ortello: On, OnC, OnD, Or, OrC.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.[2]	Severe: moderately rapid permeability.	Severe: loamy fine sand in lower part; cutbanks may cave.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.	Trench type. Severe: moderately rapid permeability. Area type. Severe: moderately rapid permeability.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.
Orwet: Ot	Severe: seasonal high water table at depth of 0 to 1 foot.[2]	Severe: seasonal high water table at depth of 0 to 1 foot; rapid permeability below depth of 24 inches.	Severe: poorly drained; seasonal high water table at depth of 0 cutbanks to 1 foot; may cave.	Severe: poorly drained; seasonal high water table at depth of 0 to 1 foot; cutbanks may cave.	Trench type. Severe: poorly drained. Area type. Severe: poorly drained.	Severe: poorly drained; subject to flooding; subject to frost action.
Ovina: Ov	Severe: seasonal high water table at depth of 2 to 3 feet.[2]	Severe: seasonal high water table at depth of 2 to 3 feet.	Severe: somewhat poorly drained; seasonal high water table at depth of 2 to 3 feet; cutbanks cave.	Severe: rare flooding; seasonal high water table at depth of 2 to 3 feet; subject to frost action.	Trench type. Severe: seasonal high water table at depth of 2 or 3 feet; moderately rapid permeability. Area type. Severe: seasonal high water table at depth of 2 or 3 feet; moderately rapid permeability.	Severe: somewhat poorly drained; subject to flooding; subject to frost action.

interpretations—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Poor: subject to frost action; seasonal high water table at a depth of 2 to 3 feet.	Fair: excessive fines; poor gradation.	Fair: moderately thick surface layer; difficult to reclaim borrow area.	Poor: thin layer; difficult to reclaim borrow area.	Seasonal high water table at depth of 2 or 3 feet; high seepage; can be used for dugouts.	Medium to high susceptibility to piping; high permeability of compacted material; subject to seepage.	Somewhat poorly drained; outlets may not be available; rare flooding.	Somewhat poorly drained; moderate available water capacity; moderate or rapid intake rate; moderately rapid permeability; nearly level.	Nearly level.[3]
Good	Poor: excessive fines; poorly graded.	Good where slopes are less than 8 percent; moderate where slopes are more than 8 percent.	Good where slopes are less than 8 percent; fair where slopes are more than 8 percent.	Moderate to high seepage.	Medium to low permeability of compacted soil; medium to high susceptibility to piping; erodes easily.	Well drained.[3]	Moderate available water capacity; moderate intake rate; moderately rapid permeability; subject to soil blowing.	Nearly level to strongly sloping; complex slopes; subject to erosion by wind and water.
Poor: poorly drained; subject to frost action.	Poor: excessive fines; poor gradation; needs dewatering.	Poor: poorly drained.	Poor: poorly drained.	Seasonal high water table at depth of 0 to 1 foot; moderate to high seepage; suited to dugouts.	Medium to high susceptibility to piping; high permeability of compacted soil; erodes easily.	Poorly drained; outlets may not be available; rare flooding.	Poorly drained.[3]	([3]).
Poor: high susceptibility to frost action.	Fair: check for sand below depth of 47 inches; too many fines; poorly graded.	Poor: too sandy; subject to soil blowing.	Fair: loamy sand texture in surface layer.	Seasonal high water table at depth of 2 or 3 feet; moderate to high seepage; can be used for dugouts.	Medium to high susceptibility to piping; medium to low permeability of compacted soil; erodes easily.	Somewhat poorly drained; outlets may not be available; rare flooding.	Somewhat poorly drained; moderate available water capacity; rapid intake rate; moderately rapid permeability; nearly level; subject to soil blowing.	Nearly level.[3]

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill [1]	Local roads and streets
Paka: Ph, PhC, PhD, PkB, PkC, PkD.	Moderate: moderate permeability; slopes less than 15 percent; severe where slopes are more than 15 percent.	Moderate: moderate permeability; slopes less than 7 percent; severe where slopes are more than 7 percent.	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Moderate: moderate shrink-swell potential; slopes less than 15 percent; severe where slopes are more than 15 percent.	Trench type. Slight: slopes less than 15 percent; moderate: slopes 15 to 25 percent; severe: slopes more than 25 percent. Area type. Slight: slopes less than 8 percent; moderate: slopes 8 to 15 percent; severe: slopes more than 15 percent.	Moderate: moderate shrink-swell potential.
Simeon ---------------------------- Mapped only with Valentine soils.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.	Severe: rapid permeability.	Severe: sandy texture; cutbanks cave.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.	Trench type. Severe: sandy texture. Area type. Severe: rapid permeability.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent; severe hazard of soil blowing.
*Thurman: TfB, TfC, TfD, ThB, ThC, TnF, ToC. For Crofton part of TnF, see Crofton series. For Valentine part of ToC, see Valentine series.	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Severe: rapid permeability.	Severe: loamy sand and fine sand texture; cutbanks cave.	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.	Trench type. Severe: fine sand texture. Area type. Severe: rapid permeability.	Slight where slopes are less than 8 percent; moderate where slopes are 8 to 15 percent; severe where slopes are more than 15 percent.
Trent: Tr ----------------------------	Moderate: rare flooding.	Severe: rare flooding.	Moderate: moderately well drained; rare flooding.	Severe: rare flooding; subject to frost action.	Trench type. Moderate: rare flooding; moderately well drained. Area type. Slight.	Moderate: subject to frost action; moderate shrink swell potential; rare flooding.

interpretations—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Fair: moderate shrink-swell potential.	Unsuited: no sand available.	Fair: too clayey; slopes less than 15 percent; poor where slopes are more than 15 percent.	Fair: clay loam texture in subsoil.	Low to moderate seepage; nearly level to steep slopes.	Fair to poor compaction; subject to piping; low permeability of compacted soil.	Well drained.[3]	High available water capacity; moderate intake rate; moderate permeability; slopes subject to erosion; steep soils are not suitable.	Nearly level to steep slopes; subject to erosion by wind and water; steep slopes not suited to terraces.
Good	Fair: excess fines; limited uses; poor gradation.	Poor: sandy; droughty; subject to soil blowing.	Poor: sand texture.	High seepage; nearly level to strongly sloping.	High permeability of compacted soil; subject to erosion; medium to high susceptibility to piping.	Excessively drained.[3]	Nearly level to gently sloping areas are suitable; low available water capacity; very high intake rate; rapid permeability.[3]	([3])
Good: cut and fill slopes subject to water erosion and soil blowing.	Fair to poor: fine sand below depth of 24 inches; limited uses; poor gradation.	Poor: loamy sand and fine sand textures in surface layer; severe hazard of soil blowing.	Fair where surface layer is loamy sand; poor where surface is fine sand; severe hazard of soil blowing in borrow areas.	High seepage; nearly level to steep slopes.	High permeability of compacted material; medium to high susceptibility to piping.	Well drained.[3]	Not suitable where slope is more than 6 percent; low available water capacity; rapid intake rate; rapid permeability; subject to wind and water erosion.	Loamy sand and fine sand textures.[3]
Fair: moderate shrink-swell potential.	Unsuited: no sand available.	Good	Good	Low to moderate seepage.	Medium compressibility; fair to good compaction; low permeability of compacted soil.	Moderately well drained.[3]	High available water capacity; moderate intake rate; moderately slow permeability.	Nearly level.[3]

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with or without basements	Sanitary landfill [1]	Local roads and streets
*Valentine: VaC, VaE, VsB, VsC, VsD. For Simeon part of VsB, VsC, and VsD, see Simeon series.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.[3]	Severe: rapid permeability	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent; cutbanks may cave.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.	Trench type. Severe: fine sand texture. Area type. Severe: rapid permeability.	Slight where slopes are less than 8 percent; moderate where slopes are more than 8 percent.

