United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
University of Nebraska
Conservation and Survey
Division

Soil Survey of Garden County, Nebraska

How To Use This Soil Survey

General Soil Map

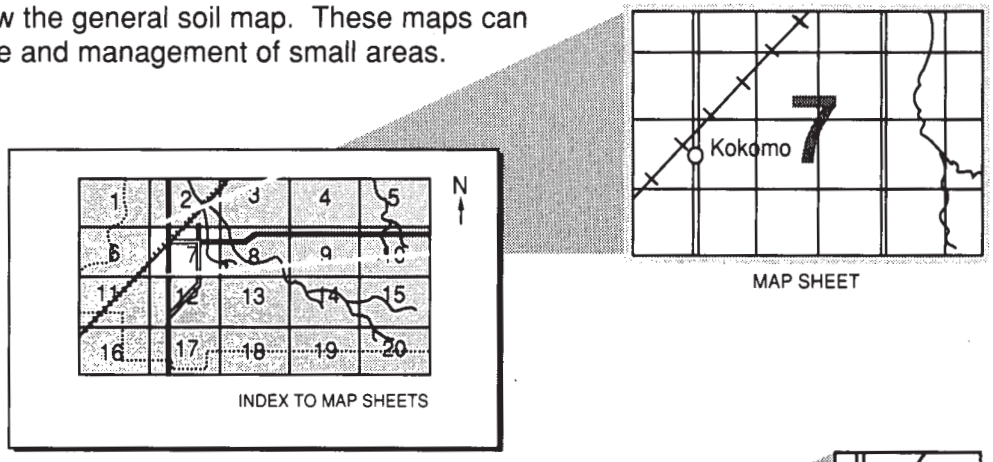
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

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

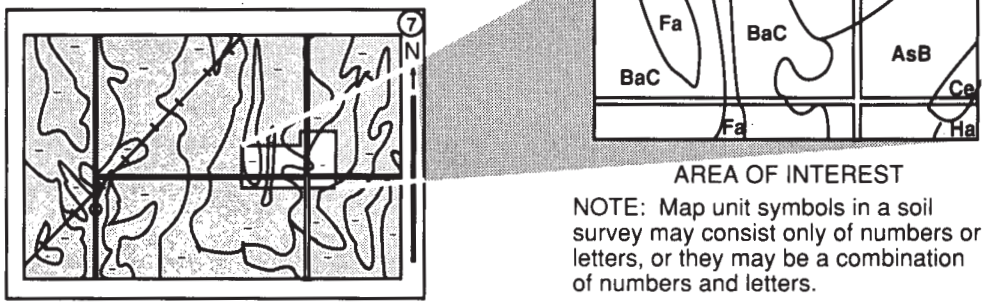
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

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



MAP SHEET

AREA OF INTEREST

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

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

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

Major fieldwork for this soil survey was completed in 1993. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1993. This survey was made cooperatively by the Natural Resources Conservation Service and the University of Nebraska Conservation and Survey Division. It is part of the technical assistance furnished to the North Platte Natural Resources District.

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

Cover: A native grass hay meadow in the foreground and native grass rangeland in the background in the North Platte River valley south of Oshkosh in Garden County.

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Issued 1999

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Summary of Tables

Foreword

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

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

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

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

Stephen K. Chick
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Garden County, Nebraska

By Jay R. Wilson, A. Tyler Labenz, Renee D. Gross, Glenn A. Borchers, Steven A. Scheinost, Charles F. Mahnke, Daniel R. Shurtliff, David R. Hoover, Arthur Voigtlander, and Alan J. Steube, Natural Resources Conservation Service; and Randy Kowalski, Stephen L. Hartung, and Neal B. Stolpe, University of Nebraska, Conservation and Survey Division

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

Garden County is in the southeastern part of the panhandle in western Nebraska (fig. 1). The county is nearly rectangular in shape. It is about 30 miles wide and 54 miles long and encompasses an area of 1,687 square miles, or 1,107,584 acres. Oshkosh, the county seat, is the largest town in the county. Other towns in the county are Lewellen and Lisco.

Farming and ranching are the main economic enterprises in the county. Corn; alfalfa; and dry, edible beans are the main irrigated crops. Winter wheat is the main dryland crop. Ranching consists mainly of cow-calf herds in which the calves are sold as feeders.

In the county about 15 percent of the agricultural land is cropland and 80 percent is native grass, which is used as rangeland or for hay. The rest of the land in the county is made up of the Crescent Lake National Wildlife Refuge, Ash Hollow State Historical Park, wildlife habitat, water, roads and highways, farm and ranch headquarters, towns, and waste areas.

This soil survey updates the survey of Garden County published by the U.S. Department of Agriculture in 1924 *(11)*. It provides a more detailed soil survey on aerial photography and contains more interpretive information.

General Nature of the County

This section provides general information about history and population; climate; geology and ground water; physiography, relief, and drainage; transportation; agriculture and industry; and trends in agriculture in Garden County.

History and Population

The earliest known expedition through what is now Garden County was in 1810 by John T. Brackenridge. Three years later a party led by Robert Stuart traveled along the North Platte River on its way from the Pacific coast to St. Louis. Stuart's party camped one-half mile west of present-day Oshkosh on March 25, 1813 *(6)*.

The area that is now Garden County was a favorite hunting ground of Native Americans because thousands of buffalo grazed the rich grasslands *(3)*. The great Oglala Sioux chief Red Cloud was born in the county in 1821. He forced the signing of the Fort Laramie treaty in 1868 after refusing to let immigrants travel the Bozeman Trail into Montana and defeating the soldiers sent to protect the trail.

The Mormon Trail and the two branches of the Oregon Trail came together at a place called Ash Hollow in the southeastern part of the county. Many westward travelers descended to the lowlands from Windlass Hill at Ash Hollow because travel was easier along the river. In their rush to get to the West, few of these travelers stopped to settle in Garden County.

Large ranchers were the first to use Garden County's resources. One of the first large ranches was the Oshkosh Land and Cattle Company, headed by Henry and Alfred Gumaer, George P. Kendell, H.W. Potter, and John Robinson. These men drove their first herd into the county from St. Paul, Nebraska in 1885.

Garden County was originally part of Cheyenne County. In 1889, Deuel County was formed from the eastern part of Cheyenne County. As first organized,

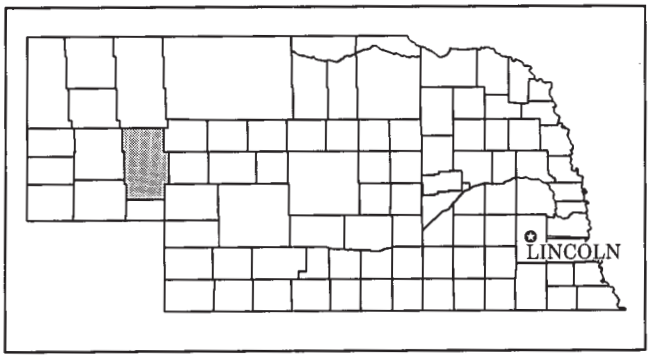

Figure 1.—Location of Garden County in Nebraska.

Deuel County included the area that later became Garden County. When the Union Pacific Railroad reached Oshkosh in 1908, people in the central and northern parts of Deuel County wanted to form their own county since they were 75 miles from Chappell, the county seat. Petitions requesting division of the county were circulated in 1909. The issue was voted on, and early in 1910 Oshkosh became the county seat of Garden County. The county grew until 1930, when the population reached 5,099. Since then the population has steadily decreased. By 1990, it was 2,460.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Oshkosh, Nebraska in the period 1951 to 1987. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 27 degrees F and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Oshkosh on January 19, 1963, is -34 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Oshkosh on July 11, 1954, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 17 inches. Of this, 14 inches, or 80 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 5.13 inches at Oshkosh on August 14, 1964. Thunderstorms occur on about 44 days each year.

The average seasonal snowfall is about 31 inches. The greatest snow depth at any one time during the period of record was 16 inches. On the average, 16 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring.

Geology and Ground Water

R.F. Diffendal, Jr., research geologist, Conservation and Survey Division, University of Nebraska-Lincoln, helped prepare this section.

All of Garden County is underlain by the Brule Formation. This formation is tightly cemented and yields sufficient water to wells only in areas where the siltstone has been fractured. In most places the Brule Formation forms an impermeable seal that prevents water from moving downward from the overlying aquifers.

The Arikaree Group is unimportant as an aquifer in the county, but the younger Ash Hollow Formation is important, particularly beneath the Cheyenne Tableland. Most, if not all, of the domestic and livestock wells on the tableland tap this aquifer. The thickness of the Ash Hollow Formation is 100 feet or less beneath much of the tableland except in the southeastern part of the county in the Ash Hollow Creek area, where it is more than 200 feet thick, and in the southwestern part of the county in the Rush Creek area, where it is more than 300 feet thick. In most of the area of the Cheyenne Tableland, the supply of ground water is adequate for domestic and livestock watering needs but not for irrigation. The Ash Hollow Formation is more than 700 feet thick in the northeastern part of the county beneath the Sandhills and contains an abundant supply of water. It has not been used extensively as a source of water because the overlying younger deposits also contain an abundant supply of water.

The Broadwater Formation and the younger

Quaternary alluvium are probably hydraulically connected directly to the Ash Hollow Formation beneath most of the Sandhills. These units contain abundant ground water and have been used for domestic and livestock watering needs. Some development of irrigation has occurred in this area, particularly in the flatter upland areas adjacent to the North Platte River valley. The unit equivalent in age to the Broadwater Formation in the southeastern part of the county does not contain abundant water and is not an important aquifer.

Quaternary alluvial sands and gravels are important sources of water for domestic, livestock, irrigated agricultural, and business needs in the North Platte River valley. The thickness of these deposits is as much as 100 feet or more. In 1991 Garden County had 313 registered irrigation wells, 2 registered municipal wells, 1 registered commercial well, and 8 other registered but unclassified wells. A larger number of wells used for domestic needs and livestock watering were unrecorded. A fish farming operation south of Lisco uses ground water from Quaternary alluvium.

The quality of the water in the county is good. It is hard or very hard for the most part. The water in the Sandhills varies from soft to hard. Contamination of water supplies is not a major problem in the county, but levels of nitrates above 10 ppm have been recorded in wells near Oshkosh. The potential for other forms of contamination is present.

Ground water issuing from springs produces surface flows near Ash Hollow and along Rush Creek south of the North Platte River. Springs feed Blue Creek and Mutton Creek north of the North Platte River. Ground water also is responsible for the lakes in the Sandhills.

Garden County includes parts of three physiographic regions of the State. From north to south they are the Sandhills, the North Platte River Valley, and the Cheyenne Tableland. The rocks and sediments exposed across these regions were first described in some detail by H. Stansbury in 1849 and were mapped and named by N.H. Darton in 1899. Numerous investigations have been carried out in the county since then.

The oldest rocks in the county belong to the Whitney and the younger Brown Siltstone members of the Brule Formation (White River Group) of the Oligocene epoch. These pink to brown siltstones are generally thick bedded to massive rocks made up of airfall volcanic debris carried into the county by high altitude winds after eruptions of volcanoes probably to the west in the Great Basin about 30 million years ago. The siltstones are made up of silt- and fine sand-sized grains of volcanic ash, or glass, shards and mineral crystals cemented together by clays. Most of the siltstones are impure, but some almost pure volcanic ash beds occur in the sequence. The Brown Siltstone beds contain abundant concretions of cemented calcium carbonate that are not common in the older Whitney member.

The Brule Formation crops out more or less continuously westward along the south side of the North Platte River valley from the county line on the east to Coumbe Bluff, a distance of about 24 miles. The formation also crops out discontinuously along the north side of the valley from near Lewellen to about 3 miles east of Lisco and along the valley sides of the lower reaches of Blue Creek, a northern tributary of the North Platte River. Most of the rugged tributary valleys on the south side of the North Platte River are formed in the Brule Formation (fig. 2).

In other parts of the Nebraska Panhandle the Brule Formation is overlain by grayish brown, silty sandstones of the Arikaree Group. The group is largely made up of volcanic debris and carbonate concretions. The Arikaree Group is not exposed in Garden County but has been encountered in test holes beneath parts of the Sandhills. The rocks of the group were deposited unconformably above the Brule Formation in valleys carved into the formation by rivers. The age of the Arikaree Group ranges from the late Oligocene epoch to the early Miocene epoch.

The Ash Hollow Formation of the Ogallala Group is unconformably above the Brule Formation beneath all of the Cheyenne Tableland and beneath the floor of the North Platte River valley from about 3 miles east of Lisco west to the county line (fig. 3). It is unconformably above the Brule Formation and, where present, the Arikaree Group beneath the Sandhills. In contrast to the Brule Formation and the Arikaree Group the Ash Hollow Formation is dominantly made up of river-deposited sediments eroded from the Rocky Mountains of southern Wyoming and north-central Colorado. The formation consists of siltstones, sandstones, conglomerates, and pebbly sandstones and their uncemented equivalent sediments that have been deposited in valleys that were carved by rivers into the underlying older beds. Diatomites mark the positions of ponds in the area during the deposition of the Ash Hollow beds. At least five volcanic ash beds were deposited in the Ash Hollow Formation during its accumulation in the area that is now Garden County during the late Miocene epoch. Caliche horizons that mark the positions of stable land surfaces and soil formation are common throughout the Ash Hollow Formation. Ground water calcretes that resemble caliches in appearance and general chemistry occur in some conglomerates.

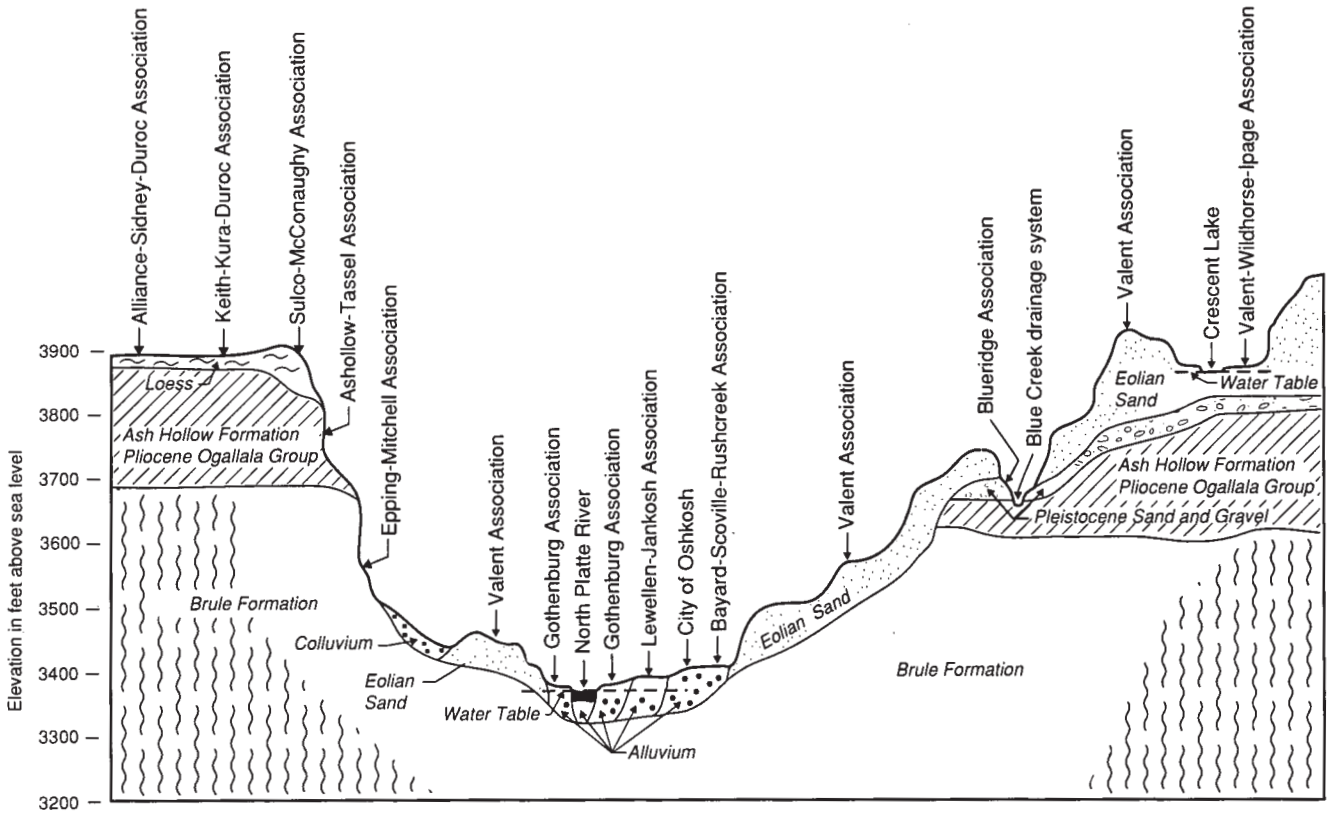

Figure 2.—A schematic cross section of Garden County, showing the general relationship of parent materials, soil associations, and elevations.

Deformation of the Ash Hollow and Brule Formations in the form of folding has affected the distribution and inclination of the strata of both units in western Garden County. Dips of 8 to 9 degrees have been observed in the Rush Creek drainage basin and near Lisco. This folding formed a structural basin with a long axis that roughly follows Rush Creek.

Overlying the older rocks are unconsolidated Pliocene and Quaternary alluvial sediments and Quaternary windblown silts and sands. The oldest alluvium belongs to the Broadwater Formation and equivalents of Pliocene age. The Broadwater Formation is exposed high on the north side of the North Platte River valley discontinuously across the county and underlies the southern part of the Sandhills. It consists primarily of sand and gravel beds that are generally coarser grained than the older Ash Hollow sands and gravels. Lesser quantities of diatomite and wind-deposited silts are interbedded with the alluvium. The formation was deposited in a valley eroded by a major river into the underlying Ash Hollow and Brule Formations. Sands and gravels that are closely equivalent in age were also deposited in a river valley carved into the Ash Hollow Formation in the extreme southeastern part of the county. These deposits crop out along Ash Hollow Creek and its tributaries and on parts of the Cheyenne Tableland. Terraces and flood plains of the North Platte River and its tributaries, drainageways crossing the Cheyenne Tableland, and some parts of the Sandhills are underlain by Quaternary alluvium. Wind-deposited silt (loess) mantles the older beds beneath the surface of the Cheyenne Tableland in the southern part of the county and at a few sites north of the North Platte River. Some of the land that is farmed on the uplands just south of the well developed Sandhills may also be loessic. The Sandhills are underlain by wind-deposited sand of Quaternary age. They extend down the north side of the valley onto the flood plain of the North Platte River east of Oshkosh. Wind-deposited sands also mantle the lower slopes on the south side of the North Platte River and extend in a few places onto the Cheyenne Tableland.

Physiography, Relief, and Drainage

Garden County is in the Central High Plains, Central High Tableland, and Nebraska Sandhills major

land resource areas of the Great Plains. The dominant physiographic features consist of tablelands, dissected uplands, river valleys, sandhills, and sandhill valleys.

The tablelands make up about 9 percent of the county and are mainly south of the North Platte River valley and the dissected uplands that border the valley. They generally have low relief, and most of the soils are level or very gently sloping. The tablelands do not have extensively developed drainage systems and in many cases drain into closed upland depressions. Most of the soils are used for the production of wheat in a wheat-fallow rotation.

The dissected uplands are generally adjacent to the North Platte River valley and its tributaries. The dissected uplands are characterized by strongly sloping to very steep; shallow to very deep; silty, loamy, and sandy soils that have well defined drainage systems. Relief is significant, and the elevation changes as much as 500 feet from the valley floor to the uppermost reaches of the drainageways. The dissected uplands make up about 10 percent of the county, and the soils are used mainly as rangeland.

River valleys consist of flood plains and the slightly higher stream terraces. The flood plains have low relief and are adjacent to river stream channels. The soils on flood plains are loamy and sandy and commonly have a seasonal water table and a hazard of flooding. The stream terraces are commonly above the flood plains and at the base of uplands. The soils on stream terraces have low relief and generally have slopes of

Figure 3.—Exposure of the Ash Hollow Formation of the Pliocene Ogallala Group. Material weathered from this formation is the parent material for several soil series in Garden County.

less than 3 percent. They normally do not have defined drainageways, are more than 6 feet above ground water, and do not have a hazard of flooding. River valleys make up about 4 percent of the county, and the soils are used as rangeland and hayland and for cultivated crops.

About 77 percent of Garden County consists of sandhills and sandhill valleys that are part of the Nebraska Sandhills. The physiography is typified by dunes and interdune valleys. The relief ranges from a few feet to as much as 200 feet. The slopes range from nearly level to very steep. The dunes are irregular in slope and do not have defined drainage patterns because the rapid permeability allows the soils to absorb most of the precipitation. Some of the soils in the valleys in the northern part of the county commonly have a seasonal high water table and shallow lakes. The Sandhills in the southern and southeastern parts of the county tend to have dry interdune valleys. Most of the soils in this area are well drained or excessively drained and have a water table at a depth of more than 6 feet. These valleys typically do not have shallow lakes, marshy soils, and other characteristics of the soils in the northern part of the county.

The county is drained mainly by the North Platte River and its tributaries. The main tributaries are Blue Creek, Ash Hollow Creek, and Rush Creek. The North Platte River flows southeast across the southern part of the county. Blue Creek originates from springs in the sandhills in the central part of the county and flows southeast to join the North Platte River near Lewellen. Ash Hollow Creek originates on the tablelands in the southern part of the county and flows east and north to join the North Platte River near Lewellen. Rush Creek enters Garden County from Cheyenne County and flows northeast to join the North Platte River near Lisco. The North Platte River and Blue Creek flow continuously, while other tributaries are intermittent and depend on rains and snowmelt for their water supply.

The elevation ranges from 3,260 feet above sea level where the North Platte River flows out of the county to 4,145 feet at the highest elevation 9 miles north of Lisco in the west-central part of the county.

Transportation

U.S. Highway 26 runs from east to west across Garden County, following the North Platte River valley and passing through Lewellen, Oshkosh, and Lisco. State Highway 27 enters the south-central part of the county and joins U.S. Highway 26 in Oshkosh.

Twenty-seven miles south on State Highway 27 is Interstate Highway 80, which runs from east to west across Nebraska. In the southern wheat producing area of the county improved gravel roads are on most section lines. In the rangeland areas roads are generally in poor condition and are not maintained. Some ranch headquarters are accessed by trails off the main roads.

The Union Pacific Railroad follows the North Platte River valley and is used mainly to transport coal from Wyoming to the Eastern States.

Oshkosh has an airfield accommodating small aircraft. The nearest commercial air service is in Scottsbluff, Nebraska, about 82 miles from Oshkosh.

Agriculture and Industry

Agriculture and related services and industry form the economic base of Garden County. About 40,000 acres of cropland is irrigated and used for the production of corn; alfalfa; and dry, edible beans. Irrigation water is derived from streams, rivers, and wells. Winter wheat is the most common dryland crop and is produced in a fallow-wheat rotation. About 120,000 acres is used for dryland crop production. Most of the winter wheat and dry, edible beans are marketed at elevators in neighboring counties. Much of the winter wheat is harvested by custom combine operators. Corn and alfalfa are mainly grown for local use as livestock feed.

Cow-calf herds are on most of the ranches in the area, and the calves are generally sold as feeders. One large commercial livestock feed yard is in the county. In the Sandhills area, native hay is harvested for winter livestock feed.

Industry in the county includes a manufacturing company that produces instruments and gauges in Oshkosh. Service and repair businesses, sand and gravel mining, and educational, governmental, and medical services provide other employment.

Tourism contributes to the local economy by providing services, food, and fuel to travelers going to and from Lake McConaughy, which is east of Garden County. This large lake is often visited by tourists from surrounding states as well as by Nebraska residents.

Ash Hollow, in the southeastern part of the county near Lewellen, is a tourist attraction where wagon ruts on the Oregon Trail, which are still visible today, can be viewed. Ash Hollow is also a scenic area that provides picnic facilities.

Goose and duck hunting is a popular sport in the county. Many hunters commonly lease hunting sites from local landowners. Crescent Lake National Wildlife Refuge also attracts hunters and fishermen.

Trends in Agriculture

Farming and ranching have been the most important enterprises in Garden County since its settlement. In the early years, crops were grown mainly for local use. When railroads, highways, and elevators became available, grain and livestock began to be shipped from the county to other markets. The total production has increased over the years because of the increased use of irrigation, more efficient machinery, the use of fertilizer, herbicides, and pesticides, and improved crop varieties. Farms that are a combination of cash-grain and livestock enterprises have decreased in number and have increased in size. In 1980, 345 farms were in Garden County. By 1990 the number of farms had decreased to 325. The acreage of irrigated crops has increased slightly. In 1980, 36,000 acres was irrigated, and by 1990 about 40,000 acres was irrigated *(4, 5)*.

Wheat is the main cultivated crop in the county. Other major crops are hay; corn; alfalfa; and dry, edible beans. Minor crops include sorghum, oats, barley, rye, soybeans, sunflower, and millet. In 1990, wheat was grown on about 55,000 acres. Hay is an important crop, although the acreage decreased from 75,900 acres in 1980 to 41,600 acres in 1990. In 1980, corn was grown on about 17,000 acres, and in 1990, it was grown on only 14,500 acres. However, the average production of dry, edible beans increased from about 700 acres in 1980 to about 5,600 acres in 1990. The acreage of alfalfa hay has increased from 12,100 acres in 1980 to 13,400 acres in 1990 *(4, 5)*.

Livestock is an important enterprise on most farms. The number of cattle decreased from 102,000 head in 1980 to 95,000 head in 1990. However, the number of beef cows has remained fairly consistent over the past 10 years, at about 38,000 head. The number of hogs has decreased from 3,400 head in 1980 to 2,900 head in 1990 *(4, 5)*.

How This Survey Was Made

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

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

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

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

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the

soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

Soil Descriptions

Dominantly Sandy Soils in the Sandhills

1. Valent association

Very deep, nearly level to very steep, excessively drained, sandy soils; in the sandhills (fig. 4)

Setting

Landscape: Sandhills
Composite slopes: 0 to 60 percent

Composition

Percent of the survey area: 41.6
Valent soils: 96 percent
Minor soils: 4 percent

Soil Properties and Qualities

Valent

Depth class: Very deep
Drainage class: Excessively drained
Landform: Dunes
Parent material: Eolian sand
Surface textural class: Fine sand
Slope: 0 to 60 percent

Minor Soils

- Dailey and Ipage soils are somewhat excessively drained and moderately well drained and are on interdune hummocks.
- Wildhorse and Els soils are somewhat poorly drained and are on hummocks and in interdune swales.
- Hoffland soils are poorly drained and very poorly drained and are in interdune swales.
- Marlake soils are very poorly drained and are in interdune depressions.

Use and Management

Major uses: Rangeland
Management concerns: Proper range management

2. Valent-Wildhorse-Ipage calcareous association

Very deep, nearly level to very steep, excessively drained, moderately well drained, and somewhat poorly drained, sandy soils; in the sandhills (fig. 5)

Setting

Landscape: Sandhills
Composite slopes: 0 to 60 percent

Composition

Percent of the survey area: 28.6
Valent soils: 78 percent
Wildhorse soils: 7 percent
Ipage soils: 5 percent
Minor soils: 10 percent

Soil Properties and Qualities

Valent

Depth class: Very deep
Drainage class: Excessively drained
Landform: Dunes
Parent material: Eolian sand

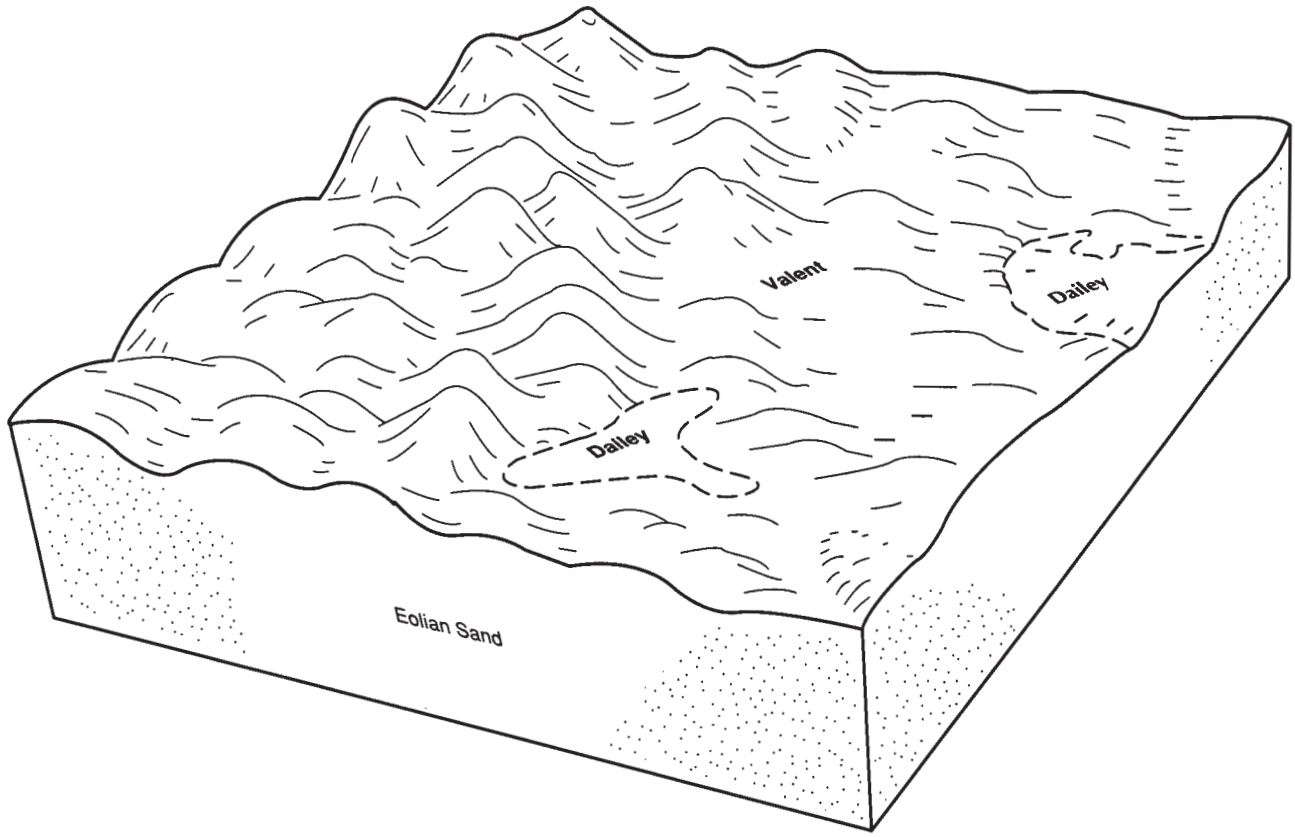

Figure 4.—Typical pattern of the soils and underlying material in the Valent association.

Surface textural class: Fine sand
Slope: 3 to 60 percent

Wildhorse

Depth class: Very deep
Drainage class: Somewhat poorly drained
Landform: Interdune swales
Parent material: Sandy alluvium
Surface textural class: Fine sand
Slope: 0 to 3 percent

Ipage calcareous

Depth class: Very deep
Drainage class: Moderately well drained
Landform: Interdune hummocks
Parent material: Eolian sand
Surface textural class: Fine sand
Slope: 0 to 3 percent

Minor Soils

- Hoffland, Crowther, and Els soils are in interdune swales.
- Marlake soils are very poorly drained and are in interdune depressions.

Use and Management

Major uses: Rangeland and hayland
Management concerns: Proper range management

Dominantly Loamy and Sandy Soils in the Sandhills and on Tablelands

3. Jayem-Sarben-Valent association

Very deep, nearly level to steep, well drained and excessively drained, loamy and sandy soils; in the sandhills and on tablelands

Setting

Landscape: Tablelands and sandhills
Composite slopes: 0 to 24 percent

Composition

Percent of the survey area: 4.7
Jayem soils: 36 percent

Sarben soils: 25 percent
Valent soils: 12 percent
Minor soils: 27 percent

Soil Properties and Qualities

Jayem

Depth class: Very deep
Drainage class: Well drained
Landform: Plains and hillslopes
Parent material: Sandy and loamy eolian material
Surface textural class: Loamy fine sand and fine sandy loam
Slope: 0 to 6 percent

Sarben

Depth class: Very deep
Drainage class: Well drained
Landform: Plains and hillslopes
Parent material: Sandy and loamy eolian material
Surface textural class: Loamy fine sand
Slope: 0 to 20 percent

Valent

Depth class: Very deep
Drainage class: Excessively drained
Landform: Dunes
Parent material: Eolian sand
Surface textural class: Loamy fine sand and fine sand
Slope: 0 to 24 percent

Minor Soils

- McConaughy and Sulco soils are on hillslopes.
- Vetal soils are on plains.
- Dailey soils are on interdune hummocks.

Use and Management

Major uses: Cropland and rangeland
Management concerns: Maintaining adequate cover to control soil blowing

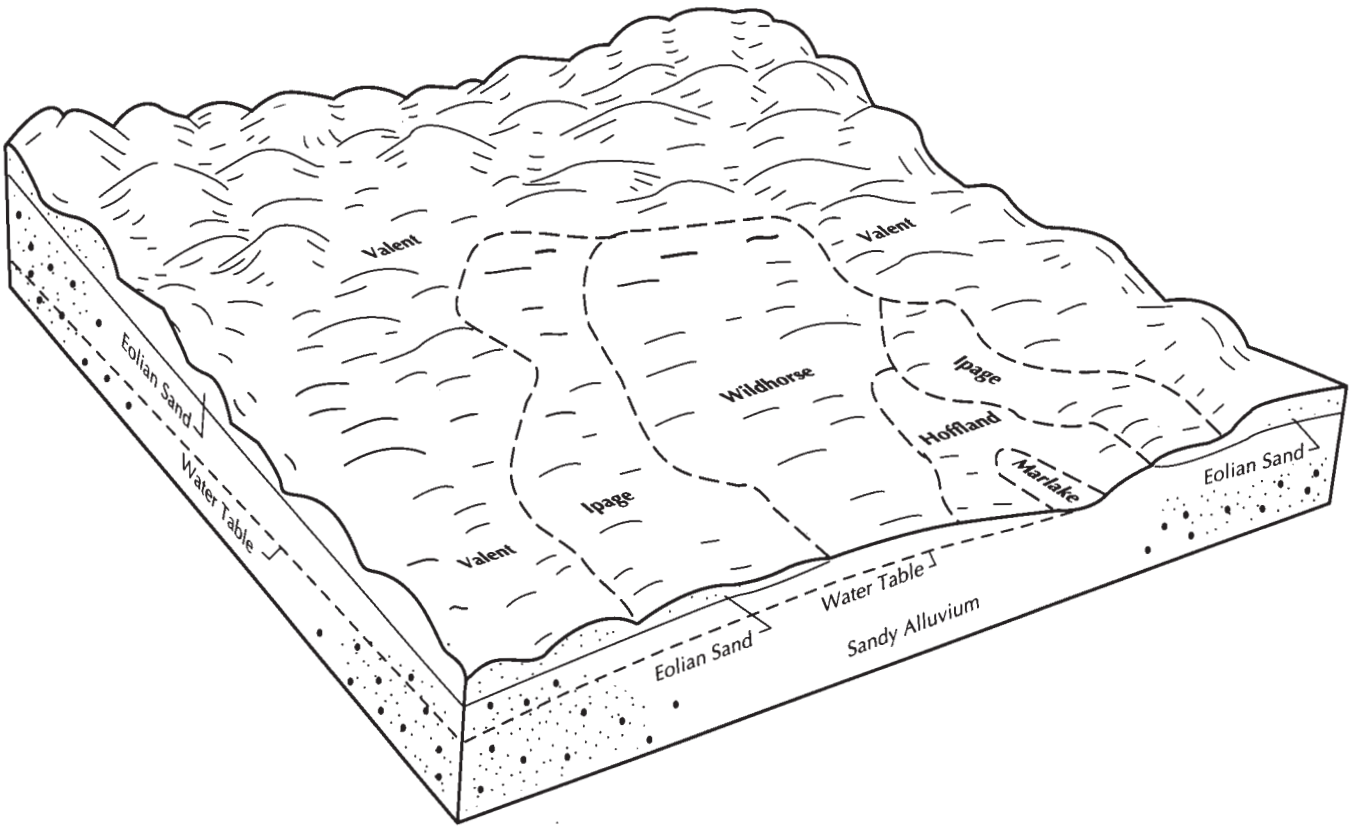

Figure 5.—Typical pattern of the soils and underlying material in the Valent-Wildhorse-Ipage calcareous association.

Dominantly Loamy and Sandy Soils on Valley Floors

4. Bayard-Scoville-Rushcreek association

Very deep, nearly level to gently sloping, well drained, moderately well drained, and somewhat excessively drained, loamy and sandy soils; in valleys (fig. 6)

Setting

Landscape: Valleys
Composite slopes: 0 to 6 percent

Composition

Percent of the survey area: 1.9
Bayard soils: 49 percent
Scoville soils: 30 percent
Rushcreek soils: 9 percent
Minor soils: 12 percent

Soil Properties and Qualities

Bayard

Depth class: Very deep
Drainage class: Well drained
Landform: Stream terraces
Parent material: Alluvium
Surface textural class: Fine sandy loam, loam, and very fine sandy loam
Slope: 0 to 6 percent

Scoville

Depth class: Very deep
Drainage class: Somewhat excessively drained
Landform: Stream terraces
Parent material: Wind worked sandy alluvium over loamy alluvium
Surface textural class: Loamy fine sand
Slope: 0 to 2 percent

Rushcreek

Depth class: Very deep
Depth to sand and gravel: Deep
Drainage class: Moderately well drained
Landform: Flood plains
Parent material: Loamy alluvium over gravelly coarse sands
Surface textural class: Loam
Slope: 0 to 2 percent

Minor Soils

- Lemoyne soils are on flood plains in landscape positions lower than those of the major soils.

Use and Management

Major uses: Cropland
Management concerns: Efficient management of irrigation water

Dominantly Sandy and Loamy Soils on Valley Floors

5. Gothenburg association

Nearly level, poorly drained, sandy soils that are very shallow and shallow over coarse sand; on valley floors (fig. 6)

Setting

Landscape: Valleys
Composite slopes: 0 to 2 percent

Composition

Percent of the survey area: 1.4
Gothenburg soils: 58 percent
Minor soils: 42 percent

Soil Properties and Qualities

Gothenburg

Depth class: Very deep
Depth to sand and gravel: Very shallow and shallow over coarse sand
Drainage class: Poorly drained
Landform: Flood plains
Parent material: Sandy and gravelly alluvium
Surface textural class: Loamy sand
Slope: 0 to 2 percent

Minor Soils

- McCuligan and Lewellen soils are on the higher flood plains.
- Areas of Fluvaquents are on the slightly lower flood plains and are saturated with water at or above the surface during most of the year.

Use and Management

Major uses: Rangeland and wildlife habitat
Management concerns: Proper range management

6. Lewellen-Jankosh association

Nearly level, somewhat poorly drained, loamy soils that are moderately deep over coarse sand or gravelly coarse sand; in valleys (fig. 6)

Setting

Landscape: Valleys

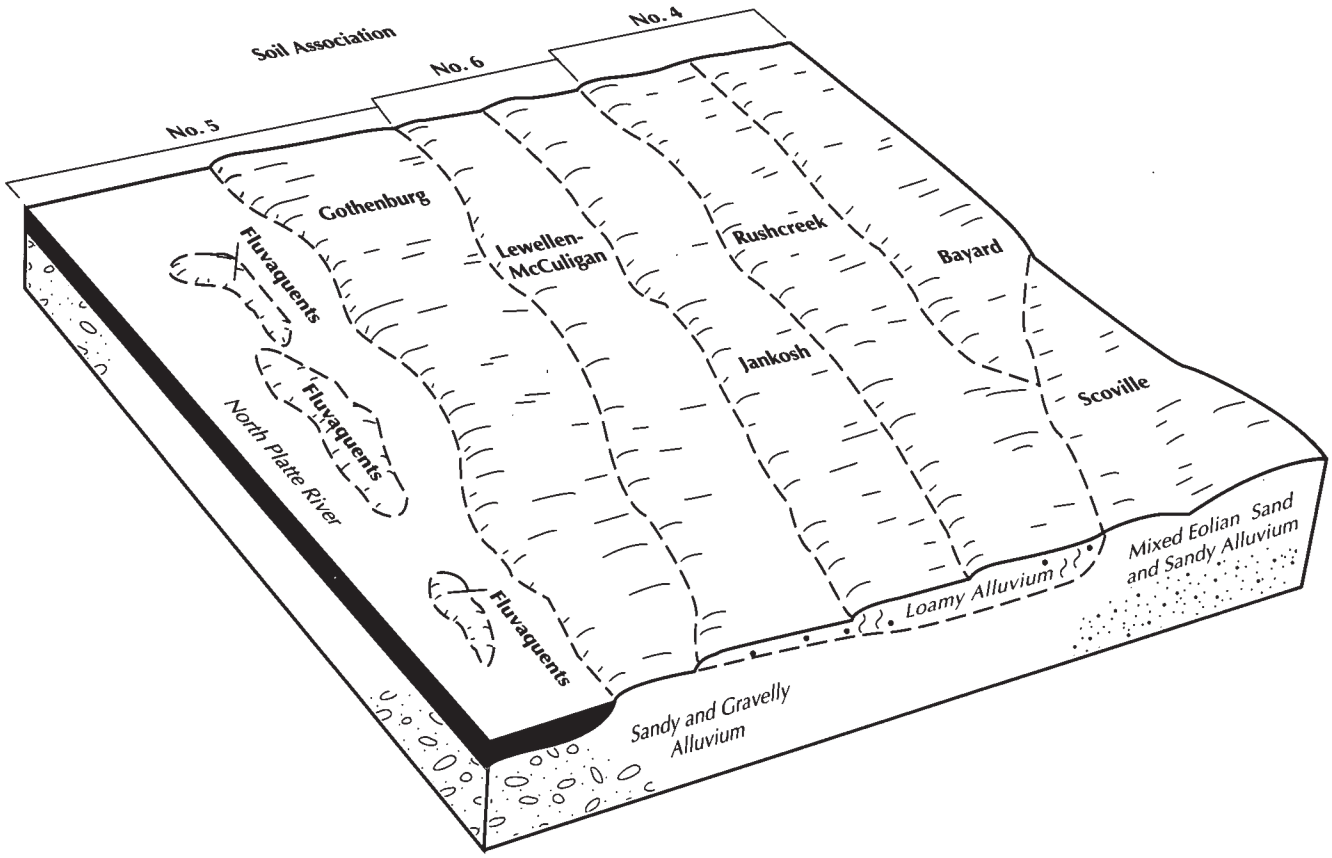

Figure 6.—Typical pattern of the soils and underlying material in the Gothenburg, Lewellen-Jankosh, and Bayard-Scoville-Rushcreek associations.

Composite slopes: 0 to 2 percent

Composition

Percent of the survey area: 0.9
Lewellen soils: 48 percent
Jankosh soils: 44 percent
Minor soils: 8 percent

Soil Properties and Qualities

Lewellen

Depth class: Very deep
Depth to sand and gravel: Moderately deep over coarse sand
Drainage class: Somewhat poorly drained
Landform: Flood plains
Parent material: Loamy over sandy alluvium underlain by coarse sand or gravelly sands
Surface textural class: Loam
Slope: 0 to 2 percent

Jankosh

Depth class: Very deep
Depth to sand and gravel: Moderately deep to gravelly coarse sand
Drainage class: Somewhat poorly drained
Landform: Flood plains
Parent material: Alluvium
Surface textural class: Loam
Slope: 0 to 2 percent

Minor Soils

- McCulligan soils are poorly drained and are slightly lower on the landscape than the major soils.
- Rushcreek and Lemoyne soils are moderately well drained and are on flood plains in landscape positions higher than those of the major soils.

Use and Management

Major uses: Hayland and rangeland
Management concerns: Proper hayland and range management

Dominantly Very Shallow to Very Deep, Loamy and Sandy Soils in the Sandhills and on Valley Sides and Uplands

7. Ashollow-Tassel association

Very deep, shallow, and very shallow, moderately steep to very steep, well drained and somewhat excessively drained, loamy soils; on uplands (fig. 7)

Setting

Landscape: Uplands
Composite slopes: 9 to 60 percent

Composition

Percent of the survey area: 6.3
Ashollow soils: 37 percent
Tassel soils: 31 percent
Minor soils: 32 percent

Soil Properties and Qualities

Ashollow

Depth class: Very deep
Drainage class: Well drained
Landform: Hillslopes
Parent material: Residuum weathered from sandstone
Surface textural class: Very fine sandy loam
Slope: 9 to 25 percent

Tassel

Depth class: Very shallow and shallow
Drainage class: Somewhat excessively drained
Landform: Hillslopes
Parent material: Weathered sandstone
Surface textural class: Fine sandy loam
Slope: 9 to 60 percent

Minor Soils

• Sarben, Busher, Epping, Mitchell, Sulco, and McConaughy soils are on hillslopes.

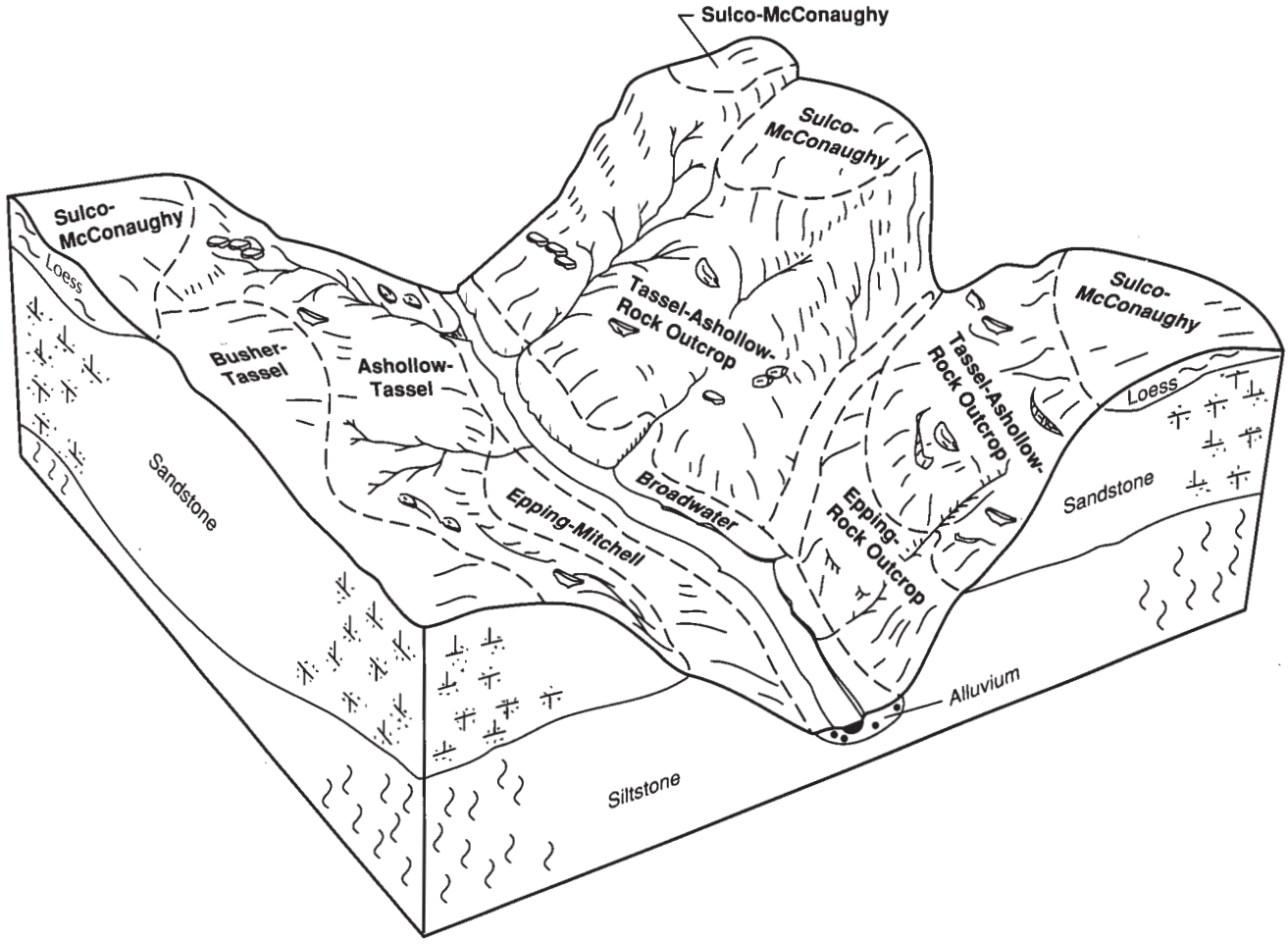

Figure 7.—Typical pattern of the soils and underlying material in the Ashollow-Tassel association.

- Areas of rock outcrop are on hillslopes.
- Broadwater soils formed in sandy alluvium and are on flood plains. They are lower on the landscape than the major soils.
- Valent soils formed in eolian sand and are on dunes.

Use and Management

Major uses: Rangeland
Management concerns: Proper range management

8. Epping-Mitchell association

Shallow and very deep, moderately steep to very steep, well drained, loamy soils; on uplands

Setting

Landscape: Uplands
Composite slopes: 9 to 60 percent

Composition

Percent of the survey area: 0.9
Epping soils: 49 percent
Mitchell soils: 9 percent
Minor soils: 42 percent

Soil Properties and Qualities

Epping

Depth class: Shallow
Drainage class: Well drained
Landform: Hillslopes
Parent material: Residuum weathered from siltstone
Surface textural class: Very fine sandy loam
Slope: 9 to 60 percent

Mitchell

Depth class: Very deep
Drainage class: Well drained
Landform: Hillslopes
Parent material: Alluvium and colluvium derived from siltstone
Surface textural class: Very fine sandy loam
Slope: 3 to 30 percent

Minor Soils

- Ashollow and Tassel soils are on hillslopes and are higher on the landscape than the major soils.
- Areas of rock outcrop are on hillslopes.
- Broadwater soils formed in sandy alluvium and are on flood plains. They are lower on the landscape than the major soils.

Use and Management

Major uses: Rangeland
Management concerns: Proper range management

9. Sarben-Valent association

Very deep, gently sloping to steep, well drained and excessively drained, sandy soils; on uplands and in the sandhills

Setting

Landscape: Uplands and sandhills
Composite slopes: 3 to 24 percent

Composition

Percent of the survey area: 1.6
Sarben soils: 54 percent
Valent soils: 10 percent
Minor soils: 36 percent

Soil Properties and Qualities

Sarben

Depth class: Very deep
Drainage class: Well drained
Landform: Hillslopes
Parent material: Sandy and loamy eolian material
Surface textural class: Loamy fine sand
Slope: 6 to 20 percent

Valent

Depth class: Very deep
Drainage class: Excessively drained
Landform: Dunes
Parent material: Eolian sand
Surface textural class: Fine sand
Slope: 3 to 24 percent

Minor Soils

- Sulco, McConaughy, and Jayem soils are on upland hillslopes.
- Broadwater soils formed in alluvium and are on flood plains. They are lower on the landscape than the major soils.

Use and Management

Major uses: Rangeland
Management concerns: Proper range management

10. Blueridge association

Strongly sloping to steep, excessively drained, sandy soils that are shallow over gravelly coarse sand; on uplands

Setting

Landscape: Uplands
Composite slopes: 6 to 30 percent

Composition

Percent of the survey area: 1.9
Blueridge soils: 64 percent
Minor soils: 36 percent

Soil Properties and Qualities

Blueridge

Depth class: Very deep
Depth to sand and gravel: Shallow to gravelly coarse sand
Drainage class: Excessively drained
Landform: Hillslopes
Parent material: Sandy and gravelly alluvium
Surface textural class: Coarse sand
Slope: 6 to 30 percent

Minor Soils

- Sarben and Valent soils are on hillslopes and dunes.
- Dankworth soils are on foot slopes.
- Almeria and Broadwater soils are on flood plains and are lower on the landscape than the Blueridge soils.

Use and Management

Major uses: Rangeland
Management concerns: Proper range management

11. Sulco-McConaughy association

Very deep, gently sloping to steep, well drained, loamy soils; on uplands (fig. 8)

Setting

Landscape: Uplands
Composite slopes: 3 to 30 percent

Composition

Percent of the survey area: 1.2
Sulco soils: 60 percent
McConaughy soils: 35 percent
Minor soils: 5 percent

Soil Properties and Qualities

Sulco

Depth class: Very deep
Drainage class: Well drained
Landform: Hillslopes
Parent material: Loess
Surface textural class: Loam
Slope: 3 to 30 percent

McConaughy

Depth class: Very deep
Drainage class: Well drained
Landform: Hillslopes
Parent material: Loess
Surface textural class: Loam
Slope: 3 to 15 percent

Minor Soils

- Sarben soils have more sand than the major soils. They are on hillslopes.
- Keith soils have more clay in the subsoil than the major soils. They are on plains above the major soils.

Use and Management

Major uses: Rangeland and cropland
Management concerns: Controlling water erosion on cultivated soils

12. Sulco-McConaughy-Tassel association

Very deep and shallow, strongly sloping to very steep, well drained and somewhat excessively drained, loamy soils; on uplands

Setting

Landscape: Uplands
Composite slopes: 6 to 60 percent

Composition

Percent of the survey area: 0.4
Sulco soils: 53 percent
McConaughy soils: 20 percent
Tassel soils: 15 percent
Minor soils: 12 percent

Soil Properties and Qualities

Sulco

Depth class: Very deep
Drainage class: Well drained
Landform: Hillslopes
Parent material: Loess
Surface textural class: Loam
Slope: 6 to 60 percent

McConaughy

Depth class: Very deep
Drainage class: Well drained
Landform: Hillslopes
Parent material: Loess
Surface textural class: Loam
Slope: 6 to 15 percent

Tassel

Depth class: Shallow

Drainage class: Somewhat excessively drained
Landform: Shoulders
Parent material: Weathered sandstone
Surface textural class: Fine sandy loam
Slope: 9 to 60 percent

Minor Soils

- Sarben soils have more sand than the major soils. They are on hillslopes.
- Ashollow soils formed in residuum weathered from sandstone and are on hillslopes.
- Areas of rock outcrop are on hillslopes below the major soils.

Use and Management

Major uses: Rangeland
Management concerns: Proper range management

Dominantly Loamy Soils on Tablelands

13. Keith-Kuma-Duroc association

Very deep, level to gently sloping, well drained, loamy soils; on tablelands (fig. 9)

Setting

Landscape: Tablelands
Composite slopes: 0 to 6 percent

Composition

Percent of the survey area: 3.6
Keith soils: 59 percent
Kuma soils: 22 percent
Duroc soils: 10 percent
Minor soils: 9 percent

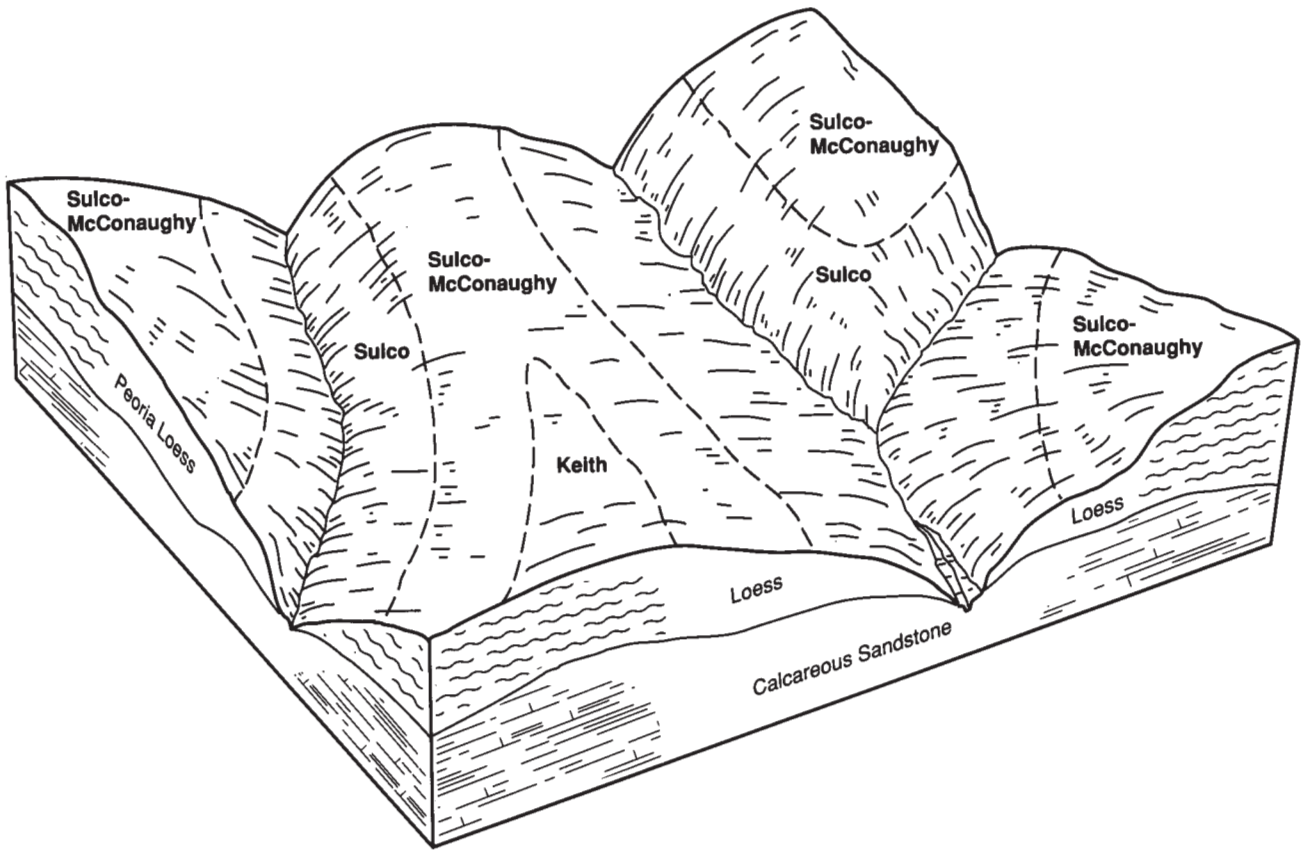

Figure 8.—Typical pattern of the soils and underlying material in the Sulco-McConaughy association.

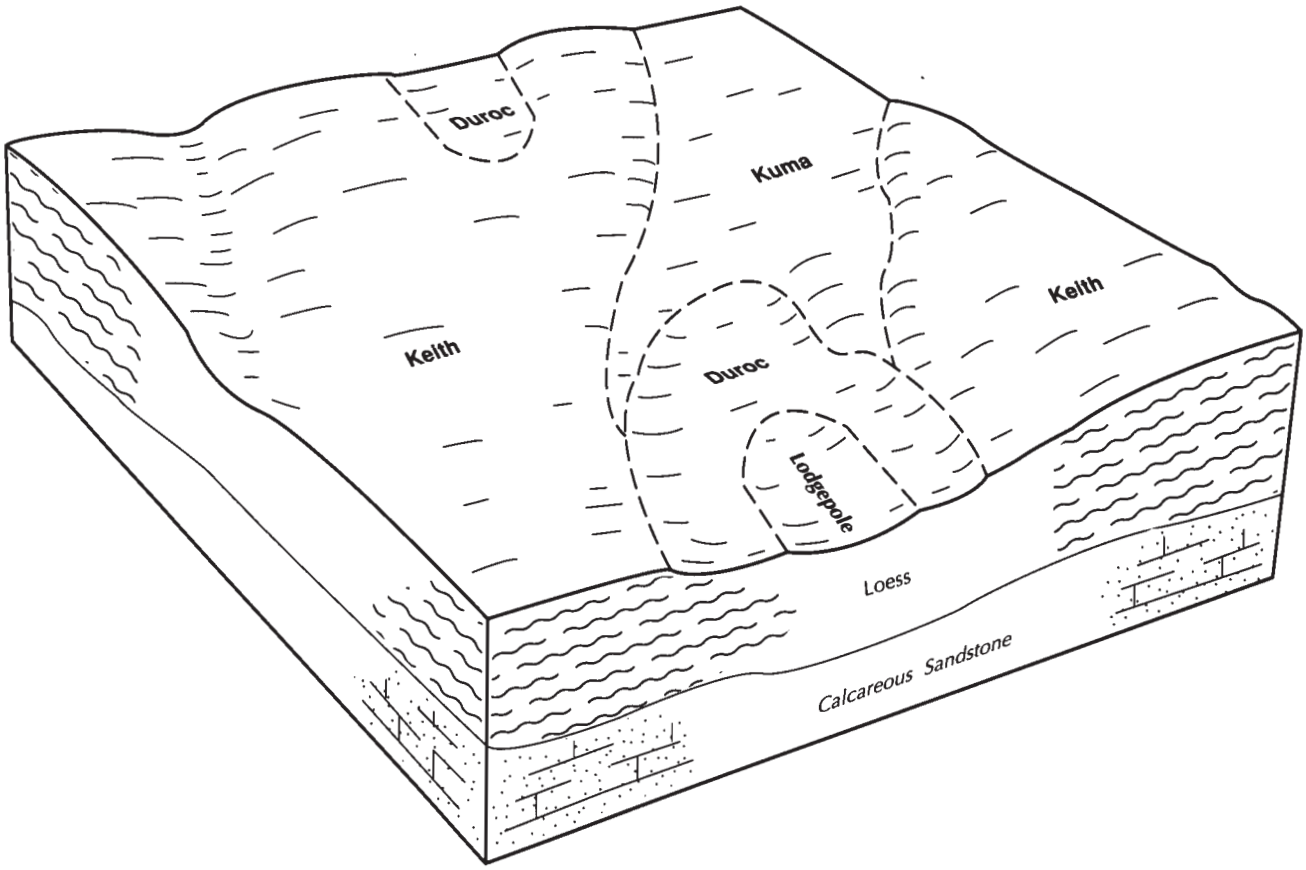

Figure 9.—Typical pattern of the soils and underlying material in the Keith-Kuma-Duroc association.

