



United States  
Department of  
Agriculture



Natural  
Resources  
Conservation  
Service

In cooperation with  
Oklahoma Agriculture  
Experiment Station and  
Oklahoma Conservation  
Commission

# Soil Survey of Noble County, Oklahoma





# How To Use This Soil Survey

## General Soil Map

The general soil map, which is a color map, 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.

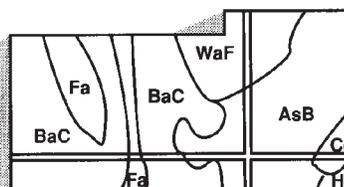
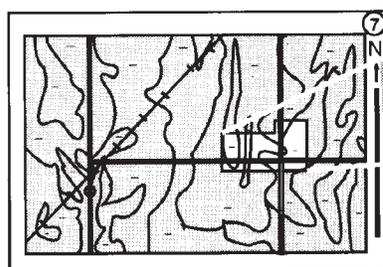
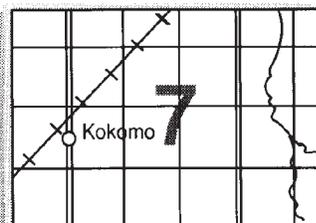
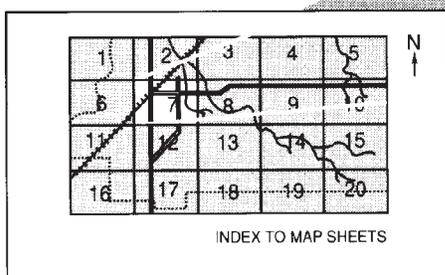
To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

## Detailed Soil Maps

The detailed soil maps 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**. Note the number of the map sheet and turn to that sheet.

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



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

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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 1992. Soil names and descriptions were approved in 1994. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1996. This survey was mapped utilizing survey photographic imagery of 1:24,000 and rectified to 1995 digital orthophotography for SSURGO digitizing. This survey was made cooperatively by the Natural Resources Conservation Service, the Oklahoma Agriculture Experiment Station, and the Oklahoma Conservation Commission. It is part of the technical assistance furnished to the Noble County Conservation District.

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

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**Cover: Wheat on a terraced field of Renfrow silt loam, 3 to 5 percent slopes, and Renfrow silt loam, 1 to 3 percent slopes.**

*Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at <http://www.nrcs.usda.gov>.*

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# Foreword

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This soil survey contains information that can be used in land-planning programs in Noble 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, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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

M. Darrel Dominick  
State Conservationist  
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# Soil Survey of Noble County, Oklahoma

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Fieldwork by Gregory F. Scott, Troy L. Collier, Jim E. Henley, R. Dwaine Gelnar, and Karen B. Stevenson, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,  
in cooperation with  
Oklahoma Agriculture Experiment Station and Oklahoma Conservation Commission

NOBLE COUNTY is located in north-central Oklahoma (fig. 1). It has an area of about 475,475 acres, or about 742 square miles. The population of the county is 11,388. Perry, the county seat, is in the southwestern part of the county and has a population of about 5,230. Lake McMurtry, Sooner Lake, the Arkansas River, and other water areas of more than 40 acres in size make up about 5,400 acres. Noble County is bordered on the north by Kay and Osage Counties, on the east by Pawnee County, on the west by Garfield County, and on the south by Logan and Payne Counties.

This soil survey updates the survey of Noble County published in 1956 (9). It provides additional information and has maps on a photographic background.

## General Nature of the Survey Area

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

### History

Noble County is located in the part of Oklahoma known as the Cherokee Outlet or "Cherokee Strip." In the 1800's, cattlemen leased the area from the Cherokee Tribe and used the land to fatten cattle from Texas before moving them to railheads in Kansas. The West Shawnee Trail went through Noble County from Boggy Depot in Atoka County, Oklahoma, to Wichita, Kansas. Part of the strip was opened to settlers at noon on September 16, 1893. This was one of a series of "runs" that opened "unassigned lands" to white settlement. The Ponca Tribe and the Otoe-Missouri Tribe retained land in the northern part of the survey area.

As the survey area was settled, the land gradually changed from lush bluestem prairies to areas of cultivated crops. Alfalfa, corn, cotton, and small grains were the major crops of the early settlers. Today, wheat is the main crop.

### Physiography and Drainage

Noble County is within the Central Rolling Red Prairies Major Land Resource Area (MLRA 80A) and the Cross Timbers Major Land Resource Area (MLRA 84A). Most of the county drains eastward into the Arkansas River. The southern one-fourth of the county is drained by Stillwater Creek, which drains southeastward into the Cimarron River. The Arkansas River and the Salt Fork of the Arkansas River border the

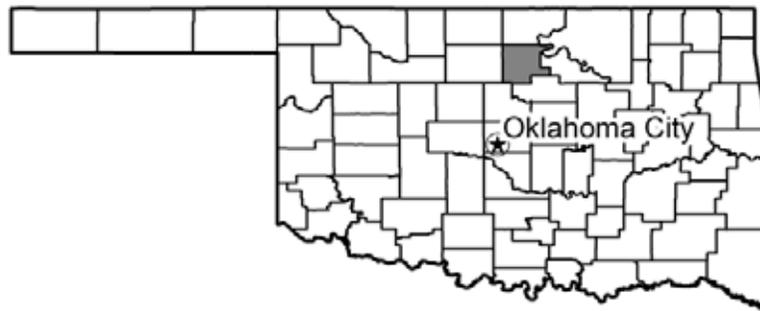


Figure 1.—Location of Noble County in Oklahoma.

northeastern corner of the county. Black Bear Creek and Red Rock Creek drain the western and eastern parts of the county. Major flooding occurs along Black Bear Creek, Red Rock Creek, the Salt Fork of the Arkansas River, and the Arkansas River.