[1] Onsite study is needed of the deep, underlying strata, the water table, and the hazards of aquifer pollution and drainage into ground water in landfills deeper than 5 or 6 feet.

three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are capacity to support load and resist settlement under load and ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of solid waste, either in excavated trenches or on the surface of the soil. The waste is spread, compacted in layers, and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock and a seasonal water table, are free of large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is high, water seeps into the trenches and causes problems in excavating and filling the trenches. Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 6 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Onsite investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Local roads and streets, as rated in table 6, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stablized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and also the shrink-swell potential indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand is used in great quantities in many kinds of construction. The ratings in table 6 provide guidance about where to look for probable sources. A soil rated as *good* or *fair* source of sand generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other

interpretations—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand	Topsoil	Cover material for landfill	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Good	Fair: too many fines; limited uses; poor gradation.	Poor: fine sand texture.	Poor: fine sand texture; borrow area difficult to reclaim.	High seepage.	High permeability of compacted material; medium to high susceptibility to piping; unstable fill.	Excessively drained.[3]	Slopes less than 6 percent are suitable; low available water capacity; very high intake rate; rapid permeability; subject to severe erosion by wind; droughty.	Complex slopes; subject to severe soil blowing; fine sand texture.[3]

[2] Pollution is a hazard because of moderately rapid or rapid permeability in underlying material.
[3] This practice or structure generally not suited because of soil characteristics, slope, or position.

factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Daily cover for sanitary landfills should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

Pond reservoirs hold water behind a dam or embankment. Soils suitable as pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Stones and organic material in a soil are among the features that are unfavorable.

Drainage of crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope, stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in a fragipan or another layer that restricts movement of water; amount of water held available to plants; need for drainage; and depth to the water table or bedrock.[6]

Terraces and diversions are embankments or ridges constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures

[6] Further information on use of soils for irrigation is contained in "Irrigation Guide for Nebraska," Soil Conservation Service, 1971.

TABLE 7.—*Engineering*

[Tests performed by the Nebraska Department of Roads in accordance with standard procedures

Soil name and location	Parent material	Report number S72	Depth	Specific gravity	Mechanical analysis [1] Percentage passing sieve— No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)
			In				
Bazile loam: 0.11 mile south and 375 feet west of the northeast corner of sec. 5, T. 28 N., R. 8 . (Modal)	Loess over sand.	1654	0–7	2.65		100	96
		1655	14–26	2.70		100	99
		1656	36–60	2.65		100	86
Boelus loamy fine sand: 0.22 mile north and 0.15 mile east of the southwest corner of sec. 16, T. 24 N., R. 7 W. (Modal)	Eolian sand over loess.	1638	0–10	2.63		100	98
		1639	10–29	2.66		100	99
		1640	29–42	2.67			100
Brunswick fine sandy loam: 1,925 feet north and 235 feet west of the southeast corner of sec. 16, T. 28 N., R. 7 W. (Modal)	Eolian sand.	1663	0–4	2.60		100	98
		1664	4–12	2.66		100	99
		1665	20–43	2.65		100	99
Cozad silt loam: 0.1 mile west and 0.12 mile south of the northeast corner of sec. 28, T. 25 N., R. 6 W. (Modal)	Alluvium.	1632	0–6	2.58			100
		1633	14–20	2.65			
		1634	35–60	2.69			
Loretto sandy loam: 0.1 mile east and 100 feet north of the southwest corner of sec. 16, T. 24 N., R. 7 W. (Modal)	Eolian sand over loess.	1641	0–5	2.60		100	99
		1642	19–47	2.69			100
		1643	47–60	2.69			
Moody silty clay loam: 0.47 mile south and 0.1 mile west of the northeast corner of sec. 19, T. 23 N., R. 6 W. (Modal)	Peoria loess.	1635	0–8	2.63			
		1636	13–23	2.69			
		1637	40–60	2.73			
Nora silt loam: 0.38 mile west and 0.1 mile north of the southeast corner of sec. 13, T. 25 N., R. 6 W. (Modal)	Peoria loess.	1646	0–8	2.64		100	98
		1647	12–21	2.68			100
		1648	32–60	2.71			
Ord fine sandy loam: 0.58 mile west and 0.1 mile south of the northeast corner of sec. 5, T. 25 N., R. 7 W. (Modal)	Alluvium.	1649	0–12	2.63		100	96
		1650	19–60	2.65		100	91
Paka loam: 0.26 mile south and 275 feet east of the northwest corner of sec. 2, T. 27 N., R. 8 W. (Modal)	Siltstone.	1660	0–7	2.63		100	99
		1661	17–35	2.69			100
		1662	35–47	2.69			100
Thurman loamy fine sand: 0.35 mile east and 325 feet south of the northwest corner of sec. 26, T. 27 N., R. 8 W. (Modal)	Eolian sand.	1651	0–10	2.63		100	97
		1652	16–24	2.68	100	99	97
		1653	24–60	2.66		100	98
Trent silt loam: 0.4 mile south and 100 feet west of the northeast corner of sec. 11, T. 28 N., R. 7 W. (Modal)	Loess.	1657	0–8	2.63		100	95
		1658	21–36	2.66		100	98
		1659	36–54	2.72			

test data

of the American Association of State Highway and Transportation Officials (AASHTO)]

Mechanical analysis [1]—Continued						Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued		Percentage smaller than						AASHTO [2]	Unified [3]
No. 60 (0.25 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm	*Pct*			
86	69	62	37	23	19	27	9	A-4(7)	CL
96	90	85	60	37	33	45	23	A-7-6(14)	CL
57	8	6	4	4	3	---	[4] NP	A-3(-2)	SP-SM
83	22	18	12	9	8	---	NP	A-2-4(0)	SM
90	40	32	15	13	10	19	1	A-4(1)	SM
98	92	80	35	25	22	39	17	A-6(11)	CL
90	43	33	18	11	8	---	NP	A-4(2)	SM
89	26	21	15	13	10	---	NP	A-2-4(0)	SM
92	39	24	13	10	8	---	NP	A-4(1)	SM
98	87	74	33	17	15	31	7	A-4(8)	ML
100	96	87	40	24	19	37	14	A-6(10)	CL
100	97	88	34	22	17	33	10	A-4(8)	CL
90	40	32	22	13	9	---	NP	A-4(1)	SM
98	90	85	44	33	27	41	20	A-7-6(12)	CL
100	99	91	43	27	21	37	14	A-6(10)	CL
100	97	87	48	33	27	37	14	A-6(10)	CL
100	99	92	58	39	35	53	31	A-7-6(19)	CH
100		87	40	26	18	37	13	A-6(9)	CL
91	74	67	39	27	22	32	12	A-6(9)	CL
99	97	91	49	33	27	46	23	A-7-6(14)	CL
100	98	91	46	29	21	38	15	A-6(10)	CL
82	35	23	10	6	4	---	NP	A-2-4(0)	SM
67	7	4	3	2	1	---	NP	A-3-2(-2)	SP-SM
92	65	55	33	23	19	32	12	A-6(7)	CL
97	72	61	35	27	25	38	20	A-6(11)	CL
96	72	60	33	22	14	33	14	A-6(9)	CL
88	38	27	14	9	8	---	NP	A-4(1)	SM
84	19	14	11	10	8	---	NP	A-2-4(0)	SM
84	14	10	8	6	5	---	NP	A-2-4(-2)	SM
89	75	66	36	23	17	34	13	A-6(9)	CL
96	91	86	60	37	31	39	16	A-6(10)	CL
100	99	92	64	41	33	49	27	A-7-6(17)	CL

TABLE 7.—*Engineering*

Soil name and location	Parent material	Report number S72	Depth	Specific gravity	Mechanical analysis[1] Percentage passing sieve— No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)
			In				
Valentine fine sand 0.35 mile north and 400 feet east of the southwest corner of sec. 33, T. 25 N., R. 6 W. (Modal)	Eolian sand.	1644	0–5	2.67		100	96
		1645	17–60	2.63		100	94

[1] Mechanical analysis according to the American Association of State Highway and Transportation Officials (AASHTO) Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including the 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 analysis data used in this table are not suitable for naming textural classes for soils.

provided outlets for runoff and is not difficult to vegetate.

Soil test data

Table 7 contains engineering test data for some of the major soil series in Antelope County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. The mechanical analyses were made by combined sieve and hydrometer methods.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material as have been explained in the discussion of table 5.

Specific gravity is the ratio of the unit weight of the soil solids to the unit weight of water. It is a measure of, and a means of expressing, the heaviness of soil. The specific gravity of the solid particles of a soil, exclusive of the void spaces, is also called the "true" or "real" specific gravity. This property has an important influence on the density of the soil.

Formation and Classification of Soils

This part of the survey describes the factors of soil formation and explains how they have affected the soils of Antelope County. It also explains the current system of soil classification and classifies each soil series according to that system.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil 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 the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It is largely responsible for the chemical and mineralogical composition of the soils. The soils of Antelope County formed in five different types of parent material: eolian sand, loess, alluvium, water-deposited sand and gravel, and material weathered from the Ogallala Sandstone and Siltstone Formation (fig. 19).