Soil Properties and Qualities

Keith

Depth class: Very deep
Drainage class: Well drained
Landform: Plains
Parent material: Loess
Surface textural class: Loam
Slope: 1 to 6 percent

Kuma

Depth class: Very deep
Drainage class: Well drained
Landform: Plains
Parent material: Loess
Surface textural class: Loam
Slope: 0 to 1 percent

Duroc

Depth class: Very deep
Drainage class: Well drained
Landform: Plains
Position on the landform: Swales
Parent material: Loess
Surface textural class: Loam
Slope: 0 to 1 percent

Minor Soils

- Alliance soils have sandstone at a depth of 40 to 60 inches. They are on plains.
- Jayem soils have more sand than the major soils. They are on plains and hillslopes.
- Sulco, McConaughy, and Sidney soils are on hillslopes.
- Lodgepole soils are in depressions. They are lower on the landscape than the major soils.

Use and Management

Major uses: Cropland
Management concerns: Controlling soil blowing and water erosion

14. Alliance-Sidney-Duroc association

Deep and very deep, level to strongly sloping, well drained, loamy soils; on tablelands (fig. 10)

Setting

Landscape: Tablelands
Composite slopes: 0 to 9 percent

Composition

Percent of the survey area: 5.0
Alliance soils: 45 percent
Sidney soils: 19 percent
Duroc soils: 18 percent
Minor soils: 18 percent

Soil Properties and Qualities

Alliance

Depth class: Deep
Drainage class: Well drained
Landform: Plains
Parent material: Loess over sandstone
Surface textural class: Loam
Slope: 0 to 3 percent

Sidney

Depth class: Deep
Drainage class: Well drained
Landform: Hillslopes
Parent material: Residuum weathered from sandstone
Surface textural class: Loam
Slope: 3 to 9 percent

Duroc

Depth class: Very deep
Drainage class: Well drained
Landscape: Plains
Position on the landform: Swales
Parent material: Loess
Surface textural class: Loam
Slope: 0 to 1 percent

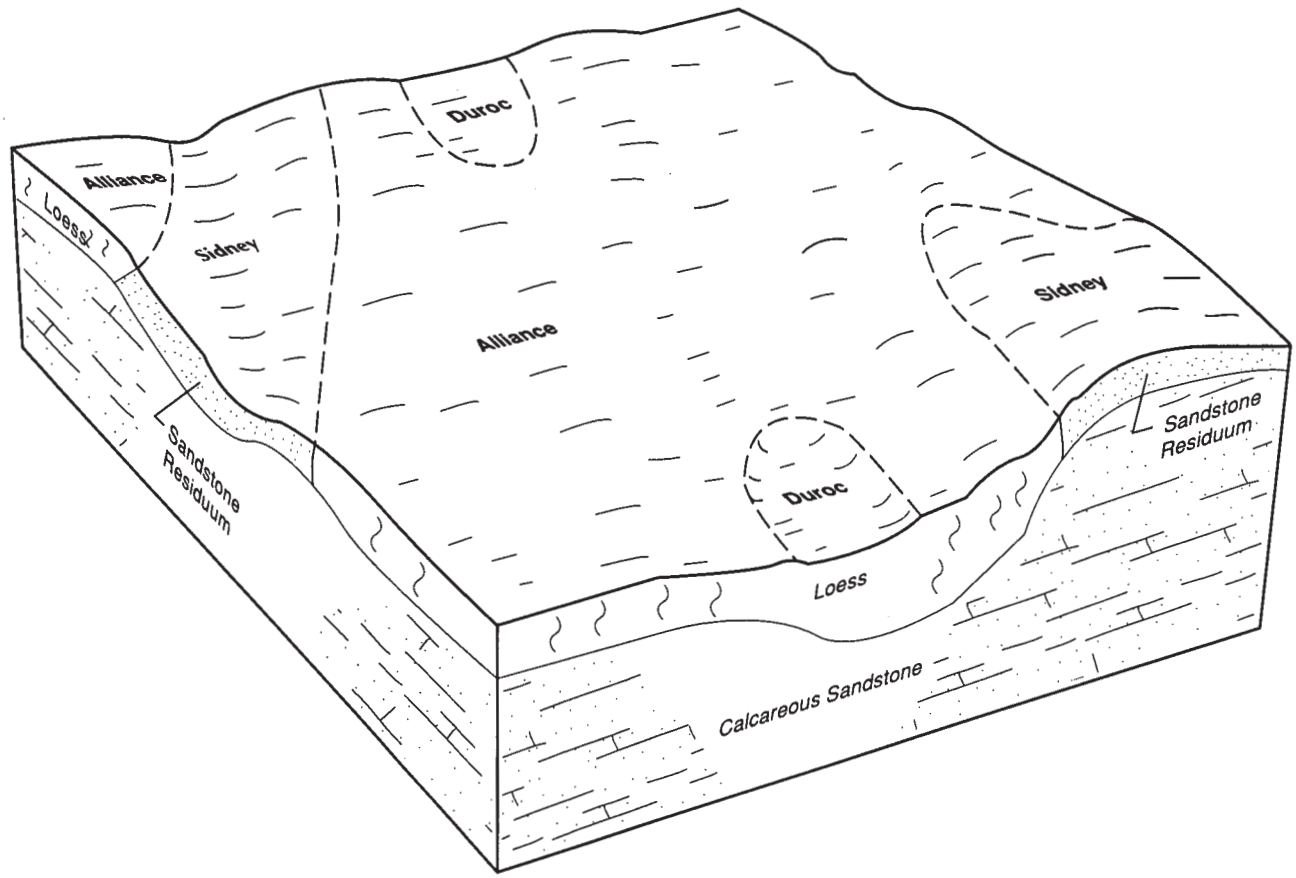

Figure 10.—Typical pattern of the soils and underlying material in the Alliance-Sidney-Duroc association.

Minor Soils

- Keith and Kuma soils are very deep. They formed in loess and are on plains.
- Canyon soils are on hillslopes and are higher on the landscape than the major soils.
- Lodgepole soils are in playas and are lower on the landscape than the major soils.

Use and Management

Major uses: Cropland
Management concerns: Controlling soil blowing and water erosion

Detailed Soil Map Units

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

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

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

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

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

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Ashollow-Tassel complex, 9 to 30 percent slopes, is an example.

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

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

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

Soil Descriptions

Ao—Alliance loam, 0 to 1 percent slopes

Setting

Landscape: Tablelands
Landform: Plains
Slope range: 0 to 1 percent (mainly 1 percent)
Major use: Cropland

Composition

Alliance soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Keith soil, 5 percent (plus or minus 5 percent)
Kuma soil, 5 percent (plus or minus 5 percent)
Duroc soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsoil:
8 to 19 inches—brown, friable clay loam

19 to 30 inches—pale brown, very friable, calcareous clay loam

Substratum:
30 to 44 inches—very pale brown, calcareous loam
44 to 60 inches—very pale brown, calcareous sandstone

Soil Properties and Qualities

Depth to paralithic contact: Deep, 40 to 60 inches
Potential rooting depth: Deep, 40 to 60 inches
Organic matter content: Moderate (2 to 4 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess over sandstone
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Water intake rate: Moderately low

Inclusions

Contrasting inclusions:
- Keith soils, which do not have sandstone within a depth of 60 inches
- Duroc and Kuma soils, which do not have sandstone within a depth of 60 inches and are dark below a depth of 20 inches
- Soils that have sandstone within a depth of 40 inches

Similar inclusions:
- Soils that have less clay in the subsoil than the Alliance soil

Use and Management

Dryland crops

Suitability: Suited
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface maintains or improves tilth and helps to conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
- If this soil is irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface maintains or improves tilth and helps to conserve moisture.

Rangeland and hay

Suitability: Suited
Management measures:
- This soil is suited to but seldom used as rangeland or for hay.

Windbreaks

Suitability: Suited
Management measures:
- The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by application of approved herbicides.
- Supplemental water for seedlings is needed during periods of low rainfall.

Dwellings

Suitability: Suited
Management measures:
- The soft bedrock generally can be easily excavated on sites for dwellings with basements or buildings that have deep foundations.

Septic tank absorption fields

Suitability: Suited
Management measures:
- Increasing the size of the absorption field can generally overcome the restricted permeability of the soil.
- Building up or mounding with suitable fill material increases the filtering capacity of the field.

Interpretive Groups

Land capability classification: Dryland—IIc-1; irrigated—I-4
Windbreak suitability group: 3
Range site: Silty
Irrigation design group: 4

AoB—Alliance loam, 1 to 3 percent slopes

Setting

Landscape: Tablelands
Landform: Plains
Slope range: 1 to 3 percent (mainly 2 percent)
Major use: Cropland

Composition

Alliance soil and similar soils: 85 percent (plus or minus 15 percent)

Contrasting inclusions:
Keith soil, 5 percent (plus or minus 5 percent)
Duroc soil, 5 percent (plus or minus 5 percent)
Kuma soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsurface layer:
6 to 12 inches—very dark grayish brown, very friable loam

Subsoil:
12 to 20 inches—grayish brown, very friable clay loam
20 to 26 inches—pale brown, friable clay loam
26 to 34 inches—very pale brown, very friable, calcareous loam

Substratum:
34 to 54 inches—very pale brown, calcareous very fine sandy loam
54 to 60 inches—very pale brown, calcareous sandstone

Soil Properties and Qualities

Depth to paralithic contact: Deep, 40 to 60 inches
Potential rooting depth: Deep, 40 to 60 inches
Organic matter content: Moderate (2 to 4 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess over sandstone
Runoff potential: Moderately low
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Water intake rate: Moderately low

Inclusions

Contrasting inclusions:
- Keith soils, which do not have sandstone within a depth of 60 inches
- Kuma and Duroc soils, which do not have sandstone within a depth of 60 inches and are dark to a depth of more than 20 inches
- Soils that have sandstone within a depth of 40 inches

Similar inclusions:
- Soils in which most of the original dark surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil

Use and Management

Dryland crops

Suitability: Suited
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
- Terraces on long slopes help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
- If this soil is irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
- Land leveling can be used to establish a suitable grade for a gravity irrigation system, but severe cuts during land leveling could expose the clayey subsoil and reduce the potential productivity of crops.
- A sprinkler irrigation system can be used if the slopes are irregular or suitable grades cannot be established for a gravity irrigation system.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.

Rangeland and hay

Suitability: Suited
Management measures:
- This soil is suited to but seldom used as rangeland or for hay.

Windbreaks

Suitability: Suited
Management measures:
- The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by application of approved herbicides.
- Supplemental water for seedlings is needed during periods of low rainfall.

Dwellings

Suitability: Suited

Management measures:
• The soft bedrock generally can be easily excavated on sites for dwellings with basements or buildings that have deep foundations.

Septic tank absorption fields

Suitability: Suited
Management measures:
• Increasing the size of the absorption field can generally overcome the restricted permeability of the soil.
• Building up or mounding with suitable fill material increases the filtering capacity of the field.

Interpretive Groups

Land capability classification: Dryland—IIe-1; irrigated—IIe-4
Windbreak suitability group: 3
Range site: Silty
Irrigation design group: 4

Ar—Almeria fine sandy loam, channeled, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 2 percent (mainly 1 percent)
Major use: Rangeland and hayland

Composition

Almeria soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Fluvaquents, 10 percent (plus or minus 10 percent)
Scoville soil, 3 percent (plus or minus 3 percent)
Broadwater soil, 2 percent (plus or minus 2 percent)

Typical Profile

Surface layer:
0 to 3 inches—gray, very friable, calcareous fine sandy loam

Substratum:
3 to 13 inches—light brownish gray, calcareous, stratified, mottled loamy fine sand
13 to 60 inches—gray and light gray, calcareous, stratified loamy fine sand and fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low (1 to 2 percent)
Drainage class: Poorly drained
Depth to the seasonal high water table: Surface during wet years to a depth of 1.5 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Low
Hazard of flooding: Frequent
Hazard of water erosion: Slight
Hazard of soil blowing: Slight

Inclusions

Contrasting inclusions:
• Areas of Fluvaquents, which have a seasonal high water table above the surface, are in the lower areas, and are generally vegetated with rushes and cattails
• Scoville soils, which are somewhat excessively drained and are slightly higher on the landscape than the Almeria soil
• Broadwater soils, which are excessively drained and are slightly higher on the landscape than the Almeria soil

Similar inclusions:
• Soils that have a surface layer of loam

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited
Management measures:
• This soil is unsuited to cultivated crops because of the wetness and the hazard of flooding.

Rangeland and hay

Suitability: Suited
Management measures:
• Grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• After the ground is frozen, livestock can graze without damaging the meadows. The livestock should be removed in the spring, before the ground thaws.

Windbreaks

Suitability: Suited
Management measures:
• The species suitable for planting are those that can tolerate the occasional wetness.
• Planting trees and shrubs by hand may be

necessary because of the wetness.
• The weeds and undesirable grasses that compete with the trees and shrubs can be controlled by cultivation between the tree rows when the water table is at its lowest level.

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the wetness caused by the seasonal high water table and the hazard of flooding.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the wetness caused by the seasonal high water table, the poor filtering capacity, and the hazard of flooding.

Interpretive Groups

Land capability classification: Dryland—VIw-7
Windbreak suitability group: 10
Range site: Wet Subirrigated

AsF—Ashollow-Tassel complex, 9 to 30 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Ashollow—back slopes and foot slopes; Tassel—summits and shoulders
Slope range: Ashollow—9 to 17 percent (mainly 12 percent); Tassel—9 to 30 percent (mainly 25 percent)
Major uses: Rangeland

Composition

Ashollow soil and similar soils: 65 percent (plus or minus 5 percent)
Tassel soil and similar soils: 25 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soil, 5 percent (plus or minus 5 percent)
Areas of rock outcrop, 5 percent (plus or minus 5 percent)

Typical Profile

Ashollow

Surface layer:
0 to 4 inches—brown, very friable, calcareous very fine sandy loam

Transitional layer:
4 to 13 inches—pale brown, very friable, calcareous very fine sandy loam

Substratum:
13 to 36 inches—pale brown, calcareous very fine sandy loam
36 to 60 inches—very pale brown, calcareous very fine sandy loam

Tassel

Surface layer:
0 to 6 inches—grayish brown, very friable, calcareous fine sandy loam

Substratum:
6 to 9 inches—pale brown, calcareous loamy fine sand
9 to 60 inches—white, weakly cemented sandstone

Soil Properties and Qualities

Ashollow

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderate (1 to 2 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Residuum weathered from sandstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Very severe

Tassel

Potential rooting depth: Very shallow and shallow, 6 to 20 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: Very low (0 to 3 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Weathered sandstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Very severe

Inclusions

Contrasting inclusions:
• Busher soils, which have weakly cemented sandstone at a depth of 40 to 60 inches
• Areas of rock outcrop, which have weathered bedrock at the surface
• Shallow soils, which have loam or very fine sandy loam throughout

Similar inclusions:
- Soils that have a surface layer of loamy fine sand

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

Windbreaks

Suitability: Ashollow—suited; Tassel—unsuited
Management measures:
- Only those species that can tolerate a high amount of calcium should be selected for planting.
- Onsite investigation is needed to identify the areas that are best suited to planting trees.
- An irrigation system is needed during dry periods.
- Planting trees on the contour and terracing help to reduce the rate of runoff and control water erosion on sloping soils.

Dwellings

Suitability: Ashollow—suited; Tassel—unsuited
Management measures:
- Onsite investigation is needed to identify the areas that are best suited to dwellings.
- Land shaping may be needed during construction.
- The soft bedrock generally can be excavated on sites for dwellings or buildings that have deep foundations.
- Lawns may be difficult to establish because of the rocks on the surface.

Septic tank absorption fields

Suitability: Ashollow—suited; Tassel—unsuited
Management measures:
- Onsite investigation is needed to identify the areas that are best suited to septic tank absorption fields.
- Land shaping and installing the absorption field on the contour is generally necessary to ensure that the system operates properly.

Interpretive Groups

Land capability classification: Ashollow—VIe-3, dryland; Tassel—VIs-4, dryland
Windbreak suitability group: Ashollow—8; Tassel—10
Range site: Ashollow—Sandy; Tassel—Shallow Limy

Bh—Bayard fine sandy loam, 0 to 1 percent slopes

Setting

Landscape: Valleys
Landform: Stream terraces
Slope range: 0 to 1 percent (mainly 0.5 percent)
Major use: Irrigated cropland

Composition

Bayard soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
- Rushcreek soil, 10 percent (plus or minus 10 percent)
- Scoville soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 7 inches—brown, very friable fine sandy loam

Subsurface layer:
7 to 12 inches—dark grayish brown, very friable fine sandy loam

Transitional layer:
12 to 17 inches—grayish brown, very friable fine sandy loam

Substratum:
17 to 40 inches—brown, calcareous fine sandy loam
40 to 60 inches—light brownish gray, calcareous loamy fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Alluvium
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Water intake rate: Moderately high

Inclusions

Contrasting inclusions:
- Scoville soils, which contain more sand than the Bayard soil and are somewhat excessively drained
- Rushcreek soils, which are moderately well drained,

are moderately affected by alkalinity, and are slightly lower on the landscape than the Bayard soil

Similar inclusions:
- Soils that have a thin or light colored surface layer
- Soils that have calcium carbonate at a depth of less than 13 inches
- Soils that have a surface layer of loam or very fine sandy loam

Use and Management

Dryland crops

Suitability: Suited
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
- If this soil is irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it results in poor plant vigor and depletes the protective plant cover, resulting in the hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
- Soil blowing and water erosion can be controlled by planting a cover crop between the tree rows.
- An irrigation system is needed for establishing seedlings during dry periods.
- Grasses and weeds can be controlled by cultivation or by application of approved herbicides.

Dwellings

Suitability: Suited
Management measures:
- The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IIIe-3; irrigated—IIe-8
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 8

BhB—Bayard fine sandy loam, 1 to 3 percent slopes

Setting

Landscape: Valleys
Landform: Stream terraces
Slope range: 1 to 3 percent (mainly 1 percent)
Major use: Cropland

Composition

Bayard soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Scoville soil, 10 percent (plus or minus 10 percent)
Ashollow soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 7 inches—brown, very friable fine sandy loam

Subsurface layer:
7 to 13 inches—dark grayish brown, very friable fine sandy loam

Transitional layer:
13 to 22 inches—grayish brown, very friable, calcareous fine sandy loam

Substratum:
22 to 60 inches—light brownish gray and grayish brown, calcareous fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches

Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Alluvium
Runoff potential: Moderately low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Water intake rate: Moderately high

Inclusions

Contrasting inclusions:
• Scoville soils, which contain more sand than the Bayard soil and are somewhat excessively drained
• Ashollow soils, which are calcareous at or near the surface and are higher on the landscape than the Bayard soil

Similar inclusions:
• Soils that have a thin or light colored surface layer
• Soils that have a surface layer of loam or very fine sandy loam

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
• Land leveling is needed to establish a suitable grade for a gravity irrigation system.
• If this soil is irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and depletes the protective plant cover, resulting in the hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing and water erosion can be controlled by planting a cover crop between the tree rows.
• An irrigation system is needed for establishing seedlings during dry periods.
• Grasses and weeds can be controlled by cultivation or by application of approved herbicides.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IIIe-3; irrigated—IIe-8
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 8

BhC—Bayard fine sandy loam, 3 to 6 percent slopes

Setting

Landscape: Valleys
Landform: Hillslopes
Position on the landform: Foot slopes
Slope range: 3 to 6 percent (mainly 4 percent)
Major use: Rangeland and cropland

Composition

Bayard soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Scoville soil, 10 percent (plus or minus 10 percent)

Ashollow soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 6 inches—grayish brown, very friable fine sandy loam

Subsurface layer:
6 to 9 inches—dark grayish brown, very friable fine sandy loam

Transitional layer:
9 to 15 inches—grayish brown, very friable fine sandy loam

Substratum:
15 to 60 inches—light brownish gray, calcareous fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Alluvium
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Water intake rate: Moderately high

Inclusions

Contrasting inclusions:
- Scoville soils, which contain more sand than the Bayard soil and are somewhat excessively drained
- Ashollow soils, which are calcareous at or near the surface and are higher on the landscape than the Bayard soil

Similar inclusions:
- Soils that have a thin or light colored surface layer

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and suited to sprinkler irrigation systems
Management measures:
- If this soil is irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
- A sprinkler irrigation system is best suited to this soil because extensive land leveling would be needed for a gravity irrigation system.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
- Close-growing crops, such as small grains and alfalfa, help to control soil blowing.
- If a sprinkler irrigation system is used, terraces can be constructed to control water erosion and reduce the rate of runoff.

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it results in poor plant vigor and depletes the protective plant cover, resulting in the hazards of water erosion and soil blowing.

Windbreaks

Suitability: Suited
Management measures:
- Soil blowing and water erosion can be controlled by planting a cover crop between the tree rows.
- An irrigation system is needed for establishing seedlings during dry periods.
- Grasses and weeds can be controlled by cultivation or by application of approved herbicides.

• Planting the trees on the contour and terracing also help to control water erosion.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IVe-3; irrigated—IIIe-8
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 8

BmB—Bayard very fine sandy loam, 1 to 3 percent slopes

Setting

Landscape: Valleys
Landform: Stream terraces
Slope range: 1 to 3 percent (mainly 1 percent)
Major use: Cropland

Composition

Bayard soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Scoville soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsurface layer:
9 to 16 inches—grayish brown, very friable, calcareous very fine sandy loam

Transitional layer:
16 to 24 inches—pale brown, very friable, calcareous very fine sandy loam

Substratum:
24 to 42 inches—pale brown, calcareous very fine sandy loam
42 to 60 inches—very pale brown, calcareous loamy very fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Alluvium
Runoff potential: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Water intake rate: Moderately high

Inclusions

Contrasting inclusions:
• Scoville soils, which contain more sand than the Bayard soil and are somewhat excessively drained

Similar inclusions:
• Soils that have a thin or light colored surface layer
• Soils that have a surface layer of loam or fine sandy loam

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
• Land leveling is needed to establish a suitable grade for a gravity irrigation system.
• If this soil is irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.

Rangeland and hay

Suitability: Suited

Management measures:
• This soil is suited to but seldom used as rangeland or for hay.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Suited
Management measures:
• The walls and sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IIIe-3; irrigated—IIe-8
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 8

Bn—Bayard loam, 0 to 1 percent slopes

Setting

Landscape: Valleys
Landform: Stream terraces
Slope range: 0 to 1 percent (mainly 0.5 percent)
Major use: Irrigated cropland

Composition

Bayard soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Rushcreek soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsurface layer:
7 to 15 inches—dark grayish brown, very friable loam

Transitional layer:
15 to 20 inches—grayish brown, very friable fine sandy loam

Substratum:
20 to 37 inches—brown, calcareous fine sandy loam
37 to 60 inches—pale brown, calcareous fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Alluvium
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Water intake rate: Moderately high

Inclusions

Contrasting inclusions:
• Rushcreek soils, which are moderately well drained, are moderately affected by alkalinity, and are slightly lower on the landscape than the Bayard soil

Similar inclusions:
• Soils that have a thin or light colored surface layer
• Soils that have a surface layer of fine sandy loam

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface maintains or improves tilth and helps to conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
• Irrigation water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited

Management measures:
• This soil is suited to but seldom used as rangeland or for hay.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing can be controlled by planting a cover crop between the tree rows.
• An irrigation system is needed for establishing seedlings during dry periods.
• Grasses and weeds can be controlled by cultivation or by application of approved herbicides.

Dwellings

Suitability: Suited
Management measures:
• This soil is well suited to dwellings and small buildings.
• The walls and sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IIIc-1; irrigated—I-8
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 8

BpB—Blanche loamy fine sand, 0 to 3 percent slopes

Setting

Landscape: Tablelands
Landform: Plains
Slope range: 0 to 3 percent (mainly 2 percent)
Major use: Rangeland

Composition

Blanche soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Tassel soil, 10 percent (plus or minus 10 percent)
Sidney soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 8 inches—brown, very friable loamy fine sand

Subsurface layer:
8 to 14 inches—grayish brown, very friable, calcareous fine sandy loam

Subsoil:
14 to 27 inches—brown, friable, calcareous fine sandy loam
27 to 32 inches—pale brown, very friable, calcareous fine sandy loam

Substratum:
32 to 60 inches—white, calcareous, weakly cemented sandstone

Soil Properties and Qualities

Potential rooting depth: Moderately deep, 20 to 40 inches
Organic matter content: Moderately low (1 to 2 percent)
Drainage class: Well drained
Available water capacity: Low (3 to 6 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Residuum weathered from sandstone
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Very severe
Water intake rate: Very high

Inclusions

Contrasting inclusions:
• Tassel soils, which are calcareous at the surface and have sandstone at a depth of 6 to 20 inches
• Sidney soils, which have more silt and clay throughout than the Blanche soil and have sandstone below a depth of 40 inches

Similar inclusions:
• Soils that have a surface layer of fine sandy loam

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the

prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• Frequent, light applications of irrigation water are needed to promote good crop growth because of the low available water capacity, the very high rate of water intake, and the potential for the leaching of nutrients below the root zone.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.
• Close-growing crops, such as small grains and alfalfa, help to control soil blowing.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by timely applications of the appropriate herbicide.
• A drip irrigation system can provide the moisture needed during periods of low rainfall.
• Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows.
• Because of the low available water capacity, drought-tolerant trees and shrubs are best suited to this soil.

Dwellings

Suitability: Suited
Management measures:
• The soft bedrock generally can be excavated on sites for dwellings with basements or buildings that have deep foundations.
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• Building up or mounding with suitable fill material increases the filtering capacity of the field.

Interpretive Groups

Land capability classification: Dryland—IVe-5; irrigated—IVe-11
Windbreak suitability group: 6R
Range site: Sandy
Irrigation design group: 11

BrF—Blueridge coarse sand, 6 to 30 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Shoulders and back slopes
Slope range: 6 to 30 percent (mainly 15 percent)
Major use: Rangeland

Composition

Blueridge soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
- Broadwater soil, 5 percent (plus or minus 5 percent)
- Dankworth soil, 5 percent (plus or minus 5 percent)
- Valent soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 4 inches—grayish brown, loose coarse sand

Substratum:
4 to 80 inches—light gray, gravelly coarse sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Excessively drained
Available water capacity: Very low (0 to 3 inches)
Permeability: Very rapid (more than 20 inches per hour)
Parent material: Sandy and gravelly alluvium
Runoff potential: High
Hazard of water erosion: Moderate
Hazard of soil blowing: Very severe
Distinctive property: 15 to 35 percent gravel, by volume, at a depth of 10 to 40 inches

Inclusions

Contrasting inclusions:
• Broadwater soils, which are on flood plains and are lower on the landscape than the Blueridge soil

• Dankworth soils, which contain less gravel at a depth of 10 to 40 inches and are lower on the landscape than the Blueridge soil
• Valent soils, which do not contain gravel and are on landscapes similar to those of the Blueridge soil

Similar inclusions:
• Soils that have more than 35 percent gravel in the 10- to 40-inch layer

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Poorly suited
Management measures:
• The excessive slope is a limitation affecting building sites.
• Land shaping is required for sites for dwellings.
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.
• Lawns are difficult to establish and maintain because of the coarse texture of the soil material.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the underground water supplies.

Interpretive Groups

Land capability classification: Dryland—VIs-4
Windbreak suitability group: 10
Range site: Shallow to Gravel

Bw—Broadwater loamy sand, channeled, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 2 percent (mainly 1 percent)
Major use: Rangeland

Composition

Broadwater soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Scoville soils, 10 percent (plus or minus 10 percent)

Typical Profile

Surface layer:
0 to 3 inches—light brownish gray, very friable, calcareous loamy sand

Substratum:
3 to 9 inches—pale brown, calcareous loamy sand
9 to 60 inches—pale brown and very pale brown, calcareous, stratified gravelly coarse sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Excessively drained
Depth to the seasonal high water table: More than 6 feet
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour) and very rapid (more than 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Low
Hazard of flooding: Frequent
Hazard of water erosion: Slight
Hazard of soil blowing: Very severe

Inclusions

Contrasting inclusions:
• Scoville soils, which do not have gravel and are slightly higher on the landscape than the Broadwater soil

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Deposition of sediment by floodwater can partly cover the grasses and thus reduce their vigor and impair their growth.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the hazard of flooding.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the hazard of flooding and the poor filtering capacity of the soil.

Interpretive Groups

Land capability classification: Dryland—VIw-7
Windbreak suitability group: 10
Range site: Shallow to Gravel

BxD—Busher-Tassel complex, 3 to 9 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Busher—back slopes and foot slopes; Tassel—summits and shoulders
Slope range: Busher—3 to 9 percent (mainly 7 percent); Tassel—3 to 9 percent (mainly 7 percent)
Major uses: Rangeland

Composition

Busher soil and similar soils: 55 percent (plus or minus 10 percent)
Tassel soil and similar soils: 30 percent (plus or minus 10 percent)
Contrasting inclusions:
Ashollow soil, 8 percent (plus or minus 8 percent)
Sarben soil, 5 percent (plus or minus 5 percent)
Areas of rock outcrop, 2 percent (plus or minus 2 percent)

Typical Profile

Busher

Surface layer:
0 to 10 inches—dark grayish brown, very friable fine sandy loam

Subsoil:
10 to 29 inches—brown, friable fine sandy loam

Substratum:
29 to 34 inches—pale brown fine sandy loam
34 to 48 inches—very pale brown, calcareous fine sandy loam
48 to 60 inches—very pale brown, calcareous, soft, fine grained sandstone

Tassel

Surface layer:
0 to 8 inches—pale brown, very friable, calcareous fine sandy loam

Substratum:
8 to 11 inches—very pale brown, calcareous fine sandy loam
11 to 60 inches—white, calcareous, soft, fine grained sandstone

Soil Properties and Qualities

Busher

Potential rooting depth: Deep (40 to 60 inches)
Organic matter content: Moderately low (1 to 2 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid
Parent material: Residuum weathered from sandstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Severe
Water intake rate: Moderately high

Tassel

Potential rooting depth: Very shallow and shallow (6 to 20 inches)
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: Very low (0 to 3 inches)
Permeability: Moderately rapid
Parent material: Weathered sandstone
Runoff potential: High

Hazard of water erosion: Severe
Hazard of soil blowing: Severe

Inclusions

Contrasting inclusions:
- Ashollow soils, which do not have a dark surface layer, have carbonates within a depth of 10 inches, and have sandstone below a depth of 60 inches
- Sarben soils, which do not have a dark surface layer and have sandstone below a depth of 60 inches
- Areas of rock outcrop, which is sandstone bedrock at the surface

Similar inclusions:
- Soils that have sandstone at a depth of 20 to 40 inches
- Soils that have a surface layer of loamy sand or loamy fine sand

Use and Management

Dryland crops

Suitability: Busher—poorly suited; Tassel—unsuited
Management measures:
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and water erosion, maintains or improves tilth, and helps to conserve moisture.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.
- Cuts during the construction of terraces can expose weathered, calcareous sandstone, which can limit the potential growth and productivity of crops.

Irrigated crops

Suitability: Busher—unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems; Tassel—unsuited
Management measures:
- If a sprinkler irrigation system is used, terraces, contour farming, and leaving residue on the surface help reduce the rate of runoff and control erosion.
- Cuts during the construction of terraces can expose sandstone or calcareous underlying material, which can reduce the potential productivity of crops.
- A cropping system that includes close-growing crops, such as small grains and alfalfa, helps to control soil blowing and water erosion.
- Frequent, light applications of water are needed to maintain the growth of crops because of the moderate available water capacity.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and water erosion, maintains or improves tilth, and helps to conserve moisture.
- Irrigation water should be applied at a rate and quantity based on the ability of the soils to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Busher—suited; Tassel—poorly suited
Management measures:
- Overgrazing should be avoided because it depletes the protective plant cover, resulting in the hazards of soil blowing and water erosion.

Windbreaks

Suitability: Busher—suited; Tassel—unsuited
Management measures:
- Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Cultivation needs to be restricted to the tree rows.
- A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.
- Onsite investigation is needed to identify the areas that are best suited to windbreaks.

Dwellings

Suitability: Busher—suited; Tassel—poorly suited
Management measures:
- The soft bedrock generally can be easily excavated for construction of dwellings with basements or buildings that have deep foundations.
- Onsite investigation is needed to identify the areas that are best suited to dwellings.

Septic tank absorption fields

Suitability: Busher—poorly suited; Tassel—unsuited
Management measures:
- Building up or mounding with suitable fill material increases the filtering capacity of the field.
- Onsite investigation is needed to identify the areas that are best suited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Busher—IVe-3, dryland, and IVe-8, irrigated; Tassel—VIs-4, dryland
Windbreak suitability group: Busher—5; Tassel—10
Range site: Busher—Sandy; Tassel—Shallow Limy

Irrigation design group: Busher—8

BxE—Busher-Tassel complex, 9 to 20 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Busher—back slopes and foot slopes; Tassel—summits and shoulders
Slope range: Busher—9 to 20 percent (mainly 12 percent); Tassel—9 to 20 percent (mainly 15 percent)
Major uses: Rangeland

Composition

Busher soil and similar soils: 55 percent (plus or minus 10 percent)
Tassel soil and similar soils: 30 percent (plus or minus 10 percent)
Contrasting inclusions:
- Ashollow soil, 10 percent (plus or minus 10 percent)
- Sarben soil, 3 percent (plus or minus 3 percent)
- Areas of rock outcrop, 2 percent (plus or minus 2 percent)

Typical Profile

Busher

Surface layer:
0 to 10 inches—dark grayish brown, very friable fine sandy loam

Subsoil:
10 to 20 inches—brown and pale brown, very friable fine sandy loam

Substratum:
20 to 44 inches—light gray, calcareous fine sandy loam
44 to 60 inches—very pale brown, calcareous, soft, fine grained sandstone

Tassel

Surface layer:
0 to 6 inches—dark grayish brown, very friable, calcareous fine sandy loam

Substratum:
6 to 9 inches—grayish brown, calcareous fine sandy loam
9 to 60 inches—white, calcareous, soft, fine grained sandstone

Soil Properties and Qualities

Busher

Potential rooting depth: Deep (40 to 60 inches)
Organic matter content: Moderately low (1 to 2 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid
Parent material: Residuum weathered from sandstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Severe

Tassel

Potential rooting depth: Very shallow and shallow (6 to 20 inches)
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: Very low (0 to 3 inches)
Permeability: Moderately rapid
Parent material: Weathered sandstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Severe

Inclusions

Contrasting inclusions:
- Ashollow soils, which do not have a dark surface layer, have free carbonates within a depth of 10 inches, and have sandstone below a depth of 60 inches
- Sarben soils, which do not have a dark surface layer and are more than 60 inches deep
- Areas of rock outcrop, which is sandstone bedrock at the surface

Similar inclusions:
- Soils that have sandstone at a depth of 20 to 40 inches

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Busher—suited; Tassel—poorly suited
Management measures:
- Overgrazing should be avoided because it depletes the protective plant cover, resulting in the hazards of soil blowing and water erosion.

Windbreaks

Suitability: Busher—suited; Tassel—unsuited
Management measures:
• Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.
• Onsite investigation is needed to identify the areas that are best suited to windbreaks.

Dwellings

Suitability: Busher—poorly suited; Tassel—unsuited
Management measures:
• Onsite investigation is needed to identify the areas that are best suited to dwellings.
• The soft bedrock generally can be easily excavated on sites for dwellings with basements or buildings that have deep foundations.
• Dwellings and small commercial buildings need to be properly designed so that they conform to the natural slope of the land, or the site can be graded to an acceptable gradient.

Septic tank absorption fields

Suitability: Busher—poorly suited; Tassel—unsuited
Management measures:
• Onsite investigation is needed to identify suitable areas.
• Building up or mounding with suitable fill material increases the filtering capacity of the field.
• Land shaping and installing the septic tank absorption fields on the contour are generally necessary to ensure that the system operates properly.

Interpretive Groups

Land capability classification: Busher—VIe-5, dryland; Tassel—VIs-4, dryland
Windbreak suitability group: Busher—7; Tassel—10
Range site: Busher—Sandy; Tassel—Shallow Limy

Cw—Crowther loam, 0 to 1 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales
Slope range: 0 to 1 percent (mainly 0.5 percent)
Major use: Hayland

Composition

Crowther soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Wildhorse soil, 5 percent (plus or minus 5 percent)
Marlake soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
2 inches to 0—partly decomposed plant material
0 to 5 inches—gray, very friable, calcareous loam

Subsurface layer:
5 to 18 inches—gray, very friable, calcareous loam

Transitional layer:
18 to 27 inches—gray, very friable, calcareous loam

Substratum:
27 to 35 inches—light gray loamy fine sand
35 to 60 inches—light gray fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Very high (8 to 16 percent)
Drainage class: Poorly drained
Depth to the seasonal high water table: Surface during wet years to a depth of 1.5 feet during dry years
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour) and rapid (6 to 20 inches per hour)
Parent material: Loamy and sandy alluvium
Runoff potential: Very low
Hazard of flooding: Rare
Hazard of water erosion: None
Hazard of soil blowing: Slight
Distinctive property: The surface soil has 15 percent or more calcium carbonate.

Inclusions

Contrasting inclusions:
• Wildhorse soils, which have fine sand that is higher in the profile than that in the Crowther soil, are strongly alkaline, and are slightly higher on the landscape
• Marlake soils, which have water above the surface for most of the year and are in depressions
• Soils that have fine sand within a depth of 20 inches

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be rotated in successive years.

Windbreaks

Suitability: Suited
Management measures:
• The species suitable for planting are those that can tolerate the wetness, and planting should be delayed because of the high water table.
• The weeds and undesirable grasses that compete with the trees and shrubs can be controlled by cultivation between the tree rows when the water table is at its lowest level.

Dwellings

Suitability: Unsuited
Management measures:
• This soil is not suited to dwellings because of the excessive wetness. A suitable alternative site should be selected.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• This soil is not suited to septic tank absorption fields because of the excessive wetness caused by the high water table and the poor filtering capacity. A suitable alternative site should be selected.

Interpretive Groups

Land capability classification: Dryland—Vw-7
Windbreak suitability group: 2D
Range site: Wet Subirrigated

Cx—Crowther loam, wet, 0 to 1 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales
Slope range: 0 to 1 percent (mainly 0.5 percent)
Major use: Hayland

Composition

Crowther soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Wildhorse soil, 5 percent (plus or minus 5 percent)
Marlake soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
3 inches to 0—partly decomposed plant material
0 to 6 inches—grayish brown, friable, calcareous loam

Subsurface layer:
6 to 11 inches—gray, very friable, calcareous loam
11 to 18 inches—gray, friable, calcareous loam

Transitional layer:
18 to 28 inches—gray, friable, calcareous loam
28 to 33 inches—light gray, friable, calcareous loam

Substratum:
33 to 60 inches—grayish brown, calcareous fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Very high (8 to 16 percent)
Drainage class: Very poorly drained
Depth to the seasonal high water table: 0.5 foot above the surface during wet years to a depth of 1.0 foot during dry years
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour) and rapid (6 to 20 inches per hour)
Parent material: Loamy and sandy alluvium
Runoff potential: Very low
Hazard of ponding: Rare
Hazard of water erosion: None
Hazard of soil blowing: Slight
Distinctive property: The upper part of the profile has more than 15 percent calcium carbonate.

Inclusions

Contrasting inclusions:
• Wildhorse soils, which have fine sand that is higher in the profile than that in the Crowther soil, are strongly alkaline, and are slightly higher on the landscape
• Marlake soils, which have water above the surface for most of the year and are in depressions

Similar inclusions:
• Soils that have fine sand at a depth of less than 20 inches

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• In wet years, hay cannot be harvested from some areas of this soil.
• After the ground is frozen, livestock can graze without damaging the meadows. The livestock should be removed in the spring, before the ground thaws.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
Management measures:
• This soil is not suited to dwellings because of the excessive wetness. A suitable alternative site should be selected.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• This soil is not suited to septic tank absorption fields because of the excessive wetness caused by the high water table and the poor filtering capacity. A suitable alternative site should be selected.

Interpretive Groups

Land capability classification: Dryland—Vw-7
Windbreak suitability group: 10
Range site: Wetland

DbB—Dailey loamy fine sand, 0 to 3 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Hummocks and swales
Slope range: 0 to 3 percent (mainly 2 percent)
Major use: Rangeland and cropland

Composition

Dailey soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Jayem soil, 10 percent (plus or minus 10 percent)

Typical Profile

Surface layer:
0 to 5 inches—grayish brown, loose loamy fine sand

Subsurface layer:
5 to 14 inches—dark grayish brown, very friable loamy fine sand

Transitional layer:
14 to 23 inches—grayish brown, loose fine sand

Substratum:
23 to 60 inches—grayish brown and light brownish gray fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Somewhat excessively drained
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Eolian sand
Runoff potential: Low
Hazard of water erosion: None
Hazard of soil blowing: Very severe
Water intake rate: Very high

Inclusions

Contrasting inclusions:
• Jayem soils, which have more silt and clay throughout than the Dailey soil

Similar inclusions:
• Soils that have a dark surface layer of less than 10 inches

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps

to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Frequent, light applications of irrigation water are needed because of the low available water capacity and the potential for the leaching of nutrients, pesticides, and herbicides below the root zone.
• Close-growing crops, such as small grains and alfalfa, help to control soil blowing.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Because seedlings can be damaged by high winds and can be covered by drifting sand, strips of sod or other vegetation between the tree rows are needed to control soil blowing.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the underground water supplies.

Interpretive Groups

Land capability classification: Dryland—IVe-5; irrigated—IVe-11
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 11

DdC—Dankworth loamy sand, 3 to 6 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Foot slopes
Slope range: 3 to 6 percent (mainly 5 percent)
Major use: Rangeland and cropland

Composition

Dankworth soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Bayard soil, 5 percent (plus or minus 5 percent)
Scoville soil, 5 percent (plus or minus 5 percent)
Blueridge soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 6 inches—grayish brown, very friable loamy sand

Transitional layer:
6 to 18 inches—grayish brown, loose sand

Substratum:
18 to 48 inches—pale brown coarse sand
48 to 80 inches—light gray sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Excessively drained
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Very severe
Water intake rate: Very high
Distinctive property: 2 to 15 percent gravel, by volume, at a depth of 10 to 40 inches

Inclusions

Contrasting inclusions:
• Bayard soils, which have more silt and clay in the subsoil than the Dankworth soil and are lower on the landscape
• Scoville soils, which generally do not have gravel in the profile and are lower on the landscape than the Dankworth soil

• Blueridge soils, which have 15 to 35 percent gravel, by volume, at a depth of 10 to 40 inches and are higher on the landscape than the Dankworth soil

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• Frequent, light applications of irrigation water are needed because of the low available water capacity and the potential for the leaching of nutrients below the root zone.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Close-growing crops, such as small grains and alfalfa, help to control soil blowing.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the surface as possible.
• Because seedlings can be damaged by high winds and can be covered by drifting sand, strips of sod or other vegetation between the tree rows are needed to control soil blowing.
• An irrigation system is needed for establishing seedlings during dry periods.
• The weeds and undesirable grasses in the tree rows can be controlled by cultivation and by application of approved herbicides.

Dwellings

Suitability: Suited
Management measures:
• Lawns are difficult to establish and maintain because of the low available water capacity.
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

Interpretive Groups

Land capability classification: Dryland—VIe-5; irrigated—IVe-11
Windbreak suitability group: 7
Range site: Sands

Dw—Duroc loam, 0 to 1 percent slopes

Setting

Landscape: Tablelands
Landform: Swales
Slope range: 0 to 1 percent (mainly 0.5 percent)
Major use: Cropland

Composition

Duroc soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Kuma soil, 5 percent (plus or minus 5 percent)
Lodgepole soil, 5 percent (plus or minus 5 percent)
Keith soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsurface layer:
6 to 14 inches—grayish brown, very friable loam

Subsoil:
14 to 27 inches—dark grayish brown, very friable loam
27 to 32 inches—grayish brown, very friable, calcareous loam
32 to 42 inches—pale brown, very friable, calcareous loam

Substratum:
42 to 60 inches—very pale brown, calcareous loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained

Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Water intake rate: Moderate

Inclusions

Contrasting inclusions:
• Kuma and Keith soils, which have more clay in the subsoil than the Duroc soil and are slightly higher on the landscape
• Lodgepole soils, which have more clay in the subsoil than the Duroc soil, are in depressions, and are subject to occasional ponding

Similar inclusions:
• Soils that have 1 to 3 percent slopes

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface maintains or improves tilth and helps to conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
• Irrigation water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited
Management measures:
• This soil is suited to but seldom used as rangeland or for hay.

Windbreaks

Suitability: Suited
Management measures:
• The weeds and undesirable grasses can be controlled by cultivation and by applying approved herbicides.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited
Management measures:
• The moderate permeability is a limitation on sites for septic tank absorption fields, but increasing the size of the absorption field can generally overcome this limitation.

Interpretive Groups

Land capability classification: Dryland—IIc-1; irrigated—I-6
Windbreak suitability group: 1
Range site: Silty
Irrigation design group: 6

Eh—Els fine sand, calcareous, 0 to 2 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales
Slope range: 0 to 2 percent (mainly 0.5 percent)
Major use: Rangeland and hayland

Composition

Els soil and similar soils: 80 percent (plus or minus 20 percent)
Contrasting inclusions:
Wildhorse soil, 10 percent (plus or minus 10 percent)
Ipage soil, 5 percent (plus or minus 5 percent)
Hoffland soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 7 inches—dark grayish brown, very friable, calcareous fine sand

Transitional layer:
7 to 15 inches—grayish brown, very friable, calcareous fine sand

Substratum:
15 to 60 inches—light brownish gray and light gray, calcareous fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches

Organic matter content: Low to moderate (0.5 to 3.0 percent)
Drainage class: Somewhat poorly drained
Depth to the seasonal high water table: 1.5 feet during wet years to 3.0 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Eolian sand
Runoff potential: Low
Hazard of water erosion: None
Hazard of soil blowing: Very severe in cultivated areas and slight in areas used for native range or hay
Water intake rate: Very high
Distinctive property: Calcium carbonate at a depth of 0 to 5 inches and generally throughout the profile

Inclusions

Contrasting inclusions:
- Wildhorse soils, which are strongly affected by alkalinity and are slightly lower on the landscape than the Els soil
- Hoffland soils, which have more than 15 percent calcium carbonate, a higher seasonal high water table than the Els soil, and are lower on the landscape
- Ipage soils, which have a seasonal high water table at a depth of 3 to 5 feet and are slightly higher on the landscape than the Els soil

Similar inclusions:
- Soils that do not have calcium carbonate in the surface layer

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.
- Close-growing crops, such as small grains and alfalfa, help to control soil blowing.
- Frequent, light applications of irrigation water are needed because of the low available water capacity and the potential for the leaching of nutrients below the root zone.

Rangeland and hay

Suitability: Suited
Management measures:
- Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be rotated in successive years.

Windbreaks

Suitability: Suited
Management measures:
- Tree and shrub species that can withstand the occasional wetness survive and grow well. During wet years, cultivation and planting may be delayed until the soil has begun to dry.
- The pH of the soil affects the selection of trees and shrubs.
- Soil blowing can be controlled by maintaining grass or by planting a cover crop between the tree rows.

Dwellings

Suitability: Poorly suited
Management measures:
- Constructing dwellings and buildings on raised, well compacted fill material helps to overcome the wetness caused by the high water table.
- The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
- Constructing septic tank absorption fields on fill material raises the fields a sufficient distance above the seasonal high water table.
- The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the underground water supplies.

Interpretive Groups

Land capability classification: Dryland—VIe-5; irrigated—IVw-12
Windbreak suitability group: 2S
Range site: Subirrigated
Irrigation design group: 12

EuG—Epping-Rock outcrop complex, 30 to 60 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes (fig. 11)
Position on the landform: Epping—shoulders and back slopes; Rock outcrop—shoulders
Slope range: Epping—30 to 60 percent (mainly 40 percent)
Major uses: Rangeland

Figure 11.—An area of Epping-Rock outcrop complex, 30 to 60 percent slopes, in the background. Broadwater loamy sand, channeled, 0 to 2 percent slopes, is in the foreground.

Composition

Epping soil and similar soils: 60 percent (plus or minus 5 percent)
Areas of Rock outcrop: 20 percent (plus or minus 10 percent)
Contrasting inclusions:
Tassel soils, 10 percent (plus or minus 10 percent)
Ashollow soils, 5 percent (plus or minus 5 percent)
Mitchell soils, 5 percent (plus or minus 5 percent)

Typical Profile

Epping soil

Surface layer:
0 to 3 inches—light brownish gray, very friable, calcareous very fine sandy loam

Transitional layer:
3 to 9 inches—light brownish gray, very friable, calcareous very fine sandy loam

Substratum:
9 to 16 inches—very pale brown, calcareous very fine sandy loam
16 to 60 inches—very pale brown siltstone

Soil Properties and Qualities

Epping

Depth to paralithic contact: Shallow, 10 to 20 inches (mainly 16 inches)
Potential rooting depth: 10 to 20 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: Very low (0 to 3 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Residuum weathered from siltstone
Runoff potential: Very high
Hazard of water erosion: Severe
Hazard of soil blowing: Severe

Inclusions

Contrasting inclusions:
• Mitchell and Ashollow soils, which are very deep to siltstone or sandstone and are generally lower on the landscape than the Epping soil
• Tassel soils, which are shallow to sandstone and are generally higher on the landscape than the Epping soil

Similar inclusions:
- Soils that are 20 to 40 inches deep to siltstone

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Epping—suited; Rock outcrop—unsuited
Management measures:
- Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
Management measures:
- Alternative sites should be considered because of the excessive slope and the shallow depth to bedrock.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
- Alternative sites should be considered because of the excessive slope and the shallow depth to bedrock.

Interpretive Groups

Land capability classification: Epping—VIIs-4, dryland; Rock outcrop—VIIIs-8, dryland
Windbreak suitability group: 10
Range site: Epping—Shallow Limy; Rock outcrop—none

Fu—Fluvaquents, sandy, 0 to 1 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 1 percent (mainly 0 percent)
Major use: Wildlife habitat

Composition

Fluvaquents, sandy, and similar soils: 95 percent (plus or minus 5 percent)

Contrasting inclusions:
Gothenburg soil, 3 percent (plus or minus 3 percent)
McCulligan soil, 2 percent (plus or minus 2 percent)

Typical Profile

Surface layer:
4 inches to 0—dark grayish brown mucky peat
0 to 6 inches—dark grayish brown, very friable peaty sand

Substratum:
6 to 16 inches—gray sand
16 to 60 inches—light gray coarse sand and gravelly coarse sand in the lower part

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderate and high (2 to 8 percent)
Drainage class: Very poorly drained
Depth to the seasonal high water table: 2 feet above the surface during wet years to a depth of 1 foot during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Very low
Hazard of flooding: Frequent
Hazard of ponding: Frequent
Hazard of water erosion: None
Hazard of soil blowing: None

Inclusions

Contrasting inclusions:
- Gothenburg and McCulligan soils, which have a lower seasonal high water table than the Fluvaquents and are slightly higher on the landform

Similar inclusions:
- Soils that do not have an organic surface layer

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Unsuited

Management measures:
• This soil is unsuited to rangeland or hay because the water table is above the surface much of the year, and rushes and cattails are the dominant vegetation. This soil, however, provides wildlife habitat.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
Management measures:
• Alternative sites should be considered because of the ponding.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• Alternative sites should be considered because of the ponding.

Interpretive Groups

Land capability classification: Dryland—VIIIw-7
Windbreak suitability group: 10
Range site: None

Gt—Gothenburg loamy sand, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 2 percent (mainly 1 percent)
Major use: Rangeland and wildlife habitat

Composition

Gothenburg soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
McCuligan soils, 5 percent (plus or minus 5 percent)
Lewellen soils, 3 percent (plus or minus 3 percent)
Fluvaquents, 2 percent (plus or minus 2 percent)

Typical Profile

Surface layer:
0 to 5 inches—grayish brown, very friable, calcareous loamy sand

Substratum:
5 to 14 inches—pale brown, calcareous sand
14 to 60 inches—very pale brown coarse sand

Soil Properties and Qualities

Depth to sand and gravel: 6 to 20 inches (mainly 14 inches)
Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Poorly drained
Depth to the seasonal high water table: Surface during wet years to a depth of 1.5 feet during dry years
Available water capacity: Low (0 to 3 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy and gravelly alluvium
Runoff potential: Low
Hazard of flooding: Frequent
Hazard of water erosion: None
Hazard of soil blowing: Very severe

Inclusions

Contrasting inclusions:
• McCuligan soils, which have a surface layer of dark loam and are higher on the landscape than the Gothenburg soil
• Lewellen soils, which are moderately deep to sand, are strongly affected by salinity and alkalinity, and are higher on the landscape than the Gothenburg soil
• Areas of Fluvaquents, which have water above the surface for most of the year and are slightly lower on the landscape than the Gothenburg soil

Similar inclusions:
• Soils that have a surface layer of sand or coarse sand

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Unsuited
Management measures:
• The deposition of sediment by floodwater can partly cover the grasses and thus reduce their vigor and impair their growth.
• Most areas are used for trees, shrubs, and plants that provide little value for forage for livestock.
• This soil provides good habitat for many wildlife species.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the flooding and the wetness caused by the high water table.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the flooding, the wetness caused by the high water table, and the poor filtering capacity of the soil.

Interpretive Groups

Land capability classification: Dryland—VIIw-7
Windbreak suitability group: 10
Range site: None

Hh—Hoffland fine sandy loam, 0 to 1 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales
Slope range: 0 to 1 percent (mainly 0 percent)
Major use: Hayland

Composition

Hoffland soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Wildhorse soil, 5 percent (plus or minus 5 percent)
Crowther soil, 5 percent (plus or minus 5 percent)
Marlake soil, 3 percent (plus or minus 3 percent)
Els soil, 2 percent (plus or minus 2 percent)

Typical Profile

Surface layer:
1 inch to 0—partly decomposed plant material
0 to 4 inches—dark gray, very friable, calcareous fine sandy loam

Subsurface layer:
4 to 10 inches—dark gray, very friable, calcareous fine sandy loam

Substratum:
10 to 20 inches—grayish brown, calcareous fine sand
20 to 60 inches—dark grayish brown fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: High and very high (4 to 12 percent)
Drainage class: Poorly drained
Depth to the seasonal high water table: Surface during wet years to a depth of 1.5 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Very low
Hazard of flooding: Rare
Hazard of water erosion: None
Hazard of soil blowing: Slight
Distinctive property: More than 15 percent calcium carbonate in 6 inches or more of the profile

Inclusions

Contrasting inclusions:
• Crowther soils, which have more clay and silt in the upper part of the profile than the Hoffland soil and are on similar landscapes
• Wildhorse soils, which are somewhat poorly drained, are higher on the landscape than the Hoffland soil, and are strongly affected by alkalinity
• Els soils, which are somewhat poorly drained and are higher on the landscape than the Hoffland soil
• Marlake soils, which are in depressions and have water above the surface for most of the year

Similar inclusions:
• Soils that have less than 15 percent calcium carbonate

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be rotated in successive years.
• In wet years hay cannot be harvested from some areas of this soil.

Windbreaks

Suitability: Suited
Management measures:
• Tree and shrub species that can withstand the wetness from the seasonal high water table can survive and grow well. During wet years and because of the high water table, cultivation and planting may be delayed until the soil has begun to dry. Planting trees and shrubs by hand in the spring may be necessary because of the wetness.
• The pH of the soil affects the selection of trees and shrubs.
• The weeds and undesirable grasses that compete with the trees and shrubs can be controlled by cultivation between the tree rows when the water table is at its lowest level.

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the wetness caused by the seasonal high water table.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the excessive wetness and the poor filtering capacity of the soil.

Interpretive Groups

Land capability classification: Dryland—Vw-7
Windbreak suitability group: 2D
Range site: Wet Subirrigated

Ho—Hoffland fine sandy loam, wet, 0 to 1 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales
Slope range: 0 to 1 percent (mainly 0 percent)
Major use: Hayland

Composition

Hoffland soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Crowther soil, 5 percent (plus or minus 5 percent)
Wildhorse soil, 5 percent (plus or minus 5 percent)
Marlake soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
1 inch to 0—partly decomposed plant material
0 to 4 inches—grayish brown, friable, calcareous fine sandy loam

Subsurface layer:
4 to 13 inches—gray, friable, calcareous fine sandy loam

Substratum:
13 to 42 inches—light brownish gray fine sand
42 to 60 inches—dark gray fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: High and very high (4 to 12 percent)
Drainage class: Very poorly drained
Depth to the seasonal high water table: 0.5 foot above the surface during wet years to a depth of 1.0 foot during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Very low
Hazard of flooding: Rare
Hazard of water erosion: None
Hazard of soil blowing: Slight
Distinctive property: More than 15 percent calcium carbonate in 6 inches or more of the profile

Inclusions

Contrasting inclusions:
• Crowther soils, which have more clay and silt in the upper part of the profile than the Hoffland soil and are on similar landscapes
• Wildhorse soils, which are somewhat poorly drained, are strongly affected by alkalinity, and are higher on the landscape than the Hoffland soil
• Marlake soils, which are lower in depressions than the Hoffland soil and have water above the surface for most of the year

Similar inclusions:
• Soils that have less than 15 percent calcium carbonate

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• In wet years hay cannot be harvested from some areas of this soil.
• After the ground is frozen, livestock can graze without damaging the meadows. The livestock should be removed in the spring, before the ground thaws.
• Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be rotated in successive years.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the wetness caused by the seasonal high water table.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the excessive wetness and the poor filtering capacity of the soil.

Interpretive Groups

Land capability classification: Dryland—Vw-7
Windbreak suitability group: 10
Range site: Wetland

IsB—Ipage fine sand, calcareous, 0 to 3 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Hummocks
Slope range: 0 to 3 percent (mainly 2 percent)
Major use: Rangeland and hayland

Composition

Ipage soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Wildhorse soil, 5 percent (plus or minus 5 percent)
Els soil, 5 percent (plus or minus 5 percent)
Dailey soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 5 inches—grayish brown, very friable, calcareous fine sand

Transitional layer:
5 to 16 inches—light brownish gray, loose, calcareous fine sand

Substratum:
16 to 60 inches—pale brown, calcareous sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Moderately well drained
Depth to the seasonal high water table: 3 feet during wet years to 5 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Eolian sand
Runoff potential: Low
Hazard of water erosion: None
Hazard of soil blowing: Very severe
Water intake rate: Very high

Inclusions

Contrasting inclusions:
• Wildhorse soils, which are somewhat poorly drained, are strongly affected by alkalinity, and are slightly lower on the landscape than the Ipage soil
• Els soils, which are somewhat poorly drained and are slightly lower on the landscape than the Ipage soil
• Dailey soils, which are somewhat excessively drained and are on landscapes similar to those of the Ipage soil

Similar inclusions:
• Soils that do not have free calcium carbonate

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.

• Close-growing crops, such as small grains and alfalfa, help to control soil blowing.
• Frequent, light applications of irrigation water are needed because of the low available water capacity and the potential for the leaching of nutrients below the root zone.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• A low supply of moisture and soil blowing are the main concerns that affect the establishment of trees and shrubs. Because this soil is so loose, the trees should be planted in shallow furrows with as little disturbance of the surface as possible.
• Because young seedlings can be damaged by high winds and can be covered by drifting sand, maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings during periods of low rainfall.