The relief in Noble County is dominantly gently undulating to steep uplands. The northern half of the county has a large area of nearly level to gently undulating uplands, and the southern half of the county dominantly has undulating to steep uplands. Elevation ranges from 840 feet, in the Arkansas River Valley in the northeastern part of the county, to 1,270 feet, in the southwestern part of the county.

### Natural Resources

The mineral and water resources of Noble County are important to the overall development and progress of the county. Petroleum production is by far the most important mineral activity. In 1993, petroleum production in Noble County amounted to about 1.7 million barrels of crude oil (valued at \$28.5 million) and about 5 billion cubic feet of natural gas (valued at \$9.6 million). Due to these production levels, Noble County ranks near the middle of the petroleum-producing counties in Oklahoma.

Sand and gravel have been produced from a number of sites in the alluvial and terrace deposits of the county, and thin beds of limestone and sandstone have been quarried at several sites for the construction of highways and county roads. In addition, a number of small deposits of copper minerals occur at scattered locations in the county, although these deposits are not commercially mined at this time.

Small or moderate quantities of good-quality ground water occur in some of the Quaternary alluvial and terrace deposits and are locally available from thin sandstone beds in the Wellington Formation. A number of wells in Noble County yield 5 to 30 gallons of water per minute. There are also a large number of test wells, which do not yield even enough water for household use (3, 8).

### Climate

The table "Temperature and Precipitation" gives data on temperature and precipitation for the survey area as recorded at Billings, Oklahoma, in the period 1971 to 2000. The table "Freeze Dates in Spring and Fall" shows probable dates of the first freeze in fall and the last freeze in spring. The table "Growing Season" provides data on the length of the growing season.

In winter, the average temperature is 36.2 degrees F and the average daily minimum temperature is 25.4 degrees. The lowest temperature on record, which occurred at Billings on January 8, 1988, was -15 degrees. In summer, the average temperature is 80.0 degrees and the average daily maximum temperature is 91.8 degrees. The highest recorded temperature, which occurred at Billings on July 7, 1996, was 113 degrees.

Growing degree days are shown in the table "Temperature and Precipitation." 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 average annual total precipitation is 35.75 inches. Of this, 25.7 inches, or about 72 percent, usually falls in April through October. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 7.88 inches, which occurred at Billings on October 3, 1986. Thunderstorms occur on about 50 days each year, and most occur between May and August.

The average seasonal snowfall is 9.1 inches. The greatest snow depth at any one time during the period of record was 12 inches, which was recorded on March 14, 1999. On an average, 5 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 14.2 inches, which was recorded on March 14, 1999.

The average relative humidity in mid-afternoon is about 52 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 78 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the south. Average windspeed is highest, around 14 miles per hour, in March and April.

Temperature and Precipitation  
(Recorded in the period 1971-2000 at Billings, Oklahoma)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 in or more	Average snow-fall
				Maximum temp. higher than--	Minimum temp. lower than--			Less than--	More than--		
	°F	°F	°F	°F	°F	Units	In	In	In	In	In
January--	44.2	22.9	33.6	71	-2	4	1.18	0.27	1.93	2	2.6
February-	50.5	27.3	38.9	78	0	21	1.53	0.43	2.44	3	2.9
March----	59.8	35.9	47.8	85	12	102	3.13	1.52	4.58	5	1.5
April----	69.7	44.3	57.0	90	25	241	3.59	1.66	5.25	5	0.0
May-----	78.2	55.3	66.7	95	37	504	4.84	2.23	7.08	6	0.0
June-----	88.2	65.4	76.8	101	50	797	4.34	2.05	6.30	5	0.0
July-----	94.4	70.6	82.5	107	58	1,005	3.11	1.35	4.61	4	0.0
August---	92.9	68.8	80.8	105	54	930	3.10	1.09	4.77	3	0.0
September	84.1	60.4	72.3	103	37	643	3.80	1.33	5.84	4	0.0
October--	73.2	48.1	60.6	91	26	339	2.96	0.86	4.66	3	0.0
November-	57.8	35.3	46.5	80	14	74	2.57	0.68	4.12	3	0.5
December-	46.4	26.0	36.2	72	2	7	1.59	0.44	2.52	3	1.6
Yearly:											
Average-	69.9	46.7	58.3	---	---	---	---	---	---	---	---
Extreme-	113	-15	---	108	-6	---	---	---	---	---	---
Total---	---	---	---	---	---	4,668	35.75	29.94	41.31	46	9.1

\* 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).

Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Billings, Oklahoma)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 2	Apr. 14	Apr. 22
2 years in 10 later than--	Mar. 26	Apr. 8	Apr. 18
5 years in 10 later than--	Mar. 12	Mar. 26	Apr. 8
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 29	Oct. 25	Oct. 7
2 years in 10 earlier than--	Nov. 6	Oct. 30	Oct. 13
5 years in 10 earlier than--	Nov. 20	Nov. 10	Oct. 26

Growing Season

(Recorded for the period 1971-2000 at Billings, Oklahoma)

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	220	199	180
8 years in 10	231	208	186
5 years in 10	251	227	199
2 years in 10	271	245	212
1 year in 10	281	255	219

## How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; 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 and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate 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-vegetation-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 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 (13). 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. Soil taxonomy, 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 and 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 predict that a high water table will always be at a specific level in the soil on a specific date.

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

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.



# General Soil Map Units

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The general soil map shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in another but in a different pattern.