Eolian sand is the most extensive of the soil-forming *test data*—Continued

Mechanical analysis [1]—Continued						Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued		Percentage smaller than						AASHTO [2]	Unified [3]
No. 60 (0.25 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm				
						Pct			
73	10	8	6	4	3	----------	NP	A-3(-2)	SP-SM
72	5	4	3	2	1	----------	NP	A-3(-2)	SP-SM

[2] Based on AASHTO Designation: T 99-57, Method A (*1*).

[3] Based on ASTM Standard Designation 2487-69 (*2*).

[4] Nonplastic.

materials in the county. It is a wind deposited sandy material consisting mainly of quartz and feldspar minerals. The thickness of the sand ranges from a few inches to many feet; it is more than 60 feet thick on a few of the larger hills and hummocks. Except for a darkened layer at the surface, soils formed from eolian sand show little or no definite horizon development. Valentine, Thurman, and Doger soils formed in eolian sand. Soils formed in this material are on uplands, stream terraces, and foot slopes.

Loess is the second most extensive soil-forming material in the county. Most of it is in the Peoria Formation. This wind blown material is believed to have been blown from the sandhill region to the west or from the old flood plains of streams. This material is a brownish, grayish, or yellowish silty deposit and ranges in thickness from a few feet to more than 75 feet. Except where the slope is steepest, soils formed from loess generally have definite horizons. Some soils that formed in loess are Crofton, Moody, Nora, and Fillmore soils. They are on uplands.

The Loveland Formation generally underlies the Peoria Loess. It is an older, more reddish wind deposited material. The Loveland material is exposed on some side slopes of the uplands. Commonly there is a thin layer of Peoria Loess or eolian sand covering it. Longford soils formed in Loveland Loess. They are on uplands.

Alluvium is the third most extensive soil-forming material in the county. This material was deposited by moving water. It consists of clay, silt, sand, and gravel washed from higher areas and deposited on bottom land and stream terraces. It is in the valleys of drainageways, creeks, and rivers. The deposits range in thickness from a few feet to more than 25 feet. Soils formed from alluvium are young. Aside from the darkened surface layer, they have few clearly expressed horizons. Some soils formed in alluvium are Inavale, Cass, Gibbon, Hobbs, Lawet, Loup, and Ord soils. They vary in texture according to the parent material in which they formed.

Sand and gravel is a minor soil parent material in the county. The sand and gravel is water deposited; probably it was deposited by streams flowing from the west during the Pleistocene age. The thickness of the sand and gravel deposits ranges from a few feet to about 50 feet. Much of this parent material has a thin layer of eolian sand or loess covering it. Except for a darkened surface layer, soils formed in and over these deposits have only weakly expressed horizons. In Antelope County, these are Meadin and O'Neill soils. They differ from each other primarily in the depth to the underlying sand and gravel. They are on uplands and stream terraces in the northern part of the county.

Material weathered from the Ogallala Sandstone and Siltstone Formation is a minor soil parent material in the county. This material is water deposited. It is outwash from the Ogallala Formation that underlies the county. The deposits range in thickness from a few feet to about 50 feet. The material is grayish and ranges in texture from loam to sand. Most of this parent material has a thin cover of eolian sand or loess. Brunswick and Paka soils formed in and over this material. They are on uplands in the northern part of the county.

In many areas of the county, soils formed in a mixture of different parent materials or where young material was deposited over older material. Examples of soils that formed in more than one type of parent material are Boelus and Bazile soils. Hord and Cozad soils formed in loess material that was redeposited by water as alluvium.

Climate

Antelope County has a mid-continental climate. Seasonal temperature variations are wide. There is an

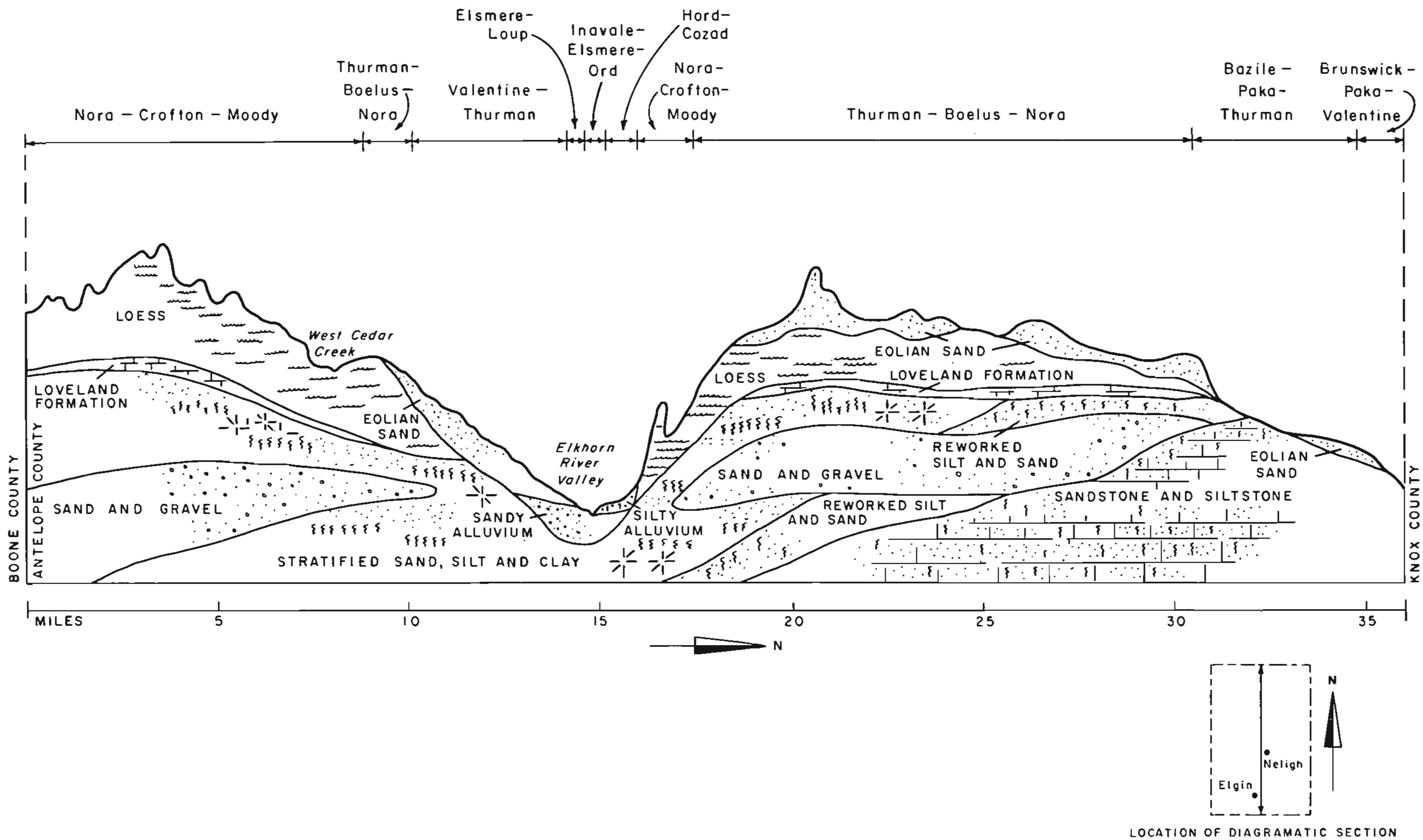

***Figure 19.*—Cross section of county showing relationship of landscape and parent material in major soil associations.**

average of 148 days per year without killing frost.

Climate has been an active agent in forming the soils of Antelope County. It has directly affected the formation of the soils and the weathering of parent material through precipitation, temperature, and wind. Wind and water movement cause continual sorting, shifting, and reworking of soil materials. Rainwater moves through the soil carrying the fine particles of clay downward into the subsoil and leaching the soluble salts produced by chemical weathering from the profile.

Temperature and moisture affect the speed of chemical weathering. Alternate freezing and thawing and wetting and drying affect soil formation by loosening and agitating the material. Wind transported the loess and much of the sandy material to its present location. Also, wind mixes and sorts the surface layer, causing changes in the physical properties of the soil.

Climate affects soil indirectly through the amount and kind of vegetation and animal life that is sustained. Biological activity increases when temperature and moisture conditions are favorable. The accumulation of organic matter and the darkening of the surface layer are promoted by the decomposition of vegetation. This decomposition is brought about by the animal and biological activity in the soil, which help convert plant remains into humus.

Under man's use and management of the soils, hard rains that come as intense thunderstorms have eroded the dark colored surface layer and lowered the organic-matter content and fertility of many finer textured soils in the county. The wind has eroded many of the sandier soils and removed their dark colored surface layer.