Dwellings

Suitability: Suited
Management measures:
• Lawns are difficult to establish and maintain because of the low available water capacity.
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

Interpretive Groups

Land capability classification: Dryland—VIe-5; irrigated—IVe-12
Windbreak suitability group: 7
Range site: Sandy Lowland
Irrigation design group: 12

Ja—Jankosh loam, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 2 percent (mainly 0.5 percent)
Major use: Rangeland and hayland

Composition

Jankosh soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Lewellen soil, 5 percent (plus or minus 5 percent)
McCuligan soil, 5 percent (plus or minus 5 percent)
Rushcreek soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 2 inches—gray, friable, calcareous loam

Subsurface layer:
2 to 4 inches—light brownish gray, friable, calcareous loam

Subsoil:
4 to 14 inches—grayish brown, firm, calcareous loam
14 to 18 inches—pale brown, firm, calcareous very fine sandy loam
18 to 33 inches—very pale brown, friable, calcareous very fine sandy loam

Substratum:
33 to 60 inches—very pale brown gravelly coarse sand

Soil Properties and Qualities

Depth to sand and gravel: Moderately deep, 20 to 40 inches
Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Somewhat poorly drained
Depth to the seasonal high water table: 1.5 feet during wet years to 3.0 feet during dry years
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour) and very rapid (more than 20 inches per hour)
Parent material: Alluvium
Runoff potential: Low
Hazard of flooding: Rare
Hazard of water erosion: None

Hazard of soil blowing: Moderate
Distinctive property: Strongly affected by alkalinity and salinity

Inclusions

Contrasting inclusions:
• Lewellen soils, which have more sand in the upper part of the profile than the Jankosh soil
• McCuligan soils, which are shallow to gravelly coarse sand, have a higher seasonal high water table than the Jankosh soil, and are lower on the landscape
• Rushcreek soils, which are moderately affected by alkalinity and are slightly higher on the landscape than the Jankosh soil

Similar inclusions:
• Soils that are more than 40 inches deep to sand and gravel

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing or grazing and haying when the soil is wet results in compaction and poor tilth.
• Production is limited mainly by the strong alkalinity.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Poorly suited
Management measures:
• Constructing dwellings and buildings on raised, well compacted fill material helps to overcome the wetness caused by the high water table.
• The strong alkalinity could adversely affect the establishment and maintenance of lawns and trees and shrubs for ornamental planting.
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the wetness and the poor filtering capacity of the soil.

Interpretive Groups

Land capability classification: Dryland—VIs-1
Windbreak suitability group: 10
Range site: Saline Subirrigated

JeB—Jayem loamy fine sand, 0 to 3 percent slopes

Setting

Landscape: Tablelands
Landform: Plains
Slope range: 0 to 3 percent (mainly 2 percent)
Major use: Cropland

Composition

Jayem soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Dailey soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 7 inches—brown, loose loamy fine sand

Subsurface layer:
7 to 17 inches—dark grayish brown, very friable loamy fine sand

Subsoil:
17 to 37 inches—grayish brown, very friable fine sandy loam

Substratum:
37 to 60 inches—pale brown fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Loamy and sandy eolian material
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Very severe
Water intake rate: High

Inclusions

Contrasting inclusions:
• Dailey soils, which have more sand throughout the profile than the Jayem soil and are on similar landscapes

Similar inclusions:
- Soils that have a dark layer that is more than 20 inches thick
- Soils that have a dark layer that is less than 10 inches thick
- Soils that have a surface layer of fine sandy loam

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and suited to sprinkler irrigation systems
Management measures:
- Frequent, light applications of irrigation water are needed because of the moderate available water capacity and the potential for the leaching of nutrients below the root zone.
- Land leveling is generally needed to establish a suitable grade for a gravity irrigation system.
- A gravity irrigation system may require a short length of run because of the high water intake rate of this soil.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Windbreaks

Suitability: Suited
Management measures:
- Competition for moisture from grasses and weeds and the hazard of soil blowing are the main concerns that affect the establishment of trees and shrubs.
- Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
- A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Suited
Management measures:
- The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IVe-5; irrigated—IIIe-10
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 10

JeC—Jayem loamy fine sand, 3 to 6 percent slopes

Setting

Landscape: Tablelands
Landform: Hillslopes
Slope range: 3 to 6 percent (mainly 5 percent)
Major use: Cropland

Composition

Jayem soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Dailey soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 5 inches—grayish brown, loose loamy fine sand

Subsurface layer:
5 to 10 inches—dark grayish brown, loose loamy fine sand

Subsoil:
10 to 18 inches—grayish brown, very friable fine sandy loam

Substratum:
18 to 27 inches—light brownish gray fine sandy loam
27 to 40 inches—pale brown fine sandy loam
40 to 60 inches—light gray, calcareous loamy sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Loamy and sandy eolian material
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Very severe
Water intake rate: High

Inclusions

Contrasting inclusions:
• Dailey soils, which have more sand throughout the profile than the Jayem soil

Similar inclusions:
• Soils that have a dark layer that is less than 10 inches thick
• Soils that have a surface layer of fine sandy loam

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Frequent, light applications of irrigation water are needed because of the moderate available water capacity and the potential for the leaching of nutrients below the root zone.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Windbreaks

Suitability: Suited
• Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IVe-5; irrigated—IVe-10
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 10

Jg—Jayem fine sandy loam, 0 to 2 percent slopes

Setting

Landscape: Tablelands
Landform: Plains
Slope range: 0 to 2 percent (mainly 1 percent)
Major use: Cropland

Composition

Jayem soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Dailey soil, 5 percent (plus or minus 5 percent)
Keith soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 6 inches—grayish brown, very friable fine sandy loam

Subsurface layer:
6 to 9 inches—dark grayish brown, very friable fine sandy loam

Subsoil:
9 to 22 inches—brown, very friable fine sandy loam

Substratum:
22 to 50 inches—pale brown fine sandy loam
50 to 60 inches—very pale brown, calcareous fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Loamy and sandy eolian material
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Water intake rate: Moderately high

Inclusions

Contrasting inclusions:
• Dailey soils, which have more sand throughout the profile than the Jayem soil and are on similar landscapes
• Keith soils, which have more clay throughout the profile than the Jayem soil and are on similar landscapes

Similar inclusions:
• Soils that have a dark layer that is more than 20 inches thick
• Soils that have a surface layer of loamy fine sand

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Land leveling is needed to establish a suitable grade for a gravity irrigation system.
• Irrigation water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IIIe-3; irrigated—IIe-8
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 8

JgC—Jayem fine sandy loam, 2 to 6 percent slopes

Setting

Landscape: Tablelands
Landform: Hillslopes
Slope range: 2 to 6 percent (mainly 5 percent)
Major use: Cropland

Composition

Jayem soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Dailey soil, 5 percent (plus or minus 5 percent)
Keith soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 5 inches—grayish brown, very friable fine sandy loam

Subsurface layer:
5 to 11 inches—dark grayish brown, very friable fine sandy loam

Subsoil:
11 to 18 inches—brown, very friable fine sandy loam

Substratum:
18 to 35 inches—pale brown fine sandy loam
35 to 60 inches—light yellowish brown fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Loamy and sandy eolian material
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Water intake rate: High

Inclusions

Contrasting inclusions:
• Dailey soils, which have more sand throughout the profile than the Jayem soil and are on similar landscapes
• Keith soils, which have more clay throughout the profile than the Jayem soil and are on similar landscapes

Similar inclusions:
• Soils that have a surface layer of loamy fine sand

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips or with fallow and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and suited to sprinkler irrigation systems
Management measures:
• Land leveling may be necessary to establish a suitable grade for a gravity irrigation system.
• Frequent, light applications of irrigation water are needed because of the moderate available water capacity and the potential for the leaching of nutrients, pesticides, and herbicides below the root zone.
• If a sprinkler irrigation system is used in areas where the slope is long and uniform enough to allow the installation of terraces, the use of terraces can help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the

contour on sloping soils help to control water erosion and reduce the rate of runoff.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IVe-3; irrigated—IIIe-8
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 8

KeB—Keith loam, 1 to 3 percent slopes

Setting

Landscape: Tablelands
Landform: Plains
Slope range: 1 to 3 percent (mainly 2 percent)
Major use: Cropland

Composition

Keith soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Alliance soil, 5 percent (plus or minus 5 percent)
Duroc soil, 3 percent (plus or minus 3 percent)
Lodgepole soil, 2 percent (plus or minus 2 percent)

Typical Profile

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

Subsurface layer:
6 to 13 inches—dark grayish brown, very friable loam

Subsoil:
13 to 22 inches—brown, friable silty clay loam
22 to 31 inches—light brownish gray, friable silt loam
31 to 48 inches—pale brown, very friable, calcareous silt loam

Substratum:
48 to 60 inches—pale brown, calcareous very fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: Moderately low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Water intake rate: Moderately low
Distinctive property: This soil has more clay in the subsoil.

Inclusions

Contrasting inclusions:
• Alliance soils, which have soft, weathered sandstone at a depth of 40 to 60 inches
• Duroc soils, which are dark to a depth of more than 20 inches and are lower on the landscape than the Keith soil
• Lodgepole soils, which have more clay in the subsoil than the Keith soil, are subject to occasional ponding, and are in depressions

Similar inclusions:
- Soils that have a surface layer of silt loam
- Kuma soils, which are dark to a depth of more than 20 inches

Use and Management

Dryland crops

Suitability: Suited
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.
- Terraces on long slopes help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems or sprinkler irrigation systems
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.
- Land leveling can be used to establish a suitable grade for a gravity irrigation system. Severe cuts during land leveling could expose the subsoil and reduce the potential productivity of crops.
- If a sprinkler irrigation system is used, terraces on long slopes help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Irrigation water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited
Management measures:
- This soil is suited to but seldom used as rangeland or for hay.

Windbreaks

Suitability: Suited
Management measures:
- The survival and growth rates of adapted species are good.
- A drip irrigation system can provide supplemental moisture during dry periods.
- The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicides.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited
Management measures:
- Increasing the size of the absorption field can generally overcome the restricted permeability of the soil.

Interpretive Groups

Land capability classification: Dryland—IIe-1; irrigated—IIe-4
Windbreak suitability group: 3
Range site: Silty
Irrigation design group: 4

KeC—Keith loam, 3 to 6 percent slopes

Setting

Landscape: Tablelands
Landform: Hillslopes
Position on the landform: Summits, shoulders, and back slopes
Slope range: 3 to 6 percent (mainly 4 percent)
Major use: Cropland

Composition

Keith soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Alliance soil, 5 percent (plus or minus 5 percent)
Sidney soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsoil:
7 to 14 inches—brown, friable silty clay loam
14 to 24 inches—grayish brown, friable silt loam
24 to 28 inches—light brownish gray, very friable loam

Substratum:
28 to 60 inches—very pale brown, calcareous loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)

Figure 12.—Terraces on Keith loam, 3 to 6 percent slopes, help keep precipitation on the soil and control water erosion.

Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Water intake rate: Moderately low
Distinctive property: This soil has more clay in the subsoil.

Inclusions

Contrasting inclusions:
- Alliance soils, which have soft, weathered sandstone at a depth of 40 to 60 inches
- Sidney soils, which have more sand and less clay than the Keith soil and are on similar landscapes

Similar inclusions:
- Soils that are dark above a depth of 7 inches

Use and Management

Dryland crops

Suitability: Suited
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture (fig. 12).
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and suited to sprinkler irrigation systems
Management measures:
• A sprinkler irrigation system is best suited to this soil because extensive land leveling or bench leveling would be needed for a gravity irrigation system. Deep cuts could expose the subsoil and reduce the potential productivity of crops.
• Irrigation water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.
• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

Windbreaks

Suitability: Suited
Management measures:
• The survival and growth of adapted species are good.
• Planting trees on the contour and terracing help to control water erosion.
• A drip irrigation system can provide supplemental moisture during dry periods.
• The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicides.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited
Management measures:
• Increasing the size of the absorption field can generally overcome the restricted permeability of the soil.

Interpretive Groups

Land capability classification: Dryland—IIIe-1; irrigated—IIIe-4
Windbreak suitability group: 3
Range site: Silty
Irrigation design group: 4

Ku—Kuma loam, 0 to 1 percent slopes

Setting

Landscape: Tablelands
Landform: Plains
Slope range: 0 to 1 percent (mainly 0 percent)
Major use: Cropland

Composition

Kuma soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Lodgepole soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Transitional layer:
7 to 17 inches—dark grayish brown, friable loam

Subsoil:
17 to 24 inches—grayish brown, friable loam
24 to 37 inches—dark grayish brown, friable loam
37 to 44 inches—pale brown, friable, calcareous loam

Substratum:
44 to 60 inches—very pale brown, calcareous loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderate (2 to 4 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Water intake rate: Moderately low

Distinctive property: The subsoil formed in a buried, dark surface layer.

Inclusions

Contrasting inclusions:
• Lodgepole soils, which have more clay in the subsoil than the Kuma soil, are subject to occasional ponding, and are in depressions

Similar inclusions:
• Keith soils, which have a dark layer that is less than 20 inches thick and are on landscapes similar to those of the Kuma soil

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface maintains or improves tilth and helps to conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems and sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface maintains or improves tilth and helps to conserve moisture.
• Irrigation water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited
Management measures:
• This soil is suited to but seldom used as rangeland and for hay.

Windbreaks

Suitability: Suited
Management measures:
• The survival and growth rates of adapted species are good.
• A drip irrigation system can provide supplemental moisture during dry periods.
• The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicides.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited
Management measures:
• Increasing the size of the absorption field can generally overcome the restricted permeability of the soil.

Interpretive Groups

Land capability classification: Dryland—IIc-1; irrigated—I-4
Windbreak suitability group: 3
Range site: Silty
Irrigation design group: 4

La—Lemoyne sand, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 2 percent (mainly 1 percent)
Major use: Cropland

Composition

Lemoyne soils and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Rushcreek soil, 5 percent (plus or minus 5 percent)
Lewellen soil, 5 percent (plus or minus 5 percent)
Scoville soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 6 inches—dark grayish brown, loose sand

Subsurface layer:
6 to 13 inches—grayish brown, loose, calcareous sand
13 to 18 inches—dark grayish brown, very friable, calcareous loamy sand

Subsoil:
18 to 22 inches—brown, firm, calcareous clay loam
22 to 36 inches—pale brown, friable, calcareous loam
36 to 54 inches—white, firm, calcareous clay loam

Substratum:
54 to 60 inches—very pale brown, calcareous coarse sand

Soil Properties and Qualities

Depth to sand and gravel: Deep, 40 to 60 inches

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Moderately well drained
Depth to the seasonal high water table: 3 feet during wet years to 6 feet during dry years
Available water capacity: Moderate (6 to 9 inches)
Permeability: Rapid (6 to 20 inches per hour) and moderately slow (0.2 to 0.6 inch per hour)
Parent material: Eolian sand over alluvium
Runoff potential: Low
Hazard of flooding: Rare
Hazard of water erosion: Slight
Hazard of soil blowing: Very severe
Water intake rate: Very high
Distinctive property: This soil is slightly affected to strongly affected by alkalinity and salinity in the subsoil.

Inclusions

Contrasting inclusions:
- Rushcreek soils, which are not sandy in the upper part of the profile and are on landscapes similar to those of the Lemoyne soil
- Lewellen soils, which are strongly affected by salinity and alkalinity, have a higher seasonal high water table than the Lemoyne soil, and are slightly lower on the landscape
- Scoville soils, which are sandy throughout the profile and are on landscapes similar to those of the Lemoyne soil

Similar inclusions:
- Soils that have a surface layer of loamy sand

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
- Frequent, light applications of irrigation water are needed because of the moderate available water capacity and the potential for the leaching of nutrients below the root zone.
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency of water use, and controls pests.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
- Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
- A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Poorly suited
Management measures:
- The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.
- Constructing dwellings with basements on raised, well compacted fill material helps to prevent the damage caused by floodwater and the wetness caused by the seasonal high water table.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
- Constructing septic tank absorption fields on fill material raises the fields a sufficient distance above the seasonal high water table.
- Increasing the size of the absorption field can overcome the restricted permeability of the subsoil.

Interpretive Groups

Land capability classification: Dryland—VIe-5; irrigated—IVe-12
Windbreak suitability group: 5
Range site: Sandy Lowland
Irrigation design group: 12

Lb—Lewellen loam, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 2 percent (mainly 1 percent)

Major use: Rangeland and hayland

Composition

Lewellen soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Rushcreek soil, 5 percent (plus or minus 5 percent)
Jankosh soil, 5 percent (plus or minus 5 percent)
McCuligan soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 4 inches—dark grayish brown, very friable, calcareous loam

Subsurface layer:
4 to 8 inches—grayish brown, very friable, calcareous loam

Transitional layer:
8 to 12 inches—light brownish gray, very friable, calcareous very fine sandy loam

Substratum:
12 to 29 inches—stratified light yellowish brown and very pale brown fine sand
29 to 80 inches—very pale brown coarse sand

Soil Properties and Qualities

Depth to coarse sand: Moderately deep, 20 to 40 inches
Potential rooting depth: Very deep, more than 60 inches
Organic matter content: High (4 to 8 percent)
Drainage class: Somewhat poorly drained
Depth to the seasonal high water table: 1.5 feet during wet years to 3.0 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour) and rapid (6 to 20 inches per hour)
Parent material: Alluvium
Runoff potential: Low
Hazard of flooding: Rare
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Distinctive property: Strongly affected by alkalinity and salinity

Inclusions

Contrasting inclusions:
• Rushcreek soils, which are finer textured than the Lewellen soil, are moderately affected by salinity and alkalinity, and are slightly higher on the landscape
• Jankosh soils, which are finer textured than the Lewellen soil and are slightly higher on the landscape
• McCuligan soils, which are 10 to 20 inches deep to gravelly coarse sand and are lower on the landscape than the Lewellen soil

Similar inclusions:
• Soils that are slightly affected or moderately affected by salinity and alkalinity

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Overgrazing should be avoided because it results in poor plant vigor, a decrease in the desirable plant species, and an increase in the undesirable, less productive species.

Windbreaks

Suitability: Poorly suited
Management measures:
• The species selected for planting should tolerate the salinity and alkalinity of the soil.
• Planting may be delayed because of the wetness.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.
• The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by careful use of approved herbicides.

Dwellings

Suitability: Poorly suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.
• Constructing dwellings with basements on raised, well compacted fill material helps to prevent the damage caused by floodwater and the wetness caused by the seasonal high water table.

Septic tank absorption fields

Suitability: Unsuited

Management measures:
• Constructing septic tank absorption fields on fill material raises the fields a sufficient distance above the seasonal high water table.
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

Interpretive Groups

Land capability classification: Dryland—VIs-1
Windbreak suitability group: 9S
Range site: Saline Subirrigated

Lc—Lewellen-McCuligan complex, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 2 percent (mainly 0.5 percent)
Major uses: Rangeland or hayland

Composition

Lewellen soil and similar soils: 50 percent (plus or minus 5 percent)
McCuligan soil and similar soils: 40 percent (plus or minus 5 percent)
Contrasting inclusions:
Gothenburg soil, 5 percent (plus or minus 5 percent)
Jankosh soil, 3 percent (plus or minus 3 percent)
Fluvaquents, 2 percent (plus or minus 2 percent)

Typical Profile

Lewellen

Surface layer:
0 to 4 inches—dark gray, very friable, calcareous loam

Subsurface layer:
4 to 11 inches—gray, very friable, calcareous fine sandy loam

Transitional layer:
11 to 14 inches—light gray, very friable, calcareous loamy fine sand

Substratum:
14 to 30 inches—very pale brown, stratified fine sand and loamy fine sand
30 to 80 inches—very pale brown, stratified coarse sand

McCuligan

Surface layer:
0 to 7 inches—gray, very friable, calcareous loam

Transitional layer:
7 to 12 inches—stratified grayish brown, friable, calcareous loam and dark grayish brown, friable, calcareous very fine sandy loam

Substratum:
12 to 18 inches—light gray sand
18 to 80 inches—light gray gravelly coarse sand

Soil Properties and Qualities

Lewellen

Depth to coarse sand: 20 to 40 inches (mainly 30 inches)
Potential rooting depth: Very deep (more than 60 inches)
Organic matter content: High (4 to 8 percent)
Drainage class: Somewhat poorly drained
Depth to the seasonal high water table: 1.5 to 3.0 feet
Available water capacity: Low (3 to 6 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour) and rapid (6 to 20 inches per hour)
Parent material: Alluvium
Runoff potential: Low
Hazard of flooding: Rare
Hazard of water erosion: None
Hazard of soil blowing: Severe
Distinctive property: Strongly affected by alkalinity and salinity

McCuligan

Depth to coarse sand: 10 to 20 inches (mainly 18 inches)
Potential rooting depth: Very deep (more than 60 inches)
Organic matter content: High (4 to 8 percent)
Drainage class: Poorly drained
Depth to the seasonal high water table: Surface during wet years to a depth of 1.5 feet during dry years
Available water capacity: Low
Permeability: Moderate (0.6 inch to 2.0 inches per hour) and very rapid (more than 20 inches per hour)
Parent material: Loamy and sandy alluvium
Runoff potential: Low
Hazard of flooding: Occasional
Hazard of water erosion: None
Hazard of soil blowing: Moderate

Distinctive property: Moderately affected by salinity and alkalinity

Inclusions

Contrasting inclusions:
- Gothenburg soils, which are 6 to 20 inches to coarse sand, are lower on the landscape than the Lewellen soil, and have more sand in the surface than the McCuligan soil
- Jankosh soils, which are slightly higher on the landscape than the Lewellen and McCuligan soils
- Areas of Fluvaquents, which have free water above or at the surface most of the year and are slightly lower on the landscape than the Lewellen and McCuligan soils

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
- In wet years hay cannot be harvested from some areas of this complex, or haying should be delayed to avoid wet conditions.
- Mowing large meadows at different times in successive years improves plant vigor and increases the desirable plant species.

Windbreaks

Suitability: Poorly suited
Management measures:
- Only the trees and shrubs that can withstand wetness and tolerate the salinity and alkalinity of these soils should be selected for planting. Because of the excessive wetness, planting may be delayed until the soils have begun to dry, or planting by hand may be necessary.

Dwellings

Suitability: Unsuited
Management measures:
- A suitable alternative site should be selected because of the wetness and the hazard of flooding on both soils.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
- A suitable alternative site should be selected because of the wetness, the poor filtering capacity, and the hazard of flooding on both soils.

Interpretive Groups

Land capability classification: Lewellen—VIs-1, dryland, and McCuligan—Vw-7, dryland
Windbreak suitability group: Lewellen—9S; McCuligan—2D
Range site: Lewellen—Saline Subirrigated; McCuligan—Wet Subirrigated

Lf—Lodgepole silt loam, 0 to 1 percent slopes

Setting

Landscape: Tablelands
Landform: Depressions
Slope range: 0 to 1 percent (mainly 0 percent)
Major use: Cropland

Composition

Lodgepole soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Duroc soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsoil:
5 to 14 inches—gray, firm silty clay
14 to 26 inches—dark grayish brown, firm silty clay
26 to 32 inches—brown, firm silty clay loam

Substratum:
32 to 48 inches—pale brown loam
48 to 60 inches—light gray, calcareous loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderate (2 to 4 percent)
Drainage class: Somewhat poorly drained
Depth to the perched seasonal high water table: 0.5 foot above the surface during wet years to a depth of 1.0 foot during dry years
Available water capacity: High (more than 9 inches)
Permeability: Very slow (less than 0.06 inch per hour)
Parent material: Loess
Runoff potential: Very low
Hazard of ponding: Occasional
Hazard of water erosion: None
Hazard of soil blowing: Moderate

Water intake rate: Low
Distinctive property: A high content of clay in the subsoil

Inclusions

Contrasting inclusions:
• Duroc soils, which contain less clay in the subsoil than the Lodgepole soil, are better drained, and are slightly higher on the landscape

Similar inclusions:
• Soils that have a surface layer of silty clay loam
• Soils that have weakly cemented sandstone below a depth of 60 inches

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• In some areas applying a system of conservation tillage to the surrounding sloping soils reduces the rate of runoff and the hazard of ponding.
• Tillage, planting, and harvesting can be delayed because of the excessive wetness or ponding.

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• Adjusting the application rate to the low rate of water intake allows the soil to absorb most of the water and helps to prevent ponding.
• In some areas applying a system of conservation tillage to the surrounding sloping soils reduces the rate of runoff and the hazard of ponding.
• Tillage, planting, and harvesting can be delayed because of the excessive wetness or ponding.

Rangeland and hay

Suitability: Poorly suited
Management measures:
• The excessive wetness is a limitation affecting suitable pasture grasses and legumes.

Windbreaks

Suitability: Poorly suited
• Only the trees and shrubs that can withstand the occasional ponding should be selected for planting. Tilling the soil and planting the trees in the spring may be delayed until the soil has begun to dry.
• The weeds and undesirable grasses that compete for moisture can be controlled by timely cultivation with conventional equipment.

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the ponding.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the ponding and the very slow permeability.

Interpretive Groups

Land capability classification: Dryland—IIIw-2; irrigated—IVw-2
Windbreak suitability group: 2W
Range site: Clayey Overflow
Irrigation design group: 2

Ma—Marlake fine sandy loam, 0 to 1 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Depressions
Slope range: 0 to 1 percent (mainly 0 percent)
Major use: Wildlife habitat

Composition

Marlake soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Hoffland soil, 3 percent (plus or minus 3 percent)
Wildhorse soil, 1 percent (plus or minus 1 percent)
Crowther soil, 1 percent (plus or minus 1 percent)

Typical Profile

Surface layer:
0 to 7 inches—dark gray, very friable, calcareous fine sandy loam

Transitional layer:
7 to 14 inches—grayish brown, very friable, calcareous loamy fine sand stratified with fine sandy loam and fine sand

Substratum:
14 to 60 inches—light brownish gray, mottled, calcareous loamy fine sand stratified with fine sandy loam and fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: High (4 to 8 percent)
Drainage class: Very poorly drained
Depth to the seasonal high water table: 2 feet above the surface during wet years to a depth of 1 foot during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Very low
Hazard of ponding: Frequent
Hazard of water erosion: None
Hazard of soil blowing: None
Distinctive property: An organic surface layer 1 to 3 inches thick may be present above the mineral surface layer.

Inclusions

Contrasting inclusions:
• Hoffland, Wildhorse, and Crowther soils, which are slightly higher on the landscape than the Marlake soil and do not have water above the surface for most of the year

Similar inclusions:
• Soils that have an organic surface layer 4 to 16 inches thick

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Unsuited
Management measures:
• Free water is on or above the surface of this soil for most of the year. The vegetation consists mainly of cattails, rushes, and other aquatic plants.
• Because of the wetness, this soil cannot support the grasses and legumes used as rangeland or for hay. This soil is used as wildlife habitat.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the ponding.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the ponding and the poor filtering capacity of the soil.

Interpretive Groups

Land capability classification: Dryland—VIIIw-7
Windbreak suitability group: 10
Range site: None

Mc—Marlake mucky peat, 0 to 1 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Depressions
Slope range: 0 to 1 percent (mainly 0 percent)
Major use: Wildlife habitat

Composition

Marlake soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Hoffland soil, 3 percent (plus or minus 3 percent)
Wildhorse soil, 1 percent (plus or minus 1 percent)
Crowther soil, 1 percent (plus or minus 1 percent)

Typical Profile

Surface layer:
12 inches to 0—very dark grayish brown mucky peat
0 to 7 inches—gray, loose loamy fine sand

Substratum:
7 to 60 inches—light gray loamy fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Very high (8 to 50 percent)
Drainage class: Very poorly drained
Depth to the seasonal high water table: 2 feet above the surface during wet years to a depth of 1 foot during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)

Parent material: Sandy alluvium
Runoff potential: Very low
Hazard of ponding: Frequent
Hazard of water erosion: None
Hazard of soil blowing: None
Distinctive property: An organic surface layer that is 4 to 16 inches thick

Inclusions

Contrasting inclusions:
• Hoffland, Wildhorse, and Crowther soils, which are slightly higher on the landscape than the Marlake soil and do not have water above the surface for most of the year

Similar inclusions:
• Soils that have an organic surface layer that is less than 4 inches thick
• Soils that have an organic surface layer that is more than 16 inches thick

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Unsuited
Management measures:
• The vegetation on this soil consists mainly of cattails, rushes, and other aquatic plants.
• Because of the wetness, this soil cannot support the grasses and legumes used as rangeland or for hay. This soil is used as wildlife habitat.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the frequent ponding.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the ponding and the poor filtering capacity of the soil.

Interpretive Groups

Land capability classification: Dryland—VIIIw-7
Windbreak suitability group: 10
Range site: None

MtC—Mitchell very fine sandy loam, 3 to 6 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Foot slopes
Slope range: 3 to 6 percent (mainly 5 percent)
Major use: Rangeland

Composition

Mitchell soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Epping soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 7 inches—brown, very friable very fine sandy loam

Transitional layer:
7 to 16 inches—light brownish gray, very friable, calcareous very fine sandy loam

Substratum:
16 to 60 inches—pale brown, calcareous very fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Alluvium and colluvium derived from siltstone
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Water intake rate: Moderate

Inclusions

Contrasting inclusions:
• Epping soils, which have siltstone within a depth of 20 inches

Similar inclusions:
• Soils that have siltstone at a depth of 40 to 60 inches

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and suited to sprinkler irrigation systems
Management measures:
• A sprinkler irrigation system is best suited to this soil because extensive land leveling or bench leveling would be needed for a gravity irrigation system.
• If a sprinkler irrigation system is used, terraces, contour farming, and management that leaves crop residue on the surface can be used to control erosion, reduce the runoff rate, and conserve moisture.
• Irrigation water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Only the trees and shrubs that tolerate a high amount of calcium carbonate should be selected for planting.
• Planting trees on the contour and terracing help to reduce the rate of runoff and control water erosion on sloping soils.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall.
• The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by careful use of approved herbicides.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited
• Increasing the size of the absorption field can overcome the restricted permeability of the soil.

Interpretive Groups

Land capability classification: Dryland—IIIe-3; irrigated—IIIe-6
Windbreak suitability group: 8
Range site: Limy Upland
Irrigation design group: 6

MtD—Mitchell very fine sandy loam, 6 to 9 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Shoulders and back slopes
Slope range: 6 to 9 percent (mainly 7 percent)
Major use: Rangeland

Composition

Mitchell soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Epping soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 5 inches—brown, very friable, calcareous very fine sandy loam

Transitional layer:
5 to 16 inches—pale brown, very friable, calcareous very fine sandy loam

Substratum:
16 to 60 inches—very pale brown, calcareous very fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Alluvium and colluvium derived from siltstone
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Water intake rate: Moderate

Inclusions

Contrasting inclusions:
• Epping soils, which have siltstone within a depth of 20 inches

Similar inclusions:
• Soils that have siltstone at a depth of 40 to 60 inches

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.
• Irrigation water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and depletes the protective plant cover, resulting in the formation of gullies and rills and the hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Only the trees and shrubs that tolerate a high amount of calcium carbonate should be selected for planting.
• Planting trees on the contour and terracing help to reduce the rate of runoff and control water erosion on sloping soils.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall.
• The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by careful use of approved herbicides.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited
Management measures:
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.
• Increasing the size of the absorption field can overcome the restricted permeability of the soil.

Interpretive Groups

Land capability classification: Dryland—IVe-3; irrigated—IVe-6
Windbreak suitability group: 8
Range site: Limy Upland
Irrigation design group: 6

MxF—Mitchell-Epping complex, 9 to 30 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Mitchell—back slopes and foot slopes; Epping—shoulders
Slope range: Mitchell—9 to 30 percent (mainly 15 percent); Epping—9 to 30 percent (mainly 20 percent)
Major uses: Rangeland

Composition

Mitchell soil and similar soils: 55 percent (plus or minus 5 percent)
Epping soil and similar soils: 35 percent (plus or minus 5 percent)
Contrasting inclusions:
Tassel soil, 5 percent (plus or minus 5 percent)
Ashollow soil, 5 percent (plus or minus 5 percent)

Typical Profile

Mitchell

Surface layer:
0 to 8 inches—brown, very friable, very fine sandy loam

Transitional layer:
8 to 19 inches—very pale brown, very friable, calcareous very fine sandy loam

Substratum:
19 to 60 inches—very pale brown, calcareous very fine sandy loam

Epping

Surface layer:
0 to 5 inches—brown, very friable, calcareous very fine sandy loam

Transitional layer:
5 to 8 inches—pale brown, very friable, calcareous very fine sandy loam

Substratum:
8 to 11 inches—pale brown, calcareous very fine sandy loam
11 to 60 inches—very pale brown siltstone

Soil Properties and Qualities

Mitchell

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Alluvium and colluvium derived from siltstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Severe

Epping

Depth to paralithic contact: Shallow, 10 to 20 inches
Potential rooting depth: 10 to 20 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: Very low (0 to 3 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Weathered siltstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Severe

Inclusions

Contrasting inclusions:
- Tassel soils, which are shallow to soft, weathered sandstone
- Ashollow soils, which have more sand throughout the profile than the Mitchell and Epping soils

Inclusions similar to the Mitchell soil:
- Soils that have siltstone at a depth of 40 to 60 inches

Inclusions similar to the Epping soil:
- Soils that are very shallow to siltstone bedrock

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and depletes the protective plant cover, resulting in the formation of gullies and rills and the hazard of soil blowing.

Windbreaks

Suitability: Mitchell—poorly suited; Epping—unsuited
Management measures:
• Onsite investigation is needed to identify sites that are suitable for planting trees.
• The species selected for planting should be those that tolerate a high amount of calcium.
• A few areas can be used for the trees and shrubs that enhance wildlife habitat or for forestation plantings if they are planted by hand or if other special management practices are applied.
• Planting trees on the contour and terracing help to reduce the rate of runoff and control water erosion on sloping soils.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall.
• The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by careful use of approved herbicides.

Dwellings

Suitability: Poorly suited
Management measures:
• The soft bedrock in the Epping soil generally can be excavated on sites for dwellings with basements or buildings that have deep foundations.
• Buildings can be designed so that they conform to the natural slope of the land, or grading can be used on the Mitchell soil.
• Onsite investigation would be necessary to identify suitable sites for dwellings.

Septic tank absorption fields

Suitability: Mitchell—poorly suited; Epping—unsuited
Management measures:
• Onsite investigation is needed to identify suitable areas for septic tank absorption fields.
• On the Mitchell soil, installing the distribution lines on the contour helps to ensure that the absorption fields function properly.

Interpretive Groups

Land capability classification: Mitchell—VIe-3, dryland; Epping—VIs-4, dryland
Windbreak suitability group: Mitchell—8; Epping—10
Range site: Mitchell—Limy Upland; Epping—Shallow Limy

Pg—Pits, sand and gravel

This land type consists mainly of the spoil of surface mining operations for sand and gravel. This material is primarily used in construction and road surfacing. These sites are mainly on flood plains of the North Platte River valley. They commonly are mounds of sand or coarse sand and generally do not have vegetation, unless they have been reclaimed or have been abandoned for many years. These areas have a pit or several pits, which are filled with ground water and are normally 1 to 3 feet below the original land surface. The pits are delineated on the soil maps as water.

This land type is used for mining operations or has been abandoned to use as wildlife habitat or recreational areas. Recreational uses are mainly limited to fishing in the pits or hunting.

This land is generally not suited to cultivated crops, range or hayland, building sites, or trees in windbreaks. Abandoned mine sites have limited potential for wildlife habitat and recreational uses. Onsite investigation is needed to determine the potential use and suitability.

Land capability classification: Dryland—VIIIs-8
Windbreak suitability group: 10
Range site: None

Ru—Rushcreek loam, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Flood plains
Slope range: 0 to 2 percent (mainly 0.5 percent)
Major use: Cropland

Composition

Rushcreek soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Jankosh soil, 10 percent (plus or minus 10 percent)
Lewellen soil, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsurface layer:
7 to 11 inches—dark gray, friable, calcareous loam

Subsoil:
11 to 24 inches—yellowish brown, friable, calcareous loam
24 to 34 inches—light yellowish brown, friable, calcareous loam
34 to 42 inches—very pale brown, very friable, calcareous sandy loam

Substratum:
42 to 56 inches—light gray, calcareous sandy loam
56 to 80 inches—light gray gravelly coarse sand

Soil Properties and Qualities

Depth to coarse sand and gravelly coarse sand: 40 to 60 inches
Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Moderately well drained
Depth to the seasonal high water table: 3 feet during wet years to 6 feet during dry years
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loamy alluvium over gravelly coarse sand
Runoff potential: Low
Hazard of flooding: Rare
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Water intake rate: Moderate
Distinctive property: Moderately affected by alkalinity and salinity

Inclusions

Contrasting inclusions:
- Lewellen soils, which are moderately deep over coarse sand, have a higher seasonal high water table than the Rushcreek soil, and are strongly affected by alkalinity and salinity
- Jankosh soils, which are strongly affected by alkalinity and salinity and have a higher seasonal high water table than the Rushcreek soil

Similar inclusions:
- Soils that have a surface layer of clay loam or silty clay loam
- Soils that are slightly affected by alkalinity and salinity

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
- Because of the moderate alkalinity, the species selected for planting should tolerate excess salts.
- Returning crop residue to the soil and applying manure help to maintain or increase the organic matter content, improve fertility, and maintain or improve tilth.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and sprinkler irrigation systems
Management measures:
- Because of the moderate alkalinity, the species selected for planting should tolerate excess salts.
- Returning crop residue to the soil and applying manure help to maintain or increase the organic matter content, improve fertility, and maintain or improve tilth.
- Because land leveling exposes the strongly alkaline subsoil and substratum, the potential for the growth and production of crops is limited.
- If this soil is irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited
Management measures:
- If an area is reseeded, the species selected for planting should be those that tolerate the salinity or alkalinity of the soil.

Windbreaks

Suitability: Poorly suited
Management measures:
- Only those species that tolerate the moderate alkalinity should be selected for planting.
- A drip irrigation system can provide supplemental moisture during dry periods.
- The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicides.

Dwellings

Suitability: Poorly suited

Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.
• Constructing dwellings on well compacted fill material helps to prevent the damage caused by floodwater.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• Septic tank absorption fields should be protected from possible flooding.
• Because of the alkalinity, the permeability of the soil is restricted.
• Increasing the size of the absorption field can overcome the restricted permeability of the soil.
• Constructing absorption fields on fill material raises the fields a sufficient distance above the seasonal high water table.

Interpretive Groups

Land capability classification: Dryland—IVs-1; irrigated—IIIs-6
Windbreak suitability group: 9N
Range site: Saline Lowland
Irrigation design group: 6

SaB—Sarben loamy fine sand, 0 to 3 percent slopes

Setting

Landscape: Uplands
Landform: Interdunes
Position on the landform: Plains, swales, and hummocks
Slope range: 0 to 3 percent (mainly 2 percent)
Major use: Rangeland and cropland

Composition

Sarben soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Jayem soil, 5 percent (plus or minus 5 percent)
Dailey soil, 5 percent (plus or minus 5 percent)
Valent soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 6 inches—light brownish gray, very friable loamy fine sand

Transitional layer:
6 to 14 inches—brown, very friable fine sandy loam

Substratum:
14 to 60 inches—brown and pale brown, calcareous fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Sandy and loamy eolian material
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Very severe
Water intake rate: High

Inclusions

Contrasting inclusions:
• Jayem soils, which have a dark layer that is more than 10 inches thick
• Dailey and Valent soils, which have more sand throughout the profile than the Sarben soil

Similar inclusions:
• Soils that have a surface layer of fine sandy loam

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips or with fallow and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and suited to sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.

• Land leveling is needed to establish a suitable grade for a gravity irrigation system.
• A gravity irrigation system may require a short length of run because of the high water intake rate of this soil.
• Frequent, light applications of irrigation water are needed because of the moderate available water capacity and the potential for the leaching of nutrients below the root zone.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IVe-5; irrigated—IIIe-10
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 10

SaC—Sarben loamy fine sand, 3 to 6 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Slope range: 3 to 6 percent (mainly 4 percent)
Major use: Cropland and rangeland

Composition

Sarben soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Jayem soil, 5 percent (plus or minus 5 percent)
Dailey soil, 5 percent (plus or minus 5 percent)
Valent soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 7 inches—brown, very friable loamy fine sand

Transitional layer:
7 to 15 inches—pale brown, very friable fine sandy loam

Substratum:
15 to 32 inches—light gray, calcareous fine sandy loam
32 to 60 inches—very pale brown, calcareous fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Sandy and loamy eolian material
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Very severe
Water intake rate: High

Inclusions

Contrasting inclusions:
• Jayem soils, which have a dark layer that is more than 10 inches thick
• Dailey and Valent soils, which have more sand throughout the profile than the Sarben soil

Similar inclusions:
• Soils that have a surface layer of fine sandy loam

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and

grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips or with fallow and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Frequent, light applications of irrigation water are needed because of the moderate available water capacity and the potential for the leaching of nutrients below the root zone.
• Close-growing crops, such as small grains, alfalfa, and introduced grasses, help to control soil blowing and water erosion.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IVe-5; irrigated—IVe-10
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 10

SaD—Sarben loamy fine sand, 6 to 9 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Slope range: 6 to 9 percent (mainly 7 percent)
Major use: Rangeland

Composition

Sarben soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Valent soil, 10 percent (plus or minus 10 percent)

Typical Profile

Surface layer:
0 to 5 inches—grayish brown, very friable loamy fine sand

Transitional layer:
5 to 15 inches—grayish brown, very friable fine sandy loam

Substratum:
15 to 25 inches—light gray, calcareous fine sandy loam
25 to 60 inches—very pale brown, calcareous fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Sandy and loamy eolian material
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Very severe
Water intake rate: High

Inclusions

Contrasting inclusions:
• Valent soils, which have more sand and less silt in

the profile than the Sarben soil and are on similar landscapes

Similar inclusions:
• Soils that have free carbonates within a depth of 15 inches

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• Frequent, light applications of irrigation water are needed because of the moderate available water capacity and the potential for the leaching of nutrients below the root zone.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Close-growing crops, such as small grains, alfalfa, and introduced grasses, help to control soil blowing and water erosion.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.
• Because seedlings can be damaged by high winds and can be covered by drifting sand, strips of sod or other vegetation between the tree rows are needed to control soil blowing.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—VIe-5; irrigated—IVe-10
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 10

SaE—Sarben loamy fine sand, 9 to 20 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Slope range: 9 to 20 percent (mainly 15 percent)
Major use: Rangeland

Composition

Sarben soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Valent soil, 10 percent (plus or minus 10 percent)

Typical Profile

Surface layer:
0 to 10 inches—brown, very friable loamy fine sand

Transitional layer:
10 to 15 inches—brown, very friable fine sandy loam

Substratum:
15 to 45 inches—pale brown, calcareous fine sandy loam
45 to 60 inches—pale brown, calcareous fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Sandy and loamy eolian material
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Very severe

Inclusions

Contrasting inclusions:
• Valent soils, which have more sand and less silt in the profile than the Sarben soil and are on similar landscapes

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Windbreaks

Suitability: Suited
Management measures:
• Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the surface as possible.
• Because young seedlings can be damaged by high winds and can be covered by drifting sand, maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings during periods of low rainfall.
• The weeds and undesirable grasses in the tree rows can be controlled by cultivation with conventional equipment and by the timely application of approved herbicides.

Dwellings

Suitability: Suited
Management measures:
• Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Suited
Management measures:
• Land shaping and installing the distribution lines on the contour helps to ensure that the absorption fields function properly.

Interpretive Groups

Land capability classification: Dryland—VIe-5
Windbreak suitability group: 7
Range site: Sandy

Sc—Scoville loamy fine sand, 0 to 2 percent slopes

Setting

Landscape: Valleys
Landform: Stream terraces
Slope range: 0 to 2 percent (mainly 1 percent)
Major use: Irrigated cropland

Composition

Scoville soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Bayard soil, 5 percent (plus or minus 5 percent)
Broadwater soil, 5 percent (plus or minus 5 percent)
Ipage soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 6 inches—grayish brown, very friable loamy fine sand

Transitional layer:
6 to 10 inches—brown, loose loamy fine sand

Substratum:
10 to 42 inches—pale brown fine sand
42 to 46 inches—light gray, calcareous very fine sandy loam
46 to 60 inches—light brownish gray, calcareous loamy fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Somewhat excessively drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Rapid (6 to 20 inches per hour) in the upper part and moderate (0.6 inch to 2.0 inches per hour) in the lower part
Parent material: Mixed eolian sand and sandy alluvium
Runoff potential: Low

Hazard of water erosion: None
Hazard of soil blowing: Severe

Inclusions

Contrasting inclusions:
- Bayard soils, which are fine sandy loam throughout most of the profile and are on landscapes similar to those of the Scoville soil
- Broadwater soils, which are subject to frequent flooding, have 10 to 35 percent gravel in the 10- to 40-inch layer, and are lower on the landscape than the Scoville soil
- Ipage soils, which have a seasonal high water table at a depth of 3 to 5 feet

Similar inclusions:
- Soils that do not have loamy material below a depth of 40 inches

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
- Frequent, light applications of irrigation water are needed because of the moderate available water capacity and the potential for the leaching of nutrients below the root zone.
- Close-growing crops, such as small grains, alfalfa, and introduced grasses, help to control soil blowing.

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
- Because seedlings can be damaged by high winds and can be covered by drifting sand, strips of sod or other vegetation between the tree rows are needed to control soil blowing.
- An irrigation system is needed during dry periods.

Dwellings

Suitability: Suited
Management measures:
- Onsite investigation is needed to determine suitable sites for dwellings.
- An irrigation system is needed to establish and maintain lawns, ornamental trees, and other plantings.
- The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
- The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity may result in pollution of the ground water.

Interpretive Groups

Land capability classification: Dryland—IVe-5; irrigated—IVe-11
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 11

SnC—Sidney loam, 3 to 6 percent slopes

Setting

Landscape: Tablelands
Landform: Hillslopes
Slope range: 3 to 6 percent (mainly 5 percent)
Major uses: Cropland and rangeland

Composition

Sidney soil and similar soils: 80 percent (plus or minus 20 percent)
Contrasting inclusions:
Canyon soil, 10 percent (plus or minus 10 percent)

Alliance soil, 5 percent (plus or minus 5 percent)
Soils that are moderately deep to sandstone, 5 percent (plus or minus 5 percent)

Typical Profile

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

Subsurface layer:
6 to 11 inches—dark grayish brown, very friable loam

Subsoil:
11 to 17 inches—brown, friable, calcareous loam
17 to 29 inches—light gray, friable, calcareous very fine sandy loam

Substratum:
29 to 48 inches—very pale brown, calcareous very fine sandy loam
48 to 60 inches—white, weathered sandstone

Soil Properties and Qualities

Depth to sandstone: 40 to 60 inches
Potential rooting depth: Deep, 40 to 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Sandstone residuum
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Water intake rate: Moderate

Inclusions

Contrasting inclusions:
- Alliance soils, which have more clay in the subsoil than the Sidney soil
- Canyon soils, which are 10 to 20 inches deep to sandstone
- Soils that have more clay in the subsoil than the Sidney soil and are 20 to 40 inches deep to sandstone

Similar inclusions:
- Soils that do not have sandstone within a depth of 60 inches
- Soils that are severely eroded and do not have a dark surface layer

Use and Management

Dryland crops

Suitability: Suited

Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Cuts during the construction of terraces can expose calcareous, weathered sandstone or calcareous underlying material, which can limit the potential growth and productivity of crops.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and suited to sprinkler irrigation systems
Management measures:
- A sprinkler irrigation system is best suited to this soil because extensive land leveling or bench leveling would be needed for a gravity irrigation system.
- If this soil is irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Cuts during the construction of terraces or land leveling for a gravity irrigation system can expose calcareous, weathered sandstone or calcareous underlying material, which can limit the potential growth and productivity of crops.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Rangeland and hay

Suitability: Suited

Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

Windbreaks

Suitability: Suited
Management measures:
• The survival and growth of adapted species are good.
• Planting trees on the contour and terracing help to control erosion.
• A drip irrigation system can provide supplemental moisture during dry periods.
• The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicides.

Dwellings

Suitability: Suited
Management measures:
• The soft bedrock generally can be easily excavated during the construction of dwellings with basements or buildings that have deep foundations.

Septic tank absorption fields

Suitability: Suited
Management measures:
• Building up or mounding with suitable fill material increases the filtering capacity of the field by increasing the depth to bedrock.

Interpretive Groups

Land capability classification: Dryland—IIIe-1; irrigated—IIIe-6
Windbreak suitability group: 3
Range site: Silty
Irrigation design group: 6

StD—Sidney-Canyon complex, 6 to 9 percent slopes

Setting

Landscape: Tablelands
Landform: Hillslopes
Slope range: Sidney—6 to 9 percent (mainly 7 percent); Canyon—6 to 9 percent (mainly 7 percent)
Major uses: Cropland and rangeland

Composition

Sidney soil and similar soils: 65 percent (plus or minus 5 percent)
Canyon soil and similar soils: 25 percent (plus or minus 5 percent)
Contrasting inclusions:
Alliance soil, 5 percent (plus or minus 5 percent)
Busher soil, 5 percent (plus or minus 5 percent)

Typical Profile

Sidney

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

Subsoil:
9 to 15 inches—dark brown, friable loam
15 to 22 inches—light brownish gray, friable, calcareous loam
22 to 30 inches—light gray, very friable, calcareous very fine sandy loam

Substratum:
30 to 44 inches—light brownish gray, calcareous fine sandy loam
44 to 60 inches—white, weakly cemented, fine grained sandstone

Canyon

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

Substratum:
5 to 10 inches—light brownish gray, calcareous very fine sandy loam
10 to 60 inches—white, fine grained sandstone

Soil Properties and Qualities

Sidney

Depth to paralithic contact: Deep, 40 to 60 inches (mainly 44 inches)
Potential rooting depth: 40 to 60 inches
Organic matter content: Moderately low and moderate (1 to 4 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Residuum weathered from sandstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Water intake rate: Moderate

Canyon

Depth to paralithic contact: Very shallow and shallow, 6 to 20 inches (mainly 10 inches)
Potential rooting depth: 6 to 20 inches

Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: Very low (0 to 3 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Residuum weathered from sandstone
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate

Inclusions

Contrasting inclusions:
- Alliance soils, which have more clay in the subsoil than the Sidney soil
- Busher soils, which have fine sandy loam throughout most of the profile and sandstone at a depth of 40 to 60 inches

Inclusions similar to the Sidney soil:
- Soils that are severely eroded and do not have a dark surface layer
- Soils that do not have sandstone within a depth of 60 inches

Use and Management

Dryland crops

Suitability: Sidney—poorly suited; Canyon—unsuited
Management concerns:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.
- Cuts during the construction of terraces can expose calcareous, weathered sandstone or calcareous underlying material, which can limit the potential growth and productivity of crops.

Irrigated crops

Suitability: Sidney—unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems; Canyon—unsuited to gravity irrigation systems and sprinkler irrigation systems
- If these soils are irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
- Close-growing crops, such as small grains, alfalfa, and introduced grasses, are better suited to control erosion than row crops.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Cuts during the construction of terraces can expose calcareous, weathered sandstone or calcareous underlying material, which can limit the potential growth and productivity of crops.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

Windbreaks

Suitability: Sidney—suited; Canyon—unsuited
Management measures:
- Onsite investigation is needed to determine the suitability for planting windbreaks.
- Planting trees on the contour and terracing help to control water erosion.
- A drip irrigation system can provide supplemental moisture during dry periods.
- The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicides.

Dwellings

Suitability: Sidney—suited; Canyon—poorly suited
Management measures:
- The soft bedrock generally can be excavated on sites for dwellings with basements or buildings that have deep foundations.

Septic tank absorption fields

Suitability: Sidney—suited; Canyon—unsuited

Management measures:
• Onsite investigation is needed to identify suitable areas for septic tank absorption fields.
• Building up or mounding with suitable fill material increases the filtering capacity of the field.
• Installing the absorption field on the contour is generally necessary for its proper operation.

Interpretive Groups

Land capability classification: Sidney—IVe-1, dryland, and IVe-6, irrigated; Canyon—VIs-4, dryland
Windbreak suitability group: Sidney—3; Canyon—10
Range site: Sidney—Silty; Canyon—Shallow Limy
Irrigation design group: Sidney—6

SuG—Sulco loam, 30 to 60 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Slope range: 30 to 60 percent (mainly 45 percent)
Major use: Rangeland

Composition

Sulco soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Tassel soil, 10 percent (plus or minus 10 percent)
McConaughy soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 3 inches—dark grayish brown, very friable loam

Transitional layer:
3 to 7 inches—brown, very friable, calcareous loam

Substratum:
7 to 60 inches—very pale brown, calcareous loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate

Inclusions

Contrasting inclusions:
• Tassel soils, which are shallow to sandstone bedrock and are lower on the landscape than the Sulco soil
• McConaughy soils, which have a dark surface layer 7 to 20 inches thick and have calcium carbonate below a depth of 10 inches

Similar inclusions:
• Soils that have a surface layer of very fine sandy loam

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of gullies and rills after heavy rains.
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Unsuited
• An alternative site is needed because this soil is generally too steep for sites for dwellings.

Septic tank absorption fields

Suitability: Unsuited
• An alternative site is needed because this soil is too steep for septic tank absorption fields.

Interpretive Groups

Land capability classification: Dryland—VIIe-9
Windbreak suitability group: 10
Range site: Thin Loess

SxC2—Sulco-McConaughy complex, 3 to 6 percent slopes, eroded

Setting

Landscape: Uplands

Landform: Hillslopes
Position on the landform: Sulco—ridges and shoulders; McConaughy—back slopes and foot slopes
Slope range: Sulco—3 to 6 percent (mainly 5 percent); McConaughy—3 to 6 percent (mainly 4 percent)
Major uses: Cropland

Composition

Sulco soil and similar soils: 55 percent (plus or minus 15 percent)
McConaughy soil and similar soils: 30 percent (plus or minus 15 percent)
Contrasting inclusions:
Keith soil, 10 percent (plus or minus 10 percent)
Duroc soil, 5 percent (plus or minus 5 percent)

Typical Profile

Sulco

Surface layer:
0 to 6 inches—grayish brown, very friable, calcareous loam

Transitional layer:
6 to 15 inches—grayish brown, very friable, calcareous loam

Substratum:
15 to 20 inches—light gray, calcareous loam
20 to 60 inches—light brownish gray, calcareous loam

McConaughy

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

Subsoil:
6 to 13 inches—dark brown, very friable loam
13 to 21 inches—brown, very friable, calcareous loam

Substratum:
21 to 32 inches—light gray, calcareous loam
32 to 60 inches—pale brown, calcareous loam

Soil Properties and Qualities

Sulco

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Water intake rate: Moderate

McConaughy

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: Moderately high
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Water intake rate: Moderate

Inclusions

Contrasting inclusions:
- Duroc soils, which have dark colors below a depth of 20 inches and are lower on the landscape than the Sulco and McConaughy soils
- Keith soils, which have more clay in the subsoil than the Sulco and McConaughy soils

Inclusions similar to the Sulco soil:
- Soils that have a surface layer of very fine sandy loam

Inclusions similar to the McConaughy soil:
- Soils that have a surface layer of very fine sandy loam

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Irrigated crops

Suitability: Poorly suited to gravity irrigation systems and suited to sprinkler irrigation systems
Management measures:
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.
• A sprinkler irrigation system is best suited to these soils because extensive land leveling or bench leveling would be needed for a gravity irrigation system.
• If these soils are irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

Windbreaks

Suitability: Suited
Management measures:
• Only the trees and shrubs that tolerate a high amount of calcium carbonate should be selected for planting.
• Planting trees on the contour and terracing help to reduce the rate of runoff and control water erosion on sloping soils.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall.
• The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by careful use of approved herbicides.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited
Management measures:
• The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation.

Interpretive Groups

Land capability classification: Sulco—IVe-9, dryland, and IIIe-6, irrigated; McConaughy—IVe-1, dryland, and IIIe-6, irrigated
Windbreak suitability group: Sulco—8; McConaughy—3
Range site: Sulco—Limy Upland; McConaughy—Silty
Irrigation design group: 6

SxD2—Sulco-McConaughy complex, 6 to 9 percent slopes, eroded

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Sulco—shoulders and back slopes; McConaughy—back slopes and foot slopes
Slope range: Sulco—6 to 9 percent (mainly 9 percent); McConaughy—6 to 9 percent (mainly 6 percent)
Major uses: Cropland

Composition

Sulco soil and similar soils: 65 percent (plus or minus 10 percent)
McConaughy soil and similar soils: 25 percent (plus or minus 10 percent)
Contrasting inclusions:
Keith soil, 5 percent (plus or minus 5 percent)
Sarben soil, 5 percent (plus or minus 5 percent)

Typical Profile

Sulco

Surface layer:
0 to 5 inches—brown, very friable, calcareous loam

Transitional layer:
5 to 16 inches—pale brown, very friable, calcareous loam

Substratum:
16 to 60 inches—very pale brown, calcareous loam

McConaughy

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

Subsoil:
7 to 18 inches—grayish brown, very friable loam
18 to 28 inches—pale brown, very friable, calcareous loam

Substratum:
28 to 60 inches—very pale brown, calcareous loam

Soil Properties and Qualities

Sulco

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Water intake rate: Moderate

McConaughy

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Water intake rate: Moderate

Inclusions

Contrasting inclusions:
- Keith soils, which have more clay in the subsoil than the Sulco and McConaughy soils
- Sarben soils, which have more sand and less silt and clay throughout the profile than the Sulco and McConaughy soils

Inclusions similar to the Sulco soil:
- Soils that have a surface layer of very fine sandy loam

Inclusions similar to the McConaughy soil:
- Soils that have a surface layer of very fine sandy loam

Use and Management

Dryland crops

Suitability: Poorly suited
Management measures:
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.
- Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
- Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.
- If these soils are irrigated, water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.

Rangeland and hay

Suitability: Suited

Management measures:
• Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.
• Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Windbreaks

Suitability: Suited
Management measures:
• Only the trees and shrubs that tolerate a high amount of calcium carbonate should be selected for planting.
• Planting trees on the contour and terracing helps to reduce the rate of runoff and control water erosion on sloping soils.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall.
• The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by careful use of approved herbicides.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited
Management measures:
• The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation.

Interpretive Groups

Land capability classification: Sulco—IVe-9, dryland, and IVe-6, irrigated; McConaughy—IVe-1, dryland, and IVe-6, irrigated
Windbreak suitability group: Sulco—8; McConaughy—3
Range site: Sulco—Limy Upland; McConaughy—Silty
Irrigation design group: 6

SxE2—Sulco-McConaughy complex, 9 to 20 percent slopes, eroded

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Sulco—shoulders and back slopes; McConaughy—back slopes and foot slopes
Slope range: Sulco—9 to 20 percent (mainly 14 percent); McConaughy—9 to 15 percent (mainly 11 percent)
Major uses: Rangeland or cropland

Composition

Sulco soil and similar soils: 70 percent (plus or minus 10 percent)
McConaughy soil and similar soils: 20 percent (plus or minus 10 percent)
Contrasting inclusions:
Keith soil, 5 percent (plus or minus 5 percent)
Sarben soil, 5 percent (plus or minus 5 percent)

Typical Profile

Sulco

Surface layer:
0 to 6 inches—grayish brown, very friable, calcareous loam

Transitional layer:
6 to 16 inches—pale brown, very friable, calcareous loam

Substratum:
16 to 60 inches—very pale brown, calcareous loam

McConaughy

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

Subsoil:
6 to 14 inches—grayish brown, very friable loam
14 to 24 inches—light brownish gray, very friable, calcareous loam

Substratum:
24 to 60 inches—light gray, calcareous loam

Soil Properties and Qualities

Sulco

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low and moderately low (0.5 to 2.0 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate

McConaughy

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate

Inclusions

Contrasting inclusions:
- Keith soils, which have more silt and clay in the subsoil than the Sulco and McConaughy soils
- Sarben soils, which have more sand and less silt and clay throughout the profile than the Sulco and McConaughy soils

Inclusions similar to the Sulco soil:
- Soils that have a surface layer of very fine sandy loam

Inclusions similar to the McConaughy soil:
- Soils that have a surface layer of very fine sandy loam

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.
- Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Windbreaks

Suitability: Poorly suited
Management measures:
- Only the trees and shrubs that tolerate a high amount of calcium carbonate should be selected for planting.
- Planting trees on the contour and terracing helps to reduce the rate of runoff and control water erosion on sloping soils.
- A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall.
- The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by careful use of approved herbicides.

Dwellings

Suitability: Suited
Management measures:
- Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

Septic tank absorption fields

Suitability: Suited
Management measures:
- The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation.
- Land shaping and installing the absorption fields on the contour are generally necessary to ensure that the system operates properly.