The general soil map is part of the State Soil Geographic Data Base (STATSGO). It is at a scale of 1 to 250,000. It should not be used to locate soils for intensive land uses, such as determining the suitability of a soil for house lots. It is useful for understanding the soil resource and for planning broad land uses in a State or region. The component composition of a STATSGO map unit does not statistically represent a subset (county) or any one portion of the whole STATSGO map unit. A STATSGO map unit may have up to 21 named components, but any one particular area within the STATSGO map unit may not consist of all named components or the components of the entire STATSGO map unit.

The general soil map reflects the STATSGO composition of the county subset. The subset name of a general soil map unit may vary from county to county, but it is within the parameters of the entire STATSGO map unit. In the legend for the general soil map, the STATSGO map unit name is listed first and the county general soil map unit name is listed (in parentheses) directly after the STATSGO name. The STATSGO reference number (which consists of the letters "OK" followed by a three-digit number) precedes the STATSGO name.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that 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 map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

## 1. OK086—Grainola-Lucien-Renfrow (Grainola-Lucien-Masham)

*Moderately deep and shallow, well drained, gently sloping to steep soils that formed in material weathered from shale or interbedded shale and sandstone; on prairie uplands (fig. 2)*

### **Setting**

*Location in the survey area:* Southern part of the county

*Primary landscape:* Hills

*Slope range:* 3 to 40 percent

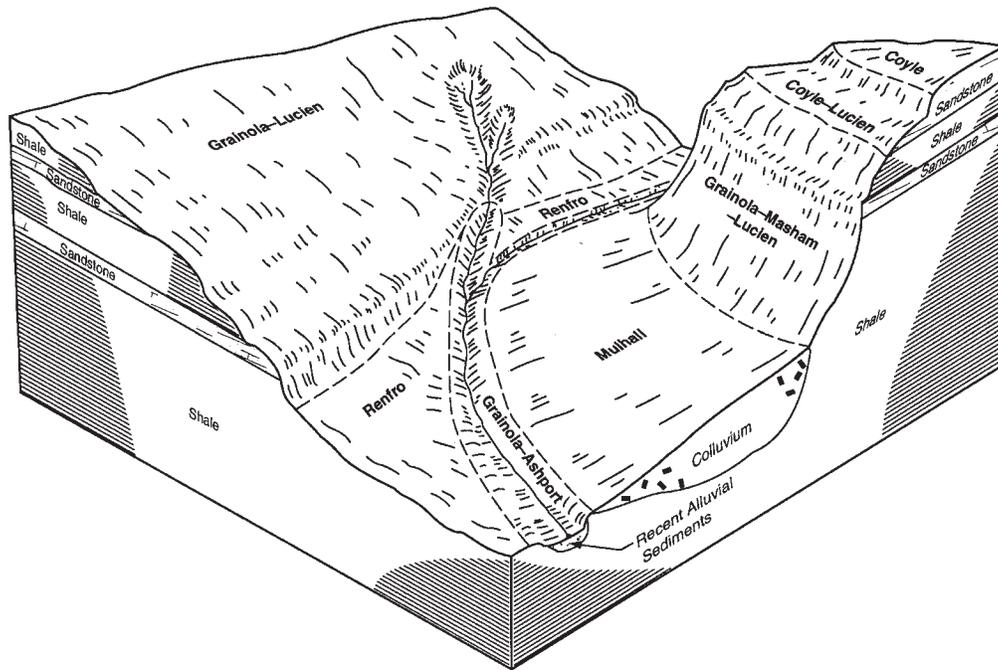


Figure 2.—Typical pattern of soils and underlying material in the Grainola-Lucien-Masham general soil map unit.

### Composition

Extent of map unit in the survey area: 14 percent

Extent of the components in the map unit:

Grainola soils—40 percent

Lucien soils—19 percent

Masham soils—11 percent

Minor soils (including Highview, Norge, Dilworth, Renfrow, Westsum, Mulhall, Kingfisher, Coyle, Ashport, Dale, Port, and Pulaski)—30 percent

### Soil Characteristics

#### Grainola

*Surface layer:* Reddish brown clay loam

*Subsoil:* Red silty clay

*Bedrock:* Red shale interbedded with siltstone

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Backslopes and footslopes of upland hills