Plant and animal life

Various forms of plant and animal life are active in the soil forming processes. Plants and animals live on and in the soil and influence its physical and chemical properties through the organic matter they provide. The other four soil forming factors affect the kinds and amounts of vegetation and animal life that live on any given soil.

The soils of Antelope County formed under mid and tall grasses. The grasses provided organic matter as the plants and their roots decomposed. The fibrous roots of grasses penetrated the soil and helped to develop a friable surface horizon and a permeable subsoil that takes in and retains water for plant growth. Plant roots take minerals from the subsoil and parent material and these nutrients add fertility to the soil as the plants decay. Plants also keep the soil porous and open to air and water movement, thus encouraging the activity of bacteria, earthworms, and burrowing animals.

The number and kind of micro-organisms in the soil are important in soil formation. Micro-organisms decompose organic matter, changing it into humus from which growing plants can obtain nutrients and through which minerals are returned to the soil. Earthworms and small burrowing animals help mix this humus with the soil. The presence of decayed organic matter gives the upper part of the soil its dark color and influences its physical and chemical composition. A few soils in Antelope County have a high content of organic matter. Hobbs, Hord, and Trent soils have about the most. Such soils as Inavale, Meadin, and Valentine soils have the least.

Micro-organisms and animal activity increase with the increase in organic matter in the well drained soils. The wetter soils are colder and more poorly aerated. Organic matter decays more slowly because living organisms are less numerous.

Man greatly affects plant and animal life by his management of the soil. Man's activity will affect the direction and rate of soil formation in the future.

Relief

Relief, or lay of land, influences the formation of soils through its effects on runoff, internal drainage, and erosion. The loamy upland soils that are nearly level have very little runoff because most of the rainfall is absorbed. Consequently, more leaching of soluble minerals and clay particles occurs, and the soils have a well developed profile. Steep loamy soils are less well developed because of rapid runoff and erosion. Less water is absorbed by these soils, and soil formation is slow. Erosion removes soil material as it forms unless a good vegetative cover holds it in place.

Soils that formed in similar parent materials and under the same vegetation and climate but differ in relief can be grouped into a sequence called a catena. Moody, Nora, and Crofton soils form such a catena in this county. The nearly level Moody soils have a well developed profile and the steep Crofton soils have only a weakly developed profile.

Relief and position also influence the development of soils on bottom land. These soils are on the lower part of the landscape and are subject to excess water and siltation. Soils on bottom land commonly have a dark colored surface layer that is high in organic matter. These soils, however, form slowly because of the fluctuating water table, flooding, and sedimentation.

Soil formation on the sandy soils is not affected so much by runoff and internal drainage as it is by erosion. The higher, more sloping sandy soils are subject to more soil blowing than the lower, less sloping sandy soils.

Time

The formation of soils requires time. The length of time needed for a soil to form depends on the influence of the other four soil forming processes, especially parent material. Soils that have been in place only a short time show little or no horizon development. Soils that have been in place for a long time have well expressed soil horizons.

The soils in Antelope County that formed on bottom land are subject to a fluctuating water table and the addition of sedimentation with each overflow or flood. These conditions are unfavorable for soil formation in parent material that has only been in place for a brief time. Loup soils are an example. Most Crofton soils are strongly sloping to very steep. They have been in place long enough for some development to occur, but erosion removes the surface horizon about as fast as it forms.

The soils that have been in place for a long time and have well defined horizons are approaching an equi-

TABLE 8.—*Soils classified according to the current system of classification*

Series	Family	Subgroup	Order
Bazile	Fine-silty over sandy or sandy-skeletal, mixed, mesic	Udic Argiustolls	Mollisols.
Blendon	Coarse-loamy, mixed, mesic	Pachic Haplustolls	Mollisols.
Boelus	Sandy over loamy, mixed, mesic	Udic Haplustolls	Mollisols.
Brunswick	Coarse-loamy, mixed, mesic	Udic Ustochrepts	Inceptisols.
Cass	Coarse-loamy, mixed, mesic	Fluventic Haplustolls	Mollisols.
Cozad	Fine-silty, mixed, mesic	Typic Haplustolls	Mollisols.
Crofton	Fine-silty, mixed (calcareous), mesic	Typic Ustorthents	Entisols.
Doger	Sandy, mixed, mesic	Typic Haplustolls	Mollisols.
Elsmere	Sandy, mixed, mesic	Aquic Haplustolls	Mollisols.
Fillmore	Fine, montmorillonitic, mesic	Typic Argialbolls	Mollisols.
Gibbon	Fine-silty, mixed (calcareous), mesic	Fluvaquentic Haplaquolls	Mollisols.
Hobbs	Fine-silty, mixed, nonacid, mesic	Mollic Ustifluvents	Entisols.
Hord	Fine-silty, mixed, mesic	Cumulic Haplustolls	Mollisols.
Inavale	Sandy, mixed, mesic	Typic Ustifluvents	Entisols.
Lawet	Fine-loamy, mesic	Typic Calciaquolls	Mollisols.
Longford	Fine, montmorillonitic, mesic	Udic Argiustolls	Mollisols.
Loretto	Fine-loamy, mixed, mesic	Udic Argiustolls	Mollisols.
Loup	Sandy, mixed, mesic	Typic Haplaquolls	Mollisols.
Meadin	Sandy-skeletal, mixed, mesic	Entic Haplustolls	Mollisols.
Moody	Fine-silty, mixed, mesic	Udic Haplustolls	Mollisols.
Nora	Fine-silty, mixed, mesic	Udic Haplustolls	Mollisols.
O'Neill [1]	Coarse-loamy, mixed, mesic	Typic Haplustolls	Mollisols.
Ord [1]	Coarse-loamy, mixed, mesic	Fluvaquentic Haplustolls	Mollisols.
Ortello	Coarse-loamy, mixed, mesic	Udic Haplustolls	Mollisols.
Orwet [1]	Sandy, mesic	Typic Calciaquolls	Mollisols.
Ovina	Coarse-loamy, mixed, mesic	Fluvaquentic Haplustolls	Mollisols.
Paka [1]	Fine-silty, mixed, mesic	Typic Argiustolls	Mollisols.
Simeon [1]	Mixed, mesic	Typic Ustipsamments	Entisols.
Thurman	Sandy, mixed, mesic	Udorthentic Haplustolls	Mollisols.
Trent	Fine-silty, mixed, mesic	Pachic Haplustolls	Mollisols.
Valentine	Mixed, mesic	Typic Ustipsamments	Entisols.

[1] O'Neill soils in Antelope County are taxadjuncts to the O'Neill series because they have a coarser control section than is defined as the range for the series.

Ord soils in Antelope County are taxadjuncts to the Ord series because they have a coarser control section than is defined as the range for the series.

Orwet soils in Antelope County are taxadjuncts to the Orwet series because they have a finer textured control section than is defined as the range for the series.

Paka soils in Antelope County are taxadjuncts to the Paka series because they have a thinner mollic epipedon than is defined as the range for the series.

Simeon soils in Antelope County are taxadjuncts to the Simeon series because they have less sand and coarse sand in the control section than is defined as the range for the series.

librium with their environment. Moody soils are upland soils that have well defined horizons.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classfication enables us to assemble knowledge about the soils, to see their relationship 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 of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; 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.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*6, 9*).

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. The same property or subdivisions of this property may be used in several different categories. In table 8, the soil series of Antelope County are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. Three exceptions to this are the Entisols, Histosols, and Vertisols, which occur in many different climates. Each order is identified by a word of three or four syllables ending in *sol* (Moll-i-sol).

SUBORDER. Each order is subdivided into suborders using those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders are more narrowly defined than are the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of a water table at a shallow depth, soil climate, the accumulation of clay, iron, or organic carbon in the upper solum, cracking of soils caused by a decrease in soil moisture, and fine stratification. Each suborder is identified by a word of two syllables. The last syllable indicates the order. An example is *Aquoll* (Aqu, meaning water or wet, and *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of soil horizons and features. The horizons used to make separations are those in which clay, carbonates, and other constituents have accumulated or have been removed, and those that have pans that interfere with growth of roots, movement of water, or both. Some features used are soil acidity, soil climate, soil composition, and soil color. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquoll (*Hapl,* meaning simple horizons, *aqu* for wetness or water, and *oll*, from Mollisols).

SUBGROUP. Each great group is divided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Other subgroups may have soil properties unlike those 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 Haplaquolls (a typical Haplaquoll).