Interpretive Groups

Land capability classification: Sulco—VIe-9, dryland; McConaughy—VIe-1, dryland
Windbreak suitability group: Sulco—8; McConaughy—3
Range site: Sulco—Limy Upland; McConaughy—Silty

SxF—Sulco-McConaughy complex, 9 to 30 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Sulco—shoulders and back slopes; McConaughy—back slopes and foot slopes
Slope range: Sulco—9 to 30 percent (mainly 25 percent); McConaughy—9 to 15 percent (mainly 12 percent)
Major uses: Rangeland

Composition

Sulco soil and similar soils: 70 percent (plus or minus 10 percent)
McConaughy soil and similar soils: 20 percent (plus or minus 10 percent)

Contrasting inclusions:
Tassel soil, 5 percent (plus or minus 5 percent)
Sarben soil, 5 percent (plus or minus 5 percent)

Typical Profile

Sulco

Surface layer:
0 to 4 inches—brown, very friable, calcareous loam

Transitional layer:
4 to 14 inches—light brownish gray, very friable, calcareous loam

Substratum:
14 to 60 inches—pale brown, calcareous loam

McConaughy

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

Subsoil:
10 to 18 inches—brown, very friable loam
18 to 24 inches—pale brown, very friable, calcareous loam

Substratum:
24 to 60 inches—light brownish gray, calcareous loam

Soil Properties and Qualities

Sulco

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate

McConaughy

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: High (more than 9 inches)
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Parent material: Loess
Runoff potential: High
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate

Inclusions

Contrasting inclusions:
- Tassel soils, which are shallow to sandstone and are lower on the landscape than the Sulco and McConaughy soils
- Sarben soils, which have more sand and less silt and clay throughout the profile than the Sulco and McConaughy soils and are on similar landscapes

Inclusions similar to the Sulco soil:
- Soils that have a surface layer of very fine sandy loam

Inclusions similar to the McConaughy soil:
- Soils that have a surface layer of very fine sandy loam

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
- Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

Windbreaks

Suitability: Sulco—unsuited; McConaughy—suited
Management measures:
- Onsite investigation is needed to identify the areas that are best suited to windbreaks.
- A few areas can be used for trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if suitable species are planted by hand or if other special management practices are applied.
- The survival and growth of adapted species are good.
- Planting trees on the contour and terracing help to control water erosion.
- A drip irrigation system can provide supplemental moisture during dry periods.
- The weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicides.

Dwellings

Suitability: Poorly suited

Management measures:
• Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• The moderate permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field can generally overcome this limitation.
• Installing the distribution lines on the contour helps to ensure that the absorption field functions properly.

Interpretive Groups

Land capability classification: Sulco—VIe-9, dryland; McConaughy—VIe-1, dryland
Windbreak suitability group: Sulco—10; McConaughy—3
Range site: Sulco—Limy Upland; McConaughy—Silty

TkG—Tassel-Ashollow-Rock outcrop complex, 20 to 60 percent slopes

Setting

Landscape: Uplands
Landform: Hillslopes
Position on the landform: Tassel—shoulders and summits; Ashollow—back slopes and foot slopes; areas of Rock outcrop—shoulders
Slope range: Tassel—20 to 60 percent (mainly 35 percent); Ashollow—20 to 30 percent (mainly 25 percent)
Major uses: Rangeland (fig. 13)

Composition

Tassel soil and similar soils: 45 percent (plus or minus 15 percent)
Ashollow soil and similar soils: 25 percent (plus or minus 10 percent)
Areas of Rock outcrop: 15 percent (plus or minus 5 percent)
Contrasting inclusions:
Busher soil, 10 percent (plus or minus 10 percent)
Epping soil, 5 percent (plus or minus 5 percent)

Typical Profile

Tassel

Surface layer:
0 to 4 inches—pale brown, very friable, calcareous fine sandy loam

Substratum:
4 to 7 inches—light yellowish brown, calcareous fine sandy loam
7 to 18 inches—very pale brown, calcareous gravelly fine sandy loam
18 to 60 inches—very pale brown, weakly cemented sandstone

Ashollow

Surface layer:
0 to 3 inches—grayish brown, very friable, calcareous very fine sandy loam

Transitional layer:
3 to 10 inches—brown, very friable, calcareous very fine sandy loam

Substratum:
10 to 32 inches—pale brown, calcareous very fine sandy loam
32 to 80 inches—light yellowish brown, calcareous very fine sandy loam

Soil Properties and Qualities

Tassel

Depth to paralithic contact: Very shallow and shallow, 6 to 20 inches
Potential rooting depth: 6 to 20 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Somewhat excessively drained
Available water capacity: Very low (0 to 3 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Weathered sandstone
Runoff potential: High
Hazard of water erosion: Very severe
Hazard of soil blowing: Very severe

Ashollow

Depth to paralithic contact: Very deep, more than 60 inches
Potential rooting depth: More than 60 inches
Organic matter content: Moderately low (1 to 2 percent)
Drainage class: Well drained
Available water capacity: High (9 inches or more)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Residuum weathered from sandstone
Runoff potential: High
Hazard of water erosion: Very severe
Hazard of soil blowing: Very severe

Inclusions

Contrasting inclusions:
• Busher soils, which are 40 to 60 inches deep to weakly cemented sandstone

Figure 13.—An area of Tassel-Ashollow-Rock outcrop complex, 20 to 60 percent slopes, used as rangeland.

- Epping soils, which are shallow over siltstone

Inclusions similar to the Tassel soil:
- Shallow soils that have more clay throughout the profile than the Tassel soil
- Soils that have a surface layer of loamy fine sand

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited

Management measures:
- Overgrazing should be avoided because it results in poor plant vigor and can result in the formation of small gullies and rills after heavy rains.

Windbreaks

Suitability: Tassel—unsuited; Ashollow—suited
Management measures:
- Onsite investigation is needed to determine the areas that are suitable for trees and shrubs.
- Only the trees and shrubs that tolerate a high amount of calcium carbonate should be selected for planting.
- Planting trees on the contour and terracing help to reduce the rate of runoff and control water erosion on sloping soils.
- A drip irrigation system can provide the

supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall.
• The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment.

Dwellings

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the slope and the depth to bedrock.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the slope and the depth to bedrock.

Interpretive Groups

Land capability classification: Tassel—VIIs-4, dryland; Ashollow—VIIe-5, dryland; areas of Rock outcrop—VIIIs-8
Windbreak suitability group: Tassel—10; Ashollow—8; areas of Rock outcrop—10
Range site: Tassel—Shallow Limy; Ashollow—Sandy; areas of Rock outcrop—None

VaD—Valent fine sand, 3 to 9 percent slopes

Setting

Landscape: Sandhills
Landform: Dunes
Slope range: 3 to 9 percent (mainly 6 percent)
Major use: Rangeland

Composition

Valent soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Ipage soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 5 inches—dark grayish brown, loose fine sand

Transitional layer:
5 to 10 inches—grayish brown, loose fine sand

Substratum:
10 to 60 inches—pale brown fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Excessively drained
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Eolian sand
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Very severe
Water intake rate: Very high

Inclusions

Contrasting inclusions:
• Ipage soils, which have a seasonal high water table at a depth of 3 to 5 feet, are calcareous, and are lower on the landscape than the Valent soil

Similar inclusions:
• Soils that have a dark surface layer that is more than 7 inches thick
• Soils that have a surface layer of loamy fine sand

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.
• Frequent, light applications of irrigation water are needed because of the low available water capacity and the potential for the leaching of nutrients below the root zone.
• Close-growing crops, such as small grains, alfalfa, and introduced grasses, help to control soil blowing.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Because this soil is loose, trees should be planted in shallow furrows with as little disturbance of the surface as possible.
• Because young seedlings can be damaged by high winds and can be covered by drifting sand,

maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings during periods of low rainfall.
• The weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

Interpretive Groups

Land capability classification: Dryland—VIe-5; irrigated—IVe-12
Windbreak suitability group: 7
Range site: Sands
Irrigation design group: 12

VaE—Valent fine sand, rolling

Setting

Landscape: Sandhills
Landform: Dunes
Slope range: 9 to 24 percent (mainly 17 percent)
Major use: Rangeland

Composition

Valent soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Ipage soils, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 4 inches—grayish brown, loose fine sand

Substratum:
4 to 36 inches—light brownish gray fine sand
36 to 60 inches—very pale brown fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Excessively drained
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Eolian sand
Runoff potential: Low
Hazard of flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Very severe

Inclusions

Contrasting inclusions:
• Ipage soils, which have a seasonal high water table at a depth of 3 to 5 feet, are calcareous in the surface layer, and are lower on the landscape than the Valent soil

Similar inclusions:
• Soils in blowouts that do not have vegetative cover
• Soils that have a surface layer of loamy fine sand
• Soils that are either more sloping or less sloping than the Valent soil

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing and the formation of blowouts.

Windbreaks

Suitability: Suited
Management measures:
• Because this soil is loose, the trees should be planted in shallow furrows with as little disturbance of the surface as possible.
• Because young seedlings can be damaged by high winds and can be covered by drifting sand, maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings during periods of low rainfall.
• The weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment.

Dwellings

Suitability: Poorly suited
Management measures:
• Buildings need to be designed so that they conform to the natural slope of the land, or land shaping is needed to modify the slope.
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.
• An irrigation system is needed to establish and maintain lawns, ornamental trees, and other plantings.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.
• Land shaping and installing the absorption field on the contour is generally necessary.

Interpretive Groups

Land capability classification: Dryland—VIe-5
Windbreak suitability group: 7
Range site: Sands

VaF—Valent complex, rolling and hilly

Setting

Landscape: Sandhills
Landform: Dunes
Slope range: 9 to 60 percent (mainly 35 percent)
Major use: Rangeland

Composition

Valent soil and similar soils: 95 percent (plus or minus 5 percent)
Contrasting inclusions:
Ipage soils, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 3 inches—grayish brown, loose fine sand

Substratum:
3 to 15 inches—light brownish gray fine sand
15 to 60 inches—pale brown fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Excessively drained
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Eolian sand
Runoff potential: Low
Hazard of water erosion: Moderate
Hazard of soil blowing: Very severe

Inclusions

Contrasting inclusions:
• Ipage soils, which have a seasonal high water table at a depth of 3 to 5 feet, are calcareous, and are lower on the landscape than the Valent soil

Similar inclusions:
• Soils in blowouts that do not have vegetative cover
• Soils that are less sloping than the Valent soil and are in swales
• Soils that have a surface layer of loamy fine sand

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing and the formation of blowouts.

Windbreaks

Suitability: Valent fine sand, rolling—poorly suited; Valent fine sand, hilly—unsuited
Management measures:
• Onsite investigation is needed to identify areas that are suited to trees and shrubs in windbreaks.
• Because this soil is loose, the trees should be planted in shallow furrows with as little disturbance of the surface as possible.
• Because young seedlings can be damaged by high winds and can be covered by drifting sand, maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings during periods of low rainfall.
• The weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment.

Dwellings

Suitability: Unsuited

Management measures:
• A suitable alternative site should be selected because of the slope and the instability of the loose soil.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the poor filtering capacity of the soil and the slope.

Interpretive Groups

Land capability classification: Valent fine sand, rolling, dryland—VIe-5; Valent fine sand, hilly, dryland—VIIe-5
Windbreak suitability group: Valent fine sand, rolling—7; Valent fine sand, hilly—10
Range site: Valent fine sand, rolling—Sands; Valent fine sand, hilly—Choppy Sands

VdB—Valent loamy fine sand, 0 to 3 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales and hummocks
Slope range: 0 to 3 percent (mainly 1.5 percent)
Major use: Rangeland

Composition

Valent soil and similar soils: 85 percent (plus or minus 15 percent)
Contrasting inclusions:
Dailey soil, 5 percent (plus or minus 5 percent)
Ipage soil, 5 percent (plus or minus 5 percent)
Jayem soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 6 inches—brown, loose loamy fine sand

Substratum:
6 to 24 inches—pale brown fine sand
24 to 60 inches—very pale brown fine sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Excessively drained
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Eolian sand
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Very severe
Water intake rate: Very high

Inclusions

Contrasting inclusions:
• Ipage soils, which have a seasonal high water table at a depth of 3 to 5 feet
• Dailey soils, which have a dark surface layer 10 to 20 inches thick
• Jayem soils, which have a dark surface layer 10 to 20 inches thick and are finer textured than the Valent soil

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• An irrigation system generally is needed for the successful production of cultivated crops on this soil.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Frequent, light applications of irrigation water are needed because of the low available water capacity and the potential for the leaching of nutrients below the root zone.
• Close-growing crops, such as small grains, alfalfa, and introduced grasses, help to control soil blowing.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Because this soil is loose, the trees should be planted in shallow furrows with as little disturbance of the surface as possible.
• Because young seedlings can be damaged by high winds and can be covered by drifting sand, maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings during periods of low rainfall.
• The weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment and by the timely application of approved herbicides.

Dwellings

Suitability: Suited
Management measures:
• The walls or sides of shallow excavations can slough or cave in unless they are temporarily shored.
• An irrigation system is needed to establish and maintain lawns, ornamental trees, and plantings.

Septic tank absorption fields

Suitability: Poorly suited
Management measures:
• This soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the ground water.

Interpretive Groups

Land capability classification: Dryland—VIe-5; irrigated—IVe-11
Windbreak suitability group: 7
Range site: Sandy
Irrigation design group: 11

Vt—Vetal fine sandy loam, 0 to 2 percent slopes

Setting

Landscape: Tablelands
Landform: Plains
Position on the landform: Swales
Slope range: 0 to 2 percent (mainly 1 percent)
Major use: Cropland or rangeland

Composition

Vetal soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Jayem soil, 5 percent (plus or minus 5 percent)
Valent soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 8 inches—grayish brown, very friable fine sandy loam

Subsurface layer:
8 to 22 inches—dark grayish brown, very friable very fine sandy loam

Transitional layer:
22 to 38 inches—grayish brown, very friable very fine sandy loam

Substratum:
38 to 60 inches—light brownish gray very fine sandy loam

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Moderately low and moderate (1 to 3 percent)
Drainage class: Well drained
Available water capacity: Moderate (6 to 9 inches)
Permeability: Moderately rapid (2 to 6 inches per hour)
Parent material: Loamy and sandy eolian and alluvial sediments
Runoff potential: Low
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Water intake rate: Moderately high

Inclusions

Contrasting inclusions:
• Jayem soils, which have dark colors that are less than 20 inches thick
• Valent soils, which have a thinner surface layer than that of the Vetal soil and have more sand and less silt and clay in the profile

Similar inclusions:
• Soils that have a surface layer of loamy fine sand

Use and Management

Dryland crops

Suitability: Suited
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the

prevailing wind, helps to control soil blowing and conserve moisture.

Irrigated crops

Suitability: Suited to gravity irrigation systems and sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
• Land leveling may be needed to establish a suitable grade for a gravity irrigation system.
• A gravity irrigation system may require a short length of run because of the moderately high water intake rate of this soil.

Rangeland and hay

Suitability: Suited
Management measures:
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in a severe hazard of soil blowing.

Windbreaks

Suitability: Suited
Management measures:
• Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the tree rows. Cultivation needs to be restricted to the tree rows.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods.

Dwellings

Suitability: Suited

Septic tank absorption fields

Suitability: Suited

Interpretive Groups

Land capability classification: Dryland—IIe-3; irrigated—IIe-8
Windbreak suitability group: 5
Range site: Sandy
Irrigation design group: 8

WeB—Wildhorse fine sand, 0 to 3 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales and hummocks
Slope range: 0 to 3 percent (mainly 0.5 percent)
Major use: Rangeland and native hayland

Composition

Wildhorse soil and similar soils: 90 percent (plus or minus 10 percent)
Contrasting inclusions:
Ipage soil, 5 percent (plus or minus 5 percent)
Hoffland soil, 5 percent (plus or minus 5 percent)

Typical Profile

Surface layer:
0 to 3 inches—grayish brown, very friable, calcareous fine sand

Subsurface layer:
3 to 8 inches—light brownish gray, very friable, calcareous fine sand

Transitional layer:
8 to 14 inches—light brownish gray, loose, calcareous sand

Substratum:
14 to 29 inches—light gray, calcareous sand
29 to 60 inches—light brownish gray, calcareous sand

Soil Properties and Qualities

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low to moderate (0.5 to 3.0 percent)
Drainage class: Somewhat poorly drained
Depth to the seasonal high water table: 1.5 feet during wet years to 3.5 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Low
Hazard of water erosion: None
Hazard of soil blowing: Very severe
Distinctive property: Strongly sodic or very strongly sodic

Inclusions

Contrasting inclusions:
• Ipage soils, which are moderately well drained, are

not strongly sodic or very strongly sodic, and are slightly higher on the landscape than the Wildhorse soil
• Hoffland soils, which have a dark surface layer of fine sandy loam, are not strongly sodic or very strongly sodic, and are slightly lower on the landscape than the Wildhorse soil

Similar inclusions:
• Soils that are moderately sodic

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• If an area is reseeded, the species selected for planting should be those that tolerate the salinity or alkalinity of the soil.
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in the hazard of soil blowing.

Windbreaks

Suitability: Unsuited

Dwellings

Suitability: Poorly suited
Management measures:
• Constructing dwellings and buildings on elevated, well compacted fill material helps to overcome the wetness caused by the seasonal high water table.
• The walls of shallow excavations can slough or cave in unless they are temporarily shored during dry periods.
• Lawns and ornamental plantings may be difficult to establish and maintain because of the strong alkalinity.

Septic tank absorption fields

Suitability: Unsuited
Management measures:
• A suitable alternative site should be selected because of the wetness caused by the seasonal high water table and the poor filtering capacity.

Interpretive Groups

Land capability classification: Dryland—VIs-1
Windbreak suitability group: 10
Range site: Saline Subirrigated

WhB—Wildhorse-Hoffland complex, 0 to 3 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Wildhorse—swales and hummocks; Hoffland—swales
Slope range: Wildhorse—0 to 3 percent (mainly 1 percent); Hoffland—0 to 1 percent (mainly 0.5 percent)
Major uses: Rangeland and native hayland

Composition

Wildhorse soil and similar soils: 60 percent (plus or minus 10 percent)
Hoffland soil and similar soils: 30 percent (plus or minus 10 percent)
Contrasting inclusions:
Ipage, calcareous, soil, 8 percent (plus or minus 8 percent)
Marlake soil, 2 percent (plus or minus 2 percent)

Typical Profile

Wildhorse

Surface layer:
0 to 3 inches—dark grayish brown, loose, calcareous fine sand

Subsurface layer:
3 to 8 inches—grayish brown, loose, calcareous fine sand

Transitional layer:
8 to 18 inches—light brownish gray, loose, calcareous fine sand

Substratum:
18 to 60 inches—light gray and light brownish gray, calcareous fine sand

Hoffland

Surface layer:
0 to 7 inches—gray, very friable, calcareous fine sandy loam

Subsurface layer:
7 to 12 inches—light gray, very friable, calcareous loamy fine sand

Substratum:
12 to 28 inches—light brownish gray, calcareous fine sand
28 to 60 inches—light brownish gray, calcareous fine sand and loamy fine sand

Soil Properties and Qualities

Wildhorse

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low to moderate (0.5 to 3.0 percent)
Drainage class: Somewhat poorly drained
Depth to the seasonal high water table: 1.5 feet during wet years to 3.5 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Low
Hazard of water erosion: None
Hazard of soil blowing: Very severe
Distinctive property: Strongly sodic or very strongly sodic

Hoffland

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: High and very high (4 to 12 percent)
Drainage class: Poorly drained
Depth to the seasonal high water table: Surface during wet years to a depth of 1.5 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Very low
Hazard of flooding: Rare
Hazard of ponding: Rare
Hazard of water erosion: None
Hazard of soil blowing: Slight
Distinctive property: More than 15 percent calcium carbonate in 6 inches or more of the profile

Inclusions

Contrasting inclusions:
• Ipage, calcareous, soils, which are not strongly alkaline or very strongly alkaline, are moderately well drained, and are slightly higher on the landscape than the Wildhorse and Hoffland soils
• Marlake soils, which are very poorly drained, have water above the surface during most of the year, and are in depressions

Inclusions similar to the Wildhorse soil:
• Soils that are moderately affected by alkalinity

Inclusions similar to the Hoffland soil:
• Soils that have a dark surface layer that is less than 7 inches thick

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Unsuited

Rangeland and hay

Suitability: Suited
Management measures:
• Grazing when the water table is highest results in damage to the grass stand, a rough soil surface, and difficulty in mowing for hay.
• Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be rotated in successive years.

Windbreaks

Suitability: Wildhorse—unsuited; Hoffland—suited
Management measures:
• Onsite investigation is needed to identify the areas that are best suited to windbreaks.
• Only the species that tolerate a high amount of calcium and the occasional wetness should be selected for planting.
• During wet years, cultivation and planting may be delayed until the soil has begun to dry. Planting by hand in the spring may be necessary because of the wetness.
• The weeds and undesirable grasses that compete with the trees and shrubs can be controlled by cultivation between the tree rows when the water table is at its lowest level.

Dwellings

Suitability: Unsuited
• A suitable alternative site should be selected because of the excessive wetness.

Septic tank absorption fields

Suitability: Unsuited
• A suitable alternative site should be selected because of the excessive wetness and the poor filtering capacity of both soils.

Interpretive Groups

Land capability classification: Wildhorse—VIs-1, dryland; Hoffland—Vw-7, dryland
Windbreak suitability group: Wildhorse—10; Hoffland—2D
Range site: Wildhorse—Saline Subirrigated; Hoffland—Wet Subirrigated

WkB—Wildhorse-Ipage, calcareous complex, 0 to 3 percent slopes

Setting

Landscape: Sandhills
Landform: Interdunes
Position on the landform: Wildhorse—swales and hummocks; Ipage—hummocks
Slope range: Wildhorse—0 to 3 percent (mainly 1 percent); Ipage, calcareous—0 to 3 percent (mainly 1 percent)
Major uses: Rangeland

Composition

Wildhorse soil and similar soils: 55 percent (plus or minus 10 percent)
Ipage soil and similar soils: 35 percent (plus or minus 10 percent)
Contrasting inclusions:
Valent soil, 5 percent (plus or minus 5 percent)
Hoffland soil, 5 percent (plus or minus 5 percent)

Typical Profile

Wildhorse

Surface layer:
0 to 5 inches—grayish brown, very friable, calcareous fine sand

Transitional layer:
5 to 14 inches—light brownish gray, loose, calcareous fine sand

Substratum:
14 to 30 inches—light brownish gray, calcareous fine sand
30 to 60 inches—light gray, calcareous fine sand

Ipage

Surface layer:
0 to 5 inches—dark grayish brown, very friable, calcareous fine sand

Transitional layer:
5 to 10 inches—grayish brown, loose, calcareous fine sand

Substratum:
10 to 22 inches—pale brown, calcareous fine sand
22 to 37 inches—very pale brown, calcareous fine sand
37 to 60 inches—light gray and light brownish gray, calcareous fine sand

Soil Properties and Qualities

Wildhorse

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low to moderate (0.5 to 3.0 percent)
Drainage class: Somewhat poorly drained
Depth to the seasonal high water table: 1.5 feet during wet years to 3.5 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Sandy alluvium
Runoff potential: Low
Hazard of water erosion: None
Hazard of soil blowing: Very severe
Distinctive property: Strongly sodic or very strongly sodic

Ipage

Potential rooting depth: Very deep, more than 60 inches
Organic matter content: Low (0.5 to 1.0 percent)
Drainage class: Moderately well drained
Depth to the seasonal high water table: 3 feet during wet years to 5 feet during dry years
Available water capacity: Low (3 to 6 inches)
Permeability: Rapid (6 to 20 inches per hour)
Parent material: Eolian sand
Runoff potential: Low
Hazard of water erosion: None
Hazard of soil blowing: Very severe
Water intake rate: Very high
Distinctive property: Free carbonates on the surface and throughout most of the profile

Inclusions

Contrasting inclusions:
• Valent soils, which are excessively drained and are higher on the landscape than the Wildhorse and Ipage soils
• Hoffland soils, which have a dark surface layer, are poorly drained, and are lower on the landscape than the Wildhorse and Ipage soils

Inclusions similar to the Wildhorse soil:
• Soils that are moderately affected by alkalinity

Inclusions similar to the Ipage, calcareous soil:
• Soils that do not have carbonates in the upper 15 inches of the profile

Use and Management

Dryland crops

Suitability: Unsuited

Irrigated crops

Suitability: Wildhorse—unsuited to gravity irrigation systems or sprinkler irrigation systems; Ipage—unsuited to gravity irrigation systems and poorly suited to sprinkler irrigation systems
Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.
• Close-growing crops, such as small grains and alfalfa, help to control soil blowing.
• Crops that tolerate the strong alkalinity of the Wildhorse soil should be selected if this map unit is used as irrigated cropland.
• Frequent, light applications of irrigation water are needed because of the low available water capacity and the potential for the leaching of nutrients below the root zone.

Rangeland and hay

Suitability: Suited
Management measures:
• If an area is reseeded, the species selected for planting should be those that tolerate the salinity or alkalinity of the soil.
• Overgrazing should be avoided because it depletes the protective plant cover, resulting in the hazard of soil blowing.

Windbreaks

Suitability: Wildhorse—unsuited; Ipage—poorly suited
Management measures:
• Onsite investigation is needed to identify the areas that are best suited to trees and shrubs.
• Because these soils are so loose, the trees planted in windbreaks need to be planted in shallow furrows with as little disturbance of the surface as possible.
• Because young seedlings can be damaged by high winds and can be covered by drifting sand, maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.
• A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall.
• The weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment and by timely applications of approved herbicides.

Dwellings

Suitability: Wildhorse—unsuited; Ipage—poorly suited
Management measures:
• Onsite investigation is needed to identify the areas that are suited to dwellings.
• Constructing dwellings on well compacted fill material helps to overcome the wetness.

Septic tank absorption fields

Suitability: Wildhorse—unsuited; Ipage—poorly suited
Management measures:
• Onsite investigation is needed to identify the areas that are suited to septic tank absorption fields because of the excessive wetness and the poor filtering capacity of both soils.
• Constructing septic tank absorption fields on fill material raises the fields a sufficient distance above the seasonal high water table.
• These soils readily absorb but do not adequately filter the effluent. The poor filtering capacity can result in pollution of the underground water table.

Interpretive Groups

Land capability classification: Wildhorse—VIs-1, dryland; Ipage—VIe-5, dryland, and IVe-12, irrigated
Windbreak suitability group: Wildhorse—10; Ipage—7
Range site: Wildhorse—Saline Subirrigated; Ipage—Sandy Lowland
Irrigation design group: Ipage—12

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and

economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service. The soils designated as prime farmland in Garden County meet that criteria if they are irrigated.

About 122,343 acres in the survey area, or nearly 11 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the southern part, mainly in associations 4, 13, and 14, which are described under the heading "General Soil Map Units."

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

Soils that receive an inadequate amount of rainfall qualify as prime farmland only in areas where this limitation has been overcome by irrigation. The need for irrigation is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

Roger Kanable, conservation agronomist, and Jay Wilson, soil scientist, Natural Resources Conservation Service, helped prepare this section.

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

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

Cropland amounts to about 160,000 acres, or 15 percent, of the land area in Garden County. The largest acreage is used for dryland winter wheat and fallow. The rest of the cropland is used mainly for irrigated corn; dry, edible beans; and alfalfa hay (fig. 14). About 25 percent of the cropland is irrigated.

Management for Dryland Crops

Good management practices for dryland crops are those that reduce the rate of runoff, help to control water erosion and soil blowing, conserve moisture, and improve tilth. Erosion is a severe hazard in many areas and should be controlled by suitable conservation practices.

Soil blowing is a hazard on nearly all of the soils used as cropland, especially during periods of below average rainfall. A conservation management system that leaves crop residue on the surface and wind stripcropping help to control soil blowing. Planting row crops in the more productive soils, and planting hay, pasture plants, or close-growing crops, such as small grain and alfalfa, on the steeper, more erodible soils, help to control both soil blowing and water erosion. In many areas only the proper use of the land can reduce the hazard of erosion.

In Garden County, low rainfall is the main limitation affecting dryland crops. A cropping system that conserves moisture and controls water erosion and soil blowing is needed. A cropping system is the sequence of crops grown on a field and the management needed to conserve soil and water. It helps to maintain tilth, fertility, and a protective plant

Figure 14.—Mowed alfalfa hay and corn on Valent loamy fine sand, 0 to 3 percent slopes, and Valent fine sand, 3 to 9 percent slopes, under center-pivot irrigation.

cover and helps to control weeds, insects, and disease on soils used for dryland crops.

The cropping system should be best suited to the soil. For example, a conservation tillage system that maintains 1,500 pounds per acre of small grain residue on the surface to help control water erosion and soil blowing is needed in areas of Bayard fine sandy loam, 3 to 6 percent slopes. In areas of Bayard loam, 0 to 1 percent slopes, however, 1,000 pounds of small grain residue protects the soil from erosion.

Winter wheat in a wheat-fallow rotation makes up most of the production of dryland crops (fig. 15). Small amounts of dry, edible beans; oats; and barley are also produced as dryland crops. Most of the dryland cropland is on the tableland in the southern part of the county. Nearly all of the soils are susceptible to soil blowing, and many are susceptible to water erosion. The hazard of soil blowing is most severe in March, April, and May, when the winds are mainly from the northwest.

Stripcropping and a conservation management system that keeps crop residue on the surface help to control soil blowing and water erosion. Keeping crop residue on the surface or growing a protective plant cover also minimizes crusting during and after heavy rains. In winter the stubble holds snow on the field and helps to increase the soil moisture supply. Soil blowing can be controlled if crop residue is left on the surface until spring planting. Contour stripcropping is best suited to soils in areas where water erosion and soil

blowing are hazards. In areas that have a hazard of soil blowing, the strips should be perpendicular to the prevailing winds. Soil blowing reduces productivity and can result in damage to growing crops.

Terraces reduce the length of slopes and help to reduce the rate of runoff and help to control erosion. Level terraces are most practical on the long, smooth, moderately sloping uplands.

On the soils assigned to capability subclass IIe, such as Alliance loam, 1 to 3 percent slopes, the best management includes a cover of crop residue, wind stripcropping, applications of fertilizer or feedlot manure, selection of suitable crop varieties, and a planned crop rotation. On the soils assigned to capability subclass IIIe, such as Sidney loam, 3 to 6 percent slopes, the best management includes a cover of crop residue throughout the winter, wind stripcropping, terracing, and a residue management system that leaves about 3,000 pounds of corn residue or 1,500 pounds of small grain residue on the surface after the crops are planted. If the slope is more than 10 percent, grasses and legumes are needed in the cropping sequence to help control water erosion.

The conversion of cropland to pasture or hayland is an economic alternative on the soils assigned to land capability class IV.

Occasionally, tillage is needed to prepare a seedbed and to control weeds. Excessive tillage reduces the extent of the plant cover and increases the hazard of erosion. Tilling in the fall should be avoided on soils that have a hazard of erosion. Tillage practices should be limited to those that are essential. Various methods of conservation tillage are used in Garden County. Ecofallow, no-till planting, disk-plant, chisel-plant, and stubble mulch are well suited to all of the common crops. Grasses and legumes can be planted without further seedbed preparation by drilling into a cover of stubble.

Tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous. Regular additions of crop residue, manure, and other organic material help to improve soil structure and tilth.

Some of the soils, such as Rushcreek loam, 0 to 2 percent slopes, are saline or sodic and thus are unsuitable for many climatically adapted plants. Saline

Figure 15.—The Keith-Kuma-Duroc association on tablelands is used mainly for wheat in a wheat-fallow rotation.

or sodic (alkali) conditions affect the production and type of crops and forage plants. Crops and forage plants that have a good degree of salt tolerance can be grown. Barley and winter wheat are more tolerant than field beans or corn. Such forage species as tall wheatgrass and birdsfoot trefoil are more tolerant than alfalfa or orchardgrass. Applications of feedlot manure and commercial fertilizer, particularly phosphorus, help to overcome the low fertility of these soils. Gypsum and sulfur can be applied on a trial basis but results in the field are commonly disappointing.

Soil fertility is lower in the eroded soils and the sandy soils. All of the soils, however, require additional plant nutrients for optimum production. The type and amount of fertilizer to be applied to the soils should be based on the results of soil tests and the moisture content in the soil at the time of application. If the subsoil is dry and the amount of rainfall is low, fertilizer should be applied at a slightly lower rate than that needed when the soil is moist. On all of the soils that are used for nonlegume crops, nitrogen fertilizer is beneficial. Phosphorus and zinc are commonly needed on the more eroded soils and in areas that are cut for terraces, diversions, or land leveling. The amount of fertilizer needed on soils used for dryland crops is smaller than the amount needed on soils used for irrigated crops because the plant population is lower. All plant nutrients should be applied in a manner that prevents contamination of surface water and ground water.

Dryland Capability Units

This section describes the suitability, management concerns, and management measures for each dryland capability unit in Garden County:

CAPABILITY UNIT IIc-1 (DRYLAND)

Suitability: Suited

Management concerns:
- The main concern is insufficient rainfall during the growing season.

Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface maintains or improves tilth and helps to conserve moisture.

CAPABILITY UNIT IIe-1 (DRYLAND)

Suitability: Suited

Management concerns:
- The main concern is the hazard of water erosion.

Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and conserves moisture.
- Terraces on long slopes help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.

CAPABILITY UNIT IIe-3 (DRYLAND)

Suitability: Suited

Management concerns:
- The main concerns are the hazards of soil blowing and water erosion.

Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
- A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
- Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and helps to conserve moisture.

CAPABILITY UNIT IIIc-1 (DRYLAND)

Suitability: Suited

Management concerns:
- The main concern is insufficient rainfall during the growing season.

Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.

CAPABILITY UNIT IIIe-1 (DRYLAND)

Suitability: Suited

Management concerns:
- The main concern is the hazard of water erosion.

Management measures:
- A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion, maintains or improves tilth, and helps to conserve moisture.

• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.

CAPABILITY UNIT IIe-3 (DRYLAND)

Suitability: Suited

Management concerns:
• The main concerns are the hazards of soil blowing and water erosion.

Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and helps to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

CAPABILITY UNIT IIIw-2 (DRYLAND)

Suitability: Suited

Management concerns:
• The main concern is the wetness resulting from the occasional ponding.

Management measures:
• In some areas applying a system of conservation tillage to the surrounding sloping soils reduces the rate of runoff and the hazard of ponding.
• Tillage, planting, and harvesting are occasionally delayed because of wetness or ponding.

CAPABILITY UNIT IVe-1 (DRYLAND)

Suitability: Suited

Management concerns:
• The main concern is the hazard of water erosion.

Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soils, improves the efficiency and quality of water use, and controls pests.
• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

CAPABILITY UNIT IVe-3 (DRYLAND)

Suitability: Poorly suited

Management concerns:
• The main concerns are the hazards of soil blowing and water erosion.

Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• Stripcropping, or growing crops in alternating strips or with fallow and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and helps to conserve moisture.

CAPABILITY UNIT IVe-5 (DRYLAND)

Suitability: Poorly suited

Management concerns:
• The main concern is the hazard of soil blowing.

Management measures:
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Stripcropping, or growing crops in alternating strips and arranged at an angle perpendicular to the prevailing wind, helps to control soil blowing and helps to conserve moisture.

CAPABILITY UNIT IVe-9 (DRYLAND)

Suitability: Poorly suited

Management concerns:
• The main concern is the hazard of water erosion.

Management measures:
• A conservation cropping sequence that consists of a rotation of row crops, small grains, legumes, and grasses helps to control soil blowing and water erosion, maintains the physical, chemical, and biological conditions of the soil, improves the efficiency and quality of water use, and controls pests.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Terraces help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.
• Tillage and planting operations that follow the contour on sloping soils help to control water erosion and reduce the rate of runoff.

CAPABILITY UNIT IVs-1 (DRYLAND)

Suitability: Poorly suited

Management concerns:
• The main concern is the moderate alkalinity.

Management measures:
• Because of the moderate alkalinity, the species selected for planting should tolerate excess salt.
• Returning crop residue to the soil and applying manure helps to maintain or increase the content of organic matter, improve fertility, and maintain or improve tilth.

CAPABILITY UNIT Vw-7 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are generally unsuited to dryland crops because of the wetness from the seasonal high water table or the hazard of flooding.

CAPABILITY UNIT VIe-1 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are generally unsuited to dryland crops because of the excessive slope and the severe hazard of water erosion.

Management measures:
• Areas previously used as cropland should be reseeded to a suitable grass mixture and used as rangeland.

CAPABILITY UNIT VIe-3 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to dryland crops because of the severe hazards of soil blowing and water erosion.

CAPABILITY UNIT VIe-5 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to dryland crops because of the severe hazard of soil blowing, the excessive slope, or the insufficient available water capacity.

CAPABILITY UNIT VIe-9 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to dryland crops because of the severe hazard of water erosion and the excessive slope.

CAPABILITY UNIT VIs-1 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to cultivated crops because of the strong alkalinity.

CAPABILITY UNIT VIs-4 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to dryland crops because of the severe hazards of water erosion and soil blowing, the low available water capacity, and the shallow depth to bedrock.

CAPABILITY UNIT VIw-5 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to dryland crops because of the severe hazard of soil blowing and the low available water capacity.

CAPABILITY UNIT VIw-7 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to cultivated crops because of the excessive wetness or the hazard of flooding.

CAPABILITY UNIT VIIe-5 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to dryland crops because of the severe hazard of soil blowing, the low available water capacity, and the excessive slope.

CAPABILITY UNIT VIIe-9 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are too steep for the production of cultivated crops.

CAPABILITY UNIT VIIs-4 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are too steep and too shallow for the production of cultivated crops.

CAPABILITY UNIT VIIs-7 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to dryland crops because of the excessive wetness and the hazard of frequent flooding.

CAPABILITY UNIT VIIIw-7 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are unsuited to the production of crops because of the excessive wetness and the hazards of frequent flooding and excessive ponding.

CAPABILITY UNIT VIIIw-8 (DRYLAND)

Suitability: Unsuited

Management concerns:
• These soils are too shallow or too rocky for crop production.

Management for Irrigated Crops

About 24 percent of the cropland in Garden County is irrigated. Corn or alfalfa is grown on most of the irrigated cropland. A small acreage is used for dry, edible beans and other crops (fig. 16). The irrigation water is obtained from wells and canals fed by the North Platte River. Gravity or sprinkler systems are used for row crops and alfalfa.

The cropping sequence on soils that are well suited to irrigation consists mainly of row crops. A crop rotation that includes different crops, such as corn, alfalfa, and dry, edible beans, helps to control the diseases and insects that are common if the same crop is grown year after year.

Gently sloping soils, such as Keith loam, 3 to 6 percent slopes, are subject to water erosion if they are furrow irrigated down the slope. If a furrow irrigation system is used, these soils should be contour bench leveled, or contour furrows should be used in combination with a ridge-till conservation tillage system. Land leveling increases the efficiency of furrow irrigation because it results in an even distribution of water.

A tailwater recovery system with a pit can be installed to store irrigation tailwater. This water can then be pumped back onto the field and used again. This practice increases the efficiency of the irrigation system and conserves the supply of underground water.

Contour farming and management that leaves crop residue on the surface help to control soil blowing and water erosion on soils irrigated by a sprinkler system. When water is applied by sprinklers at a controlled rate, it is absorbed by the soil and does not run off the surface. Sprinklers can be used on the more sloping soils and on the nearly level soils. Some soils, such as Jayem fine sandy loam, 2 to 6 percent slopes, are suited to sprinkler irrigation only if erosion is controlled. Because the application of water can be carefully regulated, sprinklers can be used for special purposes, such as establishing a new pasture on moderately steep soils. The most common type of sprinkler irrigation used in Garden County is the center-pivot system.

Irrigation is most efficient if it is started after the plants have used about half of the available water in the soil. Thus, if a soil holds 8 inches of available water, irrigation should be started when about 4 inches have been removed by the crop. All of the soils

Figure 16.—Dry, edible beans irrigated with gravity flow from a gated pipe in the Bayard-Scoville-Rushcreek association.

in Nebraska are described in the Nebraska Irrigation Guide *(9)*.

Assistance in planning and designing an irrigation system can be obtained from the local office of the Natural Resources Conservation Service or from the Cooperative Extension Service. Estimates of the cost of irrigation equipment can be obtained from local dealers and manufacturers.

Irrigated Capability Units

This section describes the suitability, management concerns, and management measures for each irrigated capability unit in Garden County:

CAPABILITY UNIT I-4 (IRRIGATED)

Suitability:
- These soils are suited to gravity and sprinkler irrigation.

Management concerns:
- The main concern is the efficient use of water.

Management measures:
- Irrigation water should be applied at a rate and quantity based on the moderately low water intake rate of the soil to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.

CAPABILITY UNIT I-6 (IRRIGATED)

Suitability:
- These soils are suited to gravity and sprinkler irrigation.

Management concerns:
- The main concern is the efficient use of water.

Management measures:
- Irrigation water should be applied at a rate and quantity based on the moderate water intake rate of the soils to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.

CAPABILITY UNIT I-8 (IRRIGATED)

Suitability:
• These soils are suited to gravity and sprinkler irrigation.

Management concerns:
• The main concern is the efficient use of water.

Management measures:
• Irrigation water should be applied at a rate and quantity based on the moderately high water intake rate of the soil to achieve the efficient use of water, reduce the rate of runoff and the leaching of nutrients, and promote good crop growth.

CAPABILITY UNIT IIe-4 (IRRIGATED)

Suitability:
• These soils are poorly suited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns are establishing suitable grades for gravity irrigation, controlling runoff and erosion, and the efficient use of water.

Management measures:
• Land leveling can be used to establish a suitable grade for a gravity irrigation system, but severe cuts during land leveling could expose the clayey subsoil and reduce the potential productivity of crops.
• Adjusting the water application rate to the moderately low water intake rate allows the soil to absorb most of the water, helps to reduce the rate of runoff, helps to control erosion, and promotes good crop growth.
• If a sprinkler irrigation system is used on long, smooth slopes, terraces and contour farming can be used to reduce the runoff rate and control erosion.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to reduce the runoff rate, control water erosion, and helps to conserve moisture.

CAPABILITY UNIT IIe-8 (IRRIGATED)

Suitability:
• These soils are poorly suited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns are the hazard of soil blowing, the proper water application rates, and the efficient use of water.

Management measures:
• Water should be applied at a rate and quantity based on the ability of the soil to absorb and hold moisture to achieve the efficient use of water, reduce the rate of runoff, control erosion, reduce the leaching of nutrients, and promote good crop growth.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps reduce the rate of runoff, controls water erosion and soil blowing, and helps to conserve moisture.
• Land leveling may be needed to establish a suitable grade for a gravity irrigation system.
• Gravity irrigation systems may require a short length of run because of the moderately high water intake rate of the soils.

CAPABILITY UNIT IIIe-4 (IRRIGATED)

Suitability:
• The soils are poorly suited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns affecting gravity irrigation are establishing suitable grades, controlling runoff and erosion, the proper water application rate, and the efficient use of water. The main concerns affecting sprinkler irrigation are controlling runoff and erosion, the proper water application rate, and the efficient use of water.

Management measures:
• A sprinkler irrigation system is best suited to these soils because extensive land leveling or bench leveling would be needed for a gravity irrigation system. Deep cuts could expose the subsoil and reduce the potential productivity of crops.
• Adjusting the water application rate to the moderately low water intake rate allows the soil to absorb most of the water, reduces the rate of runoff, controls erosion, and promotes good crop growth.
• If a sprinkler irrigation system is used, terraces, contour farming, and management that leaves crop residue on the surface can be used to reduce the runoff rate and control erosion.

CAPABILITY UNIT IIIe-6 (IRRIGATED)

Suitability:
• These soils are poorly suited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns affecting gravity irrigation are establishing suitable grades, controlling runoff and erosion, proper water application rates, and the efficient use of water. The main concerns affecting sprinkler irrigation are controlling runoff and erosion, proper water application rates, and the efficient use of water.

Management measures:
• A sprinkler irrigation system is best suited to these soils because extensive land leveling or bench leveling would be needed for a gravity irrigation system. Deep cuts could expose the calcareous underlying material and reduce the potential productivity of crops.
• Adjusting the water application rate to the moderate water intake rate allows the soil to absorb most of the water, reduces the rate of runoff, controls erosion, and promotes good crop growth.
• If a sprinkler irrigation system is used, terraces, contour farming, and management that leaves crop residue on the surface can be used to reduce the runoff rate and control erosion.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.

CAPABILITY UNIT IIIe-8 (IRRIGATED)

Suitability:
• These soils are poorly suited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns are the available supply of moisture, establishing suitable grades for gravity irrigation, the hazards of soil blowing and water erosion, and the efficient use of water.

Management measures:
• Frequent, light applications of water may be needed to promote good crop growth. A sprinkler irrigation system is best suited to these soils because extensive land leveling or bench leveling would be needed for a gravity irrigation system.
• Close-growing crops, such as small grains and alfalfa, can help to control soil blowing.
• If a sprinkler irrigation system is used, a system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control water erosion and soil blowing, maintains or improves tilth, and helps to conserve moisture.
• Terraces and contour farming help to control water erosion, reduce the rate of runoff and sedimentation, and help to conserve moisture.

CAPABILITY UNIT IIIs-6 (IRRIGATED)

Suitability:
• These soils are poorly suited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns are the moderate alkalinity and the efficient use of water.

Management measures:
• Land leveling is needed for a gravity irrigation system, but deep cuts expose the strongly alkaline subsoil and limit the potential for the growth and production of crops.
• Because of the moderate alkalinity, the species selected for planting should tolerate excess salts.
• Adjusting the water application rate to the moderate water intake rate allows the soil to absorb most of the water, reduces the rate of runoff, and promotes good crop growth.

CAPABILITY UNIT IIIe-10 (IRRIGATED)

Suitability:
• These soils are poorly suited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns are the available supply of moisture, the proper water application rates, the hazard of soil blowing, and the efficient use of water.

Management measures:
• Frequent, light applications of water may be needed to maintain crops because of the moderate available water capacity. Leaving crops or crop residue on the surface helps to control soil blowing and conserve moisture.
• A gravity irrigation system may require a short length of run because of the high water intake rate of the soil. Land leveling may also be required to establish a suitable grade for a gravity irrigation system.

CAPABILITY UNIT IVe-6 (IRRIGATED)

Suitability:
• These soils are not suited to gravity irrigation and are poorly suited to sprinkler irrigation.

Management concerns:
• The main concerns are reducing the rate of runoff, controlling water erosion, and the efficient use of water.

Management measures:
• Alfalfa, small grains, and introduced grasses are better suited to these soils than row crops because of the excessive slope and the severe hazard of water erosion.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface reduces the rate of runoff and helps to control water erosion.
• If a sprinkler irrigation system is used, terraces and contour farming can be used to control water erosion. Adjusting the water application rate to the moderate

water intake rate allows the soil to absorb most of the water, reduces the rate of runoff, helps to control erosion, and promotes good crop growth.

CAPABILITY UNIT IVe-8 (IRRIGATED)

Suitability:
• These soils are unsuited to gravity irrigation and are poorly suited to sprinkler irrigation.

Management concerns:
• The main concerns are reducing the rate of runoff, controlling water erosion and soil blowing, and the efficient use of water.

Management measures:
• If a sprinkler irrigation system is used, terraces, contour farming, and leaving crop residue on the surface help to reduce the rate of runoff and control erosion. Cuts during the construction of terraces may expose sandstone or the calcareous underlying material, which may reduce the potential productivity of crops.
• A cropping system that includes close-growing crops, such as small grains and alfalfa, helps to control soil blowing and water erosion.
• Frequent, light applications of water are needed to maintain the growth of crops because of the moderate available water capacity.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and water erosion, maintains or improves tilth, and helps to conserve moisture.

CAPABILITY UNIT IVe-10 (IRRIGATED)

Suitability:
• These soils are unsuited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns are reducing the rate of runoff, controlling water erosion and soil blowing, proper water application rates, the available supply of moisture, and the efficient use of water.

Management measures:
• A system of conservation tillage that leaves a maximum amount of crop residue on the surface reduces the rate of runoff, helps to control soil blowing and water erosion, and helps to conserve moisture.
• Close-growing crops, such as small grains and alfalfa, help to control soil blowing and water erosion.
• Because of the high water intake rate and the low available water capacity of these soils, frequent, light applications of irrigation water are needed to promote good crop growth. Excess water can leach plant nutrients below the root zone.

CAPABILITY UNIT IVe-11 (IRRIGATED)

Suitability:
• These soils are unsuited to gravity irrigation and are suited to sprinkler irrigation.

Management concerns:
• The main concerns are the hazard of soil blowing, proper water application rates, and the efficient use of water.

Management measures:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.
• Close-growing crops, such as small grains and alfalfa, help to control soil blowing.
• Because of the very high water intake rate and the low available water capacity of these soils, frequent, light applications of irrigation water are needed to promote good crop growth. Excess water can leach plant nutrients below the root zone.

CAPABILITY UNIT IVe-12 (IRRIGATED)

Suitability:
• These soils are unsuited to gravity irrigation and are poorly suited to sprinkler irrigation.

Management concerns:
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.
• Close-growing crops, such as small grains and alfalfa, help to control soil blowing.
• Because of the very high water intake rate and the low available water capacity of these soils, frequent, light applications of irrigation water are needed to promote good crop growth. Excess water leaches plant nutrients below the root zone.

CAPABILITY UNIT IVw-12 (IRRIGATED)

Suitability:
• These soils are unsuited to gravity irrigation and are poorly suited to sprinkler irrigation.

Management concerns:
• Tillage may be delayed because of wetness from the seasonal high water table.
• A system of conservation tillage that leaves the maximum amount of crop residue on the surface helps to control soil blowing and helps to conserve moisture.
• Close-growing crops, such as small grains and alfalfa, help to control soil blowing.
• Because of the very high water intake rate and the low available water capacity of these soils, frequent, light applications of irrigation water are needed to

promote good crop growth. Excess water leaches plant nutrients below the root zone.

CAPABILITY UNIT IVw-2 (IRRIGATED)

Suitability:

- These soils are unsuited to gravity irrigation and are poorly suited to sprinkler irrigation.

Management concerns:

- The main concerns are the excessive wetness resulting from the occasional hazard of ponding, the restricted rate of water intake, and the slow drainage.

Management measures:

- Terraces, contour farming, and a system of conservation tillage on adjacent soils can help reduce the rate of runoff from the adjacent slopes that results in ponding on these soils.
- Adjusting the water application rate to the low water intake rate allows the soils to absorb most of the water and prevent ponding.
- Tillage, planting, and harvesting may need to be delayed because of the excessive wetness or ponding.

Weed Control

A suitable cropping sequence or appropriate herbicides help to control weeds. Rotating different crops in a planned sequence not only helps to control weeds but also increases the productivity of crops and the content of organic matter. The kind and amount of herbicide applied to the soil should be carefully controlled. The colloidal clay and humus fractions of the soil are responsible for most of the chemical activity in the soil. Applications of an excessive amount of herbicide result in crop damage on sandy soils that have a low content of colloidal clay and on soils that have a moderately low or low content of organic matter. Herbicides should be applied in a manner that minimizes the risk of contamination to supplies of surface water and ground water. The Natural Resources Conservation Service or the Cooperative Extension Service can provide additional information about weed control.

Management of Pasture and Hayland

Pasture or hayland should be managed for maximum forage production. After a pasture is established, the grasses should be kept productive. In Garden County pastures consist mainly of cool-season grasses that start to grow early in the spring and reach their peak growth in May and June. Unless the pasture is irrigated, these grasses are dormant during July and August and start to grow again in the fall. For this reason, the grasses grown for pasture should be managed in a planned grazing system along with pastures of warm-season grasses. The management should include rotation grazing of the pasture to allow regrowth of the grasses and an extension of the grazing season. Cool-season grasses can be grazed in the spring after they reach a height of 5 or 6 inches. Until the plants reach this height, they grow on food reserves stored in their roots and rhizomes. Grazing too early in the spring or too late in the fall reduces the vigor of the plants. The most commonly grown introduced grasses in cool-season pastures are intermediate wheatgrass and pubescent wheatgrass. Other cool-season grasses and legumes that are adapted to the soils and climate in the county are western wheatgrass, tall wheatgrass, creeping foxtail, meadow bromegrass, reed canarygrass, birdsfoot trefoil, and cicer milkvetch.

Grasses and legumes used for both irrigated and dryland pasture and hayland require additional plant nutrients for maximum forage production. The type and amount of fertilizer should be determined by a soil test.

Yields per Acre

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

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

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

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are

likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

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

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit *(7)*. These levels are defined 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. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 and IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Rangeland

Kenneth L. Hladek, range conservationist, Natural Resources Conservation Service, helped prepare this section.

Rangeland makes up about 80 percent of the agricultural land in Garden County. The largest acreages are in the Valent and Valent-Wildhorse-Ipage associations in about the northern two-thirds of the county. Larger ranching operations typically are dominant in these associations. The Sandhills are predominantly wet valleys that have numerous lakes and marshes, particularly in the northern third of the county.

Farms and ranches in the southern part of the county tend to be smaller and more diversified, with cash grain and livestock operations more common. Rangeland throughout the county is used primarily for grazing by livestock. It also supports the production of native hay on subirrigated meadow sites.

The raising of livestock, mainly cow-calf herds in which the calves are sold in the fall as feeders, is the

most important agricultural enterprise in the county. The range is generally grazed from late in the spring to early in the fall. Livestock graze the regrowth on native meadows or crop residue in the fall. At the end of the year many producers hold livestock on winter pastures near their headquarters. Livestock are fed alfalfa, native hay, or both during the winter and early spring. The rangeland forage is often also supplemented with protein in fall and winter.

Some of the rangeland in the county is producing well below its forage potential because of past continuous heavy grazing. This is particularly true where stocking rates are tied to the amount of crop residue available for grazing in the fall. Poor grazing distribution, the encroachment of brush on uplands, and increased amounts of small soapweed and sand sagebrush also contribute to a reduced production of forage on rangeland in the county.

The main objective of range management is to maintain or improve the range in excellent condition. The proper management of rangeland is one of the most important practices for the conservation of the soil, water, and plant resources in Garden County. The productivity of the range can be increased by implementing proper range management improvement practices, such as proper grazing use, planned grazing systems, range seeding, and brush control. Proper management not only improves the yield of the desirable forage plants for grazing but also reduces soil losses, increases the livestock production potential, and maintains or improves water quality.

This section can aid ranchers and conservationists in planning the management of the county's rangelands. It defines range sites, the evaluation of range condition, and describes planned grazing systems and other management practices for sustained forage production on range and hayland in the county.

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

Table 8 shows, for each soil that supports rangeland vegetation suitable for grazing, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants (fig. 17). The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

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

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

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

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

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management

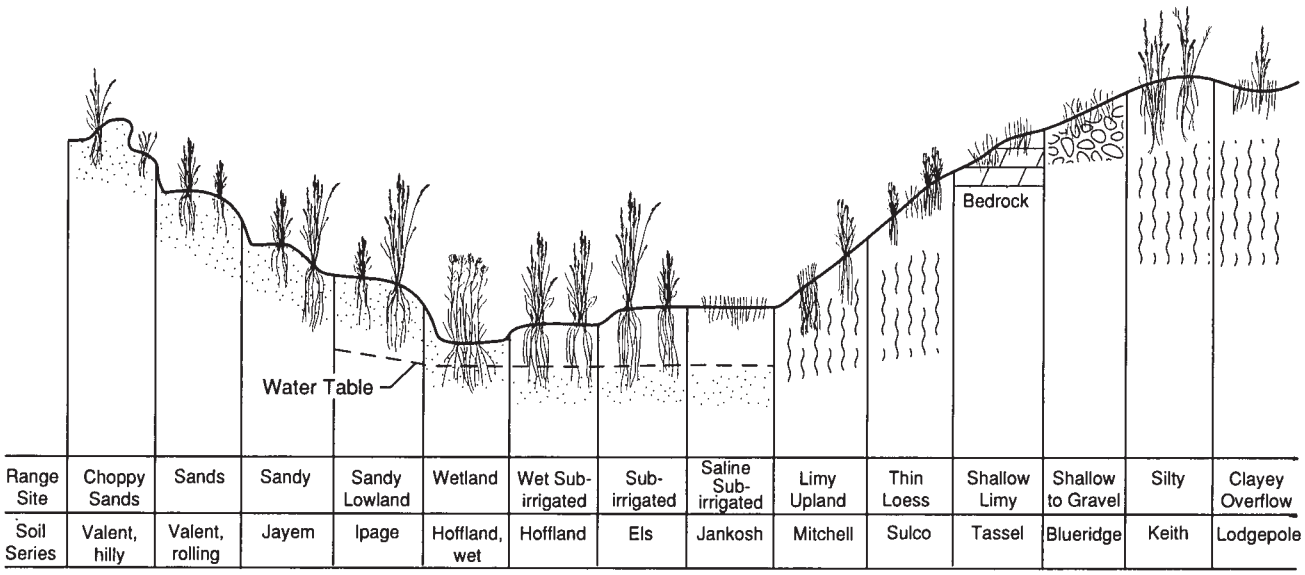

Figure 17.—A schematic cross section showing the general relationship between range site vegetation and some soil series in Garden County.

generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Proper Grazing Use

Proper grazing use is grazing at an intensity that maintains sufficient cover to protect the soil and that maintains or improves the quantity and quality of the desirable vegetation. It is the first and most important step of successful range management. It increases the vigor and reproduction of desirable plants, allows the litter and mulch that are necessary to help control erosion to accumulate, and increases forage production. Proper grazing use on rangeland removes half of the current year's growth, by weight, during the entire growing season.

Proper grazing use generally is determined by the degree a key species is grazed in a key grazing area. It is influenced by stocking rate, the distribution of livestock, and the kinds and classes of livestock.

Stocking Rates.—The stocking rate is the number of grazing animals in a particular pasture. It is calculated by using animal units and animal unit months. An *animal unit* is a 1,000 pound cow and a calf less than three months old, or its equivalent. Weight variations of animals require adjustments in animal units (AU) equal to 0.1 AU for every 100 pounds of live weight variation. For example, a 1,300 pound cow would equal 1.3 AUs. An *animal unit month* (AUM) is the amount of forage or feed necessary to sustain an animal unit for 1 month, or of approximately 780 pounds. Range sites and the range condition are used to determine animal unit months for each pasture. Suggested initial stocking rates can then be calculated for individual pastures. AUM's for each range site in excellent condition are given for each soil in the "Detailed Soil Map Units" section of this survey. AUM values are lower for range sites in less than excellent condition.

Suggested initial stocking rates for rangeland are relatively easy to calculate for any given soil or range site. For example, in an area of Valent fine sand, rolling (Sands Range Site) the suggested initial stocking rate is 0.7 AUM per acre if the range is in excellent condition. A 640-acre pasture in excellent condition would then carry 0.7 x 640, or 448 animal units, for 1 month. If the pasture is to be grazed for 5 months, the suggested initial stocking rate would be 448 divided by 5, or 90 animal units. The initial suggested stocking rates are based on the condition of the present plant community and the average annual forage production each range site is capable of producing and are conservative estimates. They may be high or low for any given year. Because of the variability of the weather, forage production often varies significantly. Stocking rates are only intended to be a starting point and should be changed as forage production or management objectives change.

Distribution of Livestock.—If proper range use is to

be accomplished evenly over a pasture, the distribution of cattle within the pasture requires planning. Livestock tend to graze areas near water, roads or trails, and on gentle relief. Distant corners of pasture, steep terrain, and areas away from water are often only lightly grazed. Poor grazing distribution may be caused by too few watering locations or by salt, shade, supplemental feed, and water in one location or in a poor location. Continued concentration of livestock causes severe use in localized parts of a pasture, resulting in areas that are subject to erosion. Careful placement of fences, salt, water, and planned grazing systems help to achieve a uniform distribution of grazing.

Fences help to distribute livestock and provide more uniform grazing of forage if placed in correct locations. They also divide pastures for grazing systems and can be used to exclude livestock from blowouts and reseeded areas. Cross fences should follow natural land features and range site boundaries where possible. More importantly, the potential stocking rates should be similar for all pastures and further subdivision could be made easily if needed. Efficiency in forage use should be considered along with convenience in operations when determining pasture size. Generally, the smaller the pasture, the more efficient the use of the forage by livestock.

Properly locating salt and minerals is the most economic and often the easiest means of encouraging uniform use of forage in a pasture. The salt and mineral locations should be located some distance away from water. Cattle do not need to drink immediately after consuming salt or minerals. They can be moved to areas of the pasture that are undergrazed during the grazing season to achieve a uniform distribution of grazing. In areas of the Valent soils, moving these locations each time they are put out lessens the hazard of blowouts resulting from concentrations of livestock.

Watering facilities need to be placed properly to encourage the distribution of grazing. In Garden County, livestock water is most often obtained from wells that use windmills for pumping in the northern two-thirds of the county (fig. 18). This water is generally supplemented by the numerous natural lakes because of the high water table. Dugouts could be used on the wetter range sites, and stockwater dams or pipelines are in the heavier textured soil associations in the county. Watering facilities should be spaced at varying distances, depending on topography. For example, in areas of rough or hilly terrain, cattle should not have to travel more than half a mile to water. In the more level areas, the distance to water should be no more than about a mile. If the distance to water is excessive, cattle tend to graze close to the water sources repeatedly rather than moving out to graze the pasture uniformly.

Kinds and Classes of Livestock.—The management of rangeland is dependent on the kind and class of livestock grazing the pasture. Cattle, sheep, and horses have different grazing habits and nutritional needs that affect the way range can best be managed for proper grazing use.