*Slope range:* 5 to 40 percent

*Parent material:* Shale

#### Lucien

*Surface layer:* Dark brown loam

*Subsoil:* Reddish brown loam

*Bedrock:* Red sandstone

*Depth class:* Shallow

*Drainage class:* Well drained

*Seasonal high water table:* None

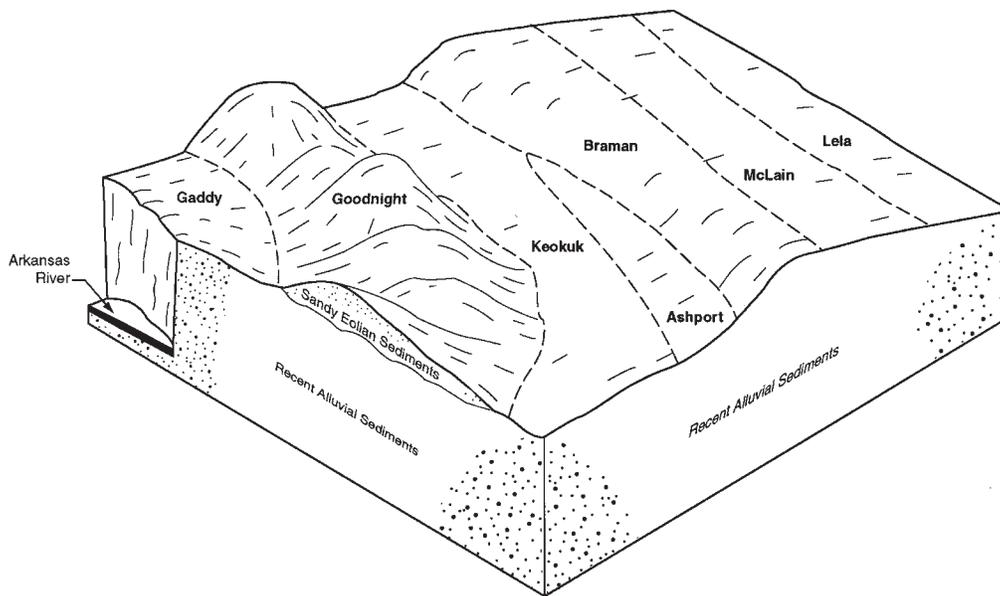


Figure 3.—Typical pattern of soils and underlying material in the Keokuk-Goodnight-Ashport and the McLain-Braman-Lela general soil map units.

*Major landform:* Summits and shoulders of upland hills

*Slope range:* 3 to 12 percent

*Parent material:* Sandstone

#### **Masham**

*Surface layer:* Reddish brown silty clay loam

*Subsoil:* Reddish brown silty clay

*Bedrock:* Red shale

*Depth class:* Shallow

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Backslopes of upland hills

*Slope range:* 8 to 40 percent

*Parent material:* Shale

#### ***Use and Management***

*Major uses:* Rangeland

*Management concerns:* Conservation of moisture, soil blowing, soil fertility, areas of rock outcrop, depth to bedrock, water erosion, potential of ground-water pollution, lime content, limited available water capacity, poor tilth, restricted permeability, slope, and surface stones or boulders

## **2. OK091—Keokuk-Pulaski-Roebuck (Keokuk-Goodnight-Ashport)**

*Very deep, well drained and excessively drained, nearly level to hilly soils that formed in alluvial sediment under prairie grasses and scattered bottomland hardwoods (fig. 3)*

#### ***Setting***

*Location in the survey area:* Flood plains along the Arkansas River and the Salt Fork of the Arkansas River

*Primary landscape:* Valley  
*Slope range:* 0 to 20 percent

### **Composition**

*Extent of map unit in the survey area:* 1 percent

*Extent of the components in the map unit:*

Keokuk soils—42 percent

Goodnight soils—17 percent

Ashport soils—14 percent

Minor soils (including Port, Tearney, Pulaski, Reinach, Miller, and Gaddy)—27 percent

### **Soil Characteristics**

#### **Keokuk**

*Surface layer:* Reddish brown very fine sandy loam

*Subsoil:* Reddish brown silt loam

*Underlying material:* Light reddish brown loamy very fine sand

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Flood plains

*Slope range:* 0 to 1 percent

*Parent material:* Loamy alluvium

#### **Goodnight**

*Surface layer:* Dark yellowish brown loamy fine sand

*Subsoil:* Brown and pink fine sand

*Underlying material:* Yellow fine sand

*Depth class:* Very deep

*Drainage class:* Excessively drained

*Seasonal high water table:* None

*Major landform:* Dunes on flood plains

*Slope range:* 3 to 20 percent

*Parent material:* Aeolian sand

#### **Ashport**

*Surface layer:* Reddish brown silt loam

*Subsoil:* Reddish brown silty clay loam

*Underlying material:* Reddish brown silty clay loam

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Flood plains

*Slope range:* 0 to 1 percent

*Parent material:* Loamy alluvium

### **Use and Management**

*Major uses:* Cropland, pasture, and hayland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility and tilth, excessive permeability, potential of ground-water pollution, slope, and flooding

### 3. OK093—Kirkland-Bethany-Tabler (Bethany-Kirkland-Norge-Tabler)

*Very deep, moderately well drained and well drained, nearly level to gently sloping soils that formed in old loamy and clayey alluvial sediment under prairie vegetation*

#### **Setting**

*Location in the survey area:* Northern and western parts of the county

*Primary landscape:* Plains on uplands

*Slope range:* 0 to 5 percent

#### **Composition**

*Extent of map unit in the survey area:* 8 percent

*Extent of the components in the map unit:*

Bethany soils—35 percent

Kirkland soils—30 percent

Norge soils—13 percent

Tabler soils—10 percent

Minor soils (including Grainola, Kingfisher, Pawhuska, Renfrow, Ashport, and Port)—12 percent

#### **Soil Characteristics**

##### **Bethany**

*Surface layer:* Brown silt loam

*Subsoil:* Dark brown and dark grayish brown silty clay loam in the upper part and brown, reddish yellow, red, and pinkish gray silty clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Broad plane summits and plane to concave footslopes

*Slope range:* 0 to 3 percent

*Parent material:* Loamy and clayey alluvium

##### **Kirkland**

*Surface layer:* Grayish brown silt loam

*Subsoil:* Dark grayish brown and grayish brown silty clay in the upper part and brown and reddish yellow silty clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Broad plane summits and plane to concave footslopes

*Slope range:* 0 to 3 percent

*Parent material:* Loamy and clayey alluvium

##### **Norge**

*Surface layer:* Brown silt loam

*Subsoil:* Reddish brown silt loam in the upper part and reddish brown, yellowish red, and red clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Summits and backslopes

*Slope range:* 0 to 5 percent  
*Parent material:* Loamy alluvium

#### **Tabler**

*Surface layer:* Grayish brown silt loam  
*Subsoil:* Very dark gray silty clay in the upper part, dark grayish brown silty clay in the middle part, and light brownish gray and reddish brown silty clay loam in the lower part  
*Depth class:* Very deep  
*Drainage class:* Moderately well drained  
*Seasonal high water table:* None  
*Major landform:* Broad plane summits and depressional areas  
*Slope range:* 0 to 1 percent  
*Parent material:* Loamy and clayey alluvium