FAMILY. Soil families are established within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, soil depth, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (see table 8). An example is the sandy, mixed, mesic family of Typic Haplaquolls.

Environmental Factors Affecting Soil Use

This section contains information on geology, physiography, relief and drainage, climate, water supply, transportation and markets, industry, and trends in farming and soil use.

Geology

The Ogallala Formation (fig. 20) of Pliocene (Tertiary) age is the oldest stratigraphic unit exposed in Antelope County. It crops out only in the northwestern part of the county along the south and east branches of Verdigris Creek and their tributaries. Elsewhere, it is mantled with unconsolidated deposits of Quaternary age. The Ogallala Formation is mostly alluvial material washed in from the west. In large part it is somewhat consolidated fine sand.

The lower part of the unconsolidated Quaternary deposits is alluvial silt, sand, and gravel, and the upper part is mostly wind-deposited silt and sand (*3, 5*). Valley floors of streams incised into these deposits are alluvium derived from the deposits. Quaternary deposits range in thickness to about 200 feet. They do not occur where the Ogallala Formation is exposed.

Nearly all the soils in Antelope County formed in the surficial sediments of Quaternary age. Although some of these surficial sediments were deposited by water, most were deposited by wind.

Physiography, Relief, and Drainage

Antelope County is within the Great Plains physiographic province, mostly within the High Plains section of that province, as defined by Fenneman (*4*). The northwestern part of the county—the area drained by the headwater tributaries of Verdigris Creek—is included in Fenneman's Unglaciated Missouri Plateau section.

The landscape of Antelope County is an east-sloping constructional plain that has been dissected by water erosion and further modified by wind. Slopes are long and gentle throughout most of the county. Somewhat sharply incised drainageways, however, that have steep sides are in both the southeastern and northwestern parts. In most places the Elkhorn River Valley is about 2 miles wide. It crosses the county in a east-southeasterly direction. The north margin is much more sharply defined than the south margin. Large areas of grass-covered sand dunes are in the southwestern part of the county. Smaller areas are in the east-central part.

The highest point in the county, near the southwest corner, is at an altitude of 2,162 feet. The lowest point, at the east border, is 1,645 feet. Relief along the west border of the county is a little more than 300 feet and along the east border is a little less than 150 feet. The lowest point along the west border is 1,821 feet, where the Elkhorn River flows into the county. Along the east border it is 1,645 feet, where the Elkhorn River flows out of the county.

Nearly three-fourths of the county is in the drainage basin of the Elkhorn River, which flows east-southeast. Clearwater and Cedar Creeks are the principal tributaries of the Elkhorn River within the county. The northern part of the county is in the drainage basins of Verdigris and Bazile Creeks, which flow northward. The southwestern part of the county is in the drainage basin of the southeast-flowing Beaver Creek, and a small area west of the southeast corner of the county is in the drainage area of the southeast-flowing Shell Creek.

In 40 years of continuous record, the Elkhorn River at Neligh has never stopped flowing. On July 2, 1932, however, its discharge averaged only 12 cubic feet per second. The average rate of discharge at Neligh is 230

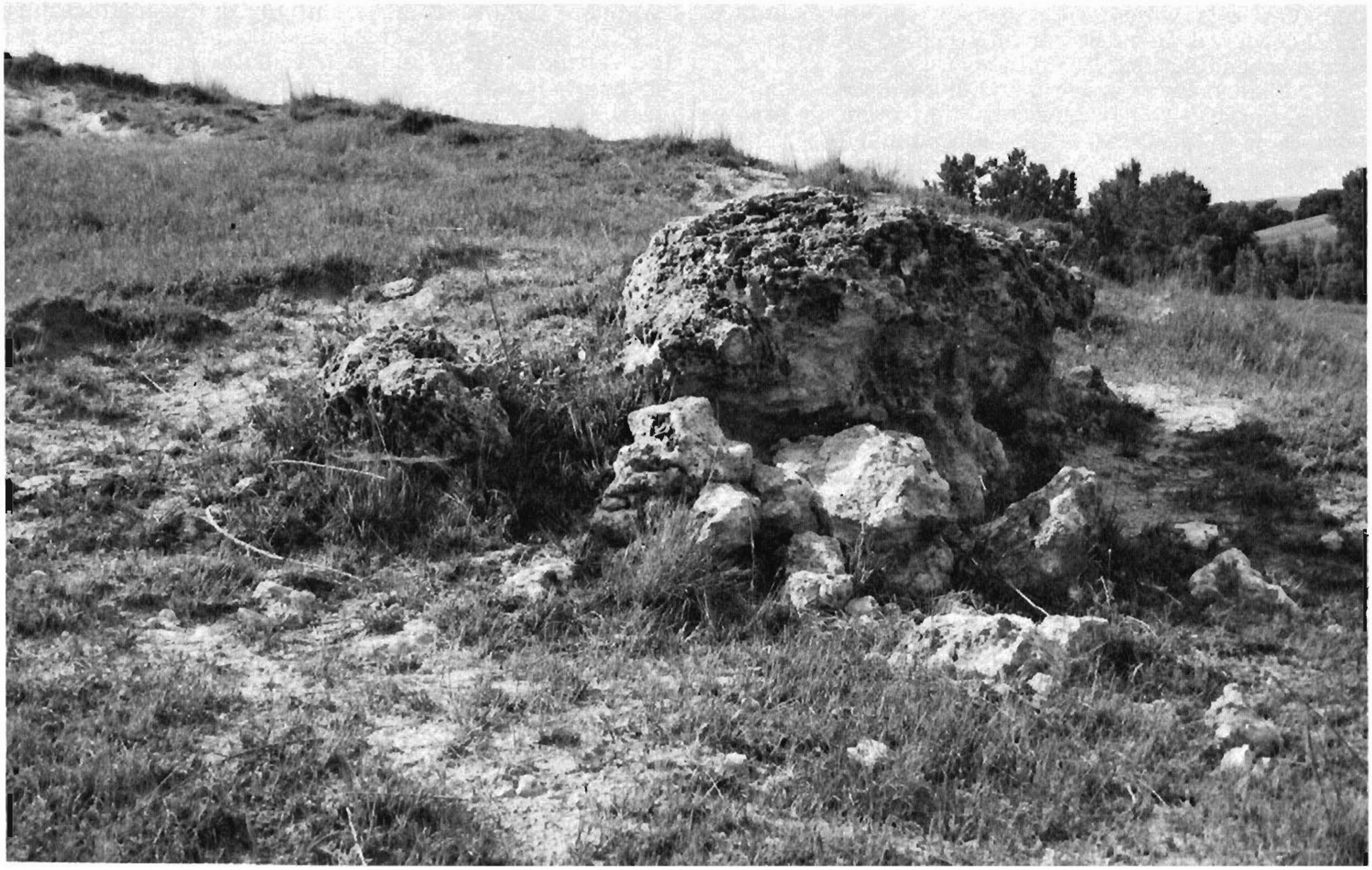

Figure 20.—Ogallala bedrock crops out in Brunswick-Paka complex.

cubic feet per second. The maximum flow was an estimated 12,000 cubic feet per second on June 23, 1947.

Clearwater Creek has a perennial flow throughout its length in Antelope County. Cedar Creek has a perennial flow only near its mouth. Bazile Creek and the headwater tributaries of Verdigris Creek flow throughout the year where they cross the north border of the county, but other streams in the county generally stop flowing in dry weather. The dry weather flow of all the perennial streams is maintained by seepage of groundwater into the stream channel.

In about 42 percent of the county the soils are so permeable that they ordinarily absorb all the precipitation not returned to the atmosphere by evaporation and plant uptake. Thus, these soils rarely contribute overland runoff to streams.

Climate[7]

Antelope County is in northeastern Nebraska. It has a continental climate typical of that found in the interior of a large continent. Summers are warm, winters are cold, and rainfall is moderate. Temperature and rainfall vary greatly from day to day and from season to season. Most moisture that falls in the county is brought by southerly winds from the Gulf of Mexico and the Caribbean Sea. The rapid changes in temperature are caused by the interchange of warm air from the south and southwest and cold air from the north and northwest.

Generally, about three-fourths of the annual precipitation falls during the growing season, April through September (table 9). Deviations from the average annual precipitation are large. In 85 years of record at Oakdale, precipitation in the driest year (1894) was 11.52 inches and in the wettest year (1920) was 38.05 inches. Precipitation in spring is slow, steady, and well distributed. As the season advances, more and more rain falls as erratic thundershowers; by the latter part of May, nearly all the precipitation falls as showers. Thunderstorms in spring and early in summer are severe at times. They are often accompanied by locally heavy downpours, hail, and damaging winds. Occasionally a tornado occurs.