Cattle are the principal livestock raised in Garden County and are well suited to grazing the predominant range sites. Grazing habits also differ among classes of cattle. Yearlings tend to travel more and farther within a pasture than cow-calf pairs. They also graze the steeper slopes more. As a result, they use a pasture more uniformly than cows with calves. However, yearlings tend to trail along fence lines, which sometimes results in erosion. Cow-calf pairs generally graze more on the gentler slopes and stay closer to watering facilities than yearlings. For these reasons, poor grazing distribution may be more of a problem in pastures stocked with cow-calf pairs than in those stocked with yearlings.

General management techniques outlined in this section and in the "Detailed Soil Map Units" section apply mainly to the production of cattle. Where different livestock are grazed, management may need to be adjusted.

Range Condition

The range condition is the existing state of the vegetation compared to its potential, or climax, vegetation. Climax vegetation is a stable plant community that represents the highest potential of plant succession. It is the most productive combination of adapted plants on rangeland and represents the highest potential in the amount and diversity of vegetation for a given range site. It maintains itself and changes little as long as the climate and soil remain stable and grazing is at a proper level.

Determining the range condition provides an approximate measure of the overall health of the plant community. More importantly, it provides a basis for predicting the degree of improvement possible under different kinds of management. Four range condition classes are used to express the degree to which the composition of the present plant community has departed from that of the climax vegetation. These classes are excellent, good, fair, and poor.

All food that green plants use for maintenance, growth, and reproduction is manufactured in their leaves. The excessive removal of plant leaves during the growing season drastically affects the growth of both roots and shoots. Livestock graze selectively,

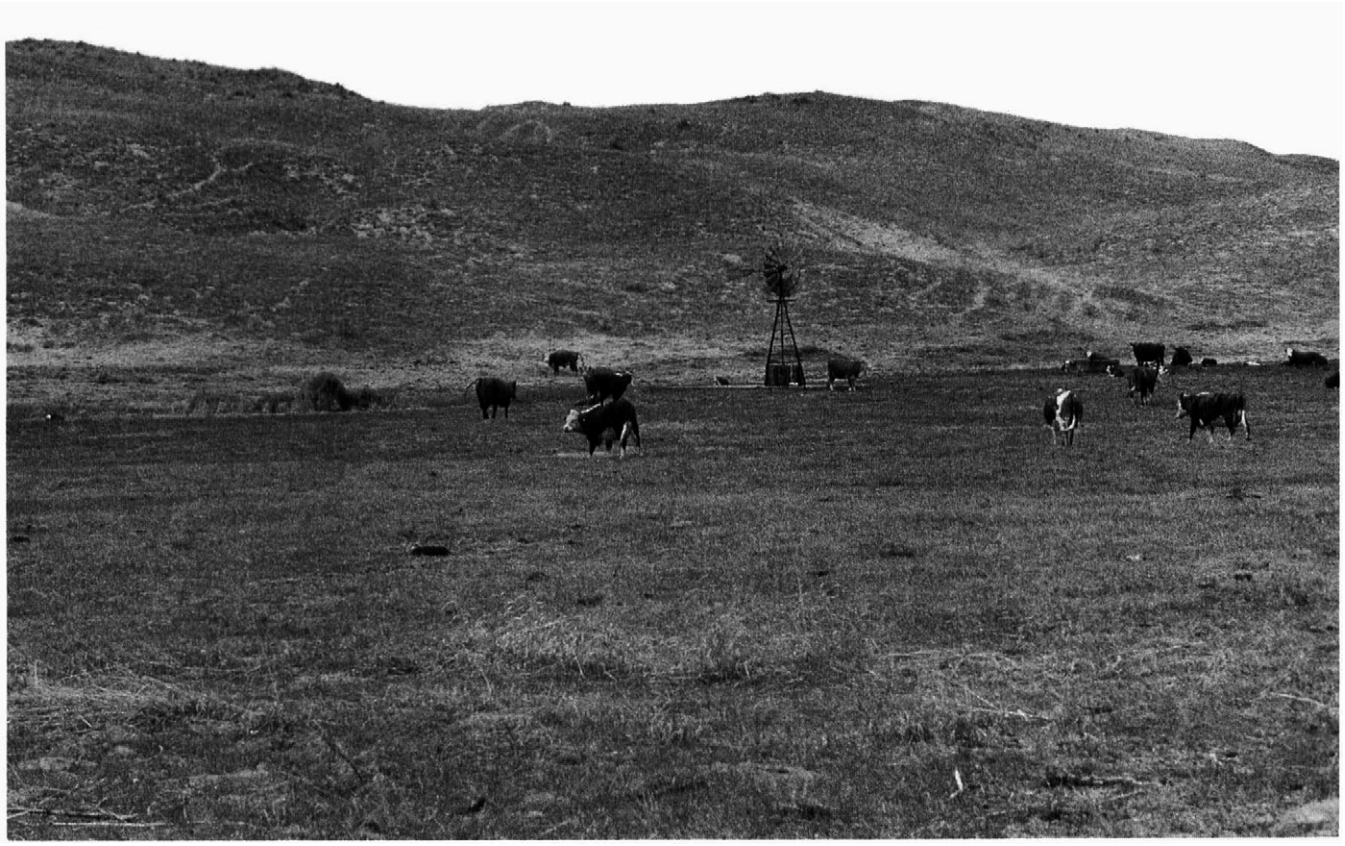

Figure 18.—Windmills provide power to pump water for livestock in the Sandhills.

removing more leaves from some plants than from others. This selective grazing varies according to the season of use and the kind and class of livestock. Various plants respond to continuous heavy grazing in different ways. Some decrease in abundance, some increase, and others not originally present may invade. Plant responses to grazing are used to classify range condition.

The *decreaser species* are those present in the original plant community that decrease in abundance if grazed closely and continuously during the growing season. The *increaser species* are those in the original plant community that normally increase, up to a point, in abundance under continuous heavy grazing. They increase as the decreaser plants cover less of the site. *Invader species* are not part of the original plant community. They begin growing in an area after the decreasers and increasers have been weakened or eliminated.

Once range condition is determined, it is important to know whether it is improving or deteriorating. This change or trend in range condition is determined to help plan adjustments in grazing use and management. Important factors affecting trends in the plant community are plant vigor, composition change, and reproductive capacities of both the desirable and undesirable species.

The goal of range management should be an excellent range condition. The optimum forage yields are obtained on a sustained basis when the range is in excellent condition and trend is up. Under these circumstances, soil blowing and water erosion are minimal and plants on rangeland in this condition can also make optimum use of precipitation.

At the end of each map unit description, the soil or soils in that unit are placed in the appropriate range site, according to the kinds and amounts of vegetation that can be expected when the site is in excellent condition.

Deferred Grazing

Deferred grazing is the resting of grazing land for a prescribed period. The need for deferment is based on plant vigor, range condition, and range trend. To be beneficial, deferments should be for a minimum of 3 consecutive months and coincide with the critical

growth periods of the key forage plants. These periods vary with grass species. Maximum benefit from deferment coincides with the food-storage periods. For warm-season native grasses this occurs late in summer, from late July to early October. In some areas, a short deferment of 3 months is all that is needed, while in other areas two growing seasons of rest may be needed before there is improvement. Generally, some grazing during the year is more beneficial than a complete yearlong deferment. Deferred pastures may be grazed after heavy frost in fall or early in spring before the initiation of growth of the warm-season grasses. During periods of grazing in winter, protein supplements should be made available to cattle to meet their nutritional needs.

Deferred grazing allows plants a rest period during critical times in their growth stages. This period allows grasses to build up vigor and to produce a mulch at the surface, thus increasing the rate of water infiltration. The mulch also helps to reduce the loss of soil by erosion. Deferred grazing also encourages natural grass reseeding by allowing desirable species to set seed and spread vegetatively.

Where severe overgrazing has eliminated the native grasses, reseeding the range to adapted grasses is the best method of native range restoration. Reseeding of native range, excluding old cropland fields, should be done only after careful evaluation to ensure that remnants of the desirable grasses do not exist in sufficient numbers to restore the area by the use of such grazing management techniques as planned grazing systems.

Planned Grazing Systems

Planned grazing systems are effective in achieving maximum forage production and livestock performance while controlling erosion. In a planned grazing system, two or more pastures are alternately rested and grazed in a planned sequence over a period of years. Each pasture is grazed in a different sequence each year. The rest periods are planned for each pasture some time during the growing season, and all livestock are removed from the pasture being rested. If livestock do not graze the same pasture at the same time each year, the plants are not close-cropped at the same stage of development every year. This grazing system improves plant vigor, forage production, and the plant community, which results in a better range condition. Planned grazing systems permit maximum and uniform use of forage, while maintaining rangeland productivity over a period of years.

Planned grazing systems can help to maintain or improve the plant cover and result in the proper use of forage. They increase the efficiency of grazing by uniformly using all parts of the pasture. The rest period built into a planned grazing system helps to improve plant vigor and vegetative reproduction and quality, thus increasing forage production. Planned grazing systems also help to reduce the adverse effects of drought and other climatic changes.

To be effective, planned grazing systems must be flexible and adapted to the needs of an individual rancher. Fences, watering facilities, range condition, range trend, range sites, kinds or classes of grazing animals, and economic factors are all important considerations in determining the best system for a particular operation. Systems may be simple, such as a one herd two pasture, or very intensive, involving one or more herds with a larger number of pastures grazed on the basis of rate of growth of the available forage. Grazing systems are dynamic and should be modified over a period of time because of improved plant vigor and forage production or changes in management goals.

The use of a planned grazing system, in time, can result in an increase in stocking rates because of improved plant production and improved plant quality. Planned grazing systems are also effective in controlling blowouts and may help to control the number of parasites and the likelihood of disease among cattle since the pastures are generally cleaner.

Range Seeding

In some areas, range management practices alone cannot restore a satisfactory cover of native vegetation. Old cultivated fields, "go-back" areas, and abandoned farmsteads may need to be restored by range seeding. Range seeding may also be required in severely overutilized areas where the vegetation has deteriorated to the point that it does not respond to management practices.

Good stands of native grasses can be reestablished if the seedbed is properly prepared, adapted species of native grasses are used, the correct seeding practices are employed, and good management is applied after seeding. Range seeding is most successful when the seedbed is firm and has a cover of mulch. A firm seedbed helps to ensure good soil-to-seed contact, which is essential for seedling development. The cover of mulch helps keep the soil moist, lowers the temperature of the surface soil, and helps to control erosion. A cover of mulch can be provided by planting a temporary crop, such as sudangrass or grain sorghum. The grass should be seeded directly into the cover crop stubble the following fall, winter, or spring. Tillage should be avoided because a firm seedbed is needed. On soils

that have a coarser textured surface layer and are subject to soil blowing, seedbed preparation and seeding should be done in strips over a period of several years, or with a range interseeder to minimize the hazard of soil blowing.

Seeding mixtures should consist of adapted native grass species that are present on the site when it is in excellent range condition. Consequently, grass mixtures should vary according to the soils and range sites. Using a grass drill with depth bands ensures the proper placement of seeds at a uniform depth in the soil. A range interseeder should be used in areas of soils in the Sands and Choppy Sands range sites and in areas that have a severe hazard of soil blowing when the soils are tilled during seedbed preparation. Interseeders place seeds in the center of a shallow furrow without disturbing the vegetation or the soil between the furrows, thus controlling the hazard of erosion.

Generally, newly seeded areas should not be fully grazed until after the grass is established. Establishment may take 2 to 4 years, depending on the grass species, the range site, the method of planting, and the weather. Initial grazing of newly seeded areas should be light. Limited grazing in early spring or late fall and winter helps to control weeds until the grass is established. Proper grazing use and a planned grazing system help keep the range productive after establishment.

Additional information about appropriate grass mixtures, grassland drills, and planting dates for range seeding can be obtained from the Natural Resources Conservation Service or the Natural Resources District office.

Control of Blowouts

Blowouts occur in areas of sandy soils, mainly in the Valent and Valent-Wildhorse-Ipage associations, where the vegetation has been disturbed. Many blowouts in areas of the Sandhills result from the livestock trailing associated with continuous heavy grazing. Larger blowouts generally form in areas near wells because livestock generally concentrate near water. Smaller blowouts often occur along trails or fence lines. Drought conditions and open winters tend to increase the likelihood of the formation of blowouts.

When blowouts are not stabilized, they are likely to become larger. The wind blows sand to bordering areas, where the windblown sand covers the vegetation. The result is an expanding area that is subject to a severe hazard of soil blowing.

A planned grazing system is the most effective way to control blowouts. Controlling grazing through a planned grazing system can stabilize many blowouts in 4 to 5 years. Locating salting facilities and mineral supplements away from blowouts discourages the concentration of livestock in these areas.

In areas where a planned grazing system is not feasible, reseeding may be necessary. Reseeding, however, may not be economically feasible. If blowouts are reseeded, steep banks around the edges should be shaped into a stable slope. A fast-growing cover crop should be planted in the spring. An adapted native grass mixture is then drilled into the undisturbed stubble left from the crop. The cover crop helps to protect the surface from soil blowing, lowers the temperature on the soil surface, and creates a good, firm seedbed. If a cover crop is not practical, a mulch of native hay can be spread over the surface and anchored into the sand after seeding. Mulching helps to control the damage caused by blowing sand while the grasses become established. Once they are seeded, fencing blowout areas help keep out livestock until a desirable stand is established. Proper grazing use and a planned grazing system help to prevent the reactivation of stabilized blowouts after the grasses are established.

Management of Native Hayland

A sizable acreage of rangeland in Garden County is used for the production of native hay. Hay is most often cut on soils that have a high water table. They are mostly associated with the Subirrigated range site in the Valent-Wildhorse-Ipage calcareous soil association (fig. 19). In some areas in the Sandy Lowland, Sandy, or Sands range sites hay is harvested from upland sites that are alternatively used for grazing. These hayfields are much less productive.

Proper hayland management can maintain or improve the production of hay on wet meadows. Timely mowing is needed to maintain strong plant vigor and a high quality and quantity of forage. Mowing the grasses between the boot stage to the emergence of seed heads allows for adequate regrowth and carbohydrate storage in the plant roots before the first frost. A mowing height of no less than 3 inches helps to maintain high plant vigor and promote rapid regrowth. A mowing height of less than 3 inches drastically reduces the reserves of nutrients in the roots.

Meadows should not be grazed or hayed when the soil is wet or the water table is within a depth of 6 inches. Grazing or using heavy machinery during these periods results in the formation of ruts and mounds that make mowing difficult in later years. Meadows can be grazed without damage after the ground is frozen, but livestock need to be removed before the ground thaws and the soil becomes wet.

Figure 19.—Baled native hay in a hay meadow in the Valent-Wildhorse-Ipage calcareous association.

When hay is cut in the drier upland areas, it should be harvested only every other year. During the following year, cutting should be deferred during the growing season and the areas should be used for fall or winter grazing, if necessary, to allow the warm-season grasses to regain vigor and decrease the abundance of cool-season grasses and weeds. As in the wetter areas, the best time for mowing is just before the dominant grasses reach boot stage. Regulating mowing allows the desirable grasses to remain vigorous and healthy. Early mowing allows enough time for adequate plant regrowth. The regrowth also helps to hold snow on the surface in the winter and increase the moisture supply.

Technical assistance in managing or improving range and hayland can be obtained from the local office of the Natural Resources Conservation Service or the Natural Resources District office.

Brush Control

Small soapweed, western snowberry, juniper, smooth sumac, and sand sagebrush are the main brush species in Garden County. Although not a major range problem at the present time, these plants are invading and increasing on the continuously heavily grazed range, resulting in reduced forage production and carrying capacity for livestock.

Yucca can generally be controlled by winter grazing. Feeding a cottonseed cake supplement in yucca-infested areas encourages cattle to browse it. Winter grazing results in yucca losing its vigor. Some plants are also broken off below the root crown when livestock feed in these areas. Applications of approved herbicides have limited effectiveness.

Western snowberry, smooth sumac, and juniper are invading prairie uplands in fairly large numbers in soil associations that are adjacent to the steep canyon areas. Western snowberry and smooth sumac are best controlled by applications of approved herbicides. Repeated applications may be needed for several consecutive years to control snowberry. Recommendations of herbicides are available from the county extension agent or the local office of the Natural Resources Conservation Service.

Juniper is best controlled by cutting the trees at ground level by hand or with earthmoving equipment in areas where the slopes and topography are suitable. Follow-up treatment is not necessary if no green branches remain. Approved herbicides are effective in controlling eastern redcedar. Deferment of pastures after treatment helps to restore plant vigor and the quality of forage.

Recommendations can be obtained from the local office of the Natural Resources Conservation Service.

Range Sites

The range sites in Garden County are described in this subsection. The climax vegetation and the

recommended stocking rate are described for each site. The section "Interpretive Groups," which follows the tables at the back of this survey, indicates the map units in each range site.

CHOPPY SANDS (CS)

The climax vegetation is dominantly sand bluestem, little bluestem, switchgrass, prairie sandreed, and sand lovegrass. These species make up 65 percent or more of the total annual forage. Blowout grass, hairy grama, blue grama, indiangrass, sandhill muhly, and some forbs and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, indiangrass, sand lovegrass, blowout grass, little bluestem, and switchgrass decrease in abundance and are replaced in the plant community by needleandthread, prairie sandreed, blue grama, hairy grama, sand dropseed, sandhill muhly, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts are formed.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Livestock cannot easily cross the very steep slopes. Shaping, seeding, and mulching hasten the reclamation of blowouts.

CLAYEY OVERFLOW (CyO)

The climax vegetation is dominantly blue grama, buffalograss, green needlegrass, and western wheatgrass. These species make up 70 percent or more of the total annual production. Sandberg bluegrass and other annual and perennial grasses, sedges, and forbs make up the remaining 30 percent. If subject to continuous heavy grazing, green needlegrass and western wheatgrass decrease in abundance. If overgrazing continues for many years on the surrounding soils, the protective plant cover is reduced, permitting rapid runoff onto this site. Occasional ponding, although brief in duration, causes sedimentation and the deposition of debris and weed seeds. Delaying grazing after periods of ponding helps to prevent soil compaction.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferments of grazing and haying help to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities, roads, and trails. The areas away from watering facilities may be underused. The distribution of livestock in a pasture can be improved by properly locating fences, watering facilities, and salting facilities. Livestock wells and salting facilities should be distributed in a manner that encourages livestock to graze a pasture uniformly. Locating salting facilities away from watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse.

LIMY UPLAND (LiU)

The climax vegetation is dominantly little bluestem, big bluestem, sideoats grama, plains muhly, western wheatgrass, and threadleaf sedge. These species make up 65 percent or more of the total annual forage. Buffalograss, prairie junegrass, hairy grama, needleandthread, numerous forbs, and some shrubs make up the rest.

If subject to continuous heavy grazing, big bluestem, little bluestem, and sideoats grama decrease in abundance and are replaced in the plant community by blue grama, hairy grama, buffalograss, prairie sandreed, western wheatgrass, needleandthread, plains muhly, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

SALINE LOWLAND (SL)

The climax vegetation is dominantly alkali sacaton, inland saltgrass, blue grama, and western wheatgrass. These species make up 65 percent or more of the total annual forage. Buffalograss, bluegrass, slender wheatgrass, and forbs make up the rest.

If subject to continuous heavy grazing or improperly harvested for hay, alkali sacaton, western wheatgrass, and slender wheatgrass decrease in abundance and are replaced by inland saltgrass, blue grama, buffalograss, bluegrass, and sedges.

If the range is in excellent condition, the suggested

initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Varying amounts of alkali on the site result in irregular patterns of short and tall grasses. Short grasses are dominant where the alkali content of the soil is very strong.

If this site is used as hayland, the forage should be harvested only every other year. Mowing should be regulated so that the grasses remain vigorous and healthy.

SALINE SUBIRRIGATED (SS)

The climax vegetation is dominantly alkali sacaton, inland saltgrass, western wheatgrass, and plains bluegrass. These species make up 70 percent or more of the total annual forage. Alkali cordgrass, little bluestem, foxtail barley, slender wheatgrass, and grasslike plants and forbs make up the rest.

If subject to continuous heavy grazing or improperly harvested for hay, alkali sacaton, western wheatgrass, and switchgrass decrease in abundance and are replaced in the plant community by inland saltgrass, blue grama, plains bluegrass, foxtail barley, sand dropseed, and alkali-tolerant sedges. If overgrazing or improper haying continues for many years, inland saltgrass, blue grama, plains bluegrass, foxtail barley, and alkali-tolerant sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. The alkali condition limits forage production and greatly influences the kinds of plants that grow. Some areas of very strongly alkaline soils support little or no vegetation and are subject to severe soil blowing during dry periods. Careful management is needed to maintain the plant cover.

If this site is used as hayland, mowing should be regulated so that the grasses remain vigorous. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws in the spring.

SANDS (Sa)

The climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 75 percent or more of the total annual forage. Blue grama, indiangrass, sand dropseed, switchgrass, sand lovegrass, sedges, and numerous forbs make up the rest.

If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced in the plant community by prairie sandreed, needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as range.

If this site is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

SANDY (Sy)

The climax vegetation is dominantly prairie sandreed, switchgrass, sand bluestem, needleandthread, little bluestem, and blue grama. These species make up 70 percent or more of the total annual forage. Switchgrass, Scribner panicum, little bluestem, sand dropseed, western wheatgrass, and numerous forbs make up the rest.

If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced in the plant community by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. This site is generally the first to be overgrazed when it is in a pasture that includes Sands or Choppy Sands range sites. Properly located fences, watering facilities, and salting facilities can result in a more uniform

distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as range.

If this site is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only every other year. During the following year, the hayland should be used only as fall or winter range.

SANDY LOWLAND (SyL)

The climax vegetation is dominantly little bluestem, needleandthread, prairie sandreed, switchgrass, and sand bluestem. These species make up 75 percent or more of the total annual forage. Blue grama, prairie junegrass, sand dropseed, purple lovegrass, Scribner panicum, sedges, and numerous forbs make up the rest.

If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced in the plant community by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and forbs dominate the site. Under these conditions, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as range.

If this site is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested for hay only every other year. During the following year, the hayland should be used only as fall or winter range.

SHALLOW LIMY (SwL)

The climax vegetation is dominantly blue grama, little bluestem, needleandthread, sideoats grama, plains muhly, threadleaf sedge, and western wheatgrass. These species make up 65 percent or more of the total annual forage. Green needlegrass, hairy grama, plains muhly, prairie sandreed, sand bluestem, and numerous forbs and shrubs make up the rest.

If subject to continuous heavy grazing, little bluestem, sideoats grama, blue grama, sand bluestem, and green needlegrass decrease in abundance and are replaced in the plant community by needleandthread, plains muhly, western wheatgrass, threadleaf sedge, and forbs. If overgrazing continues for many years, the less desirable woody plants may increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Livestock cannot easily cross areas of very steep slopes. Brush management may be needed in some areas to control the woody plants that invade the site.

SHALLOW TO GRAVEL (SwG)

The climax vegetation is dominantly blue grama, little bluestem, prairie sandreed, sand bluestem, needleandthread, and sand dropseed. These species make up 55 percent or more of the total annual forage. Buffalograss, Fendler threeawn, prairie junegrass, sideoats grama, clubmoss, and forbs and shrubs are also important plants on the site.

If subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie junegrass decrease in abundance and are replaced in the plant community by blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, blue grama, sedges, common pricklypear, brittle pricklypear, fringed sagewort, and other forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Planned short periods of heavy grazing during the grazing season or deferment of grazing in 2 years out of 3 helps to retain little bluestem and prairie sandreed in the plant community. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing.

SILTY (Si)

The climax vegetation is dominantly big bluestem, blue grama, little bluestem, needleandthread, sideoats grama, and western wheatgrass. These species make up 70 percent or more of the total annual forage. Green needlegrass, threadleaf sedge, buffalograss, and numerous forbs and some shrubs make up the rest.

If subject to continuous heavy grazing, big bluestem, little bluestem, sideoats grama, and western wheatgrass decrease in abundance and are replaced in the plant community by blue grama, buffalograss, needleandthread, threadleaf sedge, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing can be excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing.

Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If this site is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

SUBIRRIGATED (Sb)

The climax vegetation is dominantly big bluestem, indiangrass, little bluestem, prairie cordgrass, switchgrass, various sedges and rushes, bulrush, and spike sedge. These species make up 75 percent or more of the total annual forage. Needleandthread, plains bluegrass, slender wheatgrass, and some forbs are also important plants on the site.

If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance and are replaced in the plant community by sideoats grama, western wheatgrass, plains bluegrass, slender wheatgrass, green muhly, sedges, and rushes. If overgrazing or improper haying continues for many years, plains bluegrass, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.6 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to maintain or improve the range condition. This site is generally the first to be overgrazed when it is in a pasture that includes better drained, sandy soils. Properly located fences, watering facilities, and salting facilities result in a more uniform distribution of grazing.

If this site is used as hayland, mowing should be regulated so that the grasses remain vigorous. It should be avoided between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. Most of the carbohydrate storage occurs between this stage and seed maturity. The maximum storage of these food reserves is completed by the first frost. The quality of hay is higher when grasses are cut earlier. A proper mowing height helps to maintain the stand of grasses and high forage production. When the soil is frozen, livestock can graze without damaging the meadows. They should be removed from the meadows before the soil thaws in the spring.

THIN LOESS (TL)

The climax vegetation is dominantly big bluestem, sideoats grama, plains muhly, western wheatgrass, and threadleaf sedge. These species make up 60 percent or more of the total annual forage. Blue grama, hairy grama, prairie sandreed, needleandthread, and numerous forbs and shrubs make up the rest.

If subject to continuous heavy grazing, big bluestem, little bluestem, and sideoats grama decrease in abundance and are replaced in the plant community by blue grama, hairy grama, prairie sandreed, western wheatgrass, needleandthread, plains muhly, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use helps to maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing.

WETLAND (WL)

The climax vegetation is dominantly bluejoint reedgrass, northern reedgrass, prairie cordgrass, various sedges and rushes, bulrush, and spike sedge. These species make up 75 percent or more of the total annual forage. Plains bluegrass, slender wheatgrass, and some forbs make up the remaining 25 percent.

If subject to continuous heavy grazing or improperly harvested for hay, prairie cordgrass, bluejoint reedgrass, and northern reedgrass decrease in abundance and are replaced in the plant community by slender wheatgrass, plains bluegrass, green muhly,

sedges, rushes, and forbs. If overgrazing or improper haying methods continue for many years, plains bluegrass, foxtail barley, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 2.0 animal unit months per acre. This site produces a high quantity of low-quality forage. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition. When the surface is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of mounds and ruts, which make grazing or harvesting for hay difficult.

If this site is used as hayland, mowing should be regulated so that the grasses remain vigorous. It should be avoided between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. A proper mowing height helps to maintain the stand of grasses and high forage production. The mowing height should not be less than 3 inches. In some years hay cannot be harvested because of the excessive wetness. When the soil is frozen, livestock can graze without damaging the meadows. They should be removed from the meadows before the soil thaws in the spring and the water table reaches a high level.

WET SUBIRRIGATED (WS)

The climax vegetation is dominantly big bluestem, indiangrass, prairie cordgrass, switchgrass, various sedges and rushes, bulrush, and spike sedge. These species make up 75 percent or more of the total annual forage production. Plains bluegrass, slender wheatgrass, and some forbs are also important plants on this site.

If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, indiangrass, prairie cordgrass, and switchgrass decrease in abundance and are replaced in the plant community by slender wheatgrass, foxtail barley, plains bluegrass, western wheatgrass, green muhly, sedges, rushes, and forbs. If overgrazing or improper haying continues for many years, plains bluegrass, foxtail barley, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.8 animal unit months per acre. A planned grazing system, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition. When the surface is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of mounds and ruts, which make grazing or harvesting for hay difficult.

If this site is used as hayland, mowing should be regulated so that the grasses remain vigorous. It should be avoided between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. A proper mowing height helps to maintain the stand of grasses and high forage production. The mowing height should not be less than 3 inches. In some years hay cannot be harvested because of the excessive wetness. When the soil is frozen, livestock can graze without damaging the meadows. They should be removed from the meadows before the soil thaws in the spring and the water table reaches a high level.

Windbreaks, Environmental Plantings, and Woodland

Gary Kuhn, forester, Natural Resources Conservation Service, and Doak Nickerson, extension forester, Nebraska Forest Service District, helped prepare this section.

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

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

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

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Most of the existing windbreaks in Garden County were planted to protect farmsteads, ranch headquarters, and livestock. Most of the windbreaks that are more than 40 years old and that consist of Siberian elm are in poor condition. Some of the older windbreaks that consist of at least one row of eastern redcedar still provide year-round protection from the wind. Windbreaks that are made up mainly of Siberian elm without an evergreen component need supplemental plantings of cedar or juniper on the upwind or downwind side to improve the low- and mid-level density of these windbreaks and provide excellent protection from wind and snow. Some excellent multirow windbreaks that protect farmsteads and livestock are in the county. These tend to be younger (10 to 15 years old) and can consist of eastern redcedar, Rocky Mountain juniper, green ash, hackberry, and honeylocust.

In many areas in the Sandhills region of the county, windbreaks are needed to protect livestock and roadways. Windbreaks in such areas as unprotected calving pastures, watering facilities, and riparian woodland along streams benefit livestock. A combination of living snow fences and livestock windbreaks along ranch access roads protect livestock and keep roadways clear during the winter. These windbreaks should have four or more rows. The first two windward rows should consist of cedar or juniper. The leeward rows can consist of additional rows of cedar or juniper, or suitable pines, shrubs, or broadleaf trees.

In the areas of Garden County used as cropland, field windbreaks can provide much needed soil and crop protection. Currently, most of the existing field windbreaks are single-row Siberian elms along the field borders. These elms are in poor condition and do not provide adequate protection from strong winds. Also, there are no windbreaks within the fields. Modern designed, single-row field windbreaks need to be planted in both the gravity irrigated and dry cropland areas in the county. A field windbreak system includes a series of one-row windbreaks, spaced at specified intervals within the field, to provide full protection from soil blowing and crop damage. Field windbreaks have been proven to help increase crop yields by increasing the soil moisture content through trapping and holding snow and reducing evaporation from the hot winds in the summer. Eastern redcedar, Rocky Mountain juniper, and ponderosa pine are excellent species for use in one-row field windbreak systems.

Windbreaks can also be established in center-pivot corners and around the perimeters. Multirow plantings in the center-pivot corners provide excellent wildlife habitat and protect livestock during the gleaning of cornstalks in winter. Single- or double-row windbreaks around the perimeter protect the soil from soil blowing and increase the efficiency of the center-pivot irrigation system. Field windbreaks have been proven to increase the efficiency of irrigation by 20 percent by improving the water application rate and reducing evaporation.

Establishing a windbreak in western Nebraska is a 5-year commitment. The suitability of the soil for trees and shrubs, site preparation, weed control, livestock exclusion, and fire control are necessary factors to consider before a windbreak is planted. The trees and shrubs must be adapted to the local climate and soils. Site preparation is extremely important to store moisture, control weeds, and mellow the soil. Planting trees and shrubs into sodbound sites without site preparation greatly decreases their chances of survival and growth. Table 10 can be used to determine the best site preparation method, according to the existing vegetation and texture of the soil.

Weed control within the tree rows is critical during the first 5 years of establishing a windbreak. A weed-free strip 4 to 6 feet wide is essential to allow the trees and shrubs sufficient moisture for growth. Weeds within the tree rows can be controlled by applying preemergent or postemergent herbicides, by mechanical tillage, such as a weed badger, or by installing a fabric mulch. The vegetation between the tree rows can be mowed or tilled. In areas of sandy soils, a cover crop of milo or oats planted between the rows is highly beneficial to the young trees or shrubs. Cover crops trap snow and protect the young windbreaks from harsh winter winds and hot summer winds. Windbreaks planted around livestock operations need good fencing, and firebreaks may need to be constructed if flammable vegetation is nearby.

Areas of native woodland are very limited in Garden County. Most of the native woodland is along the North Platte River and its tributaries. Species include eastern cottonwood, green ash, willow, Russian-olive, boxelder, and eastern redcedar. Native shrubs, such as buffaloberry, American plum, chokecherry, and skunkbush sumac, are interspersed in these woodland areas.

These woodlands are mainly non-commercial; however, they provide valuable habitat for wildlife, livestock protection, and water quality enhancement through stabilizing streambanks and buffering streams from runoff from the adjacent areas of cropland. Unrestricted use and overgrazing by livestock, however, is a management concern in riparian

woodland. Regeneration of hardwoods suffers, resulting in a stagnated ecosystem. Wildlife and water quality values are also degraded.

Woodland management includes fencing livestock out of the existing riparian woodland and establishing new woodlands on suitable soils for growing on-farm products, such as fuelwood, fence posts, and rough corral lumber.

Windbreak Suitability Groups

In this section the windbreak suitability groups in the survey area are described. The soils in Nebraska are grouped into windbreak suitability groups according to a statewide system. Not all of the groups in this system are represented in Garden County. To find the name of all the soils in any group refer to the "Detailed Soil Map Units" and the section "Interpretive Groups."

Specific information on the design, establishment, and care of windbreaks is available from the local office of the Natural Resources Conservation Service and the Cooperative Extension Service.

WINDBREAK SUITABILITY GROUP 1

The soils in this group receive beneficial moisture because of favorable landscape positions or runoff from adjacent areas. Competition for moisture from undesirable grasses is the main management concern. The weeds and undesirable grasses can be controlled by cultivating between the tree rows with conventional equipment and by hoeing by hand, rototilling, and applying approved herbicides in the tree rows.

WINDBREAK SUITABILITY GROUP 2D

The soils in this group are excessively wet during the spring or during wet periods. The trees and shrubs that can withstand wetness from the seasonal high water table can survive and grow well. During wet years, cultivation and planting may be delayed until the soils have begun to dry. Planting by hand in spring may be necessary because of the wetness. The pH of the soils in this group affects the selection of trees and shrubs. The weeds and undesirable grasses that compete with the trees and shrubs for moisture can be controlled by cultivating between the tree rows when the water table is at its lowest level.

WINDBREAK SUITABILITY GROUP 2S

The soils in this group are somewhat poorly drained. The trees and shrubs that can withstand the occasional wetness survive and grow well. During wet years, cultivation and planting may be delayed until the soils have begun to dry. The pH of the soils in this group affects the selection of trees and shrubs. The weeds and undesirable grasses that compete with the trees and shrubs for moisture can be controlled by cultivating between the tree rows when the water table is at its lowest level. Soil blowing can be controlled by planting a cover crop between the tree rows.

WINDBREAK SUITABILITY GROUP 2W

The soils in this group are occasionally ponded. The trees and shrubs selected for planting on these soils should be those that can withstand the occasional ponding. Tilling the soil and planting the trees in spring may be delayed until the soils have begun to dry. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by timely cultivation with conventional equipment.

WINDBREAK SUITABILITY GROUP 3

The soils in this group are deep and very deep and are well drained. Competition for moisture from grasses and weeds and the hazard of water erosion on the gently sloping to moderately steep slopes are the main concerns that affect the establishment of trees and shrubs. The survival and growth rates of adapted species are good. Water erosion can be controlled by planting the trees on the contour in combination with terraces. A drip irrigation system can provide supplemental water to the trees during dry periods. The weeds and undesirable grasses can be controlled by cultivating with conventional equipment or by applying approved herbicides.

WINDBREAK SUITABILITY GROUP 5

The soils in this group are loamy or sandy and are deep or very deep. Competition for moisture from grasses and weeds and the hazard of soil blowing are the main concerns that affect the establishment of trees and shrubs. Soil blowing can be controlled by maintaining strips of sod or by planting cover crops between the tree rows. In areas of sandy soils, cultivation needs to be restricted to the tree rows. A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during dry periods. The weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of approved herbicides.

WINDBREAK SUITABILITY GROUP 6R

The soils in this group are well drained and are moderately deep over bedrock. A low supply of moisture, competition for moisture from grasses and

weeds, and the hazard of soil blowing are the main concerns that affect the establishment of trees and shrubs. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment or by timely applications of approved herbicides. A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Because of the low available water capacity, drought-tolerant trees and shrubs are best suited to these soils.

WINDBREAK SUITABILITY GROUP 7

The soils in this group are moderately deep to very deep, are well drained to excessively drained, and typically have a moderate or low available water capacity. A low supply of moisture and the hazard of soil blowing are the main concerns that affect the establishment of trees and shrubs. These soils are so loose that the trees grown in windbreaks should be planted in shallow furrows with as little disturbance of the surface as possible. Young seedlings can be damaged by high winds and can be covered by drifting sand. Maintaining strips of sod or cover crops between the tree rows helps to control soil blowing. A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall. The weeds and undesirable grasses in the tree rows can be controlled by cultivation with conventional equipment and by timely applications of approved herbicides.

WINDBREAK SUITABILITY GROUP 8

The soils in this group are calcareous at or near the surface and are very deep. A high content of calcium carbonate, competition for moisture from grasses and weeds, and the hazard of water erosion on gently sloping to moderately steep slopes are the main concerns that affect the establishment of trees and shrubs. The trees and shrubs selected for planting on these soils should be those that can tolerate a high amount of calcium carbonate. Planting the trees on the contour and terracing help to reduce the rate of runoff and control water erosion on sloping soils. A drip irrigation system can provide the supplemental moisture needed for establishing seedlings and moisture during periods of low rainfall. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation with conventional equipment and by careful use of approved herbicides.

WINDBREAK SUITABILITY GROUP 9N

The soils in this group are affected by the moderate alkalinity and are moderately well drained. The moderate alkalinity is the main concern that affects the establishment of trees and shrubs. The alkaline condition can be minimized by planting only those species that tolerate the moderate alkalinity. The undesirable grasses and weeds that compete with the trees for moisture can be controlled by cultivation between the tree rows with conventional equipment or by careful use of approved herbicides.

WINDBREAK SUITABILITY GROUP 9S

The soils in this group are saline or alkaline and are somewhat poorly drained or poorly drained. The salinity or alkalinity and the excessive wetness are the main concerns that affect the establishment of trees and shrubs. The trees and shrubs selected for planting should be those that can tolerate the high salinity or alkalinity of these soils. Planting may be delayed because of the excessive wetness. The undesirable grasses and weeds that compete with the trees for moisture can be controlled by cultivation between the tree rows with conventional equipment or by careful use of approved herbicides.

WINDBREAK SUITABILITY GROUP 10

The soils in this group have severe limitations affecting the establishment of trees and shrubs because of depth to bedrock, texture, wetness, flooding, excessive slope, or other factors. These restrictions severely limit the planting, survival, or growth of trees and shrubs in windbreaks. Onsite investigation may identify small areas that are suitable for windbreaks. These areas also can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if suitable species are planted by hand or if other approved special management practices are applied.

Recreation

Alan J. Stuebe, soil scientist, Natural Resources Conservation Service, helped prepare this section.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water

impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

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

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

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

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Garden County offers a wide variety of recreational opportunities, including hunting, fishing, hiking, camping, picnicking, bird watching, and other outdoor activities and opportunities for sightseeing and photography.

Ash Hollow State Historical Park, in the southeastern corner of the county, plays an important role in preserving the history of the county. Here remnants of the Oregon Trail can be seen. This trail provided a path for thousands of pioneers to settle the West. This area of Garden County was documented in the diaries of some of the travelers as "the most rugged terrain encountered since Missouri."

The Crescent Lake National Wildlife Refuge is 28 miles north of Oshkosh in the Sandhills region of the county. The refuge contains numerous lakes, which many species of waterfowl use during migration, in its 45,818 acres. As many as 273 species of birds have been observed on the refuge since its opening in 1931. Waterfowl, such as Canada geese, mallards, gadwalls, pintails, and canvasbacks, are most commonly seen by birdwatchers. Mammals, such as pronghorn antelope, white-tailed deer, mule deer, coyotes, raccoons, badgers, and many species of small mammals, are also abundant on the refuge. The refuge also offers many recreational activities, such as sightseeing, fishing on Island Lake, observing wildlife, hiking the mile-and-a-half self-guided nature trail, and driving the self-guided auto tour.

Hunting is one of the most popular recreational activities. The county is known for goose hunting. Large numbers of Canada geese use the area during the fall and winter. Hunting occurs during regular seasons, both in public areas and on private lands with permission of the landowner.

Big and small game are also available to the hunter. Small game includes both birds and mammals. Ring-necked pheasant, sharp-tailed grouse, rabbit, squirrel, raccoon, and coyote are some of the major small game species. Mourning dove are common throughout the county and are hunted early in the fall. White-tailed deer and mule deer are plentiful for big game hunters.

Most water recreational activities center around nearby Lake McConaughy. At about 35,000 surface acres in size, this lake is Nebraska's largest reservoir. Waterskiing, boating, fishing, picnicking, camping, and swimming are all available. Wintering bald eagles can be seen here between the months of December and March.

Lake McConaughy is known for its opportunities for fishing. Walleye, white bass, smallmouth bass, striped bass, and channel catfish are most commonly caught. Also, Lake Ogallala, which is below Kingsley Dam, and nearby creeks are known for trout. Rainbow trout is the most abundant species; however, cutthroat trout can also be caught.

Oshkosh, the county seat, offers additional recreational activities. A nine-hole golf course is about 2 miles south of Oshkosh. A museum, picnic areas, playgrounds, and swimming pool are also in the community.

Wildlife Habitat

Jay R. Wilson, soil scientist, Natural Resources Conservation Service, helped prepare this section.

Garden County offers a wide variety of habitat for openland, wetland, woodland, and rangeland wildlife species.

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

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the degree of management needed for each element of the habitat.

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

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

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

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big bluestem, little bluestem, switchgrass, sideoats grama, sunflower, ragweed, and blue grama.

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

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are Scotch pine, Austrian pine, ponderosa pine, fir, redcedar, and Rocky Mountain juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of fruit producing shrubs and trees are American plum, skunkbush sumac,

chokecherry, silver buffaloberry, cotoneaster, and crabapple.

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

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

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

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

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous woody plants and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodpeckers, squirrels, gray fox, raccoon, deer, and songbirds.

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include pronghorn antelope, mule deer, coyote, sharp-tailed grouse, greater prairie chicken, meadowlark, gopher, and lark bunting.

The three major land resource areas in Garden County are the Central High Tableland, Central High Plains, and the Nebraska Sandhills. These areas often have different potential for wildlife production. In these major land resource areas, 14 soil associations have been identified. Many of these associations can be grouped according to the wildlife habitat and wildlife species they support. Each soil association and its relation to wildlife are discussed in the following paragraphs.

In Garden County, the Nebraska Sandhills major land resource area is essentially in the sandhills north of the North Platte River. The Valent and Valent-Wildhorse-Ipage soil associations make up most of this area. These associations are almost entirely rangeland that is used for grazing. The plants that make up the good-quality rangeland habitat in these associations consist of native grasses and forbs and scattered woody plants. Sharp-tailed grouse, prairie chicken, coyote, mule deer, jackrabbits, small rodents, meadowlark, horned lark, hawks, and occasional pronghorn antelope are typical wildlife species in these associations. Numerous shallow lakes and marshes also provide much habitat for migratory waterfowl, such as ducks, geese, and sandhill cranes.

The Central High Tableland major land resource area has less diverse wildlife habitat than the Nebraska Sandhills major land resource area. Several associations have similar potential for wildlife habitat and can be grouped together.

The Jayem-Sarben-Valent, Keith-Kuma-Duroc, and Alliance-Sidney-Duroc associations are dominantly used for the production of winter wheat in a wheat-fallow rotation. Shallow upland depressions that are occasionally ponded are common. The secondary crops are mainly dryland corn, millet, and sunflowers. These associations provide habitat for a variety of openland wildlife, such as pheasant, cottontail rabbit, and mourning dove. The depressions furnish feeding and resting habitat for migrating waterfowl and shore birds in the spring. Undisturbed nesting areas, permanent water, and winter cover, such as field shelterbelts and farmstead shelterbelts, are limitations affecting wildlife habitat.

The Central High Plains major land resource area has the greatest diversity of wildlife habitat. This area includes the North Platte River valley, the bordering dissected uplands, and the sand-loess transition areas north of the valley. It is made up of 9 soil associations in the county.

The North Platte River and the low flood plain along the river make up the Gothenburg association. The permanent vegetation and the islands in the river provide excellent cover and habitat throughout the year. Common plant species in the area include cattail, rushes, Russian-olive, American plum, indigobush, wild grape, cottonwood, and willow. Common wildlife species include ducks, geese, sandhill cranes, herons, shore birds, mink, raccoon, beaver, coyote, bobcat, wild turkey, bobwhite quail, songbirds, white-tailed deer, cottontail rabbit, great horned owl, and small rodents. Areas of the Gothenburg association provide important seasonal habitat to several species of wildlife on the Federal endangered species list, including bald eagle, least tern, piping plover, and

whooping cranes. The river otter, which inhabits areas of this association throughout the year, is on the State endangered species list.

The Lewellen-Jankosh association consists of sandy and silty, strongly alkaline and very strongly alkaline soils on the flood plains of the North Platte River. This association is predominantly native hayland and rangeland that is used for native hay production and livestock grazing. The scarcity of grain crops may limit wildlife production, although adjacent associations have abundant cultivated crops.

The Bayard-Scoville-Rushcreek association occurs in the North Platte River valley and is mainly used for the production of irrigated corn and alfalfa. This association occurs as narrow bands along the valley. These areas support good numbers of openland wildlife. Irrigation canals and their adjacent grassy borders, the nearby North Platte River, and farmstead shelterbelts provide essential habitat elements. This association is also very important for use as feeding and resting areas for large numbers of migrating ducks and Canada geese during the fall and winter.

The Ashollow-Tassel, Epping-Mitchell, Blueridge, Sulco-McConaughy-Tassel, Sarben-Valent, and Sulco-McConaughy associations make up much of the dissected uplands and the uplands bordering the North Platte River. Mule deer, white-tailed deer, coyote, sharp-tailed grouse, prairie chicken, pheasants, wild turkey, vultures, red-tailed hawks, and other hawks are common. These associations are used mainly as rangeland. Some areas have many eastern redcedar trees, which provide good cover for many types of wildlife.

Engineering

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

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

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

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design. This information is not meant to supersede local, State, or Federal laws, regulations, or criteria.

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

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

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

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

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings

with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe. Slight limitations do not infer complete safety, as from sloughing or the hazard of caving.

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

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

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

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

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

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and

spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

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

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

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

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

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

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

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to

overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

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

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

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

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

Soil Properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 20.

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

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

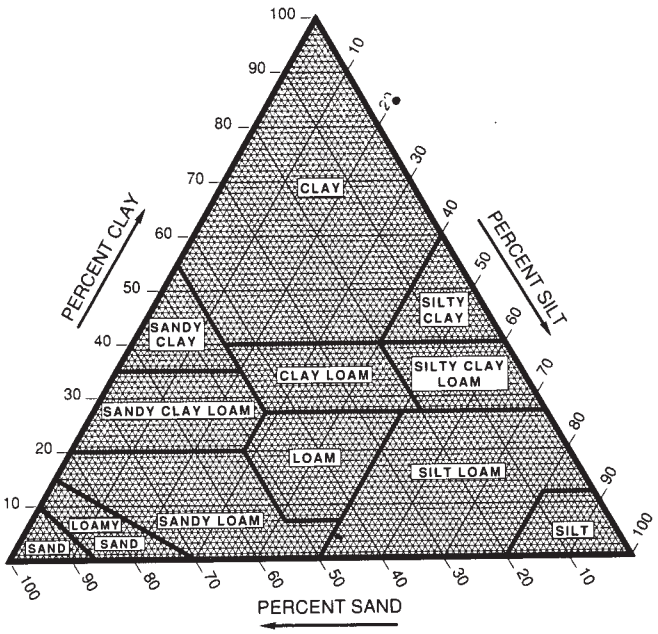

Figure 20.—Percentages of clay, silt, and sand in the basic USDA textural classes.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

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

engineering properties of two groups can have a dual classification, for example, CL-ML.

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

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

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

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

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in

the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

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

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information about flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

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

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

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The

rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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

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

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

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

Engineering Index Test Data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

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

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); Moisture density—T 99 (AASHTO), D 698 (ASTM); and Specific gravity—T 100 (AASHTO). The group index number that is part of the AASHTO classification is computed by using the Nebraska modified system.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(8)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 21 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

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

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

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

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(10)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(8)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alliance Series

Depth class: Deep
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)

Landscape: Tablelands
Landform: Plains
Parent material: Loess over sandstone
Slope range: 0 to 3 percent

Taxonomic class: Fine-silty, mixed, mesic Aridic Argiustolls

Typical Pedon

Alliance loam, 1 to 3 percent slopes, 1,200 feet north and 300 feet west of the southeast corner of sec. 12, T. 15 N., R. 45 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.
A—6 to 12 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; clear smooth boundary.
Bt1—12 to 20 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few thin discontinuous clay films on faces of peds; neutral; clear smooth boundary.
Bt2—20 to 26 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate coarse prismatic structure parting to weak fine subangular blocky; hard, friable; few thin discontinuous clay films on faces of peds; slightly alkaline; clear smooth boundary.
Bk—26 to 34 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; few soft masses of calcium carbonate; violently effervescent; slightly alkaline; gradual smooth boundary.
C—34 to 54 inches; very pale brown (10YR 8/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; violently effervescent; slightly alkaline; abrupt wavy boundary.
Cr—54 to 60 inches; very pale brown (10YR 8/2), violently effervescent sandstone.

Range in Characteristics

Depth to paralithic contact: 40 to 60 inches
Thickness of the mollic epipedon: 8 to 20 inches
Depth to carbonates: 16 to 35 inches
Content of clay in the particle-size control section: 18 to 35 percent
Thickness of the solum: 16 to 35 inches

A horizon:
Hue—10YR
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loam

Bt horizon:
Hue—10YR
Value—5 to 7 (3 to 5 moist)
Chroma—2 or 3
Texture—clay loam, loam, silt loam, or silty clay loam

BC or Bk horizon:
Hue—10YR
Value—6 or 7 (4 to 6 moist)
Chroma—2 or 3
Texture—loam, silt loam, or very fine sandy loam

C horizon:
Hue—10YR
Value—6 to 8 (4 to 6 moist)
Chroma—2 or 3
Texture—loam, silt loam, or very fine sandy loam

Almeria Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Valleys
Landform: Flood plains
Parent material: Sandy alluvium
Slope range: 0 to 2 percent

Taxonomic class: Sandy, mixed, mesic Typic Fluvaquents

Typical Pedon

Almeria fine sandy loam, channeled, 0 to 2 percent slopes, 100 feet south and 2,300 feet east of the northwest corner of sec. 8, T. 17 N., R. 42 W.

A—0 to 3 inches; gray (10YR 5/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, very friable; violently effervescent; moderately alkaline; abrupt smooth boundary.
Cg1—3 to 13 inches; light brownish gray (10YR 6/2) stratified loamy fine sand, dark grayish brown (10YR 4/2) moist; common medium prominent yellowish brown (10YR 5/6) iron masses in matrix; massive; soft, very friable; violently effervescent; moderately alkaline; abrupt wavy boundary.
Cg2—13 to 37 inches; gray (5Y 6/1) stratified loamy

fine sand, dark gray (5Y 4/1) moist; single grain; loose; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cg3—37 to 60 inches; light gray (5Y 7/1) stratified fine sand, dark gray (5Y 4/1) moist; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to redoximorphic features: Less than 16 inches
Depth to carbonates: 0 to 20 inches

A horizon:
Hue—2.5Y or 10YR
Value—3 to 6 (2 to 5 moist)
Chroma—1 to 3
Texture—fine sandy loam

Cg horizon:
Hue—2.5Y, 5Y, or 10YR
Value—3 to 8 (2 to 7 moist)
Chroma—1 to 3
Texture—stratified sand to fine sandy loam

Ashollow Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid (2 to 6 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Position on the landform: Back slopes and foot slopes
Parent material: Residuum weathered from sandstone
Slope range: 9 to 30 percent

Taxonomic class: Coarse-loamy, mixed (calcareous), mesic Aridic Ustorthents

Typical Pedon

Ashollow very fine sandy loam, in an area of Tassel-Ashollow-Rock outcrop complex, 20 to 60 percent slopes, 100 feet south and 1,100 feet east of the northwest corner of sec. 23, T. 15 N., R. 42 W.

A—0 to 3 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; slightly effervescent; moderately alkaline; clear smooth boundary.

AC—3 to 10 inches; brown (10YR 5/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable; 2 percent, by volume, sandstone gravel; violently effervescent; moderately alkaline; gradual smooth boundary.

C1—10 to 32 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; 2 percent, by volume, sandstone gravel; violently effervescent; moderately alkaline; gradual smooth boundary.

C2—32 to 80 inches; light yellowish brown (10YR 6/4) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; 3 percent, by volume, sandstone gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches
Content of gravel in the particle-size control section: 2 to 15 percent, by volume, of soft to hard, calcareous sandstone gravel

A horizon:
Hue—10YR
Value—4 or 5 (3 or 4 moist)
Chroma—2 or 3
Texture—very fine sandy loam, fine sandy loam, or loamy very fine sand

AC horizon:
Hue—10YR
Value—4 to 6 (4 or 5 moist)
Chroma—2 to 4
Texture—very fine sandy loam, fine sandy loam, or loamy very fine sand

C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (4 to 7 moist)
Chroma—2 to 4
Texture—very fine sandy loam, fine sandy loam, or loamy very fine sand

Bayard Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid (2 to 6 inches per hour)
Landscape: Valleys
Landform: River valley stream terraces (fig. 21)
Parent material: Alluvium
Slope range: 0 to 6 percent

Taxonomic class: Coarse-loamy, mixed, mesic Torriorthentic Haplustolls

Typical Pedon

Bayard fine sandy loam, 1 to 3 percent slopes, 1,800 feet east and 1,600 feet north of the southwest corner of sec. 13, T. 17 N., R. 45 W.

Ap—0 to 7 inches; brown (10YR 4/3) fine sandy loam,

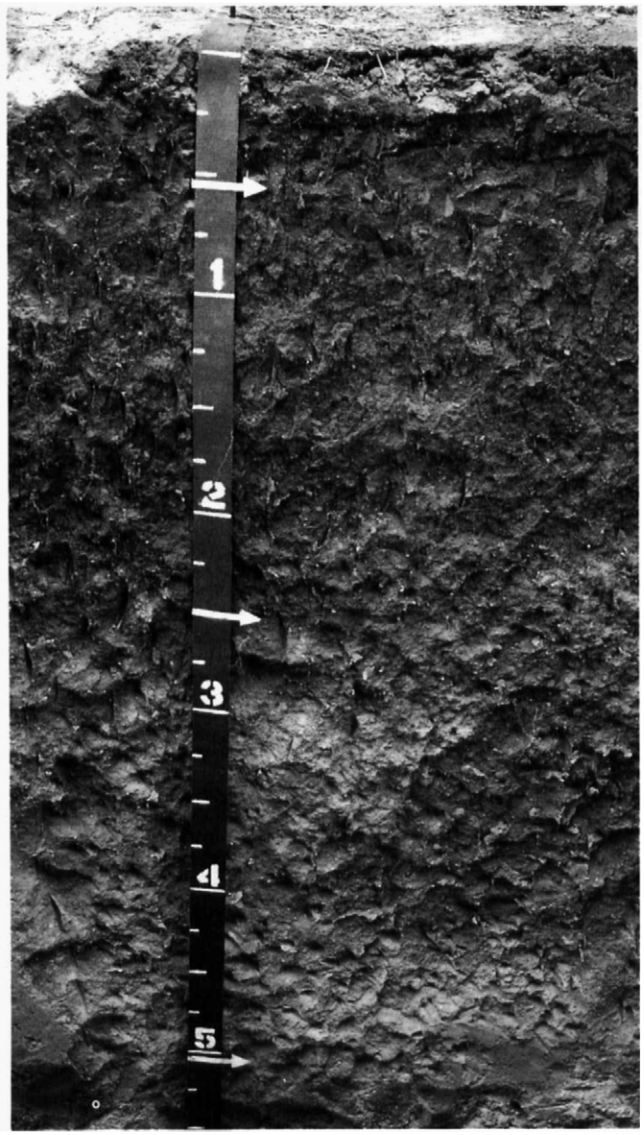

Figure 21.—A typical profile of the Bayard series formed in alluvium on a stream terrace. The top markers indicate the lower boundary of the plow layer and the A horizon. Depth is marked in feet.

dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A—7 to 13 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

AC—13 to 22 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable; slightly effervescent; slightly alkaline; clear smooth boundary.

C1—22 to 42 inches; light brownish gray (10YR 6/2) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; strongly effervescent; slightly alkaline; gradual wavy boundary.

C2—42 to 55 inches; grayish brown (10YR 5/2) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; strongly effervescent; moderately alkaline; gradual wavy boundary.

C3—55 to 60 inches; grayish brown (10YR 5/2) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 20 inches
Depth to carbonates: 13 to 20 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 or 3
Texture—loam, fine sandy loam, or very fine sandy loam

AC horizon:
Hue—10YR
Value—5 or 6 (3 or 4 moist)
Chroma—2 or 3
Texture—fine sandy loam or very fine sandy loam

C horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—fine sandy loam or very fine sandy loam; in some pedons, loamy very fine sand below a depth of 30 inches

Blanche Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderately rapid (2 to 6 inches per hour)
Landscape: Tablelands
Landform: Plains
Parent material: Residuum weathered from sandstone
Slope range: 0 to 3 percent

Taxonomic class: Coarse-loamy, mixed, mesic Aridic Haplustolls

Typical Pedon

Blanche loamy fine sand, 0 to 3 percent slopes, 400 feet east and 75 feet south of the northwest corner of sec. 24, T. 15 N., R. 43 W.

Ap—0 to 8 inches; brown (10YR 5/3) loamy fine sand,

dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; 2 percent, by volume, sandstone fragments; neutral; abrupt smooth boundary.

A—8 to 14 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; 2 percent, by volume, sandstone fragments; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—14 to 27 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; soft, friable; common fine concretions of calcium carbonate; violently effervescent; 10 percent, by volume, sandstone fragments; slightly alkaline; clear smooth boundary.

Bk—27 to 32 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable; many fine to very coarse concretions of calcium carbonate; violently effervescent; 10 percent, by volume, sandstone fragments; slightly alkaline; abrupt smooth boundary.

Cr—32 to 60 inches; white (10YR 8/1) weakly cemented sandstone, light gray (10YR 7/2) moist; violently effervescent.

Range in Characteristics

Depth to paralithic contact: 20 to 40 inches
Thickness of the mollic epipedon: 8 to 20 inches
Depth to carbonates: 8 to 20 inches
Thickness of the solum: 17 to 39 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 to 3
Texture—loamy fine sand or fine sandy loam

Bw horizon:
Hue—10YR
Value—4 to 6 (2 to 4 moist)
Chroma—2 or 3
Texture—fine sandy loam, very fine sandy loam, or loam

Bk horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—fine sandy loam or very fine sandy loam

Blueridge Series

Depth class: Very deep
Depth to sand and gravel: Shallow
Drainage class: Excessively drained
Permeability: Very rapid (more than 20 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Position on the landform: Shoulders and back slopes
Parent material: Sandy and gravelly alluvium
Slope range: 6 to 30 percent

Taxonomic class: Mixed, mesic Aridic Ustipsamments

Typical Pedon

Blueridge coarse sand, 6 to 30 percent slopes, 4,050 feet west and 2,500 feet south of the northeast corner of sec. 4, T. 17 N., R. 42 W.

A—0 to 4 inches; grayish brown (10YR 5/2) coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose; 9 percent gravel, by volume; moderately acid; clear wavy boundary.

C1—4 to 40 inches; light gray (10YR 7/2) gravelly coarse sand, light brownish gray (10YR 6/2) moist; single grain; loose; 18 percent gravel, by volume; moderately acid; clear wavy boundary.

C2—40 to 80 inches; light gray (10YR 7/2) gravelly coarse sand, light brownish gray (10YR 6/2) moist; single grain; loose; 23 percent gravel, by volume; slightly acid.

Range in Characteristics

Content of gravel in the particle-size control section: 15 to 35 percent, by volume
Depth to carbonates: Typically do not have free carbonates, but in places the gravel is coated with carbonates on the underside

A horizon:
Hue—10YR
Value—3 to 6 (2 to 5 moist)
Chroma—1 to 3
Texture—coarse sand

C horizon:
Hue—10YR or 2.5Y
Value—5 to 8 (4 to 7 moist)
Chroma—2 to 4
Texture—coarse sand, gravelly coarse sand, or sand

Broadwater Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid (6 to 20 inches per hour) and very rapid (more than 20 inches per hour)
Landscape: Valleys
Landform: Flood plains
Parent material: Sandy alluvium (fig. 22)
Slope range: 0 to 2 percent

Taxonomic class: Sandy, mixed, mesic Aridic Ustifluvents

Typical Pedon

Broadwater loamy sand, channeled, 0 to 2 percent slopes, 1,600 feet south and 900 feet west of the northeast corner of sec. 21, T. 16 N., R. 44 W.

A—0 to 3 inches; light brownish gray (10YR 6/2) loamy sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; 3 percent gravel, by volume; strongly effervescent; slightly alkaline; clear smooth boundary.

C1—3 to 9 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; single grain; soft, very friable; thin strata of loamy very fine sand; 3 percent gravel, by volume; strongly effervescent; slightly alkaline; abrupt smooth boundary.