#### ***Use and Management***

*Major uses:* Cropland  
*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility and tilth, restricted permeability, and water table

### **4. OK097—McLain-Dale-Reinach (McLain-Braman-Lela)**

*Very deep, well drained to somewhat poorly drained, nearly level soils that formed in alluvial sediment under prairie grasses and scattered bottomland hardwoods (fig. 3)*

#### ***Setting***

*Location in the survey area:* Flood plains along the Arkansas River and Bird's Nest Creek  
*Primary landscape:* Valley  
*Slope range:* 0 to 1 percent

#### ***Composition***

*Extent of map unit in the survey area:* 0.5 percent  
*Extent of the components in the map unit:*  
 McLain soils—47 percent  
 Braman soils—28 percent  
 Lela soils—13 percent  
 Minor soils (including Dale, Port, Ashport, Pulaski, and Gaddy)—12 percent

#### ***Soil Characteristics***

##### **McLain**

*Surface layer:* Reddish brown silty clay loam  
*Subsoil:* Dark reddish gray silty clay loam in the upper part, reddish brown silty clay loam in the middle part, and reddish brown silty clay in the lower part  
*Depth class:* Very deep  
*Drainage class:* Moderately well drained  
*Seasonal high water table:* None  
*Major landform:* Flood plains  
*Slope range:* 0 to 1 percent  
*Parent material:* Clayey and loamy alluvium

##### **Braman**

*Surface layer:* Dark brown silt loam

*Subsoil:* Reddish brown silty clay loam in the upper part and reddish brown silt loam in the lower part

*Underlying material:* Stratified reddish brown silty clay and loam

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Flood plains

*Slope range:* 0 to 1 percent

*Parent material:* Loamy alluvium

### **Lela**

*Surface layer:* Dark reddish brown silty clay

*Subsoil:* Dark reddish brown silty clay in the upper part, dark reddish gray silty clay in the middle part, and reddish brown silty clay in the lower part

*Depth class:* Very deep

*Drainage class:* Somewhat poorly drained

*Seasonal high water table:* None

*Major landform:* Flood plains

*Slope range:* 0 to 1 percent

*Parent material:* Clayey alluvium

### ***Use and Management***

*Major uses:* Cropland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility, flooding, restricted permeability, potential of ground-water pollution, and poor tilth

## **5. OK112—Port-Pulaski-Ashport (Port-Ashport-Pulaski)**

*Very deep, well drained, nearly level and very gently sloping soils that formed in alluvial sediment under prairie grasses and scattered bottomland hardwoods (fig. 4)*

### ***Setting***

*Location in the survey area:* Flood plains along Black Bear Creek and Red Rock Creek and narrow flood plains throughout the county

*Primary landscape:* Valley

*Slope range:* 0 to 3 percent

### ***Composition***

*Extent of map unit in the survey area:* 12 percent

*Extent of the components in the map unit:*

Port soils—37 percent

Ashport soils—30 percent

Pulaski soils—11 percent

Minor soils (including Easpur, Dale, Miller, Oscar, and Lela)—22 percent

### ***Soil Characteristics***

#### **Port**

*Surface layer:* Reddish gray and reddish brown silt loam

*Subsoil:* Reddish brown and yellowish red silt loam in the upper part and reddish brown silty clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

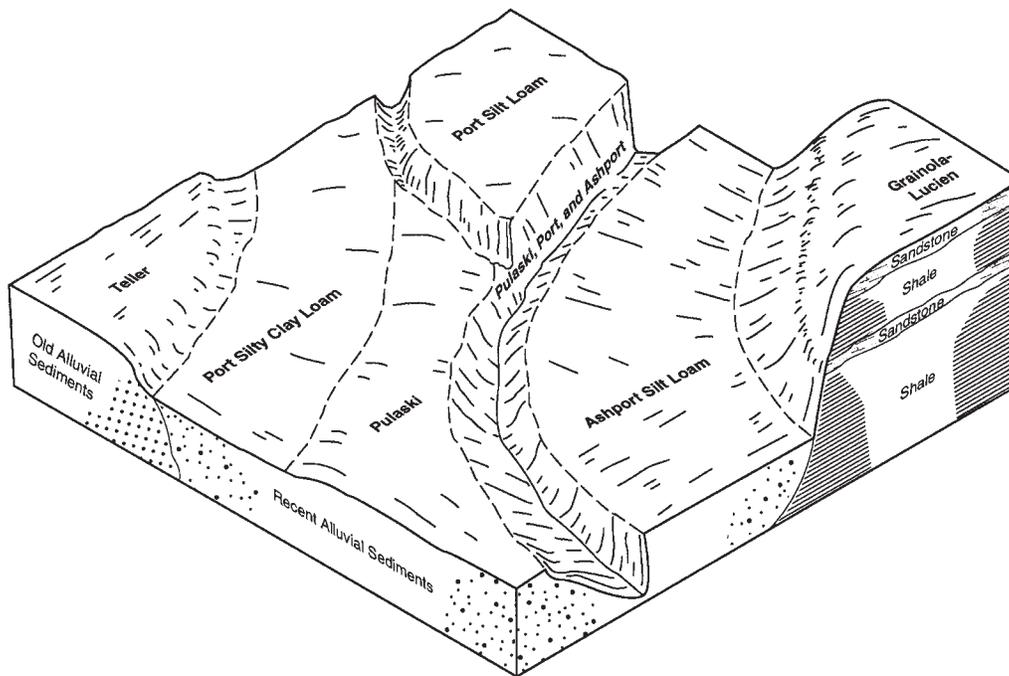


Figure 4.—Typical pattern of soils and underlying material in the Port-Ashport-Pulaski general soil map unit.