As the fall progresses, showers become lighter and farther apart. The drier weather is generally sunny; days are mild and nights are cool. Most of the winter precipitation falls as snow, generally light but occasionally heavy. Low temperatures and strong northerly winds frequently accompany the snow. The snow is likely to accumulate in huge drifts before the wind subsides. Average annual snowfall is about 25 inches,

[7] Furnished by climatology office, Conservation and Survey Division, University of Nebraska.

TABLE 9.—*Temperature and precipitation*

[All data from Oakdale]

Month	Temperature				Precipitation				
	Average daily maximum [1]	Average daily minimum [1]	Two years in 10 will have at least 4 days with [2]—		Average monthly total [1]	One year in 10 will have [3]—		Days with 1 inch or more snow cover [1]	Average depth of snow on days with snow cover [1]
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Equal to or less than—	Equal to or more than—		
	°F	*°F*	*°F*	*°F*	*Inches*	*Inches*	*Inches*		*Inches*
January	31	8	52	−15	.6	.1	1.3	16	5
February	36	13	62	− 9	.8	.1	1.6	15	5
March	45	22	68	2	1.4	.4	2.7	10	5
April	61	36	81	21	2.3	.8	4.9	1	3
May	72	47	87	34	4.0	1.4	6.3	([4])	3
June	82	57	96	46	4.5	1.5	7.0		
July	87	62	102	52	3.1	1.0	5.9		
August	85	61	98	50	3.1	.9	5.3		
September	75	50	94	36	2.3	.7	5.1		
October	66	38	85	24	1.5	.2	3.4	([4])	2
November	48	25	69	5	.8	.1	2.0	3	3
December	36	13	58	− 6	.7	.1	1.5	13	4
Year	60	36	[5] 101	[6] −22	25.1	18.0	31.2	58	4

[1] Based on period 1944–73.

[2] Based on computer study per period 1948–63.

[3] Based on period 1889–1973.

[4] Less than 0.5 day.

[5] Average annual maximum.

[6] Average annual minimum.

TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Oakdale]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	April 11	April 18	May 1	May 13	May 23
2 years in 10 later than	April 4	April 13	April 25	May 8	May 18
5 years in 10 later than	March 25	April 2	April 15	April 27	May 7
Fall:					
1 year in 10 earlier than	October 20	October 15	October 9	September 25	September 17
2 years in 10 earlier than	October 26	October 21	October 14	September 30	September 22
5 years in 10 earlier than	November 6	October 30	October 24	October 10	October 2

but this varies considerably from year to year. The amount of snow cover on the ground varies greatly also from season to season, but generally there is a partial cover of snow from December to mid March.

Temperature records have been kept in Oakdale since 1895. The extremes recorded there are 115 degrees on July 24, 1936, and 38 degrees below zero on January 12, 1912.

The average date of the last frost in the spring is May 7. The average date of the first frost in the fall is October 2. See table 10 for other temperature thresholds.

Local topography has little effect upon average temperatures over a long period of time. Long-term average temperatures recorded on flat land, for example, do not differ greatly from those recorded on rolling hills or in valleys in the immediate area. Records based on dates when specific temperatures were reached may, however, differ markedly over short distances. Whenever freeze data are used, dates should be adjusted to fit the particular exposure. In less exposed areas the last freeze in spring is earlier and the first freeze in fall is later.

Annual evaporation from the free surface of the water in small lakes and farm ponds averages 42 inches; about 75 percent of this amount occurs from May through October.

All data on freezing temperatures are measured in a standard National Weather Service thermometer shelter; the thermometers are approximately 5 feet above the ground. The exposure is believed representative of the surrounding area, but at times temperatures are lower nearer the ground and in local areas subject to extreme air drainage on calm nights.

Water Supply

The two main sources of surface water in Antelope County are the Elkhorn River and Verdigris Creek. Their flow of water is fairly constant throughout the year. Several other creeks have a continual flow of water, but they do not carry nearly as much water. The Elkhorn River has a gradient of about 4.8 feet per mile across the county.

The principal open body of water in the county is Grove Lake. It is north of the town of Royal. It was formed by damming the upper end of the East Branch of Verdigris Creek. It has about 60 acres of open water and is spring fed. The lake and the area surrounding it are a State Wayside and Special Use Area.

The supply of underground water is plentiful for domestic use. Many good irrigation wells have been drilled. They are generally 100 to 200 feet deep. The thick underground deposits of Quaternary sand and gravel and the Ogallala formation provide a large underground water storage reservoir. These deposits are between 300 and 500 feet thick in the southern part of the county and between 100 and 200 feet thick in the northern part. Thus, the southern part of the county has the best potential for high-yielding irrigation wells and the most northern part of the county has a lower potential for good wells. Well yields of 200 gallons per minute are obtainable throughout the county. Yields of 1,000 to 2,000 gallons per minute are obtainable in about half the area. Depth of water ranges from 5 feet or less in some bottom land areas to little more than 200 feet in parts of the upland.

Antelope County has very good quality of water, which is moderately hard. Dissolved solids range from about 150 to 425 parts per million (*7*). The water is excellent for irrigation, and, except for hardness, it is suitable for municipal, industrial, and domestic uses.

On the south side of the Elkhorn River movement of the underground water is towards the east and northeast. North of the river the movement is towards the various major drainageways. Depth to the static water level ranges from approximately 200 feet in the southeastern corner of the county to the surface along the flowing rivers and creeks.

The ground water recharge in Antelope County is chiefly by precipitation. Some recharge also comes from irrigation water, surface water in areas adjacent to streams, and very slow underground flow. To date, pumping has not lowered the water level or storage because the amount of pumping is small in comparison to the size of the underground reservoir. The wide lateral extent and thickness of the saturated permeable rocks and the very slow rate of ground water movement provide a vast natural reservoir. Except in small, local areas where large amounts of pumping are done, this insures against rapid changes in water supplies.

Transportation and Markets

There are several hard-surface highways in the county. U.S. Highway 20 crosses the northern part of the county from east to west. U.S. Highway 275 generally follows the Elkhorn River from northwest to southeast. State Highway 13 is in the northeastern corner of the county. State Highway 70 extends west from Elgin to the county line. All towns in the county are connected by hard-surface highways. The county maintains gravel or dirt roads on most section lines except in the sand hill areas, the Elkhorn River Valley, and the northwestern part of the county. There are several miles of farm-to-market asphalt roads.

The Chicago and Northwestern Railroad follows the Elkhorn River Valley through the towns of Tilden, Oakdale, Neligh, and Clearwater. A branch line extends from Oakdale southwestward to Elgin. There is also a railroad line in the northeastern corner of the county that serves towns in bordering counties. The Burlington Northern Railroad provides service from east to west through the northern part of the county. It serves the towns of Brunswick, Royal, and Orchard.

Neligh has regular bus service to larger towns outside the county. There are several small airplane landing strips in the county. The best facilities and the only hard-surface landing strip are in Neligh.

Market facilities for farm products are located both in the county and outside it. Part of the livestock is shipped by trucks to markets outside the county at Norfolk, Sioux City, and Omaha. Many fattened cattle are sold directly to buyers from packing companies and are then hauled from the farm to packing plants by truck. Some livestock is marketed locally at a weekly livestock auction at Elgin. Most of the dairy products are sold locally to the cheese factory at Orchard or to a cooperative creamery in Plainview. Nearly all grade A milk is marketed outside the county at Norfolk. Most poultry products are sold in the larger towns in the county or in nearby towns in bordering counties. Grain crops grown for cash are sold at local elevators. Most of the hay, fruit, and vegetables grown are marketed locally.

Industry

Antelope County has a few small industries. In Neligh manufacturing plants make small multipurpose plastic flags and farm implements. One plant processes alfalfa hay into alfalfa pellets for livestock feed. The largest manufacturing plant in the county assembles mobile homes. Vetch processing mills are in Neligh and Elgin. The town of Orchard has a cheese factory. There are four gravel pits in the northern part of the county, which furnish sand and gravel for roads and construction.

Natural gas is available to all towns in the county except Royal and Brunswick. All towns and rural areas of the county are served by electricity.

Trends in Agriculture

Combination cash-grain and livestock farming has been the most important enterprise in Antelope County since its settlement. Crop production has increased through the years as more and more of the rangeland has been broken for cultivation. Even with the decrease in grassland, the number of cattle has increased through the years, mainly because more cattle are fattened in dry lots. The reduction in range has slowed the growth of cow-calf operations.