2C2—9 to 32 inches; pale brown (10YR 6/3) gravelly coarse sand, brown (10YR 5/3) moist; single grain; loose; thin strata of loamy very fine sand; 18 percent gravel, by volume; strongly effervescent; slightly alkaline; abrupt smooth boundary.

2C3—32 to 60 inches; very pale brown (10YR 7/3) gravelly coarse sand, pale brown (10YR 6/3) moist; single grain; loose; thin strata of coarse sand; 31 percent gravel, by volume; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches
Content of gravel in the particle-size control section: 10 to 35 percent, by volume, granitic and sandstone gravel

A horizon:
Hue—10YR
Value—5 or 6 (3 to 5 moist)
Chroma—2 to 4
Texture—loamy sand
Volume of sandstone and granitic gravel—2 to 15 percent

C horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loamy sand or sand
Volume of sandstone and granitic gravel—2 to 15 percent

2C horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—coarse sand or gravelly coarse sand
Volume of sandstone and granitic gravel—15 to 35 percent

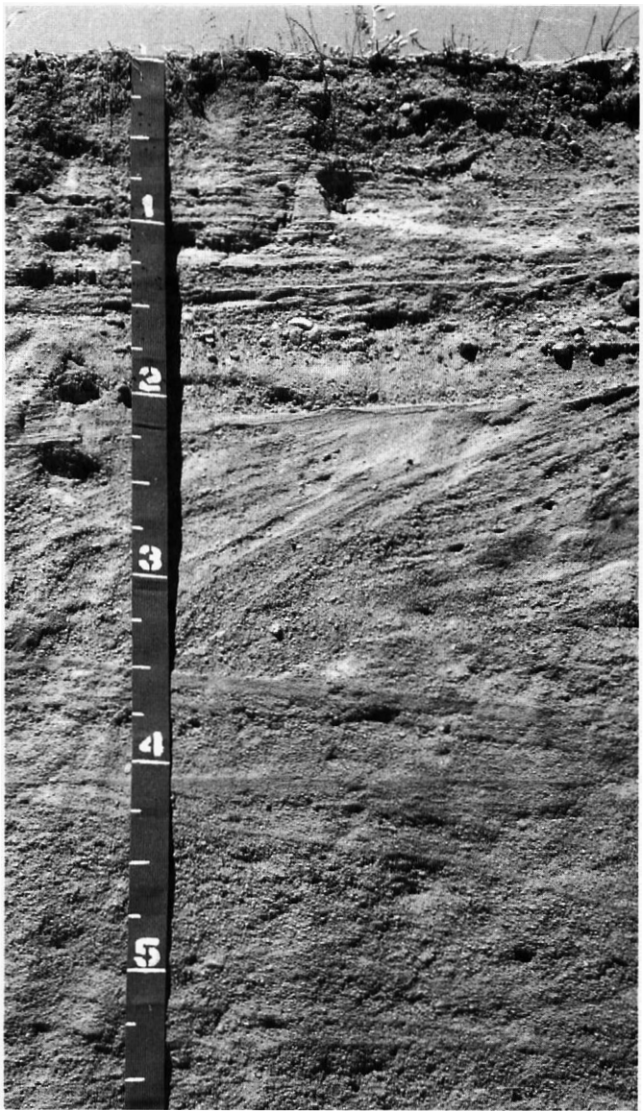

Figure 22.—A typical profile of the Broadwater series. It formed in stratified sandy alluvium and contains between 10 and 35 percent gravel, by volume. Depth is marked in feet.

Busher Series

Depth class: Deep
Drainage class: Well drained
Permeability: Moderately rapid (2 to 6 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Position on the landform: Ridges, back slopes, and foot slopes
Parent material: Residuum weathered from sandstone
Slope range: 3 to 20 percent

Taxonomic class: Coarse-loamy, mixed, mesic Aridic Haplustolls

Typical Pedon

Busher fine sandy loam, in an area of Busher-Tassel complex, 3 to 9 percent slopes, 100 feet south and 100 feet east of the northwest corner of sec. 9, T. 15 N., R. 46 W.

A—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.
Bw1—10 to 19 inches; brown (10YR 4/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, friable; neutral; clear smooth boundary.
Bw2—19 to 29 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, friable; neutral; clear smooth boundary.
C1—29 to 34 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; neutral; clear smooth boundary.
C2—34 to 48 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; massive; loose; slightly effervescent; few fine sandstone fragments; slightly alkaline; gradual wavy boundary.
Cr—48 to 60 inches; very pale brown (10YR 7/3), violently effervescent, soft, fine grained sandstone.

Range in Characteristics

Depth to paralithic contact: 40 to 60 inches
Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 18 to 48 inches
Thickness of the solum: 15 to 40 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 or 3
Texture—fine sandy loam or loamy very fine sand

Bw horizon:
Hue—10YR
Value—4 to 6 (4 or 5 moist)
Chroma—2 or 3
Texture—fine sandy loam or loamy very fine sand

C horizon:
Hue—10YR
Value—5 to 8 (4 to 7 moist)
Chroma—2 or 3
Texture—fine sandy loam, very fine sandy loam, or loamy very fine sand

Canyon Series

Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Tablelands
Landform: Hillslopes
Position on the landform: Summits and shoulders
Parent material: Residuum weathered from sandstone
Slope range: 6 to 9 percent

Taxonomic class: Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents

Typical Pedon

Canyon loam, in an area of Sidney-Canyon complex, 6 to 9 percent slopes, 1,000 feet north and 750 feet west of the southeast corner of sec. 31, T. 16 N., R. 45 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; violently effervescent; 5 percent, by volume, sandstone fragments; slightly alkaline; abrupt smooth boundary.
C—5 to 10 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violently effervescent; 10 percent, by volume, sandstone fragments; slightly alkaline; abrupt wavy boundary.
Cr—10 to 60 inches; white (10YR 8/1), soft, fine grained sandstone, very pale brown (10YR 7/3) moist.

Range in Characteristics

Depth to paralithic contact: 6 to 20 inches
Depth to carbonates: 0 to 6 inches
Content of gravel in the particle-size control section: 0 to 25 percent, by volume

A horizon:
Hue—10YR
Value—4 to 7 (3 to 6 moist)
Chroma—2 or 3
Texture—loam

C horizon:
Hue—10YR
Value—6 to 8 (4 to 7 moist)
Chroma—2 to 4
Texture—very fine sandy loam or loam in which the content of clay is more than 12 percent

Crowther Series

Depth class: Very deep
Drainage class: Poorly drained and very poorly drained
Permeability: Moderately rapid (2 to 6 inches per hour) in the solum, rapid (6 to 20 inches per hour) in the underlying material
Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales
Parent material: Loamy and sandy alluvium
Slope range: 0 to 1 percent

Taxonomic class: Coarse-loamy over sandy or sandy-skeletal, mesic Typic Calciaquolls

Typical Pedon

Crowther loam, 0 to 1 percent slopes, 1,900 feet north and 200 feet east of the southwest corner of sec. 34, T. 22 N., R. 45 W.

Oe—2 inches to 0; partly decomposed plant material.
Ak1—0 to 5 inches; gray (10YR 5/1) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; 24 percent calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary.
Ak2—5 to 18 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate fine granular structure parting to weak medium subangular blocky; soft, very friable; 20 percent calcium carbonate; violently effervescent; moderately alkaline; abrupt smooth boundary.
ACk—18 to 27 inches; gray (10YR 6/1) loam, dark gray (10YR 4/1) moist; weak medium prismatic structure; soft, very friable; 17 percent calcium carbonate; violently effervescent; moderately alkaline; abrupt smooth boundary.
2Cg1—27 to 35 inches; light gray (10YR 7/2) loamy fine sand, grayish brown (10YR 5/2) moist; single grain; loose; few fine distinct yellowish brown (10YR 5/6) iron masses in matrix; neutral; gradual smooth boundary.
2Cg2—35 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 24 inches
Depth to carbonates: 0 to 10 inches

Ak1 horizon:
Hue—10YR
Value—4 to 6 (2 or 3 moist)
Chroma—1 or 2
Texture—loam

Ak2 horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (3 or 4 moist)
Chroma—1 or 2
Texture—loam

ACk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (3 to 5 moist)
Chroma—1 or 2
Texture—loam, clay loam, or sandy clay loam

2Cg horizon:
Hue—10YR or 2.5Y
Value—5 to 8 (4 to 6 moist)
Chroma—1 or 2
Texture—sand, fine sand, or loamy fine sand

Dailey Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Sandhills
Landform: Interdunes
Position on the landform: Hummocks and swales
Parent material: Eolian sand
Slope range: 0 to 3 percent

Taxonomic class: Sandy, mixed, mesic Torriorthentic Haplustolls

Typical Pedon

Dailey loamy fine sand, 0 to 3 percent slopes, 200 feet south and 300 feet west of the northeast corner of sec. 23, T. 18 N., R. 44 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand, dark brown (10YR 3/3) moist; weak fine granular structure; loose; slightly acid; abrupt smooth boundary.

A—5 to 14 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; slightly acid; clear smooth boundary.
AC—14 to 23 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; loose; neutral; gradual smooth boundary.
C1—23 to 31 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; gradual smooth boundary.
C2—31 to 60 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 or 3
Texture—loamy fine sand

AC horizon:
Hue—10YR
Value—4 or 5 (4 or 5 moist)
Chroma—2 or 3
Texture—fine sand or loamy fine sand

C horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—fine sand, loamy sand, or loamy fine sand

Dankworth Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Position on the landform: Foot slopes
Parent material: Sandy alluvium
Slope range: 3 to 6 percent

Taxonomic class: Mixed, mesic Aridic Ustipsamments

Typical Pedon

Dankworth loamy sand, 3 to 6 percent slopes, 1,900 feet north and 800 feet west of the southeast corner of sec. 23, T. 18 N., R. 43 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; 2 percent gravel, by volume; slightly acid; clear smooth boundary.
AC—6 to 18 inches; grayish brown (10YR 5/2) sand, dark brown (10YR 3/3) moist; single grain; loose; 2 percent gravel, by volume; slightly acid; clear smooth boundary.
C1—18 to 48 inches; pale brown (10YR 6/3) coarse sand, brown (10YR 5/3) moist; single grain; loose; 13 percent gravel, by volume; slightly acid; gradual smooth boundary.
C2—48 to 80 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; 2 percent gravel, by volume; slightly acid.

Range in Characteristics

Content of gravel in the particle-size control section: 2 to 15 percent, by volume

A horizon:
Hue—10YR
Value—4 or 5 (3 or 4 moist)
Chroma—2 or 3
Texture—loamy sand

AC horizon:
Hue—10YR
Value—4 to 6 (3 or 4 moist)
Chroma—2 or 3
Texture—sand

C horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—sand or coarse sand

Duroc Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Tablelands
Position on the landform: Swales
Parent material: Loess
Slope range: 0 to 1 percent

Taxonomic class: Fine-silty, mixed, mesic Pachic Haplustolls

Typical Pedon

Duroc loam, 0 to 1 percent slopes, 100 feet north and 300 feet west of the southeast corner of sec. 20, T. 15 N., R. 44 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

A—6 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; neutral; clear smooth boundary.

Bw1—14 to 27 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; soft, very friable; neutral; clear smooth boundary.

Bw2—27 to 32 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; soft, very friable; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk—32 to 42 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; strongly effervescent; moderately alkaline; visible threads and coatings of calcium carbonate on faces of peds; clear smooth boundary.

C—42 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; soft, very friable; strongly effervescent; moderately alkaline; visible accumulations of calcium carbonate in root channels and pores.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 36 inches
Depth to carbonates: 20 to 36 inches
Thickness of the solum: 36 to 50 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 or 3
Texture—loam

Bw horizon:
Hue—10YR
Value—4 to 6 (2 to 4 moist)
Chroma—2 or 3
Texture—loam or silt loam

Bk horizon:
Hue—10YR
Value—5 to 7 (3 to 5 moist)
Chroma—2 or 3
Texture—loam or silt loam

C horizon:
Hue—10YR
Value—6 or 7 (5 or 6 moist)
Chroma—2 or 3
Texture—loam, silt loam, or very fine sandy loam

Els Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales
Parent material: Eolian sand
Slope range: 0 to 2 percent

Taxonomic class: Mixed, mesic Aquic Ustipsamments

Typical Pedon

Els fine sand, calcareous, 0 to 2 percent slopes, 900 feet south and 400 feet east of the northwest corner of sec. 11, T. 22 N., R. 44 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strongly effervescent; moderately alkaline; clear smooth boundary.

AC—7 to 15 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak fine prismatic structure; soft, very friable; violently effervescent; moderately alkaline; clear wavy boundary.

C—15 to 32 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; few fine distinct light yellowish brown (10YR 6/4) iron masses in matrix; single grain; loose; violently effervescent; moderately alkaline; gradual smooth boundary.

Cg—32 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; few fine distinct very dark grayish brown (10YR 3/2) and light yellowish brown (10YR 6/4) iron masses in matrix; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 5 inches

A horizon:
Hue—10YR
Value—4 or 5 (3 or 4 moist)

Chroma—1 or 2
Texture—fine sand

AC horizon:
Hue—10YR
Value—5 or 6 (4 or 5 moist)
Chroma—1 or 2
Texture—fine sand, sand, or loamy fine sand

C and Cg horizons:
Hue—10YR
Value—5 to 7 (5 or 6 moist)
Chroma—2 or 3
Texture—fine sand, sand, or loamy sand

Epping Series

Depth class: Shallow
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Position on the landform: Shoulders and back slopes
Parent material: Residuum weathered from siltstone
Slope range: 9 to 60 percent

Taxonomic class: Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents

Typical Pedon

Epping very fine sandy loam, in an area of Epping-Rock outcrop complex, 30 to 60 percent slopes, 1,200 feet north and 1,900 feet west of the southeast corner of sec. 36, T. 17 N., R. 45 W.

A—0 to 3 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; 2 percent, by volume, siltstone gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

AC—3 to 9 inches; light brownish gray (10YR 6/2) very fine sandy loam, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, very friable; 2 percent, by volume, siltstone gravel; violently effervescent; slightly alkaline; clear smooth boundary.

C—9 to 16 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; 10 percent, by volume, siltstone gravel; violently effervescent; slightly alkaline; clear smooth boundary.

Cr—16 to 60 inches; very pale brown (10YR 8/2) siltstone, light gray (10YR 7/2) moist.

Range in Characteristics

Depth to paralithic contact: 10 to 20 inches
Depth to carbonates: 0 to 6 inches
Content of rock fragments in the particle-size control section: 2 to 15 percent

A horizon:
Hue—10YR
Value—5 to 7 (3 or 4 moist)
Chroma—2 or 3
Texture—very fine sandy loam

AC horizon:
Hue—10YR
Value—5 to 7 (4 or 5 moist)
Chroma—2 or 3
Texture—very fine sandy loam, silt loam, or loam

C horizon:
Hue—10YR
Value—5 to 8 (4 to 6 moist)
Chroma—2 or 3
Texture—very fine sandy loam, silt loam, or loam

Gothenburg Series

Depth class: Very deep
Depth to sand and gravel: Very shallow and shallow
Drainage class: Poorly drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Valleys
Landform: Flood plains
Parent material: Sandy and gravelly alluvium
Slope range: 0 to 2 percent

Taxonomic class: Mixed, mesic Typic Psammaquents

Typical Pedon

Gothenburg loamy sand, 0 to 2 percent slopes, 2,500 feet south and 1,700 feet east of the northwest corner of sec. 15, T. 17 N., R. 45 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strongly effervescent; moderately alkaline; clear smooth boundary.

C—5 to 14 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose; common coarse prominent strong brown (7.5YR 4/6) and yellowish brown (10YR 5/6) iron masses in matrix; slightly effervescent; moderately alkaline; clear smooth boundary.

Cg—14 to 60 inches; very pale brown (10YR 7/3) coarse sand, light brownish gray (10YR 6/2) moist;

single grain; loose; common coarse prominent strong brown (7.5YR 4/6) and yellowish brown (10YR 5/6) iron masses in matrix; 10 percent gravel, by volume; mildly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 6 inches

A horizon:
Hue—10YR
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loamy sand

C and Cg horizons:
Hue—10YR
Value—6 to 8 (4 to 7 moist)
Chroma—1 to 3
Texture—fine sand to coarse sand

Hoffland Series

Depth class: Very deep
Drainage class: Poorly drained and very poorly drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales
Parent material: Sandy alluvium
Slope range: 0 to 1 percent

Taxonomic class: Sandy, mixed, mesic Mollic Endoaquepts

Typical Pedon

Hoffland fine sandy loam, 0 to 1 percent slopes, 500 feet north and 500 feet east of the southwest corner of sec. 10, T. 21 N., R. 44 W.

Oe—1 inch to 0; partly decomposed plant material.
Ak1—0 to 4 inches; dark gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium granular structure; soft, very friable; 20 percent calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary.
Ak2—4 to 10 inches; dark gray (10YR 4/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, very friable; 18 percent calcium carbonate; violently effervescent; moderately alkaline; clear smooth boundary.
Cg1—10 to 20 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; common fine faint black (2.5Y 2.5/1) iron depletions in matrix; loose; slightly effervescent; strongly alkaline; gradual smooth boundary.
Cg2—20 to 60 inches; dark grayish brown (10YR 4/2) fine sand, dark gray (10YR 4/1) moist; single grain; loose; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 10 inches
Depth to carbonates: At the surface; 15 to 40 percent calcium carbonate in the solum

Ak horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—fine sandy loam or loamy fine sand

Cg horizon:
Hue—10YR or 2.5Y
Value—4 to 8 (2 to 6 moist)
Chroma—1 or 2
Texture—fine sand, sand, or loamy fine sand

Ipage Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Sandhills
Landform: Interdunes
Position on the landform: Hummocks
Parent material: Eolian sand
Slope range: 0 to 3 percent

Taxonomic class: Mixed, mesic Oxyaquic Ustipsamments

Typical Pedon

Ipage fine sand, calcareous, 0 to 3 percent slopes, 900 feet south and 300 feet east of the northwest corner of sec. 18, T. 22 N., R. 45 W.

A—0 to 5 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; slightly effervescent; slightly alkaline; clear smooth boundary.
AC—5 to 16 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; violently effervescent; moderately alkaline; gradual smooth boundary.
C1—16 to 38 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose; violently effervescent; moderately alkaline; gradual smooth boundary.

C2—38 to 60 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; few fine faint yellowish brown (10YR 5/6) iron masses in matrix; single grain; loose; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to redoximorphic features: Iron masses at a depth of less than 40 inches
Depth to carbonates: 0 to 15 inches

A horizon:
Hue—10YR
Value—4 to 6 (3 or 4 moist)
Chroma—1 or 2
Texture—fine sand

AC horizon:
Hue—10YR
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—fine sand, sand, or loamy fine sand

C horizon:
Hue—10YR
Value—6 to 8 (4 to 7 moist)
Chroma—2 or 3
Texture—fine sand, sand, or loamy fine sand

Jankosh Series

Depth class: Very deep
Depth to sand and gravel: Moderately deep
Drainage class: Somewhat poorly drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour) in the upper part, very rapid (more than 20 inches per hour) in the lower part
Landscape: Valleys
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent

Taxonomic class: Coarse-silty over sandy- or sandy-skeletal, mixed (calcareous), mesic Aeric Halaquepts

Typical Pedon

Jankosh loam, 0 to 2 percent slopes, 200 feet north and 2,575 feet east of the southwest corner of sec. 35, T. 17 N., R. 44 W.

A—0 to 2 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; slight effervescence; slightly alkaline; sodium adsorption ratio 8; abrupt smooth boundary.

E—2 to 4 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; slight effervescence; slightly alkaline; sodium adsorption ratio 5; abrupt smooth boundary.

Bn1—4 to 14 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm; violent effervescence; very strongly alkaline; sodium adsorption ratio 19; clear smooth boundary.

Bn2—14 to 18 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; hard, firm; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulations irregular in shape and with sharp to diffuse boundaries in matrix; violent effervescence; very strongly alkaline; sodium adsorption ratio 25; clear smooth boundary.

Bkn—18 to 33 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; moderate medium prismatic structure; slightly hard, friable; few fine and medium distinct yellowish brown (10YR 5/6) masses of iron accumulations irregular in shape and with sharp to diffuse boundaries in matrix; violent effervescence; very strongly alkaline; few fine accumulations of calcium carbonate; sodium adsorption ratio 15; abrupt wavy boundary.

2Cg—33 to 60 inches; very pale brown (10YR 8/2) gravelly coarse sand, light gray (10YR 7/2) moist; single grain; loose; 26 percent gravel, by volume; neutral.

Range in Characteristics

Depth to carbonates: Typically at the surface and throughout the solum
Depth to gravelly coarse sand or gravelly sand: 20 to 40 inches
Thickness of the solum: 20 to 36 inches

A horizon:
Hue—10YR
Value—4 or 5 (3 or 4 moist)
Chroma—1 or 2
Texture—loam

E horizon:
Hue—10YR
Value—6 or 7 (4 or 5 moist)
Chroma—1 or 2
Texture—loam

Bn horizon:
Hue—10YR
Value—5 to 7 (4 or 5 moist)

Chroma—2 or 3
Texture—loam or very fine sandy loam
Sodium adsorption ratio—more than 13

Bkn horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—loam or very fine sandy loam
Sodium adsorption ratio—more than 13

2Cg horizon:
Hue—10YR
Value—5 to 8 (6 or 7 moist)
Chroma—2 to 4
Texture—gravelly coarse sand or gravelly sand
Volume of gravel—15 to 35 percent

Jayem Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid (2 to 6 inches per hour)
Landscape: Tablelands
Landform: Plains and hillslopes
Parent material: Loamy and sandy eolian material
Slope range: 0 to 6 percent

Taxonomic class: Coarse-loamy, mixed, mesic Aridic Haplustolls

Typical Pedon

Jayem fine sandy loam, 0 to 2 percent slopes, 100 feet south and 1,850 feet west of the northeast corner of sec. 15, T. 18 N., R. 45 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.
A—6 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.
Bw—9 to 22 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; slightly alkaline; gradual smooth boundary.
C1—22 to 50 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; soft, friable; slightly alkaline; gradual smooth boundary.
C2—50 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, friable; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Thickness of the solum: 15 to 40 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 or 3
Texture—fine sandy loam or loamy fine sand

Bw horizon:
Hue—10YR
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—fine sandy loam or very fine sandy loam

C horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—fine sandy loam or very fine sandy loam; in some pedons loamy sand below a depth of 40 inches

Keith Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Tablelands
Landform: Plains and hillslopes
Parent material: Loess
Slope range: 1 to 6 percent

Taxonomic class: Fine-silty, mixed, mesic Aridic Argiustolls

Typical Pedon

Keith loam, 1 to 3 percent slopes, 100 feet north and 150 feet west of the southeast corner of sec. 33, T. 15 N., R. 43 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; very friable; neutral; abrupt smooth boundary.
A—6 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; neutral; clear smooth boundary.
Bt1—13 to 22 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium

prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; few thin patchy clay films; slightly acid; clear smooth boundary.

Bt2—22 to 31 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; few thin patchy clay films; slightly alkaline; clear smooth boundary.

BCk—31 to 48 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to fine medium subangular blocky; soft, very friable; violently effervescent; moderately alkaline; clear smooth boundary.

C—48 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; weak medium prismatic structure; soft, very friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 15 to 38 inches
Content of clay in the control section: 25 to 32 percent
Thickness of the solum: 24 to 48 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loam

Bt1 horizon:
Hue—10YR
Value—4 or 5 (2 to 4 moist)
Chroma—2 or 3
Texture—silt loam, silty clay loam, or loam

Bt2 horizon:
Hue—10YR
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—silt loam, silty clay loam, or loam

BCk horizon:
Hue—10YR
Value—5 to 7 (3 to 6 moist)
Chroma—2 or 3
Texture—silt loam, silty clay loam, or loam

C horizon:
Hue—10YR
Value—6 to 8 (5 or 6 moist)
Chroma—2 to 4
Texture—silt loam, loam, or very fine sandy loam

Kuma Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Tablelands
Landform: Plains
Parent material: Loess (fig. 23)
Slope range: 0 to 1 percent

Taxonomic class: Fine-silty, mixed, mesic Pachic Argiustolls

Typical Pedon

Kuma loam, 0 to 1 percent slopes, 1,200 feet south and 75 feet west of the northeast corner of sec. 15, T. 15 N., R. 46 W.

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

BA—7 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate fine granular; slightly hard, friable; slightly acid; clear smooth boundary.

Bt—17 to 24 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; discontinuous clay films on faces of peds and in pores; neutral; clear smooth boundary.

Btb—24 to 37 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; discontinuous clay films on faces of peds and in pores; neutral; gradual smooth boundary.

Btkb—37 to 44 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; discontinuous clay films on faces of peds and in pores; violently effervescent; moderately alkaline; clear smooth boundary.

Bk—44 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; threads and

Figure 23.—A typical profile of Kuma loam, which formed in loess over a buried soil that also formed in loess. The arrow indicates the top of the buried soil. Depth is marked in feet.

coatings of calcium carbonate on faces of peds; violently effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 50 inches
Depth to carbonates: 20 to 40 inches
Content of clay in the particle-size control section: 18 to 24 percent in the Bt horizon and 24 to 35 percent in the Btb horizon
Thickness of the solum: 30 to 60 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 to 3
Texture—loam

Bt horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 to 3
Texture—loam, silt loam, or silty clay loam

Btb and Btkb horizons:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—loam, silty clay loam, or silt loam

Bk horizon:
Hue—10YR
Value—4 to 7 (2 to 6 moist)
Chroma—1 to 4
Texture—loam, silt loam, or silty clay loam

Lemoyne Series

Depth class: Very deep
Depth to sand and gravel: Deep
Drainage class: Moderately well drained
Permeability: Rapid (6 to 20 inches per hour) and moderately slow (0.2 to 0.6 inch per hour)
Landscape: Valleys
Landform: Flood plains
Parent material: Eolian sand over alluvium
Slope range: 0 to 2 percent

Taxonomic class: Sandy over loamy, mixed, mesic Haplocalcidic Ustochrepts

Typical Pedon

Lemoyne sand, 0 to 2 percent slopes, 100 feet west and 600 feet south of the northeast corner of sec. 7, T. 16 N., R. 43 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) sand, dark brown (10YR 3/3) moist; weak fine granular structure; loose; neutral; abrupt smooth boundary.

A1—6 to 13 inches; grayish brown (10YR 5/2) sand, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; loose; slightly effervescent; slightly alkaline; clear smooth boundary.

A2—13 to 18 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; slightly effervescent; slightly alkaline; clear smooth boundary.
2Bw1—18 to 22 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; sodium adsorption ratio 5; 9 percent calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.
2Bw2—22 to 36 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable; sodium adsorption ratio 5; 7 percent calcium carbonate; violently effervescent; strongly alkaline; gradual smooth boundary.
2Bk—36 to 54 inches; white (10YR 8/1) clay loam, light gray (10YR 7/2) moist; few fine prominent yellowish brown (10YR 6/4) iron masses in matrix; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm; sodium adsorption ratio 11; 30 percent calcium carbonate; violently effervescent; strongly alkaline; clear wavy boundary.
2Cg—54 to 60 inches; very pale brown (10YR 7/3) coarse sand, light gray (10YR 7/2) moist; single grain; loose; sodium adsorption ratio 7; strongly effervescent; strongly alkaline.

Range in Characteristics

Depth to lithologic discontinuity: 12 to 24 inches
Depth to the 2Cg horizon: 40 to 60 inches
Depth to carbonates: 0 to 15 inches

A horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—sand, loamy sand, or fine sand
Sodium adsorption ratio—0 to 6

2Bw horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay loam, loam, or sandy clay loam
Sodium adsorption ratio—0 to 6
Calcium carbonate equivalent—1 to 10 percent

2Bk horizon:
Hue—10YR
Value—6 to 8 (5 to 7 moist)
Chroma—1 to 3
Texture—clay loam or loam
Sodium adsorption ratio—6 to 13
Calcium carbonate equivalent—15 to 40 percent

2Cg horizon:
Hue—10YR
Value—6 to 8 (5 to 7 moist)
Chroma—1 to 4
Texture—coarse sand or sand
Sodium adsorption ratio—3 to 9
Calcium carbonate equivalent—1 to 10 percent

Lewellen Series

Depth class: Very deep
Depth to sand and gravel: Moderately deep
Drainage class: Somewhat poorly drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour) and rapid (6 to 20 inches per hour)
Landscape: Valleys
Landform: Flood plains
Parent material: Loamy over sandy alluvium underlain by coarse sand to gravelly coarse sand
Slope range: 0 to 2 percent

Taxonomic class: Sandy, mixed, mesic Typic Halaquepts

Typical Pedon

Lewellen loam, 0 to 2 percent slopes, 800 feet south and 550 feet west of the northeast corner of sec. 4, T. 16 N., R. 44 W.

Ak1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; sodium adsorption ratio 17; 18 percent calcium carbonate; violently effervescent; strongly alkaline; abrupt wavy boundary.
Ak2—4 to 8 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable; sodium adsorption ratio 39; 19 percent calcium carbonate; 9 mmhos electrical conductivity; violently effervescent; strongly alkaline; abrupt wavy boundary.
ACk—8 to 12 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; moderate fine granular structure; slightly hard, very friable; sodium adsorption ratio 35; 4 percent calcium carbonate; 6 mmhos electrical conductivity; violently effervescent; strongly alkaline; abrupt wavy boundary.
2C—12 to 29 inches; light yellowish brown (10YR 6/4) and very pale brown (10YR 7/3) fine sand, yellowish brown (10YR 5/4) and pale brown (10YR

6/3) moist; few fine prominent yellowish brown (10YR 5/6) iron masses in matrix; single grain; loose; sodium adsorption ratio 9; moderately alkaline; abrupt wavy boundary.

2Cg—29 to 80 inches; very pale brown (10YR 7/3) coarse sand, pale brown (10YR 6/3) moist; common medium prominent yellowish brown (10YR 5/6) iron masses in matrix; single grain; loose; 13 percent gravel, by volume; slightly acid.

Range in Characteristics

Depth to the 2Cg horizon: 20 to 40 inches
Volume of gravel: 5 to 35 percent in the 2Cg horizon

Ak horizon:
Hue—10YR or 2.5Y
Value—4 to 7 (3 to 5 moist)
Chroma—1 to 3
Texture—loam
Sodium adsorption ratio—14 to 54
Electrical conductivity—2 to 10 millimhos per centimeter
Calcium carbonate equivalent—15 to 20 percent

ACk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 or 5 moist)
Chroma—1 to 3
Texture—very fine sandy loam, loam, or fine sandy loam
Sodium adsorption ratio—14 to 54
Electrical conductivity—2 to 15 millimhos per centimeter
Calcium carbonate equivalent—1 to 10 percent

2C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (4 to 6 moist)
Chroma—2 to 4
Texture—fine sand or loamy fine sand
Sodium adsorption ratio—5 to 22
Electrical conductivity—2 to 10 millimhos per centimeter
Calcium carbonate equivalent—0 to 5 percent

2Cg horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—coarse sand, gravelly coarse sand, or gravelly sand

Lodgepole Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Very slow (less than 0.06 inch per hour)
Landscape: Tablelands
Landform: Depressions
Parent material: Loess
Slope range: 0 to 1 percent

Taxonomic class: Fine, montmorillonitic, mesic Typic Argiaquolls

Typical Pedon

Lodgepole silt loam, 0 to 1 percent slopes, 2,300 feet north and 2,200 feet west of the southeast corner of sec. 34, T. 15 N., R. 45 W. (fig. 24)

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; moderately acid; abrupt smooth boundary.

Bt1—5 to 14 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; strong medium prismatic structure parting to strong fine subangular blocky; hard, firm; few clay films on faces of peds and coatings in pores; slightly acid; gradual smooth boundary.

Bt2—14 to 26 inches; dark grayish brown (10YR 4/2)

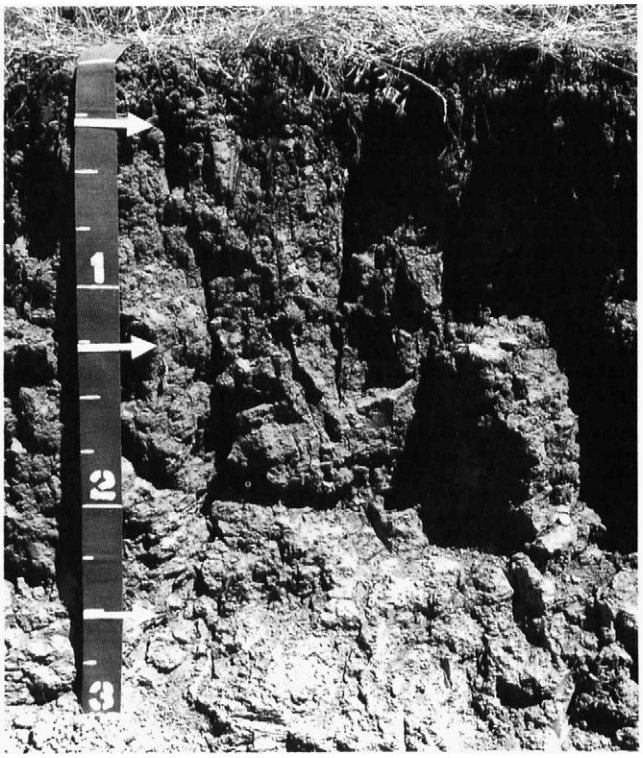

Figure 24.—A profile of a soil in the Lodgepole series. Because of the high content of clay, the subsoil has a high shrink-swell potential. The markers indicate the horizon boundaries.

silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm; few clay films on faces of peds and coatings in pores; neutral; gradual smooth boundary.

BC—26 to 32 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm; neutral; gradual smooth boundary.

C1—32 to 48 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate medium prismatic structure; hard, friable; neutral; gradual smooth boundary.

C2—48 to 60 inches; light gray (10YR 7/2) loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 41 inches
Depth to carbonates: 30 to more than 60 inches
Content of clay in the control section: 35 to 50 percent
Thickness of the solum: 24 to 48 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—silt loam

Bt horizon:
Hue—10YR
Value—3 to 5 (2 to 4 moist)
Chroma—1 or 2
Texture—silty clay or silty clay loam in which the content of clay is more than 35 percent

BC horizon:
Hue—10YR
Value—4 to 6 (2 to 5 moist)
Chroma—2 or 3
Texture—silty clay loam or silty clay

C horizon:
Hue—10YR or 2.5Y
Value—5 to 8 (4 to 7 moist)
Chroma—2 to 4
Texture—loam, silt loam, or very fine sandy loam

Marlake Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Sandhills
Landform: Interdunes
Position on the landform: Depressions
Parent material: Eolian and alluvial sand
Slope range: 0 to 1 percent

Taxonomic class: Mixed, mesic Mollic Psammaquents

Typical Pedon

Marlake mucky peat, 0 to 1 percent slopes, 1,000 feet south and 600 feet west of the center of sec. 29, T. 21 N., R. 42 W.

Oe—12 inches to 0; very dark grayish brown (10YR 3/2) mucky peat, very dark brown (10YR 2/2) moist; neutral; abrupt smooth boundary.

A—0 to 7 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; single grain; slightly hard, loose; neutral; clear smooth boundary.

Cg—7 to 60 inches; light gray (10YR 7/1) loamy fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; slightly alkaline.

Range in Characteristics

Thickness of mollic color of the mineral soil: 6 to 10 inches
Thickness of organic layer: 1 to 16 inches

Oe horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—mucky peat

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loamy fine sand or fine sandy loam

Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (3 to 6 moist)
Chroma—1 or 2
Texture—loamy fine sand, fine sand, or sand

McConaughy Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Position on the landform: Back slopes and foot slopes
Parent material: Loess

Slope range: 3 to 15 percent

Taxonomic class: Coarse-silty, mixed, mesic Aridic Haplustolls

Typical Pedon

McConaughy loam, in an area of Sulco-McConaughy complex, 6 to 9 percent slopes, eroded, 200 feet north and 550 feet east of the southwest corner of sec. 27, T. 15 N., R. 42 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; soft, very friable; neutral; abrupt smooth boundary.
Bw—7 to 18 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable; slightly alkaline; clear smooth boundary.
Bk—18 to 28 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable; violently effervescent; slightly alkaline; clear smooth boundary.
C—28 to 60 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violently effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 10 to 18 inches
Thickness of the solum: 25 to 46 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 or 3
Texture—loam

Bw horizon:
Hue—10YR
Value—5 to 7 (4 or 5 moist)
Chroma—2 or 3
Texture—loam or very fine sandy loam

Bk and C horizons:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loam or very fine sandy loam

McCuligan Series

Depth class: Very deep
Depth to sand and gravel: Shallow
Drainage class: Poorly drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour) and very rapid (more than 20 inches per hour) in the substratum
Landscape: Valleys
Landform: Flood plains
Parent material: Loamy and sandy alluvium
Slope range: 0 to 2 percent

Taxonomic class: Sandy, mixed, mesic Mollic Fluvaquents

Typical Pedon

McCuligan loam, in an area of Lewellen-McCuligan complex, 0 to 2 percent slopes, 2,200 feet south and 1,000 feet west of the northeast corner of sec. 4, T. 16 N., R. 44 W.

A—0 to 7 inches; gray (10YR 5/1) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; sodium adsorption ratio 9; strongly effervescent; moderately alkaline; clear smooth boundary.
ACg—7 to 12 inches; stratified grayish brown (10YR 5/2) loam and dark grayish brown (10YR 4/2) very fine sandy loam, dark gray (10YR 4/1) and very dark gray (10YR 3/1) moist; few fine prominent yellowish brown (10YR 5/6) iron masses in matrix; weak medium subangular blocky structure; slightly hard, friable; sodium adsorption ratio 8; 4 mmhos electrical conductivity; violently effervescent; moderately alkaline; gradual smooth boundary.
Cg1—12 to 18 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; common coarse prominent strong brown (7.5YR 4/6) iron masses in matrix; single grain; loose; few thin strata of very fine sandy loam; neutral; abrupt wavy boundary.
2Cg2—18 to 80 inches; light gray (10YR 7/2) gravelly coarse sand, light brownish gray (10YR 6/2) moist; many coarse prominent dark gray (N 4/0) areas of iron depletion in matrix; single grain; loose; 28 percent gravel, by volume; neutral.

Range in Characteristics

Depth to carbonates: At the surface
Depth to the 2Cg2 horizon: 10 to 20 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loam
Electrical conductivity—0 to 4 millimhos per centimeter
Sodium adsorption ratio—0 to 9

ACg horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (3 to 5 moist)
Chroma—1 to 3
Texture—dominantly stratified loam, very fine sandy loam, or fine sandy loam
Electrical conductivity—2 to 8 millimhos per centimeter
Sodium adsorption ratio—6 to 13

Cg horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 to 4
Texture—stratified sand or fine sand
Electrical conductivity—0 to 4 millimhos per centimeter
Sodium adsorption ratio—0 to 9

2Cg horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (5 to 7 moist)
Chroma—2 or 3
Texture—gravelly coarse sand, coarse sand, or gravelly sand
Electrical conductivity—0 to 2 millimhos per centimeter
Volume of gravel—2 to 35 percent, by volume

Mitchell Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Position on the landform: Shoulders, back slopes, and foot slopes
Parent material: Colluvium and alluvium weathered from siltstone
Slope range: 3 to 30 percent

Taxonomic class: Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents

Typical Pedon

Mitchell very fine sandy loam, 3 to 6 percent slopes, 400 feet north and 300 feet west of the southeast corner of sec. 36, T. 17 N., R. 45 W.

A—0 to 7 inches; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; very friable; neutral; clear smooth boundary.
AC—7 to 16 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very friable; violently effervescent; slightly alkaline; gradual smooth boundary.
C—16 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; very friable; violently effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

A horizon:
Hue—10YR
Value—4 to 7 (4 or 5 moist)
Chroma—2 or 3
Texture—very fine sandy loam

AC horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—very fine sandy loam, loam, or silt loam

C horizon:
Hue—10YR
Value—6 to 8 (5 to 7 moist)
Chroma—2 or 3
Texture—very fine sandy loam, loam, or silt loam

The Mitchell soils in Garden County are taxadjuncts to the Mitchell series because they are in an area of higher rainfall. This difference, however, does not alter the use or behavior of these soils.

Rushcreek Series

Depth class: Very deep
Depth to sand and gravel: Deep
Drainage class: Moderately well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Valleys
Landform: Flood plains
Parent material: Loamy alluvium over gravelly coarse sand
Slope range: 0 to 2 percent

Taxonomic class: Fine-loamy, mixed, mesic Fluventic Haplustolls

Typical Pedon

Rushcreek loam, 0 to 2 percent slopes, 1,800 feet west and 900 feet north of the southeast corner of sec. 20, T. 17 N., R. 44 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, very friable; slightly effervescent; slightly alkaline; abrupt smooth boundary.
A—7 to 11 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak medium granular structure; slightly hard, friable; strongly effervescent; moderately alkaline; clear smooth boundary.
Bw1—11 to 24 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, friable; sodium adsorption ratio 9; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bw2—24 to 34 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure; hard, friable; sodium adsorption ratio 11; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bk—34 to 42 inches; very pale brown (10YR 7/4) sandy loam, yellowish brown (10YR 5/4) moist; common fine faint yellowish brown (10YR 5/6) iron masses in matrix; weak medium subangular blocky structure; slightly hard, very friable; common thin strata of loam; sodium adsorption ratio 11; soft masses of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.
Cg1—42 to 56 inches; light gray (10YR 7/2) sandy loam, light yellowish brown (10YR 6/4) moist; common fine prominent gray (10YR 5/1) iron depletions in matrix; massive; soft, very friable; few fine strata of sand; strongly effervescent; slightly alkaline; abrupt smooth boundary.
2Cg2—56 to 80 inches; light gray (10YR 7/2) gravelly coarse sand, light yellowish brown (10YR 6/4) moist; single grain; loose; 16 percent gravel, by volume; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 0 to 10 inches
Thickness of the solum: 20 to 55 inches
Depth to the 2Cg horizon: 40 to 60 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loam
Sodium adsorption ratio—0 to 9

Bw horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 to 6
Texture—loam or clay loam
Sodium adsorption ratio—9 to 13

Bk horizon:
Hue—10YR
Value—6 or 7 (5 or 6 moist)
Chroma—2 to 4
Texture—stratified sandy loam, loam, or very fine sandy loam
Sodium adsorption ratio—9 to 13

Cg horizon:
Hue—10YR
Value—6 to 8 (5 to 7 moist)
Chroma—2 to 4
Texture—sandy loam, loam, or very fine sandy loam
Sodium adsorption ratio—6 to 9

2Cg horizon:
Hue—10YR
Value—6 to 8 (5 to 7 moist)
Chroma—2 to 4
Texture—gravelly coarse sand, gravelly sand, or coarse sand
Volume of gravel—2 to 35 percent

Sarben Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid (2 to 6 inches per hour)
Landscape: Uplands
Landform: Interdunes and hillslopes
Position on the landform: Hummocks, swales, plains, and hillslopes
Parent material: Sandy and loamy eolian material
Slope range: 0 to 20 percent

Taxonomic class: Coarse-loamy, mixed, nonacid, mesic Aridic Ustorthents

Typical Pedon

Sarben loamy fine sand, 3 to 6 percent slopes, 100 feet north and 300 feet west of the southeast corner of sec. 35, T. 18 N., R. 44 W.

Ap—0 to 7 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

AC—7 to 15 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; neutral; clear smooth boundary.
C1—15 to 32 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; strongly effervescent; slightly alkaline; gradual smooth boundary.
C2—32 to 60 inches; very pale brown (10YR 8/2) fine sandy loam, light gray (10YR 7/2) moist; massive; soft, very friable; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 15 to 40 inches

A horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—loamy fine sand

AC horizon:
Hue—10YR
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—fine sandy loam, very fine sandy loam, or loamy fine sand

C horizon:
Hue—10YR
Value—5 to 8 (4 to 7 moist)
Chroma—2 or 3
Texture—fine sandy loam or very fine sandy loam but in some pedons loamy very fine sand below a depth of 40 inches

Scoville Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Rapid (6 to 20 inches per hour) in the upper part, moderate (0.6 inch to 2.0 inches per hour) in the lower part
Landscape: Valleys
Landform: Stream terraces
Parent material: Wind worked sandy alluvium over loamy alluvium
Slope range: 0 to 2 percent

Taxonomic class: Mixed, mesic Aridic Ustipsamments

Typical Pedon

Scoville loamy fine sand, 0 to 2 percent slopes, 1,000 feet south and 100 feet west of the northeast corner of sec. 19, T. 17 N., R. 44 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.
AC—6 to 10 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; soft, loose; neutral; clear smooth boundary.
C1—10 to 42 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral; abrupt wavy boundary.
2C2—42 to 46 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; slight effervescence; slightly alkaline; abrupt wavy boundary.
2C3—46 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; slight effervescence; slightly alkaline.

Range in Characteristics

Depth to the 2C horizon: 40 to 55 inches
Depth to carbonates: 40 to 55 inches

Ap horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—loamy fine sand

AC horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—loamy fine sand or fine sand

C horizon:
Hue—10YR
Value—5 or 6 (4 to 6 moist)
Chroma—2 or 3
Texture—fine sand, loamy sand, or loamy fine sand

2C horizon:
Hue—10YR
Value—6 to 8 (5 to 7 moist)
Chroma—2 or 3
Texture—very fine sandy loam, fine sandy loam, loamy fine sand, or loam; strata of sand to loamy fine sand in the lower part of the control section

Sidney Series

Depth class: Deep
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Tablelands
Landform: Hillslopes
Parent material: Residuum weathered from sandstone
Slope range: 3 to 9 percent

Taxonomic class: Coarse-loamy, mixed, mesic Torriorthentic Haplustolls

Typical Pedon

Sidney loam, 3 to 6 percent slopes, 1,450 feet south and 200 feet east of the northwest corner of sec. 24, T. 15 N., R. 45 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.
A—6 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.
Bw—11 to 17 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable; violently effervescent; slightly alkaline; clear smooth boundary.
Bk—17 to 29 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; moderate coarse prismatic structure; hard, friable; 5 percent, by volume, sandstone gravel; violently effervescent; slightly alkaline; clear wavy boundary.
C—29 to 48 inches; very pale brown (10YR 8/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable; 5 percent, by volume, sandstone gravel; slightly effervescent; slightly alkaline; clear wavy boundary.
Cr—48 to 60 inches; white (10YR 8/1), weathered sandstone, light gray (10YR 7/2) moist.

Range in Characteristics

Depth to paralithic contact: 40 to 60 inches
Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: Surface to 18 inches
Content of sandstone gravel in the particle-size control section: 0 to 15 percent, by volume
Thickness of the solum: 10 to 30 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 or 3
Texture—loam or very fine sandy loam

Bw horizon:
Hue—10YR
Value—4 to 6 (3 or 4 moist)
Chroma—2 or 3
Texture—loam, very fine sandy loam, or silt loam

Bk horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—loam, very fine sandy loam, or silt loam

C horizon:
Hue—10YR
Value—6 to 8 (4 to 6 moist)
Chroma—2 or 3
Texture—very fine sandy loam, fine sandy loam, or loam

Cr horizon:
Hue—10YR or 7.5YR
Value—6 to 8 (5 to 7 moist)
Chroma—1 to 4
Texture—weathered sandstone

Sulco Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate (0.6 inch to 2.0 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Parent material: Loess
Slope range: 3 to 60 percent

Taxonomic class: Coarse-silty, mixed (calcareous), mesic Aridic Ustorthents

Typical Pedon

Sulco loam, in an area of Sulco-McConaughy complex, 6 to 9 percent slopes, eroded, 200 feet north and 800 feet east of the southwest corner of sec. 27, T. 15 N., R. 42 W.

Ap—0 to 5 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; slightly effervescent; slightly alkaline; abrupt smooth boundary.

AC—5 to 16 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable; violently effervescent; slightly alkaline; clear smooth boundary.
C1—16 to 26 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable; violently effervescent; moderately alkaline; gradual smooth boundary.
C2—26 to 60 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable; violently effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 6 inches

A horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—loam or very fine sandy loam

AC horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—loam, very fine sandy loam, or silt loam

C horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loam, very fine sandy loam, or silt loam

Tassel Series

Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderately rapid (2 to 6 inches per hour)
Landscape: Uplands
Landform: Hillslopes
Position on the landform: Summits and shoulders
Parent material: Weathered sandstone (fig. 25)
Slope range: 3 to 60 percent

Taxonomic class: Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents

Typical Pedon

Tassel fine sandy loam, in an area of Tassel-Ashollow-Rock outcrop complex, 20 to 60 percent slopes, 300 feet south and 1,700 feet east of the northwest corner of sec. 23, T. 15 N., R. 42 W.

A—0 to 4 inches; pale brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; 14 percent, by volume, sandstone gravel; violently effervescent; slightly alkaline; clear wavy boundary.
C1—4 to 7 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; 9 percent, by volume, sandstone gravel; violently effervescent; slightly alkaline; gradual wavy boundary.
C2—7 to 18 inches; very pale brown (10YR 7/3) gravelly fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; 25 percent, by volume,

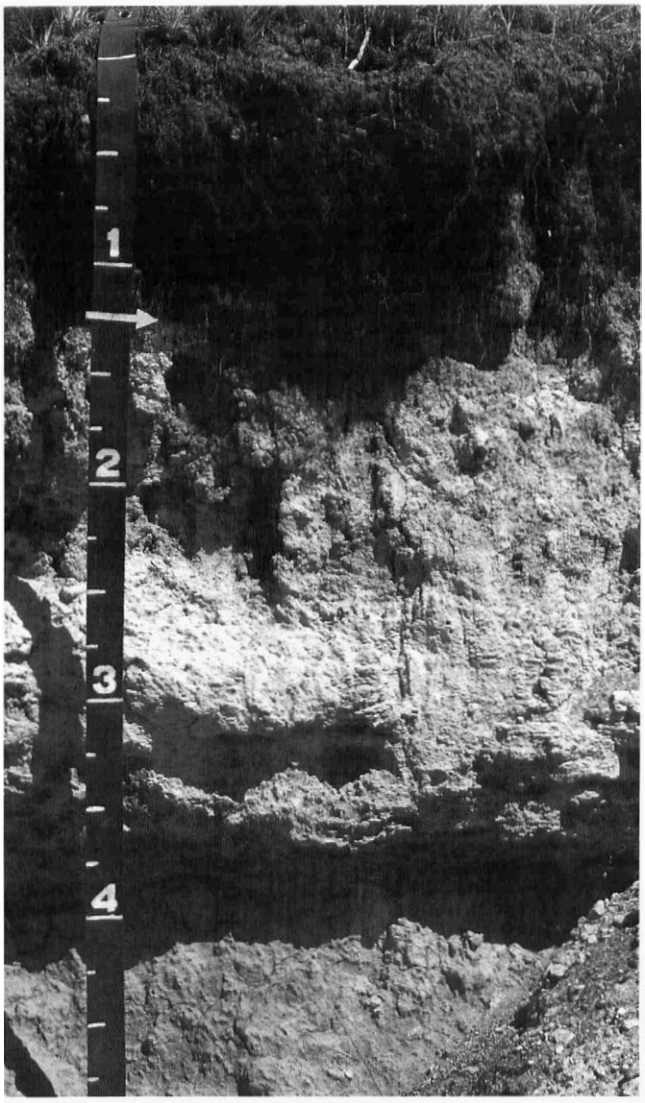

Figure 25.—A typical profile of Tassel fine sandy loam, which formed in weathered calcareous sandstone. The arrow indicates the top of the sandstone bedrock. Depth is marked in feet.

sandstone gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.
Cr—18 to 60 inches; very pale brown (10YR 8/3) weakly cemented sandstone, pale brown (10YR 6/3) moist; violently effervescent.

Range in Characteristics

Depth to paralithic contact: 6 to 20 inches
Depth to carbonates: 0 to 3 inches

A horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—fine sandy loam

C horizon:
Hue—10YR
Value—5 to 8 (4 to 7 moist)
Chroma—2 to 4
Texture—fine sandy loam, loamy fine sand, gravelly sandy loam, gravelly fine sandy loam, or gravelly loamy very fine sand

Valent Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Sandhills
Landform: Dunes and interdunes
Parent material: Eolian sand
Slope range: 0 to 60 percent

Taxonomic class: Mixed, mesic Ustic Torripsamments

Typical Pedon

Valent fine sand, rolling, 2,100 feet west and 1,900 feet south of the northeast corner of sec. 26, T. 20 N., R. 46 W.

A—0 to 4 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose; neutral; clear smooth boundary.
C1—4 to 36 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; neutral; gradual smooth boundary.
C2—36 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grain; loose; neutral.

Range in Characteristics

A horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—fine sand or loamy fine sand

C horizon:
Hue—10YR
Value—6 or 7 (4 to 6 moist)
Chroma—2 or 3
Texture—fine sand, loamy fine sand, or sand

Vetal Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid (2 to 6 inches per hour)
Landscape: Tablelands
Landform: Plains
Parent material: Loamy and sandy eolian and alluvial sediments
Slope range: 0 to 2 percent

Taxonomic class: Coarse-loamy, mixed, mesic Pachic Haplustolls

Typical Pedon

Vetal fine sandy loam, 0 to 2 percent slopes, 200 feet north and 300 feet west of the southeast corner of sec. 11, T. 15 N., R. 43 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.
A—8 to 22 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; neutral; clear smooth boundary.
AC—22 to 38 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable; mildly alkaline; gradual smooth boundary.
C—38 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; soft, very friable; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 50 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2

Texture—fine sandy loam and very fine sandy loam

AC horizon:
Hue—10YR
Value—4 to 6 (3 or 4 moist)
Chroma—1 to 3
Texture—very fine sandy loam, sandy loam, or fine sandy loam

C horizon:
Hue—10YR
Value—5 to 7 (4 or 5 moist)
Chroma—2 or 3
Texture—very fine sandy loam, sandy loam, or fine sandy loam

Wildhorse Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Rapid (6 to 20 inches per hour)
Landscape: Sandhills
Landform: Interdunes
Position on the landform: Swales and hummocks
Parent material: Sandy alluvium
Slope range: 0 to 3 percent

Taxonomic class: Sandy, mixed, mesic Typic Halaquepts

Typical Pedon

Wildhorse fine sand, 0 to 3 percent slopes, 1,900 feet north and 1,500 feet east of the southwest corner of sec. 18, T. 21 N., R. 45 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; sodium adsorption ratio 20; violently effervescent; very strongly alkaline; clear smooth boundary.
A2—3 to 8 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; sodium adsorption ratio 25; violently effervescent; very strongly alkaline; clear smooth boundary.
AC—8 to 14 inches; light brownish gray (10YR 6/2) sand, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; loose; sodium adsorption ratio 24; violently effervescent; very strongly alkaline; clear smooth boundary.
C—14 to 29 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; few fine distinct yellowish brown (10YR 5/6) iron masses in matrix; single grain; loose; sodium adsorption ratio 13; violently effervescent; very strongly alkaline; gradual smooth boundary.
Cg—29 to 60 inches; light brownish gray (2.5Y 6/2) sand, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/6) iron masses in matrix; single grain; loose; sodium adsorption ratio 7; violently effervescent; strongly alkaline.

Range in Characteristics

Depth to carbonates: At the surface
Sodium adsorption ratio: More than 13 in half or more of the upper 20 inches

A horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—1 or 2
Texture—fine sand or sand

AC horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)
Chroma—1 or 2
Texture—sand or fine sand

C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (4 to 6 moist)
Chroma—1 to 3
Texture—sand, fine sand, or loamy fine sand

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, mainly plants, are the active factors of soil formation. They act on parent material 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. 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.

Parent Material

Parent material is the unconsolidated material in which a soil forms. It determines the mineralogical and chemical composition of the soil. The soils in Garden County formed in parent material that was transported by wind or water or moved by gravity, or parent material that weathered from the underlying geological formations.

Eolian sand covers a large area in the northern part of the county and in scattered smaller areas throughout the county. It is pale brown and very pale brown sand that was deposited by the wind. It ranges from a few feet to more than 100 feet in thickness. The deposits occur as gently rolling to hilly upland dunes and interdune valleys. Valent soils are the dominant soils formed in eolian sand. They show very little profile development because eolian sand is resistant to weathering. Sarben and Jayem soils formed in mixed sandy and loamy eolian material in the loess-sand transitional areas bordering the Sandhills.

Loess, or wind-deposited silty material, mantles the tablelands and some of the dissected uplands in the county. It is yellowish brown, calcareous material that ranges from a few feet to 100 feet in thickness. Keith, Kuma, Duroc, Sulco, and McConaughy soils are the major soils formed in loess.

Alluvium is material that has been deposited by water on flood plains and stream terraces in broad river valleys or in narrow upland drainageways. It has a wide range in texture because of the differences in the material from which it was derived and in the manner in which it was deposited. Bayard soils formed in alluvium on stream terraces. Scoville soils formed in wind worked alluvium on stream terraces. Rushcreek, Jankosh, Lewellen, McCuligan, and Gothenburg soils formed in alluvium on flood plains.

Colluvium is material that accumulated as a result of the combined forces of gravity and water. In Garden County colluvial material occurs on foot slopes of dissected uplands. Ashollow and Mitchell soils formed in colluvium.

The Ogallala Group extends throughout most of the county. In some areas it is at the surface, and in other areas it is many feet below the surface. It is made up of beds ranging from silt to gravel and from soft or loose to very hard in consistence. The rock formed from this material ranges from friable caliche that is only partly indurated to relatively hard, resistant mortar beds that form ledges. Tassel, Canyon, and Sidney soils formed in parent material weathered from the Ogallala Group.

In some areas of the county, soils formed in a mixture of different types of parent material or in areas where younger parent material was deposited over older parent material. Examples of soils that formed in more than one type of parent material are Alliance soils, which are on tablelands and formed in loess deposited over material weathered from sandstone, and Lemoyne soils, which are on flood plains and formed in eolian material deposited over alluvium.

Climate

Climate has had an important effect on soil formation in Garden County by its direct effect on the parent material and its indirect effect on vegetation and micro-organisms.

The climatic factors that affect the weathering of parent material are rainfall, the fluctuating temperatures, and the wind. The climate of Garden County is characterized by cold winters and hot summers. Rainfall is heaviest in late spring and early summer. The annual precipitation averages about 17 inches. Because the amount of rainfall is relatively low, the soils generally are not leached to a great depth. Runoff of rainwater removes, relocates, and sorts the soil material. The wind also removes, sorts, and deposits the soil material. The extensive deposits of eolian sands in the county are examples of the importance of the wind as a soil-forming agent. Drying helps to develop the granular structure in the surface layer of many of the soils. Alternating periods of freezing and thawing speed the physical disintegration of the parent material and enhance the development of soil structure.

Micro-organisms in the soil have a temperature range in which they are most active. Thus, the rate at which organic matter is decomposed into humus varies, depending on the climatic conditions. Changes in temperature and moisture activate the weathering of parent material, which results in chemical and physical changes in the soil.

Because the humidity in Garden County is generally low, a fairly high amount of water is lost through evaporation and transpiration. This loss reduces the amount of water available for leaching, plant growth, decomposition of organic matter, and chemical weathering.

Plant and Animal Life

Plants, burrowing animals, micro-organisms, earthworms, and other living organisms affect soil formation. The soils in Garden County formed mainly under a mixture of short, mid, and tall grasses. Each year, the grasses grew and their fibrous roots penetrated the upper few feet of the soil. In time, a dark layer formed on the surface. It gradually became thicker as more organic matter decayed into humus. Because of the additional humus, the soils developed a granular structure and good tilth. Plant roots bring nutrients to the surface. Calcium, in particular, helps to keep the soils more porous. The decomposition of organic material forms organic acids that, in solution, hasten the leaching process. The Valent soils formed in sandy parent material that is resistant to weathering and has a low available water capacity. It developed more slowly than the Keith soils, which provide a more favorable medium for plants and animals.

Micro-organisms act on the undecomposed organic matter and help change it into humus. Some bacteria take in nitrogen from the air. When they die, the nitrogen becomes available to plants. Other bacteria oxidize sulphur, which then becomes available to plants. The plants, in turn, complete the cycle by producing more organic matter. Other living organisms, such as algae, fungi, protozoa, and actinomycetes, affect soil formation physically and chemically. Larger animals, such as gophers, moles, earthworms, millipedes, spiders, and other insects, help to mix the soil and add organic matter when they die.

Human activities also affect soil formation by immediately affecting the rate and the direction of the changes caused by the soil-forming processes. Additions of fertilizer and irrigation water change the soil. Cultivation can result in the loss of soil unless erosion is controlled. A system of conservation tillage and terraces have beneficial effects on the soil.

Relief

Relief influences soil formation mainly through its effect on runoff, erosion, aeration, and drainage. The rate of runoff is more rapid on the steep and very steep soils than on the less sloping soils. Consequently, plant growth generally is less vigorous on the steeper soils, the surface absorbs less water, soil horizons are thinner and less distinct, and the lime in calcium carbonate is not leached to so great a depth as it is in the less sloping soils. Also, the hazard of erosion is more severe on the steeper soils if all other factors are equal.