*Seasonal high water table:* None  
*Major landform:* Flood plains  
*Slope range:* 0 to 1 percent  
*Parent material:* Loamy alluvium

#### **Ashport**

*Surface layer:* Reddish brown silt loam  
*Subsoil:* Reddish brown silty clay loam  
*Depth class:* Very deep  
*Drainage class:* Well drained  
*Seasonal high water table:* None  
*Major landform:* Flood plains  
*Slope range:* 0 to 3 percent  
*Parent material:* Loamy alluvium

#### **Pulaski**

*Surface layer:* Reddish brown fine sandy loam  
*Underlying material:* Yellowish red fine sandy loam  
*Depth class:* Very deep  
*Drainage class:* Well drained  
*Seasonal high water table:* None  
*Major landform:* Flood plains  
*Slope range:* 0 to 1 percent  
*Parent material:* Loamy alluvium

### ***Use and Management***

*Major uses:* Cropland, pasture, and hayland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility and tilth, potential of ground-water pollution, and flooding

## **6. OK116—Renfrow-Kirkland-Grainola (Renfrow-Kirkland)**

*Very deep, well drained, nearly level to gently sloping soils that formed in old loamy and clayey alluvial sediment and shale under prairie vegetation*

### **Setting**

*Location in the survey area:* Southeastern part of the county

*Primary landscape:* Hills

*Slope range:* 0 to 5 percent

### **Composition**

*Extent of map unit in the survey area:* 1.2 percent

*Extent of the components in the map unit:*

Renfrow soils—50 percent

Kirkland soils—39 percent

Minor soils (including Grainola, Lucien, Zaneis, and Ashport)—11 percent

### **Soil Characteristics**

#### **Renfrow**

*Surface layer:* Reddish brown silt loam

*Subsoil:* Reddish brown silty clay loam in the upper part and red silty clay in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Backslopes and footslopes

*Slope range:* 1 to 5 percent

*Parent material:* Clayey alluvium and shale

#### **Kirkland**

*Surface layer:* Grayish brown silt loam

*Subsoil:* Dark grayish brown and grayish brown silty clay in the upper part and brown and reddish yellow silty clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Broad plane summits and plane to slightly convex footslopes

*Slope range:* 0 to 3 percent

*Parent material:* Clayey alluvium and shale

### **Use and Management**

*Major uses:* Cropland, pasture, hayland, and rangeland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility, restricted permeability, and poor tilth

## 7. OK117—Renfrow-Zaneis-Grainola (Renfrow-Grainola-Coyle)

*Very deep and moderately deep, well drained, very gently sloping to moderately sloping soils that formed in material weathered primarily from shale or sandstone under prairie vegetation*

### **Setting**

*Location in the survey area:* Upland summits, shoulder slopes, and backslopes in the eastern and central parts of the county

*Primary landscape:* Hills

*Slope range:* 1 to 8 percent

### **Composition**

*Extent of map unit in the survey area:* 11 percent

*Extent of the components in the map unit:*

Renfrow soils—28 percent

Grainola soils—23 percent

Coyle soils—9 percent

Minor soils (including Bethany, Doolin, Huska, Kirkland, Lucien, Masham, Mulhall, Norge, Pawhuska, Zaneis, Ashport, Port, Oscar, and Pulaski)—40 percent

### **Soil Characteristics**

#### **Renfrow**

*Surface layer:* Reddish brown silt loam

*Subsoil:* Reddish brown silty clay loam in the upper part and red silty clay in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Backslopes and footslopes

*Slope range:* 1 to 5 percent

*Parent material:* Clayey alluvium and shale

#### **Grainola**

*Surface layer:* Reddish brown clay loam

*Subsoil:* Red silty clay

*Bedrock:* Shale

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Backslopes and footslopes

*Slope range:* 1 to 8 percent

*Parent material:* Shale

#### **Coyle**

*Surface layer:* Reddish gray loam

*Subsoil:* Reddish brown loam in the upper part and reddish brown sandy clay loam in the lower part

*Bedrock:* Sandstone

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Seasonal high water table:* None