According to the Nebraska Agricultural Statistics reports, the total number of cattle increased from 62,920 in 1956 to 102,200 in 1973. The number of milk cows has decreased from 8,520 in 1956 to 6,100 in 1973. Hogs increased from 57,510 in 1956 to 82,400 in 1973.

Corn is the most important cultivated crop grown in the county. In 1956, 140,930 acres was planted to corn. By 1973, the acreage had increased to 180,300 acres. During this time the average yield of corn grown for grain increased from 55 to 70 bushels per acre.

Soybeans have become an important cash-grain crop. In 1956, the crop was harvested from only 1,220 acres. By 1973, the acreage in soybeans had increased to 21,500 acres.

The acreage of rye and grain sorghum has decreased in recent years. In 1956, rye was harvested from 29,470 acres. By 1973 the acreage had decreased to 22,000 acres. The acreage in grain sorghum decreased from 5,240 acres in 1956 to 4,100 acres in 1973.

Production of alfalfa hay has increased because alfalfa is needed as livestock feed in winter. In 1968 alfalfa hay was harvested from 24,850 acres. In 1973, it was grown on 33,300 acres. The average yield per acre nearly doubled during this time.

Other crops grown in the county are oats, wheat, and barley. Oats commonly are planted as a nurse crop for newly seeded legumes.

A few chickens are raised for family use on many farms. Sheep are kept on only a few farms.

Most of the increase in crop yields can be accounted for by the increased use of commercial fertilizer and increased acreages under irrigation. In 1957, 3,410 tons of commercial fertilizer was applied. By 1973, the amount applied had increased to 24,737 tons. The number of irrigation wells has increased from 65 in 1956 to about 500 in 1973. Approximately 65,000 acres was irrigated in the county in 1973.

According to the U.S. Census of Agriculture, the number of farms in the county was 1,758 in 1956 and 1,180 in 1973. The average size of farms was approximately 300 acres in 1956 and gradually increased to about 360 acres in 1972. The average cost per acre of farm land has increased steadily since 1965.

In 1973, about 65 percent of the county was in crops. About 30 percent of the county was in range and hay meadows, and 5 percent was in woodland, windbreaks, streams, urban development, and towns.

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Glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

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

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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.

Coarse textured (light textured) soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Depth, soil. The total thickness of weathered soil material over mixed sand and gravel or bedrock. In this survey the classes of soil depth are very shallow, 0 to 10 inches; shallow, 10 to 20 inches; moderately deep, 20 to 40 inches; and deep, more than 40 inches.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

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 distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated hard bedrock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Intake rate. The average rate of water that enters the soil under irrigation. Most soils have a faster initial rate which decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending upon the net irrigation application. The rate of water intake in inches per hour is expressed thus:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Leaching. The removal of soluble material from soil or other material by percolating water.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Organic-matter content. The amount of organic matter in soil material. The classes used in this survey are very low, less than 0.5 percent organic matter present; low 0.5 to 1.0 percent; moderately low, 1.0 to 2.0 percent; moderate, 2.0 to 4.0 percent; and high, 4.0 to 8.0 percent.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

GUIDE TO MAP UNITS

Map symbol	Map Unit	Described on page	Capability unit Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Number
Bc	Bazile loam, 0 to 2 percent slopes---	10	IIs-5	52	I-7	60	Silty	75	4
BcC	Bazile loam, 2 to 6 percent slopes---	12	IIIe-1	53	IIIe-7	63	Silty	75	4
BdB	Bazile complex, 0 to 3 percent slopes----------------------------	12	IIIe-6	54	IIe-10	61	Sandy	75	3
BdC	Bazile complex, 3 to 6 percent slopes----------------------------	12	IIIe-6	54	IIIe-10	64	Sandy	75	3
BdD	Bazile complex, 6 to 11 percent slopes----------------------------	12	IVe-6	56	IVe-10	67	Sandy	75	3
Be	Blendon fine sandy losm, 0 to 2 percent slopes--------------------	13	IIe-3	51	IIe-8	61	Sandy	75	3
BeC	Blendon fine sandy loam, 2 to 6 percent slopes--------------------	13	IIIe-3	53	IIIe-8	63	Sandy	75	3
Bg	Blownout land-----------------------	13	VIIe-5	59	-------	--	Sands	75	10
BoC	Boelus fine sand, 0 to 6 percent slopes----------------------------	14	IVe-6	56	IVe-10	67	Sandy	75	3
BpB	Boelus loamy fine sand, 0 to 3 percent slopes--------------------	15	IIIe-6	54	IIe-10	61	Sandy	75	3
BpC	Boelus loamy fine sand, 3 to 6 percent slopes--------------------	15	IIIe-6	54	IIIe-10	64	Sandy	75	3
BxF	Brunswick-Paka complex, 11 to 30 percent slopes--------------------	16	VIe-3	58	-------	--	---------	--	10
	Brunswick soil------------------	--	-------	--	-------	--	Sandy	75	--
	Paka soil-----------------------	--	-------	--	-------	--	Silty	75	--
Cb	Cass fine sandy loam, 0 to 2 percent slopes----------------------------	17	IIs-6	52	IIs-8	62	Sandy Lowland	74	3
Cc	Cass loam, 0 to 2 percent slopes-----	17	I-1	51	I-8	60	Sandy Lowland	74	1
Co	Cozad silt loam, 0 to 2 percent slopes----------------------------	18	I-1	51	I-6	60	Silty Lowland	74	1
CrE2	Crofton silt loam, 6 to 15 percent slopes, eroded--------------------	18	IVe-9	56	------	--	Limy Upland	75	5
CrF2	Crofton silt loam, 15 to 30 percent slopes, eroded--------------------	18	VIe-9	58	------	--	Limy Upland	75	10
CsG	Crofton soils, 30 to 60 percent slopes----------------------------	19	VIIe-7	59	------	--	Thin Loess	76	10
CuC2	Crofton-Nora silt loams, 2 to 6 percent slopes, eroded------------	19	IIIe-9	54	IIIe-6	63	---------	--	5
	Crofton soil--------------------	--	-------	--	-------	--	Limy Upland	75	--
	Nora soil-----------------------	--	-------	--	-------	--	Silty	75	--
CuD2	Crofton-Nora silt loams, 6 to 11 percent slopes, eroded------------	19	IVe-9	56	IVe-6	66	---------	--	5
	Crofton soil--------------------	--	-------	--	-------	--	Limy Upland	75	--
	Nora soil-----------------------	--	-------	--	-------	--	Silty	75	--
CuE2	Crofton-Nora silt loams, 11 to 15 percent slopes, eroded------------	19	IVe-9	56	-------	--	---------	--	5
	Crofton soil--------------------	--	-------	--	-------	--	Limy Upland	75	--
	Nora soil-----------------------	--	-------	--	-------	--	Silty	75	--

Map symbol	Map unit	Described on page	Capability unit Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Number
CuF	Crofton-Nora silt loams, 15 to 30 percent slopes	19	VIe-9	58	-------	--	--------	--	10
	Crofton soil	--	-------	--	-------	--	Limy Upland	75	--
	Nora soil	--	-------	--	-------	--	Silty	75	--
DfC	Doger fine sand, 0 to 6 percent slopes	20	IVe-5	55	IVe-12	67	Sands	75	3
DhB	Doger loamy fine sand, 0 to 3 percent slopes	20	IIIe-5	53	IIIe-11	64	Sandy	75	3
DhC	Doger loamy fine sand, 3 to 6 percent slopes	21	IVe-5	55	IVe-11	67	Sandy	75	3
Ef	Elsmere fine sand, 0 to 2 percent slopes	21	IVw-5	57	IVw-12	67	Subirrigated	74	2
Eh	Elsmere loamy fine sand, 0 to 2 percent slopes	21	IIIw-5	55	IIIw-11	65	Subirrigated	74	2
EmB	Elsmere loamy fine sand, drained, 0 to 3 percent slopes	22	IIIe-5	53	IIIe-11	64	Sandy Lowland	74	3
Fm	Fillmore silt loam, 0 to 1 percent slopes	22	IIIw-2	54	IIIw-2	65	Clayey Overflow	74	2
Gk	Gibbon silt loam, 0 to 2 percent slopes	23	IIw-4	52	IIw-6	61	Subirrigated	74	2
Gs	Gibbon silt loam, saline-alkali, 0 to 2 percent slopes	23	IVs-1	57	IIIs-6	65	---------	--	8
	Moderately alkaline part	--	-------	--	-------	--	Subirrigated	74	--
	Strongly alkaline part	--	-------	--	-------	--	Saline subirrigated	74	--
Hd	Hobbs silt loam, 0 to 2 percent slopes	24	IIw-3	51	IIw-6	61	Silty Overflow	74	1
HfB	Hobbs silt loam, channeled, 0 to 3 percent slopes	24	VIw-7	58	-------	--	Silty Overflow	74	10
HhA	Hord silt loam, 0 to 2 percent slopes	25	I-1	51	I-6	60	Silty Lowland	74	1
HhC	Hord silt loam, 2 to 6 percent slopes	25	IIe-1	51	IIIe-6	63	Silty	75	4
If	Inavale fine sand, 0 to 2 percent slopes	26	VIe-5	58	IVe-12	67	Sandy Lowland	74	7
Ih	Inavale and Elsmere soils, 0 to 2 percent slopes	26	VIw-7	58	-------	--	---------	--	10
	Inavale soil	--	-------	--	-------	--	Sandy Lowland	74	--
	Elsmere soil	--	-------	--	-------	--	Subirrigated	74	--
Lb	Lawet silt loam, 0 to 2 percent slopes	27	IVw-4	56	-------	--	Subirrigated	74	6
Lc	Lawet soils, wet, 0 to 2 percent slopes	27	Vw-7	58	-------	--	Wet Land	73	10
LdC	Longford loam, 1 to 4 percent slopes	28	IIIe-2	53	IIIe-2	62	Clayey	75	4