Because of differences in relief, the color, thickness, and horizonation of soils that formed in the same kind of parent material can differ. For example, differences among Sulco, McConaughy, Keith, and Lodgepole soils, all of which formed in Peoria Loess, can be attributed mainly to differences in relief. The gradient, shape, length, and direction of the slopes influence the amount of moisture in the soil. The steep and very steep Sulco soils are weakly developed, have a thin surface layer, and have lime at or near the surface. McConaughy soils, which are less steep than the Sulco soils, have a thicker surface layer and a thin subsoil and have been leached of lime to a greater depth. The nearly level to gently sloping Keith soils have a dark, thick surface layer and a well developed subsoil and have been leached of lime to a greater

depth than the McConaughy soils. Lodgepole soils formed in depressions. They are the most strongly developed soils in Garden County.

The soils on flood plains, such as Broadwater and Gothenburg soils, are characterized by low relief. They commonly receive additional deposits of sediment during periods of flooding. Each flood provides new parent material and starts a new cycle of soil formation. An example of a soil that formed on flood plains and is frequently flooded is Broadwater loamy sand, channeled, 0 to 2 percent slopes.

Time

Time enables relief, climate, and plant and animal life to change the parent material into a soil. If the parent material has been in place for only a short time, the soils are weakly developed. The degree of profile development depends on the intensity of the soil-forming factors. Differences in the length of time that geological material has been in place are commonly reflected in the distinctness of horizons in the soil profile.

The time needed for a soil to form depends mainly on the kinds of parent material and the climate. The resistance to the weathering of the parent material partly determines the length of time that is needed for a soil to form. Generally, soils in warm, humid areas form faster than soils in cool, dry areas.

The maturity of soils is related not only to time but also to the other four soil-forming factors. Soils that do not have a B horizon are commonly considered immature, and soils that have a well developed B horizon are considered mature. The maturity of a soil, however, depends on the interaction of all five soil-forming factors. Thus, a very steep Sulco soil that does not have a B horizon might be as mature as it can be on its particular slope and under its particular climate.

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Glossary

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

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

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.

Animal unit month. The amount of forage or feed required to carry one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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

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

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

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

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

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

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

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

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

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or

more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for

significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and are less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area

and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch

Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly

decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed

across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-87 at Oshkosh, Nebraska)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	38.3	10.5	24.4	66	10	0	0.28	0.00	0.44	1	4.2
February	44.7	16.1	30.4	73	10	6	.40	.02	.63	1	4.9
March	50.4	22.4	36.4	80	10	22	.95	.24	1.50	3	6.5
April	63.3	32.7	48.0	88	11	79	1.86	.73	2.71	4	3.3
May	72.4	43.6	58.0	93	26	261	3.16	1.59	4.25	7	.3
June	82.2	52.7	67.5	103	36	525	3.07	1.20	4.43	7	.0
July	89.2	58.7	74.0	105	44	744	2.62	.93	3.84	5	.0
August	87.2	56.2	71.7	101	41	673	1.72	.53	2.56	4	.0
September	78.3	45.4	61.9	98	24	361	1.38	.22	2.20	3	.1
October	67.1	33.2	50.2	89	14	90	.84	.23	1.31	2	1.1
November	50.6	20.9	35.8	76	14	6	.61	.16	.87	2	5.3
December	40.6	13.0	26.8	69	14	0	.41	.08	.62	1	4.9
Yearly:											
Average	63.7	33.8	48.8	---	---	---	---	---	---	---	---
Extreme	---	---	---	105	14	---	---	---	---	---	---
Total	---	---	---	---	---	2,769	17.30	14.19	20.53	40	30.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-87 at Oshkosh, Nebraska)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 1	May 10	May 24
2 years in 10 later than--	Apr. 26	May 6	May 19
5 years in 10 later than--	Apr. 16	Apr. 29	May 10
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 28	Sept. 19	Sept. 12
2 years in 10 earlier than--	Oct. 3	Sept. 23	Sept. 16
5 years in 10 earlier than--	Oct. 13	Oct. 2	Sept. 24

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-87 at Oshkosh, Nebraska)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	155	138	119
8 years in 10	163	144	125
5 years in 10	179	156	136
2 years in 10	195	167	147
1 year in 10	203	173	153

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ao	Alliance loam, 0 to 1 percent slopes	2,858	0.3
AoB	Alliance loam, 1 to 3 percent slopes	22,728	2.1
Ar	Almeria fine sandy loam, channeled, 0 to 2 percent slopes	3,647	0.3
AsF	Ashollow-Tassel complex, 9 to 30 percent slopes	31,080	2.8
Bh	Bayard fine sandy loam, 0 to 1 percent slopes	2,681	0.2
BhB	Bayard fine sandy loam, 1 to 3 percent slopes	5,025	0.5
BhC	Bayard fine sandy loam, 3 to 6 percent slopes	1,877	0.2
BmB	Bayard very fine sandy loam, 1 to 3 percent slopes	41	*
Bn	Bayard loam, 0 to 1 percent slopes	1,408	0.1
BpB	Blanche loamy fine sand, 0 to 3 percent slopes	513	*
BrF	Blueridge coarse sand, 6 to 30 percent slopes	12,113	1.1
Bw	Broadwater loamy sand, channeled, 0 to 2 percent slopes	9,660	0.9
BxD	Busher-Tassel complex, 3 to 9 percent slopes	955	0.1
BxE	Busher-Tassel complex, 9 to 20 percent slopes	1,318	0.1
Cw	Crowther loam, 0 to 1 percent slopes	942	0.1
Cx	Crowther loam, wet, 0 to 1 percent slopes	845	0.1
DbB	Dailey loamy fine sand, 0 to 3 percent slopes	4,579	0.4
DdC	Dankworth loamy sand, 3 to 6 percent slopes	2,560	0.2
Dw	Duroc loam, 0 to 1 percent slopes	14,254	1.3
Eh	Els fine sand, calcareous, 0 to 2 percent slopes	4,211	0.4
EuG	Epping-Rock outcrop complex, 30 to 60 percent slopes	5,323	0.5
Fu	Fluvaquents, sandy, 0 to 1 percent slopes	1,834	0.2
Gt	Gothenburg loamy sand, 0 to 2 percent slopes	8,737	0.8
Hh	Hoffland fine sandy loam, 0 to 1 percent slopes	5,896	0.5
Ho	Hoffland fine sandy loam, wet, 0 to 1 percent slopes	2,630	0.2
IsB	Ipage fine sand, calcareous, 0 to 3 percent slopes	11,308	1.0
Ja	Jankosh loam, 0 to 2 percent slopes	5,088	0.5
JeB	Jayem loamy fine sand, 0 to 3 percent slopes	11,713	1.1
JeC	Jayem loamy fine sand, 3 to 6 percent slopes	2,472	0.2
Jg	Jayem fine sandy loam, 0 to 2 percent slopes	5,156	0.5
JgC	Jayem fine sandy loam, 2 to 6 percent slopes	5,228	0.5
KeB	Keith loam, 1 to 3 percent slopes	25,386	2.3
KeC	Keith loam, 3 to 6 percent slopes	5,822	0.5
Ku	Kuma loam, 0 to 1 percent slopes	11,290	1.0
La	Lemoyne sand, 0 to 2 percent slopes	1,620	0.1
Lb	Lewellen loam, 0 to 2 percent slopes	6,075	0.5
Lc	Lewellen-McCuligan complex, 0 to 2 percent slopes	2,475	0.2
Lf	Lodgepole silt loam, 0 to 1 percent slopes	707	0.1
Ma	Marlake fine sandy loam, 0 to 1 percent slopes	160	*
Mc	Marlake mucky peat, 0 to 1 percent slopes	7,387	0.7
MtC	Mitchell very fine sandy loam, 3 to 6 percent slopes	272	*
MtD	Mitchell very fine sandy loam, 6 to 9 percent slopes	146	*
MxF	Mitchell-Epping complex, 9 to 30 percent slopes	1,527	0.1
Pg	Pits, sand and gravel	57	*
Ru	Rushcreek loam, 0 to 2 percent slopes	1,966	0.2
SaB	Sarben loamy fine sand, 0 to 3 percent slopes	2,458	0.2
SaC	Sarben loamy fine sand, 3 to 6 percent slopes	11,497	1.0
SaD	Sarben loamy fine sand, 6 to 9 percent slopes	11,562	1.0
SaE	Sarben loamy fine sand, 9 to 20 percent slopes	9,006	0.8
Sc	Scoville loamy fine sand, 0 to 2 percent slopes	8,545	0.8
SnC	Sidney loam, 3 to 6 percent slopes	9,429	0.9
StD	Sidney-Canyon complex, 6 to 9 percent slopes	4,171	0.4
SuG	Sulco loam, 30 to 60 percent slopes	1,619	0.1
SxC2	Sulco-McConaughy complex, 3 to 6 percent slopes, eroded	5,087	0.5
SxD2	Sulco-McConaughy complex, 6 to 9 percent slopes, eroded	3,114	0.3
SxE2	Sulco-McConaughy complex, 9 to 20 percent slopes, eroded	6,666	0.6
SxF	Sulco-McConaughy complex, 9 to 30 percent slopes	6,806	0.6
TkG	Tassel-Ashollow-Rock outcrop complex, 20 to 60 percent slopes	21,436	1.9
VaD	Valent fine sand, 3 to 9 percent slopes	88,737	8.0
VaE	Valent fine sand, rolling	166,992	15.1
VaF	Valent complex, rolling and hilly	439,804	39.7

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
VdB	Valent loamy fine sand, 0 to 3 percent slopes	2,950	0.3
Vt	Vetal fine sandy loam, 0 to 2 percent slopes	4,430	0.4
WeB	Wildhorse fine sand, 0 to 3 percent slopes	8,321	0.8
WhB	Wildhorse-Hoffland complex, 0 to 3 percent slopes	7,805	0.7
WkB	Wildhorse-Ipage, calcareous complex, 0 to 3 percent slopes	19,970	1.8
	Water areas more than 40 acres in size	9,848	0.9
	Water areas less than 40 acres in size	3,761	0.3
	Total	1,107,584	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
Ao	Alliance loam, 0 to 1 percent slopes (where irrigated)
AoB	Alliance loam, 1 to 3 percent slopes (where irrigated)
Bh	Bayard fine sandy loam, 0 to 1 percent slopes (where irrigated)
BhB	Bayard fine sandy loam, 1 to 3 percent slopes (where irrigated)
BhC	Bayard fine sandy loam, 3 to 6 percent slopes (where irrigated)
BmB	Bayard very fine sandy loam, 1 to 3 percent slopes (where irrigated)
Bn	Bayard loam, 0 to 1 percent slopes (where irrigated)
Dw	Duroc loam, 0 to 1 percent slopes (where irrigated)
Jg	Jayem fine sandy loam, 0 to 2 percent slopes (where irrigated)
JgC	Jayem fine sandy loam, 2 to 6 percent slopes (where irrigated)
KeB	Keith loam, 1 to 3 percent slopes (where irrigated)
KeC	Keith loam, 3 to 6 percent slopes (where irrigated)
Ku	Kuma loam, 0 to 1 percent slopes (where irrigated)
MtC	Mitchell very fine sandy loam, 3 to 6 percent slopes (where irrigated)
SnC	Sidney loam, 3 to 6 percent slopes (where irrigated)
SxC2	Sulco-McConaughy complex, 3 to 6 percent slopes, eroded (where irrigated)
Vt	Vetal fine sandy loam, 0 to 2 percent slopes (where irrigated)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Alfalfa hay		Corn		Winter wheat	
	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu
Ao---------- Alliance	IIc	I	---	5.8	---	145	42	65
AoB---------- Alliance	IIe	IIe	---	5.5	---	140	40	60
Ar---------- Almeria	VIw	---	---	---	---	---	---	---
AsF:								
Ashollow----------	VIe	---	---	---	---	---	---	---
Tassel----------	VIs	---	---	---	---	---	---	---
Bh---------- Bayard	IIIe	IIe	---	5.5	---	130	38	70
BhB---------- Bayard	IIIe	IIe	---	4.8	---	130	33	65
BhC---------- Bayard	IVe	IIIe	---	4.2	---	125	31	60
BmB---------- Bayard	IIIe	IIe	---	5.0	---	130	34	65
Bn---------- Bayard	IIIc	I	---	5.5	---	130	38	70
BpB---------- Blanche	IVe	IVe	1.5	3.2	---	95	22	---
BrF---------- Blueridge	VIs	---	---	---	---	---	---	---
Bw---------- Broadwater	VIw	---	---	---	---	---	---	---
BxD:								
Busher----------	IVe	IVe	---	3.2	---	100	25	---
Tassel----------	VIe	---	---	3.2	---	100	25	---
BxE:								
Busher----------	VIe	---	---	---	---	---	---	---
Tassel----------	VIs	---	---	---	---	---	---	---
Cw, Cx---------- Crowther	Vw	---	---	---	---	---	---	---
DbB---------- Dailey	IVe	IVe	---	3.6	---	110	22	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Alfalfa hay		Corn		Winter wheat	
	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu
DdC--Dankworth	VIe	IVe	---	3.5	---	120	---	---
Dw--Duroc	IIc	I	2.0	6.0	---	150	45	70
Eh--Els	VIe	IVw	---	2.8	---	80	---	---
EuG*:								
Epping	VIIs	---	---	---	---	---	---	---
Rock outcrop	VIIIs	---	---	---	---	---	---	---
Fu*--Fluvaquents	VIIIw	---	---	---	---	---	---	---
Gt--Gothenburg	VIIw	---	---	---	---	---	---	---
Hh, Ho--Hoffland	Vw	---	---	---	---	---	---	---
IsB--Ipage	VIe	IVe	---	3.5	---	100	---	---
Ja--Jankosh	VIs	---	---	---	---	---	---	---
JeB--Jayem	IVe	IIIe	1.2	4.2	---	125	33	48
JeC--Jayem	IVe	IVe	1.0	4.0	---	115	28	45
Jg--Jayem	IIIe	IIe	---	4.8	---	130	42	60
JgC--Jayem	IVe	IIIe	---	4.2	---	120	32	50
KeB--Keith	IIe	IIe	1.5	5.6	---	140	42	65
KeC--Keith	IIIe	IIIe	1.3	5.0	40	135	32	55
Ku--Kuma	IIc	I	1.5	6.0	---	150	46	70
La--Lemoyne	VIe	IVe	---	3.6	---	110	---	---
Lb--Lewellen	VIs	---	---	---	---	---	---	---
Lc:								
Lewellen	VIs	---	---	---	---	---	---	---
McCuligan	Vw	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Alfalfa hay		Corn		Winter wheat	
	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu
Lf---------- Lodgepole	IIIw	IVw	---	3.8	75	90	30	---
Ma, Mc---------- Marlake	VIIIw	---	---	---	---	---	---	---
MtC---------- Mitchell	IIIe	IIIe	---	4.7	---	130	32	---
MtD---------- Mitchell	IVe	IVe	---	4.1	---	125	30	---
MxF:								
Mitchell----------	VIe	---	---	---	---	---	---	---
Epping----------	VIs	---	---	---	---	---	---	---
Pg*---------- Pits	VIIIs	---	---	---	---	---	---	---
Ru---------- Rushcreek	IVs	IIIs	2.5	4.0	---	125	30	---
SaB---------- Sarben	IVe	IIIe	1.2	4.0	---	115	28	---
SaC---------- Sarben	IVe	IVe	1.2	3.8	---	110	26	---
SaD---------- Sarben	VIe	IVe	---	3.4	---	105	24	---
SaE---------- Sarben	VIe	---	---	---	---	---	---	---
Sc---------- Scoville	IVe	IVe	---	3.6	---	110	22	---
SnC---------- Sidney	IIIe	IIIe	---	4.6	---	125	30	---
StD:								
Sidney----------	IVe	IVe	---	3.2	---	100	25	---
Canyon----------	VIs	---	---	3.2	---	100	25	---
SuG---------- Sulco	VIIe	---	---	---	---	---	---	---
SxC2:								
Sulco----------	IVe	IIIe	---	4.4	---	115	28	---
McConaughy----------	IVe	IIIe	---	4.8	---	125	30	---
SxD2:								
Sulco----------	IVe	IVe	---	3.5	---	105	26	---
McConaughy----------	IVe	IVe	---	3.8	---	110	28	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Alfalfa hay		Corn		Winter wheat	
	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu
SxE2, SxF:								
Sulco	VIe	---	---	---	---	---	---	---
McConaughy	VIe	---	---	---	---	---	---	---
TkG*:								
Tassel	VIIs	---	---	---	---	---	---	---
Ashollow	VIIe	---	---	---	---	---	---	---
Rock outcrop	VIIIs	---	---	---	---	---	---	---
VaD---------- Valent	VIe	IVe	---	3.0	---	105	---	---
VaE---------- Valent	VIe	---	---	---	---	---	---	---
VaF---------- Valent	---	---	---	---	---	---	---	---
VdB---------- Valent	VIe	IVe	---	3.5	---	95	20	---
Vt---------- Vetal	IIe	IIe	2.5	5.5	42	140	39	---
WeB---------- Wildhorse	VIs	---	---	---	---	---	---	---
WhB---------- Wildhorse-Hoffland	---	---	---	---	---	---	---	---
WkB---------- Wildhorse-Ipage	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	29,810	---	---	---	---
II (N)	80,946	52,544	---	---	28,402
(I)	65,447	65,447	---	---	---
III (N)	30,541	28,426	707	---	1,408
(I)	43,852	41,886	---	1,966	---
IV (N)	62,683	60,717	---	1,966	---
(I)	160,725	157,317	3,408	---	---
V (N)	13,311	---	13,311	---	---
VI (N)	612,879	538,926	13,307	60,646	---
VII (N)	236,531	213,084	8,737	14,710	---
VIII (N)	13,279	---	8,676	4,603	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Ao, AoB---------- Alliance	Silty - Veg. Zone 2----------	Favorable	3,300	Western wheatgrass----------	20
		Normal	2,500	Blue grama----------	15
		Unfavorable	1,700	Needleandthread----------	15
				Little bluestem----------	10
				Buffalograss----------	5
				Sedge----------	5
				Green needlegrass----------	5
				Big bluestem----------	5
Ar---------- Almeria	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Prairie cordgrass----------	25
		Normal	4,700	Switchgrass----------	20
		Unfavorable	4,200	Big bluestem----------	20
				Reedgrass----------	15
				Sedge----------	10
AsF*:					
Ashollow----------	Sandy - Veg. Zone 2----------	Favorable	2,300	Prairie sandreed----------	25
		Normal	1,600	Blue grama----------	20
		Unfavorable	1,200	Needleandthread----------	15
				Little bluestem----------	10
				Sand bluestem----------	10
				Sedge----------	10
Tassel----------	Shallow Limy - Veg. Zone 2----	Favorable	1,200	Little bluestem----------	20
		Normal	1,100	Needleandthread----------	15
		Unfavorable	900	Threadleaf sedge----------	10
				Prairie sandreed----------	10
				Sand bluestem----------	10
				Sideoats grama----------	10
				Blue grama----------	5
				Plains muhly----------	5
Bh, BhB, BhC, BmB, Bn---------- Bayard	Sandy - Veg. Zone 2----------	Favorable	2,300	Prairie sandreed----------	30
		Normal	1,600	Blue grama----------	15
		Unfavorable	1,100	Needleandthread----------	15
				Sand bluestem----------	10
				Little bluestem----------	10
				Indian ricegrass----------	5
				Threadleaf sedge----------	5
BpB---------- Blanche	Sandy - Veg. Zone 2----------	Favorable	2,600	Needleandthread----------	20
		Normal	2,300	Blue grama----------	15
		Unfavorable	1,900	Prairie sandreed----------	15
				Sand bluestem----------	15
				Little bluestem----------	10
				Sand sagebrush----------	5
				Sand dropseed----------	5
				Sedge----------	5
BrF*---------- Blueridge	Shallow to Gravel - Veg. Zone 2.	Favorable	1,300	Blue grama----------	25
		Normal	900	Sand bluestem----------	15
		Unfavorable	600	Little bluestem----------	10
				Prairie sandreed----------	10
				Needleandthread----------	10
				Sand dropseed----------	5
				Hairy grama----------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Bw---------- Broadwater	Shallow to Gravel - Veg. Zone 2.	Favorable	1,250	Blue grama----------	30
		Normal	900	Sand bluestem----------	15
		Unfavorable	600	Prairie sandreed----------	10
				Sand dropseed----------	10
				Needleandthread----------	10
				Little bluestem----------	10
				Sand sagebrush----------	5
				Sedge----------	5
				Clubmoss----------	5
BxD*, BxE*:					
Busher----------	Sandy - Veg. Zone 2----------	Favorable	3,000	Prairie sandreed----------	25
		Normal	2,300	Sand bluestem----------	20
		Unfavorable	1,700	Little bluestem----------	20
				Needleandthread----------	10
				Blue grama----------	10
				Threadleaf sedge----------	5
Tassel----------	Shallow Limy - Veg. Zone 2----	Favorable	1,200	Little bluestem----------	20
		Normal	1,100	Needleandthread----------	15
		Unfavorable	900	Threadleaf sedge----------	10
				Prairie sandreed----------	10
				Sand bluestem----------	10
				Sideoats grama----------	10
				Blue grama----------	5
				Plains muhly----------	5
Cw---------- Crowther	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Big bluestem----------	20
		Normal	4,800	Switchgrass----------	15
		Unfavorable	4,300	Prairie cordgrass----------	15
				Indiangrass----------	10
				Slender wheatgrass----------	5
				Plains bluegrass----------	5
Cx---------- Crowther	Wetland - Veg. Zone 2---------	Favorable	5,500	Prairie cordgrass----------	30
		Normal	5,000	Northern reedgrass----------	15
		Unfavorable	4,500	Bluejoint reedgrass----------	15
				Slender wheatgrass----------	10
				Rush----------	5
DbB---------- Dailey	Sandy - Veg. Zone 2----------	Favorable	3,000	Prairie sandreed----------	30
		Normal	2,300	Sand bluestem----------	20
		Unfavorable	1,700	Little bluestem----------	15
				Needleandthread----------	15
				Blue grama----------	10
DdC---------- Dankworth	Sands - Veg. Zone 2----------	Favorable	2,100	Sand bluestem----------	20
		Normal	1,600	Prairie sandreed----------	15
		Unfavorable	1,100	Little bluestem----------	15
				Blue grama----------	10
				Needleandthread----------	10
				Sand dropseed----------	5
				Sandhill muhly----------	5
				Sand sagebrush----------	5
				Pricklypear----------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Dw---------- Duroc	Silty - Veg. Zone 2----------	Favorable	3,300	Big bluestem----------	15
		Normal	2,500	Needleandthread----------	15
		Unfavorable	1,700	Western wheatgrass----------	15
				Blue grama----------	10
				Green needlegrass----------	10
				Little bluestem----------	10
				Threadleaf sedge----------	10
				Buffalograss----------	5
Eh---------- Els	Subirrigated - Veg. Zone 2----	Favorable	4,800	Little bluestem----------	25
		Normal	4,600	Indiangrass----------	20
		Unfavorable	4,300	Switchgrass----------	15
				Big bluestem----------	10
				Plains bluegrass----------	5
				Slender wheatgrass----------	5
				Sedge----------	5
EuG*:					
Epping----------	Shallow Limy - Veg. Zone 2----	Favorable	1,500	Little bluestem----------	20
		Normal	1,100	Blue grama----------	15
		Unfavorable	700	Needleandthread----------	10
				Sideoats grama----------	10
				Western wheatgrass----------	10
				Threadleaf sedge----------	5
				Buffalograss----------	5
				Prairie sandreed----------	5
Rock outcrop.					
Hh---------- Hoffland	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Big bluestem----------	20
		Normal	4,800	Switchgrass----------	15
		Unfavorable	4,300	Prairie cordgrass----------	15
				Indiangrass----------	10
				Slender wheatgrass----------	5
				Plains bluegrass----------	5
Ho---------- Hoffland	Wetland - Veg. Zone 2---------	Favorable	5,500	Prairie cordgrass----------	30
		Normal	5,000	Northern reedgrass----------	15
		Unfavorable	4,500	Bluejoint reedgrass----------	15
				Slender wheatgrass----------	10
				Rush----------	5
IsB---------- Ipage	Sandy Lowland - Veg. Zone 2---	Favorable	3,500	Sand bluestem----------	25
		Normal	3,200	Little bluestem----------	20
		Unfavorable	3,000	Prairie sandreed----------	15
				Needleandthread----------	10
				Indiangrass----------	5
				Sedge----------	5
				Switchgrass----------	5
Ja---------- Jankosh	Saline Subirrigated - Veg. Zone 2.	Favorable	2,900	Alkali sacaton----------	35
		Normal	2,600	Inland saltgrass----------	15
		Unfavorable	2,300	Western wheatgrass----------	15
				Slender wheatgrass----------	10
				Plains bluegrass----------	10
				Sedge----------	5
				Blue grama----------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
JeB, JeC, Jg, JgC--Jayem	Sandy - Veg. Zone 2	Favorable	3,000	Prairie sandreed	20
		Normal	2,300	Little bluestem	15
		Unfavorable	1,600	Needleandthread	15
				Sand bluestem	15
				Blue grama	10
				Fringed sagebrush	5
				Sand dropseed	5
				Threadleaf sedge	5
				Western wheatgrass	5
				Switchgrass	5
KeB, KeC--Keith	Silty - Veg. Zone 2	Favorable	3,300	Blue grama	20
		Normal	2,500	Needleandthread	20
		Unfavorable	1,700	Western wheatgrass	15
				Little bluestem	10
				Buffalograss	5
				Sedge	5
				Big bluestem	5
				Sideoats grama	5
				Green needlegrass	5
Ku--Kuma	Silty - Veg. Zone 2	Favorable	2,500	Blue grama	60
		Normal	1,500	Buffalograss	10
		Unfavorable	1,000	Western wheatgrass	10
				Needlegrass	5
La--Lemoyne	Sandy Lowland - Veg. Zone 2	Favorable	3,000	Sand bluestem	25
		Normal	2,300	Little bluestem	20
		Unfavorable	1,700	Prairie sandreed	20
				Needleandthread	10
				Switchgrass	10
				Blue grama	5
Lb--Lewellen	Saline Subirrigated - Veg. Zone 2.	Favorable	3,300	Alkali sacaton	30
		Normal	2,600	Western wheatgrass	15
		Unfavorable	2,000	Inland saltgrass	15
				Plains bluegrass	10
				Switchgrass	5
				Sedge	5
Lc*:					
Lewellen	Saline Subirrigated - Veg. Zone 2.	Favorable	3,300	Alkali sacaton	30
		Normal	2,600	Western wheatgrass	15
		Unfavorable	2,000	Inland saltgrass	15
				Plains bluegrass	10
				Switchgrass	5
				Sedge	5
McCuligan	Wet Subirrigated - Veg. Zone 2	Favorable	4,700	Switchgrass	20
		Normal	4,200	Prairie cordgrass	20
		Unfavorable	3,700	Big bluestem	15
				Indiangrass	10
				Slender wheatgrass	5
				Bluejoint reedgrass	5
				Northern reedgrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Lf Lodgepole	Clayey Overflow - Veg. Zone 2	Favorable	1,200	Western wheatgrass	40
		Normal	1,000	Blue grama	15
		Unfavorable	700	Green needlegrass	15
				Buffalograss	10
				Sedge	10
MtC, MtD Mitchell	Limy Upland - Veg. Zone 2	Favorable	2,000	Blue grama	20
		Normal	1,300	Sideoats grama	15
		Unfavorable	700	Needleandthread	10
				Threadleaf sedge	10
				Little bluestem	10
				Western wheatgrass	10
				Buffalograss	5
				Prairie sandreed	5
MxF*: Mitchell	Limy Upland - Veg. Zone 2	Favorable	2,000	Blue grama	20
		Normal	1,300	Sideoats grama	15
		Unfavorable	700	Needleandthread	10
				Threadleaf sedge	10
				Little bluestem	10
				Western wheatgrass	10
				Buffalograss	5
				Prairie sandreed	5
Epping	Shallow Limy - Veg. Zone 2	Favorable	1,500	Little bluestem	20
		Normal	1,100	Blue grama	15
		Unfavorable	700	Needleandthread	10
				Sideoats grama	10
				Western wheatgrass	10
				Threadleaf sedge	5
				Buffalograss	5
				Prairie sandreed	5
Ru Rushcreek	Saline Lowland - Veg. Zone 2	Favorable	2,300	Alkali sacaton	25
		Normal	1,500	Western wheatgrass	20
		Unfavorable	700	Blue grama	15
				Inland saltgrass	15
				Buffalograss	5
				Plains bluegrass	5
				Sedge	5
SaB, SaC, SaD, SaE- Sarben	Sandy - Veg. Zone 2	Favorable	3,000	Prairie sandreed	20
		Normal	2,600	Needleandthread	20
		Unfavorable	2,200	Little bluestem	15
				Blue grama	10
				Sand bluestem	10
				Sand sagebrush	5
				Western wheatgrass	5
				Sedge	5
Sc Scoville	Sandy - Veg. Zone 2	Favorable	2,300	Prairie sandreed	25
		Normal	1,600	Blue grama	15
		Unfavorable	1,100	Needleandthread	15
				Sand bluestem	10
				Little bluestem	10
				Threadleaf sedge	10

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
SnC---------- Sidney	Silty - Veg. Zone 2----------	Favorable	2,200	Western wheatgrass----------	25
		Normal	1,500	Needleandthread----------	25
		Unfavorable	1,000	Blue grama----------	20
				Sedge----------	5
				Buffalograss----------	5
StD*:					
Sidney----------	Silty - Veg. Zone 2----------	Favorable	2,200	Western wheatgrass----------	25
		Normal	1,500	Needleandthread----------	25
		Unfavorable	1,000	Blue grama----------	20
				Sedge----------	5
				Buffalograss----------	5
Canyon----------	Shallow Limy - Veg. Zone 2----	Favorable	1,500	Little bluestem----------	20
		Normal	1,100	Blue grama----------	20
		Unfavorable	700	Needleandthread----------	15
				Sideoats grama----------	10
				Sand bluestem----------	10
				Western wheatgrass----------	10
				Threadleaf sedge----------	5
SuG---------- Sulco	Thin Loess - Veg. Zone 2------	Favorable	2,300	Little bluestem----------	25
		Normal	1,600	Sideoats grama----------	15
		Unfavorable	1,000	Blue grama----------	10
				Big bluestem----------	10
				Plains muhly----------	10
				Western wheatgrass----------	5
				Threadleaf sedge----------	5
SxC2*, SxD2*, SxE2*, SxF*:					
Sulco----------	Limy Upland - Veg. Zone 2-----	Favorable	2,800	Little bluestem----------	25
		Normal	2,000	Sideoats grama----------	15
		Unfavorable	1,500	Blue grama----------	15
				Big bluestem----------	10
				Threadleaf sedge----------	10
				Western wheatgrass----------	5
				Buffalograss----------	5
				Plains muhly----------	5
McConaughy-------	Silty - Veg. Zone 2----------	Favorable	3,250	Western wheatgrass----------	15
		Normal	2,500	Blue grama----------	15
		Unfavorable	1,700	Needleandthread----------	15
				Little bluestem----------	10
				Big bluestem----------	10
				Sideoats grama----------	5
				Sedge----------	5
TkG*:					
Tassel----------	Shallow Limy - Veg. Zone 2----	Favorable	1,200	Little bluestem----------	20
		Normal	1,100	Needleandthread----------	15
		Unfavorable	900	Threadleaf sedge----------	10
				Prairie sandreed----------	10
				Sand bluestem----------	10
				Sideoats grama----------	10
				Blue grama----------	5
				Plains muhly----------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
TkG*:					
Ashollow	Sandy - Veg. Zone 2	Favorable	2,300	Prairie sandreed	25
		Normal	1,600	Blue grama	20
		Unfavorable	1,200	Needleandthread	15
				Little bluestem	10
				Sand bluestem	10
				Sedge	10
Rock outcrop.					
VaD, VaE	Sands - Veg. Zone 2	Favorable	3,000	Sand bluestem	25
Valent		Normal	2,600	Prairie sandreed	20
		Unfavorable	2,000	Little bluestem	10
				Needleandthread	10
				Switchgrass	10
				Blue grama	5
VaF*:					
Valent, rolling	Sands - Veg. Zone 2	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Prairie sandreed	20
		Unfavorable	2,000	Little bluestem	10
				Needleandthread	10
				Switchgrass	10
				Blue grama	5
Valent, hilly	Choppy Sands - Veg. Zone 2	Favorable	2,800	Sand bluestem	30
		Normal	2,400	Prairie sandreed	20
		Unfavorable	1,800	Little bluestem	15
				Switchgrass	10
				Blue grama	5
				Needleandthread	5
VdB	Sandy - Veg. Zone 2	Favorable	2,600	Prairie sandreed	20
Valent		Normal	2,300	Sand bluestem	15
		Unfavorable	1,900	Little bluestem	15
				Needleandthread	15
				Blue grama	10
				Sand dropseed	5
				Threadleaf sedge	5
Vt	Sandy - Veg. Zone 2	Favorable	3,000	Little bluestem	25
Vetal		Normal	2,300	Prairie sandreed	20
		Unfavorable	1,700	Needleandthread	10
				Sand bluestem	10
				Blue grama	10
				Western wheatgrass	5
				Switchgrass	5
WeB	Saline Subirrigated - Veg. Zone 2.	Favorable	3,200	Alkali sacaton	35
Wildhorse		Normal	2,800	Inland saltgrass	15
		Unfavorable	2,400	Western wheatgrass	10
				Switchgrass	5
				Alkali cordgrass	5
				Slender wheatgrass	5
				Plains bluegrass	5
				Sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
WhB*:					
Wildhorse	Saline Subirrigated - Veg. Zone 2.	Favorable	3,200	Alkali sacaton	35
		Normal	2,800	Inland saltgrass	15
		Unfavorable	2,400	Western wheatgrass	10
				Switchgrass	5
				Alkali cordgrass	5
				Slender wheatgrass	5
				Plains bluegrass	5
				Sedge	5
Hoffland	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Big bluestem	20
		Normal	4,800	Switchgrass	15
		Unfavorable	4,300	Prairie cordgrass	15
				Indiangrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
WkB*:					
Wildhorse	Saline Subirrigated - Veg. Zone 2.	Favorable	3,200	Alkali sacaton	35
		Normal	2,800	Inland saltgrass	15
		Unfavorable	2,400	Western wheatgrass	10
				Switchgrass	5
				Alkali cordgrass	5
				Slender wheatgrass	5
				Plains bluegrass	5
				Sedge	5
Ipage	Sandy Lowland - Veg. Zone 2	Favorable	3,500	Sand bluestem	25
		Normal	3,200	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Indiangrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ao, AoB---------- Alliance	Skunkbush sumac, lilac, Amur honeysuckle.	Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, honeylocust, Russian-olive, bur oak, hackberry, green ash.	Siberian elm------	---
Ar. Almeria					
AsF*: Ashollow----------	Siberian peashrub, skunkbush sumac, lilac, silver buffaloberry.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, black locust, hackberry, green ash, honeylocust, Russian-olive.	Siberian elm------	---	---
Tassel.					
Bh, BhB, BhC, BmB, Bn---------- Bayard	American plum, skunkbush sumac, lilac, Siberian peashrub.	Eastern redcedar, Russian mulberry, Rocky Mountain juniper.	Ponderosa pine, green ash, hackberry, honeylocust.	Siberian elm------	---
BpB---------- Blanche	Skunkbush sumac, lilac, Peking cotoneaster, Amur honeysuckle.	Rocky Mountain juniper, eastern redcedar, hackberry, green ash, Russian-olive.	Ponderosa pine, Siberian elm, honeylocust.	---	---
BrF*. Blueridge					
Bw. Broadwater					
BxD*: Busher----------	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm------	---
Tassel.					
BxE*: Busher----------	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine----	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BxE*: Tassel.					
Cw---------- Crowther	Redosier dogwood	---	---	Golden willow-----	Eastern cottonwood.
Cx. Crowther					
DbB---------- Dailey	Common chokecherry, American plum, lilac, Tatarian honeysuckle.	Rocky Mountain juniper, Siberian peashrub, Russian-olive, Manchurian crabapple.	Ponderosa pine, green ash, honeylocust.	Siberian elm------	---
DdC---------- Dankworth	---	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine, jack pine, Scotch pine.	---	---
Dw---------- Duroc	Amur honeysuckle, lilac, American plum.	---	Rocky Mountain juniper, ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, hackberry.	Siberian elm------	Eastern cottonwood.
Eh---------- Els	Lilac, American plum, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, hackberry, ponderosa pine, green ash.	Golden willow, honeylocust.	Eastern cottonwood.
EuG*: Epping.					
Rock outcrop.					
Fu*. Fluvaquents					
Gt. Gothenburg					
Hh---------- Hoffland	Redosier dogwood	---	---	Golden willow-----	Eastern cottonwood.
Ho. Hoffland					
IsB---------- Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Ja. Jankosh					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
JeB, JeC, Jg, JgC-Jayem	Peking cotoneaster, Amur honeysuckle, Siberian peashrub, lilac.	Rocky Mountain juniper, eastern redcedar, Russian-olive, common chokecherry.	Green ash, ponderosa pine, Siberian elm, honeylocust.	---	---
KeB, KeC-Keith	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, common chokecherry, Siberian peashrub.	Hackberry, ponderosa pine, green ash, honeylocust, Russian-olive.	Siberian elm	---
Ku-Kuma	Fragrant sumac, lilac, Amur honeysuckle.	Russian-olive, common chokecherry.	Eastern redcedar, green ash, ponderosa pine, honeylocust, bur oak.	Siberian elm	---
La-Lemoyne	---	Eastern redcedar, Rocky Mountain juniper, Russian-olive, skunkbush sumac, lilac, silver buffaloberry, common chokecherry.	Ponderosa pine, green ash, hackberry, honeylocust.	Siberian elm	---
Lb-Lewellen	Lilac	Eastern redcedar, Rocky Mountain juniper, skunkbush sumac, green ash, Russian-olive, silver buffaloberry.	Siberian elm, golden willow.	---	Eastern cottonwood.
Lc*:					
Lewellen	Lilac	Eastern redcedar, Rocky Mountain juniper, skunkbush sumac, green ash, Russian-olive, silver buffaloberry.	Siberian elm, golden willow.	---	Eastern cottonwood.
McCuligan	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Lf-Lodgepole	Lilac, American plum, common chokecherry.	---	Eastern redcedar, ponderosa pine, honeylocust, hackberry, green ash, Russian mulberry.	Silver maple, golden willow.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ma, Mc. Marlake					
MtC, MtD---------- Mitchell	Siberian peashrub, silver buffaloberry, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, Russian-olive, hackberry, honeylocust, green ash.	Siberian elm------	---	---
MxF*: Mitchell.					
Epping.					
Pg*. Pits					
Ru---------- Rushcreek	Skunkbush sumac, lilac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, Russian-olive, green ash, Siberian elm.	---	---	---
SaB, SaC---------- Sarben	Amur honeysuckle, American plum, common chokecherry, lilac.	Russian mulberry, Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, hackberry, green ash, honeylocust.	Siberian elm------	---
SaD, SaE---------- Sarben	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine----	---	---
Sc---------- Scoville	American plum, Siberian peashrub, skunkbush sumac, lilac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm------	---
SnC---------- Sidney	Skunkbush sumac, silver buffaloberry, lilac.	Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Eastern redcedar, ponderosa pine, Siberian elm, honeylocust, hackberry, green ash.	---	---
StD*: Sidney----------	Skunkbush sumac, silver buffaloberry, lilac.	Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Eastern redcedar, ponderosa pine, Siberian elm, honeylocust, hackberry, green ash.	---	---
Canyon.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
SuG. Sulco					
SxC2*, SxD2*, SxE2*: Sulco	Silver buffaloberry, lilac.	Eastern redcedar, Tatarian honeysuckle, Rocky Mountain juniper, Siberian peashrub.	Siberian elm, hackberry, green ash, honeylocust, ponderosa pine, black locust.	---	---
McConaughy	American plum, lilac, skunkbush sumac.	Russian-olive, hackberry, Siberian peashrub, Rocky Mountain juniper.	Eastern redcedar, green ash, honeylocust, ponderosa pine.	Siberian elm	---
SxF*: Sulco.					
McConaughy	American plum, lilac, skunkbush sumac.	Russian-olive, hackberry, Siberian peashrub, Rocky Mountain juniper.	Eastern redcedar, green ash, honeylocust, ponderosa pine.	Siberian elm	---
TkG*: Tassel.					
Ashollow	Siberian peashrub, skunkbush sumac, lilac, silver buffaloberry.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, black locust, hackberry, green ash, honeylocust, Russian-olive.	Siberian elm	---	---
Rock outcrop.					
VaD, VaE Valent	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
VaF*: Valent, rolling	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
Valent, hilly	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
VdB Valent	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Vt Vetal	Lilac	Eastern redcedar, Rocky Mountain juniper, common chokecherry, Russian-olive, Siberian peashrub.	Hackberry, ponderosa pine, honeylocust, green ash.	Siberian elm	---
WeB. Wildhorse					
WhB*: Wildhorse.					
Hoffland	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
WkB*: Wildhorse.					
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--TREE PLANTING SITE PREPARATION GUIDE

Texture	Slope	Site preparation	
		Cropland	Grassland
Loamy or clayey--	Level--	Plant directly into site; do not destroy the existing crop residue; check for hardpan (see footnotes 1, 2, and 3).	Summer fallow the entire site 1 year prior to planting (see footnote 4); plant directly into site; do not destroy dead grass residue; check for hardpan (see footnotes 1 and 2).
Sandy----	Level--	Sow a cover crop late in summer if the soil will be bare over winter; plant directly into site or into cover crop; do not destroy the existing crop residue (see footnotes 2 and 3).	Summer fallow 4- to 8-foot strips 1 year prior to planting (see footnote 4); plant directly into the strips; do not destroy dead grass residue (see footnote 2).
Loamy or clayey--	Sloping	Plant directly into site; do not destroy the existing crop resudue (see footnotes 2 and 3); if possible, plant on the contour; check for hardpan.	Summer fallow the entire site 1 year prior to planting (see footnote 5); plant directly into site; do not destroy dead grass residue (see footnote 6); if possible, plant on the contour.
Sandy----	Sloping	Sow a cover crop late in summer if the soil will be bare over winter; plant directly into site or into cover crop; do not destroy the existing crop resudue (see footnotes 2 and 3); if possible, plant on the contour.	Summer fallow 4- to 8-foot strips 1 year prior to planting (see footnote 5); plant directly into the strips; do not destroy dead grass resudue (see footnote 6); if possible, plant on the contour.

[1] The soil may have a hardpan as a result of farming, grazing, or soil geology, especially if the texture is loamy or clayey. Check for hardpan and deep chisel the subsoil during the fall prior to planting.

[2] Till the soil lightly or treat with labeled postemergence herbicide prior to planting if weeds are beginning to emerge.

[3] Check for herbicide carry-over via cooperator records or soil analysis. Avoid planting on cropland that has been treated with nonlabeled, residual herbicide during the prior growing season.

[4] Fallow either mechanically (tillage) or chemically (no-till) with labeled postemergence herbicide.

[5] Fallow chemically (no-till) with labeled postemergence herbicide.

[6] Treat with labeled postemergence herbicide prior to planting if weeds are beginning to emerge.

TABLE 11.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ao Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
AoB Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Ar Almeria	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
AsF*: Ashollow	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
Bh Bayard	Slight	Slight	Slight	Slight.
BhB, BhC Bayard	Slight	Slight	Moderate: slope.	Slight.
BmB Bayard	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Bn Bayard	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
BpB Blanche	Slight	Slight	Slight	Slight.
BrF* Blueridge	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Bw Broadwater	Severe: flooding.	Moderate: flooding, too sandy.	Severe: flooding.	Moderate: too sandy, flooding.
BxD*: Busher	Slight	Slight	Severe: slope.	Slight.
Tassel	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
BxE*: Busher	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BxE*:				
Tassel	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Cw	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Crowther				
Cx	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Crowther				
DbB	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Dailey				
DdC	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Dankworth				
Dw	Slight	Slight	Slight	Slight.
Duroc				
Eh	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Els				
EuG*:				
Epping	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Fu*	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.
Fluvaquents				
Gt	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Gothenburg				
Hh	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Hoffland				
Ho	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Hoffland				
IsB	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Ipage				
Ja	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Moderate: wetness.
Jankosh				
JeB	Slight	Slight	Moderate: small stones.	Slight.
Jayem				

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
JeC---- Jayem	Slight	Slight	Moderate: slope, small stones.	Slight.
Jg---- Jayem	Slight	Slight	Moderate: small stones.	Slight.
JgC---- Jayem	Slight	Slight	Moderate: slope, small stones.	Slight.
KeB, KeC---- Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Ku---- Kuma	Slight	Slight	Slight	Slight.
La---- Lemoyne	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Lb---- Lewellen	Severe: flooding, excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Moderate: wetness.
Lc*:				
Lewellen----	Severe: flooding, excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Moderate: wetness.
McCuligan----	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lf---- Lodgepole	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
Ma---- Marlake	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mc---- Marlake	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
MtC---- Mitchell	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
MtD---- Mitchell	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.
MxF*:				
Mitchell----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
MxF*:				
Epping	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Pg*	Severe: slope, small stones.	Severe: slope, too sandy, small stones.	Severe: slope, small stones, too sandy.	Severe: too sandy.
Pits				
Ru	Severe: flooding.	Slight	Slight	Slight.
Rushcreek				
SaB	Slight	Slight	Slight	Slight.
Sarben				
SaC	Slight	Slight	Moderate: slope.	Slight.
Sarben				
SaD	Slight	Slight	Severe: slope.	Slight.
Sarben				
SaE	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Sarben				
Sc	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Scoville				
SnC	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Sidney				
StD*:				
Sidney	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
SuG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Sulco				
SxC2*:				
Sulco	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
McConaughy	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
SxD2*:				
Sulco	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.
McConaughy	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SxE2*:				
Sulco	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
McConaughy	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
SxF*:				
Sulco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
McConaughy	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
TkG*:				
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Ashollow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
VaD Valent	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaE Valent	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaF*:				
Valent, rolling	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Valent, hilly	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
VdB Valent	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Vt Vetal	Slight	Slight	Slight	Slight.
WeB Wildhorse	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
WhB*:				
Wildhorse	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy.
Hoffland	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
WkB*:				
Wildhorse	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy.
Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ao, AoB---------- Alliance	Good	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Poor	Good.
Ar---------- Almeria	Poor	Fair	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
AsF*:												
Ashollow----------	Poor	Fair	Good	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Tassel----------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Bh, BhB, BhC, BmB, Bn---------- Bayard	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.	Fair.
BpB---------- Blanche	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
BrF*---------- Blueridge	Poor	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Bw---------- Broadwater	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
BxD*:												
Busher----------	Fair	Good	Good	Fair	Poor	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Tassel----------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
BxE*:												
Busher----------	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Tassel----------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Cw, Cx---------- Crowther	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
DbB---------- Dailey	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
DdC---------- Dankworth	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Dw---------- Duroc	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Eh---------- Els	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
EuG*:												
Epping	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Rock outcrop	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Fu* Fluvaquents	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
Gt Gothenburg	Very poor.	Very poor.	Fair	Poor	Fair	Fair	Fair	Good	Poor	Poor	Fair	Fair.
Hh, Ho Hoffland	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
IsB Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Ja Jankosh	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Poor	Very poor.	Poor	Very poor.
JeB, JeC Jayem	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Jg, JgC Jayem	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
KeB Keith	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
KeC Keith	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Ku Kuma	Good	Good	Fair	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
La Lemoyne	Poor	Poor	Good	Good	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Lb Lewellen	Poor	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
Lc*:												
Lewellen	Poor	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
McCuligan	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Good	Poor.
Lf Lodgepole	Poor	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Poor.
Ma, Mc Marlake	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
MtC, MtD Mitchell	Fair	Good	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
MxF*:												
Mitchell	Poor	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Epping	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Pg* Pits	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Fair	Very poor.	Very poor.	Poor	Poor.
Ru Rushcreek	Fair	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Good	Very poor.	Good.
SaB, SaC, SaD Sarben	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
SaE Sarben	Poor	Fair	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Sc Scoville	Fair	Good	Fair	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.
SnC Sidney	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
StD*:												
Sidney	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
SuG Sulco	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
SxC2*, SxD2*:												
Sulco	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
McConaughy	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
SxE2*, SxF*:												
Sulco	Poor	Fair	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
McConaughy	Poor	Fair	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
TkG*:												
Tassel	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.
Ashollow	Very poor.	Very poor.	Good	Good	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Rock outcrop	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
VaD, VaE---------- Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VaF*:												
Valent, rolling---	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Valent, hilly-----	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VdB---------- Valent	Fair	Good	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Vt---------- Vetal	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
WeB---------- Wildhorse	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Poor	Fair	Poor.
WhB*:												
Wildhorse---------	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Poor	Fair	Poor.
Hoffland----------	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
WkB*:												
Wildhorse---------	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Poor	Fair	Poor.
Ipage----------	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ao, AoB Alliance	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
Ar Almeria	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
AsF*: Ashollow	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Bh, BhB Bayard	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
BhC Bayard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
BmB, Bn Bayard	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
BpB Blanche	Severe: cutbanks cave.	Slight	Moderate: depth to rock.	Slight	Slight	Moderate: depth to rock.
BrF* Blueridge	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Bw Broadwater	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty, flooding.
BxD*: Busher	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
Tassel	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
BxE*: Busher	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Tassel	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: depth to rock.
Cw Crowther	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness.	Severe: wetness.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Cx Crowther	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding.	Severe: ponding.
DbB Dailey	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
DdC Dankworth	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
Dw Duroc	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
Eh Els	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
EuG*: Epping	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Fu* Fluvaquents	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding.
Gt Gothenburg	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
Hh Hoffland	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Ho Hoffland	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
IsB Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
Ja Jankosh	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Severe: excess salt.
JeB Jayem	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
JeC Jayem	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
Jg Jayem	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
JgC---------- Jayem	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
KeB---------- Keith	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
KeC---------- Keith	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
Ku---------- Kuma	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength.	Slight.
La---------- Lemoyne	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Moderate: too sandy.
Lb---------- Lewellen	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Severe: excess salt, excess sodium.
Lc*:						
Lewellen---------	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Severe: excess salt, excess sodium.
McCuligan--------	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness.
Lf---------- Lodgepole	Severe: cutbanks cave, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
Ma---------- Marlake	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mc---------- Marlake	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
MtC, MtD---------- Mitchell	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
MxF*:						
Mitchell---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Epping-----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Pg*---------- Pits	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ru Rushcreek	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, frost action.	Slight.
SaB Sarben	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
SaC, SaD Sarben	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
SaE Sarben	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Sc Scoville	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
SnC Sidney	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
StD*: Sidney	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
SuG Sulco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SxC2*, SxD2*: Sulco	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
McConaughy	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
SxE2*: Sulco	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
McConaughy	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
SxF*: Sulco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McConaughy	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
TkG*: Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
TkG*:						
Ashollow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
VaD	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VaE	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VaF*:						
Valent, rolling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Valent, hilly	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VdB	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Vt	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
WeB	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Severe: excess sodium, droughty.
WhB*:						
Wildhorse	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Severe: excess sodium, droughty.
Hoffland	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
WkB*:						
Wildhorse	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Severe: excess sodium, droughty.
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ao Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Slight	Fair: depth to rock.
AoB Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Slight	Fair: depth to rock.
Ar Almeria	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
AsF*: Ashollow	Moderate: slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, small stones, slope.
Bh, BhB, BhC, BmB, Bn Bayard	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
BpB Blanche	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Slight	Poor: depth to rock.
BrF* Blueridge	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, small stones.
Bw Broadwater	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
BxD*: Busher	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock.	Slight	Fair: depth to rock, thin layer.
Tassel	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Slight	Poor: depth to rock, small stones.
BxE*: Busher	Moderate: depth to rock, slope.	Severe: seepage, slope.	Severe: depth to rock.	Moderate: slope.	Fair: depth to rock, slope, thin layer.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BxE*:					
Tassel	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock, small stones.
Cw	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Crowther					
Cx	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Crowther					
DbB	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Dailey					
DdC	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
Dankworth					
Dw	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Duroc					
Eh	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Els					
EuG*:					
Epping	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Fu*	Severe: flooding, ponding.	Severe: seepage, flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding.
Fluvaquents					
Gt	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Gothenburg					
Hh	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Hoffland					
Ho	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Hoffland					

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
IsB Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Ja Jankosh	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
JeB, JeC, Jg, JgC Jayem	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Good.
KeB, KeC Keith	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Ku Kuma	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
La Lemoyne	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
Lb Lewellen	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
Lc*: Lewellen	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
McCuligan	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Lf Lodgepole	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Ma Marlake	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Mc Marlake	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
MtC Mitchell	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
MtD Mitchell	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MxF*:					
Mitchell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Epping	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Pg*	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Pits					
Ru	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, wetness, thin layer.
Rushcreek					
SaB, SaC	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Sarben					
SaD	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
Sarben					
SaE	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Sarben					
Sc	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
Scoville					
SnC	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: depth to rock, thin layer.
Sidney					
StD*:					
Sidney	Moderate: depth to rock, percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: depth to rock, thin layer.
Canyon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: depth to rock.
SuG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sulco					
SxC2*:					
Sulco	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
McConaughy	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SxD2*:					
Sulco	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
McConaughy	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
SxE2*:					
Sulco	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
McConaughy	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
SxF*:					
Sulco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
McConaughy	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
TkG*:					
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, small stones, slope.
Ashollow	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
VaD Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
VaE Valent	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, slope.
VaF*:					
Valent, rolling	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, slope.
Valent, hilly	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, slope.
VdB Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Vt Vetal	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
WeB Wildhorse	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
WhB*:					
Wildhorse	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
Hoffland	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
WkB*:					
Wildhorse	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ao, AoB Alliance	Fair: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ar Almeria	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
AsF*: Ashollow	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Tassel	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
Bh, BhB, BhC, BmB, Bn- Bayard	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
BpB Blanche	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, thin layer.
BrF* Blueridge	Fair: slope.	Probable	Probable	Poor: area reclaim, too sandy, small stones.
Bw Broadwater	Good	Probable	Probable	Poor: area reclaim, too sandy, small stones.
BxD*: Busher	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
Tassel	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
BxE*: Busher	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
Tassel	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
Cw, Cx Crowther	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
DbB---- Dailey	Good----	Probable----	Improbable: too sandy.	Poor: area reclaim, too sandy.
DdC---- Dankworth	Good----	Probable----	Improbable: too sandy.	Poor: area reclaim, too sandy.
Dw---- Duroc	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Eh---- Els	Fair: wetness.	Probable----	Improbable: too sandy.	Poor: too sandy.
EuG*:				
Epping----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Rock outcrop----	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Fu*---- Fluvaquents	Poor: wetness.	Probable----	Improbable: too sandy.	Poor: too sandy, wetness.
Gt---- Gothenburg	Poor: wetness.	Probable----	Probable----	Poor: area reclaim, too sandy, wetness.
Hh, Ho---- Hoffland	Poor: wetness.	Probable----	Improbable: too sandy.	Poor: too sandy, wetness.
IsB---- Ipage	Good----	Probable----	Improbable: too sandy.	Poor: too sandy.
Ja---- Jankosh	Fair: wetness.	Probable----	Improbable: too sandy.	Poor: excess salt.
JeB, JeC, Jg, JgC---- Jayem	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
KeB, KeC---- Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ku---- Kuma	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
La---- Lemoyne	Good----	Probable----	Improbable: too sandy.	Poor: thin layer.
Lb---- Lewellen	Fair: wetness.	Probable----	Probable----	Poor: too sandy, excess salt, excess sodium.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Lc*:				
Lewellen	Fair: wetness.	Probable	Probable	Poor: too sandy, excess salt, excess sodium.
McCuligan	Poor: wetness.	Probable	Probable	Poor: area reclaim, too sandy, small stones.
Lf Lodgepole	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Ma, Mc Marlake	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
MtC, MtD Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
MxF*:				
Mitchell	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Epping	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Pg* Pits	Fair: slope.	Probable	Probable	Poor: area reclaim, too sandy, small stones.
Ru Rushcreek	Good	Probable	Improbable: too sandy.	Fair: too clayey.
SaB, SaC, SaD Sarben	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
SaE Sarben	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
Sc Scoville	Good	Probable	Improbable: too sandy.	Poor: too sandy.
SnC Sidney	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
StD*:				
Sidney	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SuG Sulco	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
SxC2*, SxD2*:				
Sulco	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
McConaughy	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
SxE2*:				
Sulco	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
McConaughy	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
SxF*:				
Sulco	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
McConaughy	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
TkG*:				
Tassel	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
Ashollow	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
VaD Valent	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VaE Valent	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
VaF*:				
Valent, rolling	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Valent, hilly	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
VdB Valent	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Vt Vetal	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
WeB---------- Wildhorse	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: area reclaim, too sandy, excess sodium.
WhB*:				
Wildhorse----------	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: area reclaim, too sandy, excess sodium.
Hoffland----------	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy, wetness.
WkB*:				
Wildhorse----------	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: area reclaim, too sandy, excess sodium.
Ipage----------	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ao, AoB---------- Alliance	Moderate: seepage, depth to rock.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Erodes easily	Too arid, erodes easily.
Ar---------- Almeria	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty, rooting depth.
AsF*: Ashollow---------	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
Tassel----------	Severe: depth to rock, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope.
Bh, BhB---------- Bayard	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
BhC---------- Bayard	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
BmB---------- Bayard	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
Bn---------- Bayard	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Favorable------	Too arid.
BpB---------- Blanche	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Fast intake, soil blowing.	Depth to rock, soil blowing.	Too arid, depth to rock.
BrF*---------- Blueridge	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
Bw---------- Broadwater	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Too arid, droughty, rooting depth.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
BxD*:							
Busher	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing	Too arid.
Tassel	Severe: depth to rock.	Severe: seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Depth to rock, soil blowing.	Too arid.
BxE*:							
Busher	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
Tassel	Severe: depth to rock, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope.
Cw Crowther	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness	Wetness, too sandy.	Wetness.
Cx Crowther	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding	Ponding, too sandy.	Wetness.
DbB Dailey	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
DdC Dankworth	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty, rooting depth.
Dw Duroc	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Erodes easily	Erodes easily.
Eh Els	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
EuG*:							
Epping	Severe: depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
EuG*:							
Rock outcrop-----	Severe: depth to rock, slope.	Severe: area reclaim.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
Fu*---------- Fluvaquents	Severe: seepage.	Severe: seepage, ponding.	Slight---------	Ponding, flooding.	Ponding, droughty, rooting depth.	Ponding, too sandy.	Wetness, droughty, rooting depth.
Gt---------- Gothenburg	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty, rooting depth.
Hh---------- Hoffland	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
Ho---------- Hoffland	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.
IsB---------- Ipage	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Ja---------- Jankosh	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Cutbanks cave, excess salt.	Wetness, rooting depth.	Erodes easily, wetness, too sandy.	Excess salt, erodes easily, rooting depth.
JeB---------- Jayem	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Too arid.
JeC---------- Jayem	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing---	Too arid.
Jg---------- Jayem	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
JgC---------- Jayem	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
KeB---------- Keith	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Erodes easily	Too arid, erodes easily.
KeC---------- Keith	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
Ku---------- Kuma	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Erodes easily	Erodes easily.
La---------- Lemoyne	Severe: seepage.	Moderate: thin layer, piping, hard to pack.	Severe: slow refill, cutbanks cave.	Deep to water	Fast intake, soil blowing, rooting depth.	Erodes easily, soil blowing.	Too arid, erodes easily, rooting depth.
Lb---------- Lewellen	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, excess salt, excess sodium.	Wetness, droughty, rooting depth.	Erodes easily, wetness, too sandy.	Excess salt, excess sodium, erodes easily.
Lc*:							
Lewellen---------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, excess salt, excess sodium.	Wetness, droughty, rooting depth.	Erodes easily, wetness, too sandy.	Excess salt, excess sodium, erodes easily.
McCuligan--------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, rooting depth.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, droughty.
Lf---------- Lodgepole	Severe: seepage.	Severe: ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
Ma---------- Marlake	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.
Mc---------- Marlake	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding--------	Ponding, too sandy.	Wetness.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MtC, MtD---------- Mitchell	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
MxF*:							
Mitchell---------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
Epping----------	Severe: depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Pg*--------- Pits	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy.	Slope, droughty, rooting depth.
Ru---------- Rushcreek	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Favorable------	Erodes easily	Erodes easily.
SaB---------- Sarben	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Soil blowing---	Droughty, rooting depth.
SaC, SaD---------- Sarben	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing---	Droughty, rooting depth.
SaE---------- Sarben	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing.	Slope, droughty, rooting depth.
Sc---------- Scoville	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Too arid, droughty, rooting depth.
SnC---------- Sidney	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
StD*:							
Sidney----------	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
StD*:							
Canyon	Severe: depth to rock.	Slight	Severe: no water.	Deep to water	Slope, depth to rock.	Depth to rock	Too arid.
SuG Sulco	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Too arid, slope, erodes easily.
SxC2*, SxD2*:							
Sulco	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily	Too arid, erodes easily.
McConaughy	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Too arid, erodes easily.
SxE2*, SxF*:							
Sulco	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Too arid, slope, erodes easily.
McConaughy	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Too arid, slope, erodes easily.
TkG*:							
Tassel	Severe: depth to rock, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope.
Ashollow	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
Rock outcrop	Severe: depth to rock, slope.	Severe: area reclaim.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
VaD Valent	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
VaE Valent	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
VaF*:							
Valent, rolling--	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
Valent, hilly----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
VdB---------- Valent	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
Vt---------- Vetal	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
WeB---------- Wildhorse	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, excess sodium.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Excess salt, excess sodium, droughty.
WhB*:							
Wildhorse--------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, excess sodium.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Excess salt, excess sodium, droughty.
Hoffland---------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
WkB*:							
Wildhorse--------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, excess sodium.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Excess salt, excess sodium, droughty.
Ipage----------	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Ao---------- Alliance	0-8	Loam----------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-40	2-15
	8-30	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	10-25
	30-44	Very fine sandy loam, silt loam, loam.	ML, CL-ML, SM, SC	A-4	0-5	85-100	85-100	70-100	40-90	15-30	NP-10
	44-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
AoB---------- Alliance	0-12	Loam----------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-40	2-15
	12-26	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	10-25
	26-34	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	60-90	20-40	2-15
	34-54	Very fine sandy loam, silt loam, loam.	ML, CL-ML, SM, SC	A-4	0-5	85-100	85-100	70-100	40-90	15-30	NP-10
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ar---------- Almeria	0-3	Fine sandy loam	SM, ML, SC-SM, SC	A-4	0	100	100	70-100	40-70	15-25	NP-10
	3-60	Stratified sand to fine sandy loam.	SM, SP-SM, SC-SM, SP	A-2, A-3, A-4	0	90-100	80-100	50-80	0-50	15-20	NP-5
AsF*:											
Ashollow--------	0-3	Very fine sandy loam.	SM, ML, SC, CL	A-4, A-2, A-1-b, A-6	0	95-100	75-100	40-100	20-80	15-30	NP-15
	3-60	Very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2, A-6	0	95-100	75-100	40-100	20-80	15-30	NP-15
Tassel----------	0-7	Fine sandy loam	ML, SM	A-4	0	95-100	90-100	75-100	40-65	<35	NP-7
	7-18	Gravelly fine sandy loam, gravelly loamy very fine sand, gravelly sandy loam.	SM	A-2, A-1	0-5	55-100	50-75	40-60	10-35	<25	NP-5
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bh---------- Bayard	0-12	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	45-85	25-55	15-25	3-10
	12-40	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	55-95	30-65	15-25	3-10
	40-60	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	10-20	NP-5