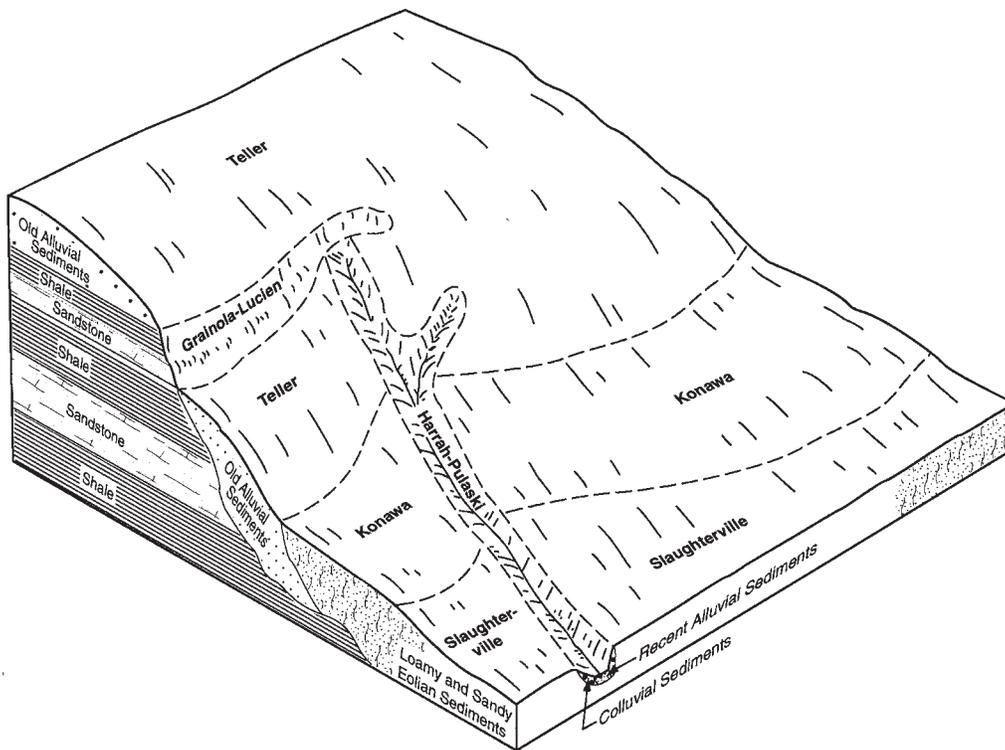


Figure 5.—Typical pattern of soils and underlying material in the Teller-Konawa general soil map unit.

*Major landform:* Summits, shoulder slopes, and backslopes

*Slope range:* 1 to 5 percent

*Parent material:* Sandstone

### ***Use and Management***

*Major uses:* Cropland, rangeland, pasture, and hayland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility, depth to bedrock, limited available water capacity, poor tilth, and restricted permeability

## **8. OK121—Teller-Konawa-Norge (Teller-Konawa)**

*Very deep, well drained, very gently sloping to moderately sloping soils that formed in old loamy and sandy alluvial sediment under prairie vegetation or an oak savannah (fig. 5)*

### ***Setting***

*Location in the survey area:* Northeastern part of the county

*Primary landscape:* Hills

*Slope range:* 1 to 8 percent

### ***Composition***

*Extent of map unit in the survey area:* 2 percent

*Extent of the components in the map unit:*

Teller soils—70 percent

Konawa soils—9 percent  
 Minor soils (including Darnell, Grainola, Harrah, Lucien, Masham, Newalla,  
 Slaughterville, Vanoss, Ashport, Oscar, Port, and Pulaski)—21 percent

### ***Soil Characteristics***

#### **Teller**

*Surface layer:* Dark reddish gray loam  
*Subsoil:* Reddish brown loam in the upper part, reddish brown and yellowish red clay loam in the middle part, and reddish yellow loam in the lower part  
*Depth class:* Very deep  
*Drainage class:* Well drained  
*Seasonal high water table:* None  
*Major landform:* Convex summits and backslopes  
*Slope range:* 1 to 8 percent  
*Parent material:* Loamy alluvium

#### **Konawa**

*Surface layer:* Brown fine sandy loam  
*Subsurface layer:* Brown fine sandy loam  
*Subsoil:* Yellowish red sandy clay loam in the upper part, yellowish red fine sandy loam in the middle part, and reddish yellow loamy fine sand in the lower part  
*Depth class:* Very deep  
*Drainage class:* Well drained  
*Seasonal high water table:* None  
*Major landform:* Summits and backslopes  
*Slope range:* 1 to 8 percent  
*Parent material:* Sandy alluvium

### ***Use and Management***

*Major uses:* Rangeland and cropland  
*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility and tilth, excessive permeability, and potential of ground-water pollution

## **9. OK151—Stephenville-Darnell-Newalla (Darnell-Grainola-Newalla-Harrah)**

*Very deep to shallow, somewhat excessively drained to moderately well drained, very gently sloping to steep soils that formed in material weathered primarily from sandstone under an oak savannah with prairie openings (fig. 6)*

### ***Setting***

*Location in the survey area:* Southern part of the county  
*Primary landscape:* Hills  
*Slope range:* 1 to 45 percent

### ***Composition***

*Extent of map unit in the survey area:* 2.5 percent  
*Extent of the components in the map unit:*  
 Darnell soils—24 percent  
 Grainola soils—16 percent  
 Newalla soils—15 percent  
 Harrah soils—13 percent

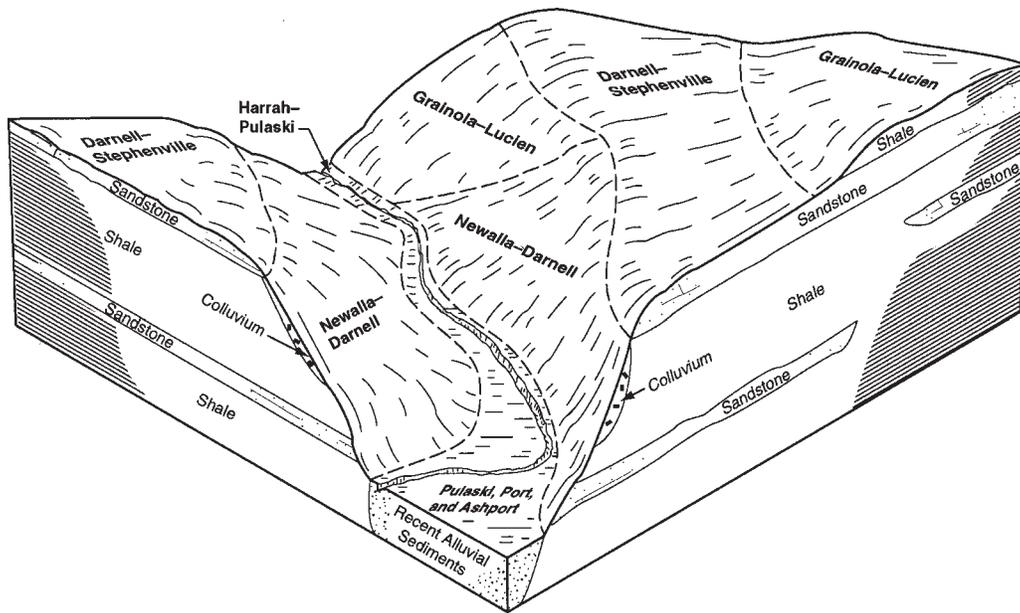


Figure 6.—Typical pattern of soils and underlying material in the Darnell-Grainola-Newalla-Harrah general soil map unit.