Map symbol	Map unit	Described on page	Capability unit Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Number
LfC	Longford complex, 1 to 4 percent slopes----------------------------	28	IIIe-6	54	IVe-10	67	Sandy	75	3
LgB	Loretto sandy loam, 0 to 3 percent slopes----------------------------	29	IIe-3	51	IIe-5	60	Sandy	75	3
LgC	Loretto sandy loam, 3 to 6 percent slopes----------------------------	29	IIIe-3	53	IIIe-5	63	Sandy	75	3
Lh	Loretto loam, 0 to 2 percent slopes--	29	I-1	51	I-4	59	Silty	75	4
LhC	Loretto loam, 2 to 6 percent slopes--	29	IIe-1	51	IIIe-4	62	Silty	75	4
Lo	Loup fine sandy loam, 0 to 2 percent slopes----------------------------	30	Vw-7	58	-------	--	Wet Land	73	6
Lp	Loup fine sandy loam, drained, 0 to 2 percent slopes--------------------	31	IVw-6	57	-------	--	Subirrigated	74	6
MeB	Meadin sandy loam, 0 to 3 percent slopes----------------------------	32	IVs-4	57	IVs-14	68	Shallow to Gravel	76	10
MeF	Meadin sandy loam, 3 to 30 percent slopes----------------------------	32	VIs-4	59	-------	--	Shallow to Gravel	76	10
Mp	Moody silty clay loam, 0 to 2 percent slopes----------------------------	33	I-1	51	I-3	59	Silty	75	4
MpC	Moody silty clay loam, 2 to 6 percent slopes----------------------------	33	IIe-1	51	IIIe-3	62	Silty	75	4
No	Nora silt loam, 0 to 2 percent slopes----------------------------	34	I-1	51	I-6	60	Silty	75	4
NoC	Nora silt loam, 2 to 6 percent slopes----------------------------	34	IIe-1	51	IIIe-6	63	Silty	75	4
NoC2	Nora silt loam, 2 to 6 percent slopes, eroded--------------------	34	IIIe-8	54	IIIe-6	63	Silty	75	4
NoD	Nora silt loam, 6 to 11 percent slopes----------------------------	35	IIIe-1	53	IVe-6	66	Silty	75	4
NoE	Nora silt loam, 11 to 15 percent slopes----------------------------	35	IVe-1	55	-------	--	Silty	75	4
Oe	O'Neill sandy loam, 0 to 2 percent slopes----------------------------	36	IIIe-3	53	IIIe-9	64	Sandy	75	5
OeC	O'Neill sandy loam, 2 to 6 percent slopes----------------------------	36	IVe-3	55	IVe-9	66	Sandy	75	5
Of	O'Neill loam, 0 to 2 percent slopes--	36	IIs-5	52	IIs-7	62	Silty	75	5
Og	Ord fine sandy loam, 0 to 2 percent slopes----------------------------	37	IIw-6	52	IIw-8	61	Subirrigated	74	2
Oh	Ord loam, 0 to 2 percent slopes------	37	IIw-4	52	IIw-8	61	Subirrigated	74	2
On	Ortello fine sandy loam, 0 to 2 percent slopes--------------------	38	IIe-3	51	IIe-8	61	Sandy	75	3
OnC	Ortello fine sandy loam, 2 to 6 percent slopes--------------------	38	IIIe-3	53	IIIe-8	63	Sandy	75	3
OnD	Ortello fine sandy loam, 6 to 11 percent slopes--------------------	38	IVe-3	55	IVe-8	66	Sandy	75	3
Or	Ortello loam, 0 to 2 percent slopes--	38	I-1	51	I-8	60	Silty	75	4
OrC	Ortello loam, 2 to 6 percent slopes--	38	IIe-1	51	IIIe-8	63	Silty	75	4
Ot	Orwet loam, 0 to 2 percent slopes----	39	IVw-4	56	-------	--	Subirrigated	74	6
Ov	Ovina loamy fine sand, 0 to 2 percent slopes----------------------------	40	IIIw-5	55	IIIw-10	65	Subirrigated	74	2
Ph	Paka loam, 0 to 2 percent slopes-----	41	I-1	51	I-4	59	Silty	75	4
PhC	Paka loam, 2 to 6 percent slopes-----	41	IIe-1	51	IIIe-4	62	Silty	75	4
PhD	Paka loam, 6 to 11 percent slopes----	41	IIIe-1	53	IVe-4	66	Silty	75	4

Map symbol	Map unit	Described on page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page	Windbreak suitability group Number
PkB	Paka complex, 0 to 3 percent slopes----------------------------	41	IIIe-6	54	IIe-10	61	Sandy	75	3
PkC	Paka complex, 3 to 6 percent slopes--	42	IIIe-6	54	IIIe-10	64	Sandy	75	3
PkD	Paka complex, 6 to 11 percent slopes-	42	IVe-6	56	IVe-10	67	Sandy	75	3
TfB	Thurman fine sand, 0 to 3 percent slopes----------------------------	43	IVe-5	55	IVe-12	67	Sandy	75	3
TfC	Thurman fine sand, 3 to 6 percent slopes----------------------------	44	IVe-5	55	IVe-12	67	Sands	75	3
TfD	Thurman fine sand, 6 to 11 percent slopes----------------------------	44	VIe-5	58	-------	--	Sands	75	7
ThB	Thurman loamy fine sand, 0 to 3 percent slopes--------------------	44	IIIe-5	53	IIIe-11	64	Sandy	75	3
ThC	Thurman loamy fine sand, 3 to 6 percent slopes--------------------	44	IVe-5	55	IVe-11	67	Sandy	75	3
TnF	Thurman-Crofton complex, 11 to 30 percent slopes--------------------	44	VIe-5	58	-------	--	--------	--	10
	Thurman soil--------------------	--	-------	--	-------	--	Sands	75	--
	Crofton soil--------------------	--	-------	--	-------	--	Limy Upland	75	--
ToC	Thurman-Valentine complex, 0 to 6 percent slopes--------------------	45	VIe-5	58	IVe-12	67	Sandy	75	3
Tr	Trent silt loam, 0 to 2 percent slopes----------------------------	45	I-1	51	I-6	60	Silty	75	4
VaC	Valentine fine sand, 0 to 6 percent slopes----------------------------	46	VIe-5	58	IVe-12	67	Sands	75	7
VaE	Valentine fine sand, rolling---------	46	VIe-5	58	-------	--	Sands	75	7
VsB	Valentine-Simeon complex, 0 to 3 percent slopes--------------------	46	IVe-5	55	IVe-11	67	--------	--	7
	Valentine soil------------------	--	-------	--	-------	--	Sandy	75	--
	Simeon soil--------------------	--	-------	--	-------	--	Sands	75	--
VsC	Valentine-Simeon complex, 3 to 6 percent slopes--------------------	47	VIe-5	58	IVe-11	67	Sands	75	7
VsD	Valentine-Simeon complex, 6 to 11 percent slopes--------------------	47	VIe-5	58	-------	--	Sands	75	7

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