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
BhB---------- Bayard	0-13	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	45-85	25-55	15-25	3-10
	13-60	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	55-95	30-65	15-25	3-10
BhC---------- Bayard	0-9	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	45-85	25-55	15-25	3-10
	9-60	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	55-95	30-65	15-25	3-10
BmB---------- Bayard	0-16	Very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	75-95	30-65	15-25	3-10
	16-60	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	55-95	30-65	15-25	3-10
Bn---------- Bayard	0-15	Loam----------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	55-75	15-30	3-10
	15-60	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	95-100	90-100	55-95	30-65	15-25	3-10
BpB---------- Blanche	0-8	Loamy fine sand	SM	A-2, A-4	0	100	100	60-80	20-45	---	NP
	8-32	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	100	70-95	40-75	15-30	NP-10
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BrF*---------- Blueridge	0-4	Coarse sand------	SP, SP-SM, SM, SC-SM	A-1, A-2, A-3	0	95-100	75-95	25-55	0-35	<20	NP-5
	4-60	Sand, coarse sand, gravelly coarse sand.	SP, SM, SP-SM	A-1, A-2, A-3	0-5	70-100	50-95	25-60	0-35	<20	NP
Bw---------- Broadwater	0-3	Loamy sand-------	SM, SP-SM, SC-SM	A-2, A-4, A-1-b	0	95-100	90-100	35-70	10-40	15-20	NP-5
	3-9	Loamy sand, sand	SM, SP-SM, SC-SM	A-2, A-4, A-1-b	0	95-100	90-100	35-70	10-40	15-20	NP-5
	9-60	Coarse sand, gravelly coarse sand.	SP, SM, SP-SM, SC-SM	A-1, A-2, A-3	0	70-100	50-95	25-60	0-35	15-20	NP-5
BxD*: Busher----------	0-10	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	15-25	NP-5
	10-48	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	15-25	NP-5
	48-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
BxD*:											
Tassel----------	0-11	Fine sandy loam	ML, SM	A-4	0	95-100	90-100	75-100	40-65	<35	NP-7
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BxE*:											
Busher----------	0-10	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	15-25	NP-5
	10-44	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	15-25	NP-5
	44-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tassel----------	0-9	Fine sandy loam	ML, SM	A-4	0	95-100	90-100	75-100	40-65	<35	NP-7
	9-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Cw----------	0-18	Loam----------	CL	A-4, A-6	0	100	100	85-100	65-90	20-40	7-20
Crowther	18-27	Clay loam, loam, sandy clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	70-100	50-85	30-50	4-24
	27-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	65-85	5-35	---	NP
Cx----------	0-18	Loam----------	CL	A-4, A-6	0	100	100	85-100	65-90	20-40	7-20
Crowther	18-33	Clay loam, loam, sandy clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	70-100	50-85	30-50	4-24
	33-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	65-85	5-35	---	NP
DbB----------	0-14	Loamy fine sand	SM	A-2, A-4	0	100	100	70-95	20-40	<20	NP
Dailey	14-60	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	95-100	75-95	5-35	<20	NP
DdC----------	0-6	Loamy sand-------	SM	A-2	0	95-100	90-100	50-90	15-35	15-20	NP-5
Dankworth	6-60	Sand, coarse sand	SP, SM, SP-SM	A-1, A-2, A-3	0	90-100	75-95	20-75	0-20	15-20	NP-5
Dw----------	0-27	Loam----------	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	60-100	25-35	5-15
Duroc	27-32	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
	32-60	Loam, silt loam, very fine sandy loam.	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
Eh----------	0-7	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-30	10-20	NP-5
Els	7-15	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	95-100	95-100	70-100	5-35	10-20	NP-5
	15-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	95-100	95-100	70-100	5-35	10-20	NP-5
EuG*:											
Epping----------	0-3	Very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	95-100	85-100	65-95	15-30	2-10
	3-16	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Fu* Fluvaquents	0-60	Sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-70	5-40	15-25	NP-5
Gt Gothenburg	0-5	Loamy sand	SM	A-2	0	100	95-100	50-90	15-35	0-20	NP
	5-14	Fine sand, sand	SM, SP-SM, SP	A-2, A-3	0	100	80-100	65-80	3-15	0-20	NP
	14-60	Stratified fine sand to coarse sand.	SP, SM, SP-SM	A-1, A-2, A-3	0	95-100	75-100	30-80	3-15	0-20	NP
Hh Hoffland	0-10	Fine sandy loam	SC, CL, CL-ML, SC-SM	A-4	0	100	100	70-95	40-55	15-25	4-10
	10-20	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
	20-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
Ho Hoffland	0-13	Fine sandy loam	SC, CL, CL-ML, SC-SM	A-4	0	100	100	70-95	40-55	15-25	4-10
	13-42	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
	42-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
IsB Ipage	0-5	Fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	5-16	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
	16-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
Ja Jankosh	0-4	Loam	ML, CL, CL-ML	A-4	0	100	100	85-95	60-75	20-30	3-10
	4-18	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-95	50-65	20-35	3-10
	18-33	Very fine sandy loam, loam.	ML, CL, CL-ML	A-4	0	100	100	85-95	50-65	20-35	3-10
	33-60	Gravelly coarse sand, gravelly sand.	SM, SP-SM	A-2	0	80-100	50-75	0-55	0-35	15-20	NP-5
JeB Jayem	0-17	Loamy fine sand	SM	A-2	0	100	85-100	75-85	25-35	15-25	NP-5
	17-37	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	15-25	NP-5
	37-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	15-25	NP-5
JeC Jayem	0-10	Loamy fine sand	SM	A-2	0	100	85-100	75-85	25-35	15-25	NP-5
	10-18	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	15-25	NP-5
	18-40	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	15-25	NP-5
	40-60	Loamy sand, fine sand, sand.	SM	A-2	0	0	100	85-100	65-80	25-35	3-10

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Jg	0-9	Fine sandy loam	SM	A-4, A-2	0	100	85-100	55-95	25-50	15-25	NP-5
Jayem	9-22	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	15-25	NP-5
	22-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	15-25	NP-5
JgC	0-11	Fine sandy loam	SM	A-4, A-2	0	100	85-100	55-95	25-50	15-25	NP-5
Jayem	11-18	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	15-25	NP-5
	18-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	15-25	NP-5
KeB	0-13	Loam	CL, ML, CL-ML	A-4	0	100	100	85-100	80-100	20-35	2-10
Keith	13-48	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	80-100	30-45	10-25
	48-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-35	2-12
KeC	0-7	Loam	CL, ML, CL-ML	A-4	0	100	100	85-100	80-100	20-35	2-10
Keith	7-28	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	80-100	30-45	10-25
	28-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-35	2-12
Ku	0-17	Loam	ML	A-4	0	100	95-100	90-100	75-95	25-35	NP-10
Kuma	17-44	Silty clay loam, silt loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	85-95	30-45	10-25
	44-60	Silty clay loam, loam, very fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	90-100	70-95	20-40	NP-20
La	0-6	Sand	SM, SP-SM, SC-SM	A-2, A-3, A-4	0	100	95-100	50-90	5-40	15-20	NP-5
Lemoyne	6-18	Sand, fine sand, loamy sand.	SM, ML, SC-SM	A-2, A-4	0	100	95-100	55-70	20-55	15-20	NP-5
	18-36	Clay loam, sandy clay loam.	CL, CH	A-6, A-7	0	100	95-100	55-100	55-90	30-60	10-30
	36-54	Clay loam, loam	CL, CH	A-6, A-7	0	100	95-100	55-100	55-90	30-60	10-30
	54-60	Coarse sand, sand	SM, SP-SM, SC-SM	A-2, A-3, A-1	0	100	75-100	30-70	5-30	15-20	NP-5

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Lb	0-4	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-75	20-35	5-15
Lewellen	4-8	Loam, sandy clay loam.	CL, SC	A-6, A-7	0	100	95-100	50-100	40-70	30-45	10-25
	8-12	Loam, very fine sandy loam, fine sandy loam.	ML, SM, SC-SM, SC	A-4, A-6	0	100	95-100	70-100	40-75	15-30	NP-15
	12-29	Fine sand, loamy fine sand.	SM, ML, SC-SM	A-2, A-4	0	100	85-100	55-70	20-55	15-20	NP-5
	29-80	Coarse sand, gravelly sand, gravelly coarse sand.	SM, SP, SP-SM, SC-SM	A-1, A-2, A-3	0	70-100	50-95	25-60	0-35	15-20	NP-5
Lc*:											
Lewellen	0-4	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-75	20-35	5-15
	4-11	Loam, very fine sandy loam, fine sandy loam.	ML, SM, SC-SM, SC	A-4, A-6	0	100	95-100	70-100	40-75	15-30	NP-15
	11-30	Fine sand, loamy fine sand.	SM, ML, SC-SM	A-2, A-4	0	100	85-100	55-70	20-55	15-20	NP-5
	30-80	Coarse sand, gravelly sand, gravelly coarse sand.	SM, SP, SP-SM, SC-SM	A-1, A-2, A-3	0	70-100	50-95	25-60	0-35	15-20	NP-5
McCuligan	0-7	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	60-75	20-35	5-15
	7-12	Loam, very fine sandy loam, fine sandy loam.	SC, ML	A-4, A-6	0	100	95-100	70-100	40-75	15-30	NP-15
	12-18	Sand, fine sand	SP-SM, SM	A-2, A-3, A-4	0	100	95-100	60-100	5-40	15-20	NP-5
	18-80	Coarse sand, gravelly sand, gravelly coarse sand.	SP-SM, SM, SP	A-1, A-2, A-3	0	70-100	50-95	25-60	0-35	15-20	NP-5
Lf	0-5	Silt loam	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-95	20-40	3-20
Lodgepole	5-32	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	90-100	85-95	50-65	25-40
	32-60	Silt loam, very fine sandy loam, loam.	CL, CL-ML, ML	A-4	0	100	100	90-100	60-90	20-35	3-10
Ma	0-7	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	40-55	15-20	NP
Marlake	7-14	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-4, A-3	0	100	100	50-85	5-50	---	NP
	14-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
Mc	12-0	Mucky peat	PT	A-8, A-1-a	---	---	---	---	---	---	NP
Marlake	0-7	Fine sand, loamy sand, loamy fine sand.	SM, SP-SM	A-2, A-4, A-3	0	100	100	50-80	5-25	---	NP
	7-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
MtC---------- Mitchell	0-7	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-95	20-35	NP-15
	7-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-100	20-35	NP-15
MtD---------- Mitchell	0-5	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-95	20-35	NP-15
	5-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-100	20-35	NP-15
MxF*:											
Mitchell--------	0-8	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-95	20-35	NP-15
	8-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-100	20-35	NP-15
Epping----------	0-5	Very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	95-100	85-100	65-95	15-30	2-10
	5-11	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Pg*---------- Pits	0-60	Gravelly sand----	SP, SP-SM, SM, GP-GM	A-1, A-2, A-3	0-5	45-100	40-100	0-80	0-40	---	NP
Ru---------- Rushcreek	0-11	Loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	60-75	20-35	5-15
	11-34	Loam, clay loam	CL-ML, CL, SC, SC-SM	A-4, A-6	0	100	95-100	80-100	45-90	20-40	5-20
	34-56	Loam, very fine sandy loam, sandy loam.	CL-ML, SC, CL	A-4, A-6	0	100	95-100	50-100	35-80	20-35	5-15
	56-80	Coarse sand, gravelly sand, gravelly coarse sand.	SP-SM, SM, SP, SC-SM	A-1, A-2, A-3	0	80-100	50-95	25-90	0-35	15-20	NP-5
SaB, SaC---------- Sarben	0-7	Loamy fine sand	SM	A-2	0	100	100	50-75	15-30	15-20	NP-5
	7-15	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	15-20	NP-5
	15-60	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	15-20	NP-5
SaD---------- Sarben	0-5	Loamy fine sand	SM	A-2	0	100	100	50-75	15-30	15-20	NP-5
	5-15	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	15-20	NP-5
	15-60	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	15-20	NP-5

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
SaE----------	0-10	Loamy fine sand	SM	A-2	0	100	100	50-75	15-30	15-20	NP-5
Sarben	10-15	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	15-20	NP-5
	15-60	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	15-20	NP-5
Sc----------	0-6	Loamy fine sand	SM	A-2	0	100	100	75-100	15-50	<20	NP
Scoville	6-42	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	100	100	75-100	5-50	<20	NP
	42-46	Very fine sandy loam, fine sandy loam, loam.	ML, CL-ML, SM	A-4	0	100	100	70-100	35-75	<30	NP-10
	46-60	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	75-100	5-50	<20	NP
SnC----------	0-11	Loam----------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	20-36	2-15
Sidney	11-29	Loam, very fine sandy loam, silt loam.	CL-ML, CL, SC-SM, ML	A-4, A-6	0	95-100	85-100	65-100	35-85	20-40	2-15
	29-48	Loam, very fine sandy loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	95-100	80-100	60-100	35-85	20-40	2-15
	48-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
StD*:											
Sidney----------	0-9	Loam----------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	20-36	2-15
	9-30	Loam, very fine sandy loam, silt loam.	CL-ML, CL, SC-SM, ML	A-4, A-6	0	95-100	85-100	65-100	35-85	20-40	2-15
	30-44	Loam, very fine sandy loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	95-100	80-100	60-100	35-85	20-40	2-15
	44-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon----------	0-5	Loam----------	ML, CL, CL-ML, SM	A-4	0-5	90-100	75-100	50-95	40-75	15-30	2-10
	5-10	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-100	50-100	40-95	30-75	20-40	NP-15
	10-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SuG----------	0-3	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	80-100	60-90	20-35	NP-15
Sulco	3-60	Silt loam, very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	20-30	NP-10
SxC2*:											
Sulco----------	0-6	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	80-100	60-90	20-35	NP-15
	6-60	Silt loam, very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	20-30	NP-10

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
SxC2*:											
McConaughy------	0-6	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	60-100	20-35	NP-12
	6-21	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-100	20-35	NP-12
	21-60	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	80-100	20-35	NP-12
SxD2*:											
Sulco----------	0-5	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	80-100	60-90	20-35	NP-15
	5-60	Silt loam, very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	20-30	NP-10
McConaughy------	0-7	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	60-100	20-35	NP-12
	7-28	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-100	20-35	NP-12
	28-60	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	80-100	20-35	NP-12
SxE2*:											
Sulco----------	0-6	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	80-100	60-90	20-35	NP-15
	6-60	Silt loam, very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	20-30	NP-10
McConaughy------	0-6	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	60-100	20-35	NP-12
	6-24	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-100	20-35	NP-12
	24-60	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	80-100	20-35	NP-12
SxF*:											
Sulco----------	0-4	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	80-100	60-90	20-35	NP-15
	4-60	Silt loam, very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	20-30	NP-10
McConaughy------	0-10	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	60-100	20-35	NP-12
	10-24	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-100	20-35	NP-12
	24-60	Loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	80-100	20-35	NP-12
TkG*:											
Tassel----------	0-7	Fine sandy loam	ML, SM	A-4	0	95-100	90-100	75-100	40-65	<35	NP-7
	7-18	Gravelly fine sandy loam, gravelly loamy very fine sand, gravelly sandy loam.	SM	A-2, A-1	0-5	55-100	50-75	40-60	10-35	<25	NP-5
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
TkG*:											
Ashollow--------	0-3	Very fine sandy loam.	SM, ML, SC, CL	A-4, A-2, A-1-b, A-6	0	95-100	75-100	40-100	20-80	15-30	NP-15
	3-60	Very fine sandy loam, fine sandy loam.	SM, ML, SC, CL	A-4, A-2, A-6	0	95-100	75-100	40-100	20-80	15-30	NP-15
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
VaD----------	0-5	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
Valent	5-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VaE----------	0-4	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
Valent	4-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VaF*:											
Valent, rolling-	0-3	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
	3-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
Valent, hilly---	0-3	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
	3-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VdB----------	0-6	Loamy fine sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	15-25	NP-5
Valent	6-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
Vt----------	0-8	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	95-100	60-100	30-55	20-30	NP-10
Vetal	8-22	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	95-100	60-100	30-65	20-30	NP-10
	22-60	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	90-100	60-100	30-65	20-30	NP-10
WeB----------	0-8	Fine sand--------	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-100	5-40	10-20	NP-5
Wildhorse	8-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	10-20	NP-5
WhB*:											
Wildhorse--------	0-8	Fine sand--------	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-100	5-40	10-20	NP-5
	8-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	10-20	NP-5
Hoffland--------	0-7	Fine sandy loam	SC, CL, CL-ML, SC-SM	A-4	0	100	100	70-95	40-55	15-25	4-10
	7-12	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	100	51-90	5-35	1-10
	12-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
WkB*:											
Wildhorse-------	0-5	Fine sand--------	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-100	5-40	10-20	NP-5
	5-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	10-20	NP-5
Ipage-----------	0-5	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	5-10	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
	10-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ao	0-8	15-20	1.25-1.45	0.6-2.0	0.20-0.22	6.6-7.8	0-0	Low	0.28	4	5	2-4
Alliance	8-30	25-35	1.15-1.30	0.2-2.0	0.18-0.20	6.6-7.8	0-0	Moderate	0.43			
	30-44	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	0-0	Low	0.24			
	44-60	---	---	---	---	---	---	---	---			
AoB	0-12	15-20	1.25-1.45	0.6-2.0	0.20-0.22	6.6-7.8	0-0	Low	0.28	4	5	2-4
Alliance	12-26	25-35	1.15-1.30	0.2-2.0	0.18-0.20	6.6-7.8	0-0	Moderate	0.43			
	26-34	15-25	1.20-1.40	0.6-2.0	0.16-0.20	6.6-8.4	0-0	Low	0.43			
	34-54	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	0-0	Low	0.24			
	54-60	---	---	---	---	---	---	---	---			
Ar	0-3	5-15	1.30-1.50	2.0-6.0	0.13-0.18	6.1-8.4	0-4	Low	0.24	5	8	1-2
Almeria	3-60	1-10	1.55-1.80	6.0-20	0.05-0.12	5.6-7.3	0-4	Low	0.15			
AsF*:												
Ashollow	0-3	5-18	1.20-1.40	2.0-6.0	0.17-0.19	7.4-8.4	0-0	Low	0.37	5	3	1-2
	3-60	5-18	1.20-1.50	2.0-6.0	0.15-0.18	7.4-8.4	0-0	Low	0.43			
Tassel	0-7	5-12	1.50-1.75	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low	0.24	2	3	.5-1
	7-18	5-12	1.50-1.60	2.0-6.0	0.09-0.11	7.4-8.4	<2	Low	0.10			
	18-60	---	---	0.2-0.6	---	---	---	---	---			
Bh	0-12	5-18	1.30-1.50	2.0-6.0	0.13-0.18	6.6-7.8	0-0	Low	0.20	5	3	1-3
Bayard	12-40	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.28			
	40-60	5-10	1.50-1.80	6.0-20	0.08-0.10	7.4-8.4	0-0	Low	0.17			
BhB	0-13	5-18	1.30-1.50	2.0-6.0	0.13-0.18	6.6-7.8	0-0	Low	0.20	5	3	1-3
Bayard	13-60	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.28			
BhC	0-9	5-18	1.30-1.50	2.0-6.0	0.13-0.18	6.6-7.8	0-0	Low	0.20	5	3	1-3
Bayard	9-60	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.28			
BmB	0-16	5-18	1.20-1.50	2.0-6.0	0.17-0.18	6.6-7.8	0-0	Low	0.32	5	3	1-3
Bayard	16-60	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.28			
Bn	0-15	7-20	1.25-1.45	2.0-6.0	0.20-0.22	6.6-7.8	0-0	Low	0.28	5	5	1-3
Bayard	15-60	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.28			
BpB	0-8	6-10	1.40-1.60	6.0-20	0.10-0.12	6.6-7.8	0-0	Low	0.17	3	2	1-2
Blanche	8-32	9-18	1.30-1.50	2.0-6.0	0.15-0.17	6.6-8.4	0-0	Low	0.24			
	32-60	---	---	0.06-0.2	---	---	---	---	---			
BrF*	0-4	0-5	1.45-1.65	6.0-20	0.04-0.06	5.6-7.3	<2	Low	0.10	5	1	<1
Blueridge	4-60	0-3	1.65-1.85	>20	0.02-0.05	5.6-7.3	<2	Low	0.05			
Bw	0-3	3-10	1.35-1.55	6.0-20	0.10-0.12	6.6-7.8	0-0	Low	0.17	5	2	.5-1
Broadwater	3-9	3-10	1.35-1.55	6.0-20	0.10-0.12	6.6-7.8	0-0	Low	0.17			
	9-60	0-3	1.65-1.85	>20	0.02-0.05	6.6-7.8	0-0	Low	0.05			
BxD*:												
Busher	0-10	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	0-0	Low	0.20	4	3	1-3
	10-48	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	0-0	Low	0.28			
	48-60	---	---	0.2-0.6	---	---	---	---	---			
Tassel	0-11	5-12	1.50-1.75	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low	0.24	2	3	.5-1
	11-60	---	---	0.2-0.6	---	---	---	---	---			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
BxE*:												
Busher	0-10	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	0-0	Low	0.20	4	3	1-3
	10-44	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	0-0	Low	0.28			
	44-60	---	---	0.2-0.6	---	---	---	---	---			
Tassel	0-9	5-12	1.50-1.75	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low	0.24	2	3	.5-1
	9-60	---	---	0.2-0.6	---	---	---	---	---			
Cw	0-18	15-35	1.20-1.40	0.6-6.0	0.17-0.23	7.4-8.4	<2	Moderate	0.24	4	8	8-16
Crowther	18-27	20-40	1.20-1.50	0.6-6.0	0.15-0.19	7.9-8.4	<2	Moderate	0.32			
	27-60	1-10	1.50-1.70	6.0-20	0.06-0.11	6.6-8.4	<2	Low	0.17			
Cx	0-18	15-35	1.20-1.40	0.6-6.0	0.17-0.23	7.4-8.4	0-0	Moderate	0.24	4	8	8-16
Crowther	18-33	20-40	1.20-1.50	0.6-6.0	0.15-0.19	7.9-8.4	0-0	Moderate	0.32			
	33-60	1-10	1.50-1.70	6.0-20	0.06-0.11	6.6-8.4	0-0	Low	0.17			
DbB	0-14	2-5	1.70-1.85	6.0-20	0.07-0.12	6.6-7.3	<2	Low	0.17	5	2	1-3
Dailey	14-60	2-5	1.75-1.95	6.0-20	0.04-0.07	6.6-8.4	<2	Low	0.10			
DdC	0-6	2-10	1.35-1.55	6.0-20	0.08-0.14	6.1-7.3	0-0	Low	0.17	5	2	.5-1
Dankworth	6-60	1-3	1.65-1.85	6.0-20	0.02-0.07	6.1-7.3	0-0	Low	0.10			
Dw	0-27	15-20	1.20-1.45	0.6-2.0	0.12-0.22	6.6-7.8	0-0	Moderate	0.28	5	5	1-3
Duroc	27-32	18-27	1.40-1.65	0.6-2.0	0.12-0.20	6.6-7.8	0-0	Moderate	0.43			
	32-60	18-27	1.40-1.65	0.6-2.0	0.12-0.20	6.6-7.8	0-0	Moderate	0.43			
Eh	0-7	1-8	1.60-1.70	6.0-20	0.07-0.09	7.4-8.4	0-2	Low	0.15	5	1	.5-3
Els	7-15	1-10	1.50-1.70	6.0-20	0.05-0.08	7.4-8.4	0-2	Low	0.15			
	15-60	1-10	1.50-1.70	6.0-20	0.04-0.07	7.4-9.0	0-2	Low	0.15			
EuG*:												
Epping	0-3	10-20	1.25-1.45	0.6-2.0	0.12-0.20	6.6-8.4	<2	Low	0.43	2	3	.5-2
	3-16	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low	0.43			
	16-60	---	---	0.06-0.2	---	---	---	---	---			
Rock outcrop	0-60	---	---	---	---	---	<2	---	---	---	8	---
Fu*	0-60	1-18	1.30-1.80	6.0-20	0.07-0.13	6.6-8.4	0-2	Low	0.17	5	8	2-8
Fluvaquents												
Gt	0-5	2-8	1.35-1.55	6.0-20	0.10-0.12	6.6-8.4	0-0	Low	0.17	5	8	.5-1
Gothenburg	5-14	1-5	1.60-1.80	6.0-20	0.06-0.08	6.6-7.8	0-0	Low	0.15			
	14-60	0-5	1.65-1.85	6.0-20	0.05-0.07	6.6-7.8	0-0	Low	0.10			
Hh	0-10	15-20	1.20-1.50	2.0-6.0	0.16-0.19	7.9-8.4	0-2	Low	0.20	3	8	4-12
Hoffland	10-20	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	0-0	Low	0.15			
	20-60	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-7.8	0-0	Low	0.15			
Ho	0-13	15-20	1.20-1.50	2.0-6.0	0.16-0.19	7.9-8.4	0-2	Low	0.20	3	8	4-12
Hoffland	13-42	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	0-0	Low	0.15			
	42-60	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-7.8	0-0	Low	0.15			
IsB	0-5	1-5	1.40-1.50	6.0-20	0.07-0.09	6.6-8.4	0-2	Low	0.15	5	1	.5-1
Ipage	5-16	1-8	1.50-1.60	6.0-20	0.04-0.10	6.6-8.4	0-2	Low	0.15			
	16-60	1-8	1.50-1.60	6.0-20	0.04-0.09	7.4-9.0	0-2	Low	0.15			
Ja	0-4	10-18	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	2-16	Low	0.32	4	4L	1-3
Jankosh	4-18	10-18	1.20-1.45	0.6-2.0	0.16-0.19	8.5-9.6	4-16	Low	0.37			
	18-33	10-18	1.20-1.45	0.6-2.0	0.16-0.19	8.5-9.6	4-16	Low	0.43			
	33-60	0-3	1.65-1.85	>20	0.02-0.04	6.6-7.3	0-2	Low	0.05			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
JeB	0-17	3-8	1.35-1.45	2.0-6.0	0.08-0.11	6.6-7.8	0-0	Low	0.17	5	2	1-3
Jayem	17-37	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.32			
	37-60	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.32			
JeC	0-10	3-8	1.35-1.45	2.0-6.0	0.08-0.11	6.6-7.8	0-0	Low	0.17	5	2	1-3
Jayem	10-18	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.32			
	18-40	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.32			
	40-60	3-10	1.45-1.60	2.0-6.0	0.07-0.09	6.6-7.8	0-0	Low	0.24			
Jg	0-9	5-15	1.20-1.35	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.20	5	3	1-3
Jayem	9-22	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.32			
	22-60	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.32			
JgC	0-11	5-15	1.20-1.35	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.20	5	3	1-3
Jayem	11-18	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.32			
	18-60	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	0-0	Low	0.32			
KeB	0-13	14-20	1.25-1.45	0.6-2.0	0.20-0.23	6.1-7.3	0-0	Low	0.28	5	5	1-3
Keith	13-48	20-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-7.3	0-0	Moderate	0.43			
	48-60	8-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	0-0	Low	0.43			
KeC	0-7	14-20	1.25-1.45	0.6-2.0	0.20-0.23	6.1-7.3	0-0	Low	0.28	5	5	1-3
Keith	7-28	20-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-7.3	0-0	Moderate	0.43			
	28-60	8-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	0-0	Low	0.43			
Ku	0-17	15-27	1.20-1.30	0.6-2.0	0.18-0.21	6.1-8.4	<2	Low	0.32	5	5	2-4
Kuma	17-44	18-35	1.25-1.35	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	0.37			
	44-60	10-30	1.40-1.50	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low	0.32			
La	0-6	1-8	1.40-1.60	6.0-20	0.07-0.09	6.6-7.8	0-2	Low	0.15	4	1	.5-1
Lemoyne	6-18	1-8	1.55-1.80	6.0-20	0.06-0.11	6.6-7.8	0-2	Low	0.15			
	18-36	20-40	1.30-1.65	0.2-0.6	0.15-0.19	7.9-9.0	0-4	Moderate	0.37			
	36-54	20-40	1.30-1.65	0.2-0.6	0.14-0.19	7.9-9.0	0-4	Moderate	0.37			
	54-60	0-6	1.60-1.85	6.0-20	0.02-0.07	7.9-9.0	0-4	Low	0.10			
Lb	0-4	12-27	1.25-1.45	0.6-2.0	0.20-0.22	7.9-9.0	2-16	Low	0.24	3	4L	4-8
Lewellen	4-8	18-27	1.35-1.65	0.6-2.0	0.16-0.19	7.9-9.0	2-16	Low	0.37			
	8-12	5-20	1.30-1.70	0.6-2.0	0.15-0.19	7.9-9.0	2-16	Low	0.37			
	12-29	1-5	1.55-1.80	6.0-20	0.06-0.11	7.9-9.0	2-16	Low	0.15			
	29-80	0-3	1.65-1.85	>20	0.02-0.04	6.1-7.3	0-0	Low	0.05			
Lc*:												
Lewellen	0-4	12-27	1.25-1.45	0.6-2.0	0.20-0.22	7.9-9.0	2-16	Low	0.24	3	4L	4-8
	4-11	18-27	1.35-1.65	0.6-2.0	0.16-0.19	7.9-9.0	2-16	Low	0.37			
	11-30	1-5	1.55-1.80	6.0-20	0.06-0.11	7.9-9.0	2-16	Low	0.15			
	30-80	0-3	1.65-1.85	>20	0.02-0.04	6.1-7.3	0-0	Low	0.05			
McCuligan	0-7	12-27	1.25-1.45	0.6-2.0	0.20-0.22	7.9-8.4	0-4	Low	0.24	3	4L	4-8
	7-12	5-20	1.30-1.70	0.6-2.0	0.15-0.19	7.9-8.4	0-4	Low	0.37			
	12-18	1-8	1.40-1.60	6.0-20	0.07-0.09	7.9-8.4	0-4	Low	0.15			
	18-80	0-3	1.60-1.85	>20	0.02-0.04	6.6-7.8	0-2	Low	0.05			
Lf	0-5	16-25	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.8	0-0	Low	0.37	5	6	2-4
Lodgepole	5-32	35-50	1.25-1.50	0.00-0.06	0.13-0.18	6.1-7.8	0-0	High	0.28			
	32-60	8-27	1.30-1.50	0.6-2.0	0.22-0.24	6.6-8.4	0-0	Low	0.43			
Ma	0-7	5-15	1.40-1.50	2.0-6.0	0.16-0.18	6.6-8.4	0-0	Low	0.20	5	8	4-8
Marlake	7-14	3-8	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	0-0	Low	0.17			
	14-60	0-5	1.50-1.60	6.0-20	0.05-0.07	6.6-8.4	0-0	Low	0.17			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Mc	12-0	---	---	---	---	---	---	---	---	---	---	---
Marlake	0-7	---	0.07-0.18	2.0-6.0	0.35-0.45	5.6-7.3	0-0	Low	---	3	8	8-50
	7-60	0-5	1.50-1.60	6.0-20	0.05-0.07	6.1-7.3	0-0	Low	0.15			
MtC	0-7	10-20	1.30-1.60	0.6-2.0	0.16-0.20	7.4-8.4	0-0	Low	0.43	5	3	.5-2
Mitchell	7-60	8-18	1.20-1.60	0.6-2.0	0.16-0.22	7.4-8.4	0-0	Low	0.43			
MtD	0-5	10-20	1.30-1.60	0.6-2.0	0.16-0.20	7.4-8.4	0-0	Low	0.43	5	3	.5-2
Mitchell	5-60	8-18	1.20-1.60	0.6-2.0	0.16-0.22	7.4-8.4	0-0	Low	0.43			
MxF*:												
Mitchell	0-8	10-20	1.30-1.60	0.6-2.0	0.16-0.20	7.4-8.4	0-0	Low	0.43	5	3	.5-2
	8-60	8-18	1.20-1.60	0.6-2.0	0.16-0.22	7.4-8.4	0-0	Low	0.43			
Epping	0-5	10-20	1.25-1.45	0.6-2.0	0.12-0.20	6.6-8.4	<2	Low	0.43	2	3	.5-2
	5-11	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low	0.43			
	11-60	---	---	0.06-0.2	---	---	---	---	---			
Pg*	0-60	0-8	1.70-2.00	>6.0	0.02-0.09	6.6-8.4	<2	Low	0.10	2	8	<.5
Pits												
Ru	0-11	12-27	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-4	Low	0.28	4	4L	1-3
Rushcreek	11-34	12-30	1.30-1.65	0.6-2.0	0.17-0.19	7.4-8.4	0-4	Low	0.37			
	34-56	10-25	1.45-1.70	0.6-2.0	0.11-0.19	7.4-8.4	0-4	Low	0.28			
	56-80	0-3	1.65-1.85	>20	0.02-0.04	6.6-7.8	0-0	Low	0.05			
SaB, SaC	0-7	4-10	1.35-1.55	2.0-6.0	0.10-0.12	6.1-7.3	0-0	Low	0.17	5	2	.5-1
Sarben	7-15	10-18	1.45-1.75	2.0-6.0	0.10-0.19	6.1-7.3	0-0	Low	0.24			
	15-60	10-18	1.45-1.75	2.0-6.0	0.10-0.18	6.6-7.8	0-0	Low	0.24			
SaD	0-5	4-10	1.35-1.55	2.0-6.0	0.10-0.12	6.1-7.3	0-0	Low	0.17	5	2	.5-1
Sarben	5-15	10-18	1.45-1.75	2.0-6.0	0.10-0.19	6.1-7.3	0-0	Low	0.24			
	15-60	10-18	1.45-1.75	2.0-6.0	0.10-0.18	6.6-7.8	0-0	Low	0.24			
SaE	0-10	4-10	1.35-1.55	2.0-6.0	0.10-0.12	6.1-7.3	0-0	Low	0.17	5	2	.5-1
Sarben	10-15	10-18	1.45-1.75	2.0-6.0	0.10-0.19	6.1-7.3	0-0	Low	0.24			
	15-60	10-18	1.45-1.75	2.0-6.0	0.10-0.18	6.6-7.8	0-0	Low	0.24			
Sc	0-6	2-8	1.35-1.55	6.0-20	0.10-0.12	6.1-7.8	<2	Low	0.17	5	2	.5-1
Scoville	6-46	2-8	1.55-1.80	6.0-20	0.06-0.11	6.6-7.8	<2	Low	0.15			
	46-60	8-18	1.45-1.70	0.6-2.0	0.12-0.19	7.4-8.4	<2	Low	0.24			
SnC	0-11	10-20	1.20-1.40	0.6-2.0	0.20-0.24	6.6-7.8	0-0	Low	0.28	4	5	1-3
Sidney	11-29	5-18	1.15-1.30	0.6-2.0	0.15-0.19	7.4-8.4	0-0	Low	0.37			
	29-48	5-18	1.20-1.50	0.6-2.0	0.12-0.19	7.4-9.0	0-0	Low	0.37			
	48-60	---	---	0.2-0.6	---	---	---	---	---			
StD*:												
Sidney	0-9	10-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	0-0	Low	0.28	4	4L	1-3
	9-30	5-18	1.15-1.30	0.6-2.0	0.15-0.19	7.4-8.4	0-0	Low	0.37			
	30-44	5-18	1.20-1.50	0.6-2.0	0.12-0.19	7.4-9.0	0-4	Low	0.37			
	44-60	---	---	0.2-0.6	---	---	---	---	---			
Canyon	0-5	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-2	Low	0.32	2	4L	1-3
	5-10	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	0-2	Low	0.20			
	10-60	---	---	0.2-0.6	---	---	---	---	---			
SuG	0-3	5-17	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-0	Low	0.37	5	4L	.5-2
Sulco	3-60	8-17	1.20-1.40	0.6-2.0	0.16-0.20	7.4-9.0	0-4	Low	0.43			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
SxC2*:												
Sulco	0-6	5-17	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-0	Low	0.37	5	4L	.5-2
	6-60	8-17	1.20-1.40	0.6-2.0	0.16-0.20	7.4-9.0	0-4	Low	0.43			
McConaughy	0-6	7-18	1.20-1.40	0.6-2.0	0.20-0.23	6.6-7.8	<2	Low	0.28	5	5	1-3
	6-21	10-18	1.20-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	0.43			
	21-60	5-18	1.20-1.40	0.6-2.0	0.16-0.20	7.9-9.0	<2	Low	0.43			
SxD2*:												
Sulco	0-5	5-17	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-0	Low	0.37	5	4L	.5-2
	5-60	8-17	1.20-1.40	0.6-2.0	0.16-0.20	7.4-9.0	0-4	Low	0.43			
McConaughy	0-7	7-18	1.20-1.40	0.6-2.0	0.20-0.23	6.6-7.8	<2	Low	0.28	5	5	1-3
	7-28	10-18	1.20-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	0.43			
	28-60	5-18	1.20-1.40	0.6-2.0	0.16-0.20	7.9-9.0	<2	Low	0.43			
SxE2*:												
Sulco	0-6	5-17	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-0	Low	0.37	5	4L	.5-2
	6-60	8-17	1.20-1.40	0.6-2.0	0.16-0.20	7.4-9.0	0-4	Low	0.43			
McConaughy	0-6	7-18	1.20-1.40	0.6-2.0	0.20-0.23	6.6-7.8	<2	Low	0.28	5	5	1-3
	6-24	10-18	1.20-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	0.43			
	24-60	5-18	1.20-1.40	0.6-2.0	0.16-0.20	7.9-9.0	<2	Low	0.43			
SxF*:												
Sulco	0-4	5-17	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-0	Low	0.37	5	4L	.5-2
	4-60	8-17	1.20-1.40	0.6-2.0	0.16-0.20	7.4-9.0	0-4	Low	0.43			
McConaughy	0-10	7-18	1.20-1.40	0.6-2.0	0.20-0.23	6.6-7.8	<2	Low	0.28	5	5	1-3
	10-24	10-18	1.20-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	0.43			
	24-60	5-18	1.20-1.40	0.6-2.0	0.16-0.20	7.9-9.0	<2	Low	0.43			
TkG*:												
Tassel	0-7	5-12	1.50-1.75	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low	0.24	2	3	.5-1
	7-18	5-12	1.50-1.60	2.0-6.0	0.09-0.11	7.4-8.4	<2	Low	0.10			
	18-60	---	---	0.2-0.6	---	---	---	---	---			
Ashollow	0-3	5-18	1.20-1.40	2.0-6.0	0.17-0.19	7.4-8.4	0-0	Low	0.37	5	3	1-2
	3-60	5-18	1.20-1.50	2.0-6.0	0.15-0.18	7.4-8.4	0-0	Low	0.43			
Rock outcrop	0-60	---	---	---	---	---	<2	---	---	---	8	---
VaD	0-5	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15	5	1	.5-1
Valent	5-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15			
VaE	0-4	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15	5	1	.5-1
Valent	4-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15			
VaF*:												
Valent, rolling-	0-3	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15	5	1	.5-1
	3-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15			
Valent, hilly-	0-3	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15	5	1	.5-1
	3-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15			
VdB	0-6	3-10	1.55-1.65	6.0-20	0.07-0.12	6.6-7.8	0-0	Low	0.17	5	2	.5-1
Valent	6-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	0-0	Low	0.15			
Vt	0-8	10-18	1.25-1.40	2.0-6.0	0.11-0.17	5.6-7.8	0-0	Low	0.20	5	3	1-3
Vetal	8-22	12-18	1.25-1.40	2.0-6.0	0.11-0.17	6.1-7.8	0-0	Low	0.20			
	22-60	10-18	1.30-1.40	2.0-6.0	0.11-0.17	6.1-8.4	0-0	Low	0.20			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
WeB----------	0-8	2-10	1.60-1.90	6.0-20	0.03-0.10	8.5-9.9	0-8	Low-------	0.15	5	1	.5-3
Wildhorse	8-60	1-10	1.50-1.70	6.0-20	0.01-0.08	8.5-9.6	0-4	Low-------	0.15			
WhB*:												
Wildhorse-------	0-8	2-10	1.60-1.90	6.0-20	0.03-0.10	8.5-9.9	0-8	Low-------	0.15	5	1	.5-3
	8-60	1-10	1.50-1.70	6.0-20	0.01-0.08	8.5-9.6	0-4	Low-------	0.15			
Hoffland--------	0-7	15-20	1.20-1.50	2.0-6.0	0.16-0.19	7.9-8.4	0-2	Low-------	0.20	3	8	4-12
	7-12	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	0-0	Low-------	0.15			
	12-60	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-7.8	0-0	Low-------	0.15			
WkB*:												
Wildhorse-------	0-5	2-10	1.60-1.90	6.0-20	0.03-0.10	8.5-9.9	0-8	Low-------	0.15	5	1	.5-3
	5-60	1-10	1.50-1.70	6.0-20	0.01-0.08	8.5-9.6	0-4	Low-------	0.15			
Ipage----------	0-5	1-5	1.40-1.50	6.0-20	0.07-0.09	6.6-8.4	0-2	Low-------	0.15	5	1	.5-1
	5-10	1-8	1.50-1.60	6.0-20	0.04-0.10	6.6-8.4	0-2	Low-------	0.15			
	10-60	1-8	1.50-1.60	6.0-20	0.04-0.09	7.4-9.0	0-2	Low-------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--SOIL AND WATER FEATURES

("Flooding," "water table," and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ao, AoB---------- Alliance	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
Ar---------- Almeria	D	Frequent----	Brief-----	Feb-Jul	0-1.5	Apparent	Nov-Jun	>60	---	Moderate	High-----	Low.
AsF*:												
Ashollow----------	B	None---------	---	---	>6.0	---	---	>80	---	Low------	Low------	Low.
Tassel----------	D	None---------	---	---	>6.0	---	---	6-20	Soft	Low------	High-----	Low.
Bh, BhB, BhC, BmB, Bn---------- Bayard	B	None---------	---	---	>6.0	---	---	>80	---	Moderate	Low------	Low.
BpB---------- Blanche	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	Low------	Low.
BrF*---------- Blueridge	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Bw---------- Broadwater	A	Frequent----	Very brief	Dec-May	>6.0	---	---	>60	---	Low------	Low------	Low.
BxD*, BxE*:												
Busher----------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Low------	Low------	Low.
Tassel----------	D	None---------	---	---	>6.0	---	---	6-20	Soft	Low------	High-----	Low.
Cw---------- Crowther	D	Rare---------	---	---	0-1.5	Apparent	Nov-May	>60	---	Moderate	High-----	Low.
Cx---------- Crowther	D	Rare---------	---	---	+.5-1.0	Apparent	Nov-Jun	>60	---	Moderate	High-----	Low.
DbB---------- Dailey	A	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
DdC---------- Dankworth	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Dw---------- Duroc	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Eh---------- Els	A	None--------	---	---	1.5-3.0	Apparent	Nov-May	>80	---	Moderate	Moderate	Moderate.
EuG*:												
Epping----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Low------	Low.
Rock outcrop-----	D	None--------	---	---	>6.0	---	---	0	Soft	---	---	---
Fu*---------- Pluvaquents	D	Frequent----	Brief to very long.	Nov-Jun	+2-1.0	Apparent	Jan-Dec	>60	---	Moderate	High-----	Low.
Gt---------- Gothenburg	D	Frequent----	Brief-----	Dec-Jul	0-1.5	Apparent	Nov-Jun	>80	---	Moderate	Moderate	Low.
Hh---------- Hoffland	D	Rare--------	---	---	0-1.5	Apparent	Nov-May	>80	---	Moderate	High-----	Low.
Ho---------- Hoffland	D	Rare--------	---	---	+.5-1.0	Apparent	Nov-Jun	>80	---	Moderate	High-----	Low.
IsB---------- Ipage	A	None--------	---	---	3.0-5.0	Apparent	Dec-Jun	>80	---	Moderate	Low------	Moderate.
Ja---------- Jankosh	C	Rare--------	---	---	1.5-3.0	Apparent	Dec-Jun	>80	---	Moderate	High-----	High.
JeB, JeC, Jg, JgC- Jayem	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
KeB, KeC---------- Keith	B	None--------	---	---	>6.0	---	---	>80	---	Moderate	Moderate	Low.
Ku---------- Kuma	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
La---------- Lemoyne	B	Rare--------	---	---	3.0-6.0	Apparent	Nov-Apr	>80	---	Low------	Moderate	Low.
Lb---------- Lewellen	B	Rare--------	---	---	1.5-3.0	Apparent	Nov-Apr	>80	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Lc*:												
Lewellen	B	Rare	---	---	1.5-3.0	Apparent	Nov-Apr	>80	---	Moderate	High	Low.
McCuligan	D	Occasional	Brief	Feb-Jul	0-1.5	Apparent	Nov-Apr	>80	---	Moderate	High	Low.
Lf	D	None	---	---	+.5-1.0	Perched	Mar-Jul	>80	---	High	High	Low.
Lodgepole												
Ma	D	None	---	---	+2-1.0	Apparent	Nov-Jun	>60	---	Moderate	High	Low.
Marlake												
Mc	D	None	---	---	+2-1.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Moderate.
Marlake												
MtC, MtD	B	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
Mitchell												
MxF*:												
Mitchell	B	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
Epping	D	None	---	---	>6.0	---	---	10-20	Soft	Low	Low	Low.
Pg*	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Pits												
Ru	B	Rare	---	---	3.0-6.0	Apparent	Nov-Apr	>80	---	Moderate	High	Low.
Rushcreek												
SaB, SaC, SaD, SaE	B	None	---	---	>6.0	---	---	>80	---	Low	High	Low.
Sarben												
Sc	A	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Scoville												
SnC	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	High	Low.
Sidney												
StD*:												
Sidney	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	High	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	Low	Low.
SuG	B	None	---	---	>6.0	---	---	>80	---	Low	High	Low.
Sulco												

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
SxC2*, SxD2*, SxE2*, SxF*:												
Sulco	B	None	---	---	>6.0	---	---	>80	---	Low	High	Low.
McConaughy	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
TkG*:												
Tassel	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Ashollow	B	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
Rock outcrop	D	None	---	---	>6.0	---	---	0	Soft	---	---	---
VaD, VaE Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
VaF*:												
Valent, rolling	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Valent, hilly	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
VdB Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Vt Vetal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
WeB Wildhorse	A	None	---	---	1.5-3.5	Apparent	Nov-May	>80	---	Moderate	High	High.
WhB*:												
Wildhorse	A	None	---	---	1.5-3.5	Apparent	Nov-May	>80	---	Moderate	High	High.
Hoffland	D	Rare	---	---	0-1.5	Apparent	Nov-May	>80	---	Moderate	High	Low.
WkB*:												
Wildhorse	A	None	---	---	1.5-3.5	Apparent	Nov-May	>80	---	Moderate	High	High.
Ipage	A	None	---	---	3.0-5.0	Apparent	Dec-Jun	>80	---	Moderate	Low	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--ENGINEERING INDEX TEST DATA

(LL means liquid limit; PI, plasticity index; and NP, nonplastic)

Soil name, report number, horizon, and depth in inches*	AASHTO classification	Grain-size distribution: Percentage passing sieve-- No. 40	No. 200	Percentage smaller than-- .05 mm	.002 mm	LL	PI	Specific gravity
						Pct		
Alliance loam (S88NE-069-84)								
Ap----- 0 to 8	A-4(8)	98	81	67	17	27	4	2.56
Bt----- 8 to 19	A-4(8)	98	86	69	17	31	10	2.63
BcK---- 19 to 30	A-4(8)	98	83	67	19	32	9	2.63
C------ 30 to 44	A-4(8)	96	85	65	16	28	5	2.65
Kuma loam (S88NE-069-76)								
Ap----- 0 to 7	A-4(8)	99	89	77	12	26	3	2.56
Bt----- 17 to 24	A-6(9)	100	90	78	24	34	13	2.60
Bk----- 44 to 60	A-4(8)	100	89	73	12	27	4	2.62
Sidney loam (S88NE-069-83)								
Ap----- 0 to 6	A-4(8)	98	76	59	16	27	6	2.57
Bw----- 11 to 17	A-4(7)	97	71	50	16	28	9	2.61
Bk----- 17 to 29	A-4(5)	96	59	46	15	26	7	2.65
C------ 29 to 48	A-4(4)	96	55	40	14	23	1	2.64
Vetal fine sandy loam (S88NE-069-91)								
Ap----- 0 to 8	A-4(4)	99	55	35	9	NP	NP	2.60
AC----- 22 to 38	A-4(7)	99	69	40	15	23	2	2.62
C------ 38 to 60	A-4(6)	99	64	42	11	23	3	2.63

* The locations of the sampled pedons are as follows:

Alliance loam, 2,250 feet east and 300 feet south of the northwest corner of sec. 28, T. 15 N., R. 44 W.

Kuma loam, 1,200 feet south and 75 feet west of the northeast corner of sec. 15, T. 15 N., R. 46 W.

Sidney loam, 1,450 feet south and 200 feet east of the northwest corner of sec. 24, T. 15 N., R. 45 W.

Vetal fine sandy loam, 200 feet north and 300 feet west of the southeast corner of sec. 11, T. 15 N., R. 43 W.

TABLE 21.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Alliance	Fine-silty, mixed, mesic Aridic Argiustolls
Almeria	Sandy, mixed, mesic Typic Fluvaquents
Ashollow	Coarse-loamy, mixed (calcareous), mesic Aridic Ustorthents
Bayard	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Blanche	Coarse-loamy, mixed, mesic Aridic Haplustolls
Blueridge	Mixed, mesic Aridic Ustipsamments
Broadwater	Sandy, mixed, mesic Aridic Ustifluvents
Busher	Coarse-loamy, mixed, mesic Aridic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Crowther	Coarse-loamy over sandy or sandy-skeletal, mesic Typic Calciaquolls
Dailey	Sandy, mixed, mesic Torriorthentic Haplustolls
Dankworth	Mixed, mesic Aridic Ustipsamments
Duroc	Fine-silty, mixed, mesic Pachic Haplustolls
Els	Mixed, mesic Aquic Ustipsamments
Epping	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Fluvaquents	Fluvaquents
Gothenburg	Mixed, mesic Typic Psammaquents
Hoffland	Sandy, mixed, mesic Mollic Endoaquepts
Ipage	Mixed, mesic Oxyaquic Ustipsamments
Jankosh	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), mesic Aeric Halaquepts
Jayem	Coarse-loamy, mixed, mesic Aridic Haplustolls
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Kuma	Fine-silty, mixed, mesic Pachic Argiustolls
Lemoyne	Sandy over loamy, mixed, mesic Haplocalcidic Ustochrepts
Lewellen	Sandy, mixed, mesic Typic Halaquepts
Lodgepole	Fine, montmorillonitic, mesic Typic Argiaquolls
Marlake	Mixed, mesic Mollic Psammaquents
McConaughy	Coarse-silty, mixed, mesic Aridic Haplustolls
McCulligan	Sandy, mixed, mesic Mollic Fluvaquents
*Mitchell	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Rushcreek	Fine-loamy, mixed, mesic Fluventic Haplustolls
Sarben	Coarse-loamy, mixed, nonacid, mesic Aridic Ustorthents
Scoville	Mixed, mesic Aridic Ustipsamments
Sidney	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Sulco	Coarse-silty, mixed (calcareous), mesic Aridic Ustorthents
Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Valent	Mixed, mesic Ustic Torripsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls
Wildhorse	Sandy, mixed, mesic Typic Halaquepts

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Map symbol and soil name	Land capability		Prime farmland*	Range site	Windbreak suitability group
	Dryland	Irrigated			
Ao---------- Alliance	IIc-1	I-4	Yes	Silty----------	3
AoB---------- Alliance	IIe-1	IIe-4	Yes	Silty----------	3
Ar---------- Almeria	VIw-7	---	---	Wet Subirrigated-----	10
AsF:					
Ashollow----------	VIs-3	---	---	Sandy----------	8
Tassel----------	VIs-4	---	---	Shallow Limy---------	10
Bh---------- Bayard	IIIe-3	IIe-8	Yes	Sandy----------	5
BhB---------- Bayard	IIIe-3	IIe-8	Yes	Sandy----------	5
BhC---------- Bayard	IVe-3	IIIe-8	Yes	Sandy----------	5
BmB---------- Bayard	IIIe-3	IIe-8	Yes	Sandy----------	5
Bn---------- Bayard	IIIc-1	I-8	Yes	Sandy----------	5
BpB---------- Blanche	IVe-5	IVe-11	---	Sandy----------	6R
BrF---------- Blueridge	VIs-4	---	---	Shallow to Gravel----	10
Bw---------- Broadwater	VIw-7	---	---	Shallow to Gravel----	10
BxD:					
Busher----------	IVe-3	IVe-8	---	Sandy----------	5
Tassel----------	VIs-4	---	---	Shallow Limy---------	10
BxE:					
Busher----------	VIe-5	---	---	Sandy----------	7
Tassel----------	VIs-4	---	---	Shallow Limy---------	10
Cw---------- Crowther	Vw-7	---	---	Wet Subirrigated-----	2D
Cx---------- Crowther	Vw-7	---	---	Wetland----------	10
DbB---------- Dailey	IVe-5	IVe-11	---	Sandy----------	5
DdC---------- Dankworth	VIe-5	IVe-11	---	Sands----------	7

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability		Prime farmland*	Range site	Windbreak suitability group
	Dryland	Irrigated			
Dw---------- Duroc	IIc-1	I-6	Yes	Silty----------	1
Eh---------- Els	VIe-5	IVw-12	---	Subirrigated---------	2S
EuG:					
Epping----------	VIIs-4	---	---	Shallow Limy---------	10
Rock outcrop----------	VIIIs-8	---	---	---	10
Fu---------- Fluvaquents	VIIIw-7	---	---	---	10
Gt---------- Gothenburg	VIIw-7	---	---	---	10
Hh---------- Hoffland	Vw-7	---	---	Wet Subirrigated-----	2D
Ho---------- Hoffland	Vw-7	---	---	Wetland----------	10
IsB---------- Ipage	VIe-5	IVe-12	---	Sandy Lowland--------	7
Ja---------- Jankosh	VIs-1	---	---	Saline Subirrigated--	10
JeB---------- Jayem	IVe-5	IIIe-10	---	Sandy----------	5
JeC---------- Jayem	IVe-5	IVe-10	---	Sandy----------	5
Jg---------- Jayem	IIIe-3	IIe-8	Yes	Sandy----------	5
JgC---------- Jayem	IVe-3	IIIe-8	Yes	Sandy----------	5
KeB---------- Keith	IIe-1	IIe-4	Yes	Silty----------	3
KeC---------- Keith	IIIe-1	IIIe-4	Yes	Silty----------	3
Ku---------- Kuma	IIc-1	I-4	Yes	Silty----------	3
La---------- Lemoyne	VIe-5	IVe-12	---	Sandy Lowland--------	5
Lb---------- Lewellen	VIs-1	---	---	Saline Subirrigated--	9S
Lc:					
Lewellen----------	VIs-1	---	---	Saline Subirrigated--	9S
McCuligan----------	Vw-7	---	---	Wet Subirrigated-----	2D

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability		Prime farmland*	Range site	Windbreak suitability group
	Dryland	Irrigated			
Lf---------- Lodgepole	IIIw-2	IVw-2	---	Clayey Overflow------	2W
Ma---------- Marlake	VIIIw-7	---	---	---	10
Mc---------- Marlake	VIIIw-7	---	---	---	10
MtC---------- Mitchell	IIIe-3	IIIe-6	Yes	Limy Upland----------	8
MtD---------- Mitchell	IVe-3	IVe-6	---	Limy Upland----------	8
MxF:					
Mitchell----------	VIe-3	---	---	Limy Upland----------	8
Epping----------	VIs-4	---	---	Shallow Limy---------	10
Pg---------- Pits	VIIIs-8	---	---	---	10
Ru---------- Rushcreek	IVs-1	IIIs-6	---	Saline Lowland-------	9N
SaB---------- Sarben	IVe-5	IIIe-10	---	Sandy----------	5
SaC---------- Sarben	IVe-5	IVe-10	---	Sandy----------	5
SaD---------- Sarben	VIe-5	IVe-10	---	Sandy----------	5
SaE---------- Sarben	VIe-5	---	---	Sandy----------	7
Sc---------- Scoville	IVe-5	IVe-11	---	Sandy----------	5
SnC---------- Sidney	IIIe-1	IIIe-6	Yes	Silty----------	3
StD:					
Sidney----------	IVe-1	IVe-6	---	Silty----------	3
Canyon----------	VIs-4	---	---	Shallow Limy---------	10
SuG---------- Sulco	VIIe-9	---	---	Thin Loess----------	10
SxC2:					
Sulco----------	IVe-9	IIIe-6	Yes	Limy Upland----------	8
McConaughy----------	IVe-1	IIIe-6	Yes	Silty----------	3
SxD2:					
Sulco----------	IVe-9	IVe-6	---	Limy Upland----------	8
McConaughy----------	IVe-1	IVe-6	---	Silty----------	3
SxE2:					
Sulco----------	VIe-9	---	---	Limy Upland----------	8
McConaughy----------	VIe-1	---	---	Silty----------	3

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability		Prime farmland*	Range site	Windbreak suitability group
	Dryland	Irrigated			
SxF:					
Sulco	VIe-9	---	---	Limy Upland	10
McConaughy	VIe-1	---	---	Silty	3
TkG:					
Tassel	VIIs-4	---	---	Shallow Limy	10
Ashollow	VIIe-5	---	---	Sandy	8
Rock outcrop	VIIIs-8	---	---	---	10
VaD Valent	VIe-5	IVe-12	---	Sands	7
VaE Valent	VIe-5	---	---	Sands	7
VaF:					
Valent, rolling	VIe-5	---	---	Sands	7
Valent, hilly	VIIe-5	---	---	Choppy Sands	10
VdB Valent	VIe-5	IVe-11	---	Sandy	7
WeB Wildhorse	VIs-1	---	---	Saline Subirrigated	10
WhB:					
Wildhorse	VIs-1	---	---	Saline Subirrigated	10
Hoffland	Vw-7	---	---	Wet Subirrigated	2D
WkB:					
Wildhorse	VIs-1	---	---	Saline Subirrigated	10
Ipage	VIe-5	IVe-12	---	Sandy Lowland	7

* Where irrigated.

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