Minor soils (including Coyle, Huska, Lucien, Masham, Mulhall, Renfrow, Stephenville, Zaneis, Ashport, Port, and Pulaski)—32 percent

### **Soil Characteristics**

#### **Darnell**

*Surface layer:* Dark brown fine sandy loam  
*Subsoil:* Brown fine sandy loam  
*Bedrock:* Sandstone  
*Depth class:* Shallow  
*Drainage class:* Somewhat excessively drained  
*Seasonal high water table:* None  
*Major landform:* Shoulder slopes and backslopes  
*Slope range:* 1 to 15 percent  
*Parent material:* Sandstone

#### **Grainola**

*Surface layer:* Reddish brown clay loam  
*Subsoil:* Red silty clay  
*Bedrock:* Shale  
*Depth class:* Moderately deep  
*Drainage class:* Well drained  
*Seasonal high water table:* None  
*Major landform:* Backslopes and footslopes  
*Slope range:* 5 to 45 percent  
*Parent material:* Shale

#### **Newalla**

*Surface layer:* Brown fine sandy loam  
*Subsurface layer:* Light brown fine sandy loam

*Subsoil:* Reddish brown sandy clay loam in the upper part, red silty clay in the middle part, and reddish brown silty clay in the lower part

*Depth class:* Deep

*Drainage class:* Moderately well drained

*Seasonal high water table:* None

*Major landform:* Backslopes

*Slope range:* 5 to 8 percent

*Parent material:* Colluvium from sandstone over shale

### **Harrah**

*Surface layer:* Reddish brown fine sandy loam

*Subsurface layer:* Reddish brown fine sandy loam

*Subsoil:* Red sandy clay loam in the upper part and red fine sandy loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Backslopes

*Slope range:* 1 to 12 percent

*Parent material:* Colluvium from sandstone

### ***Use and Management***

*Major uses:* Rangeland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility and tilth, areas of rock outcrop, depth to bedrock, excessive permeability, potential of ground-water pollution, limited available water capacity, restricted permeability, slope, and surface stones or boulders

## **10. OK221—Norge-Bethany-Kirkland (Norge-Bethany-Kirkland)**

*Very deep, well drained, nearly level to gently sloping soils that formed in old loamy and clayey alluvial sediment under prairie vegetation (fig. 7)*

### ***Setting***

*Location in the survey area:* Northern and western parts of the county

*Primary landscape:* Plains on uplands

*Slope range:* 0 to 5 percent

### ***Composition***

*Extent of map unit in the survey area:* 22.8 percent

*Extent of the components in the map unit:*

Norge soils—48 percent

Bethany soils—21 percent

Kirkland soils—15 percent

Minor soils (including Grainola, Kingfisher, Lucien, Milan, Pawhuska, Renfrow, Ashport, Port, and Pulaski)—16 percent

### ***Soil Characteristics***

#### **Norge**

*Surface layer:* Brown silt loam

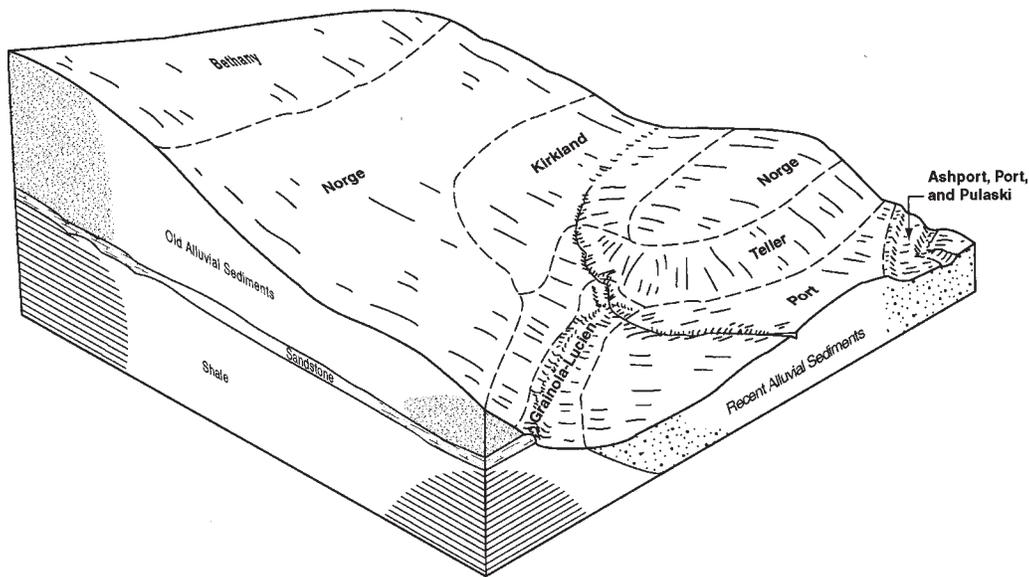


Figure 7.—Typical pattern of soils and underlying material in the Norge-Bethany-Kirkland general soil map unit.

*Subsoil:* Reddish brown silt loam in the upper part and reddish brown, yellowish red, and red clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Summits and backslopes

*Slope range:* 0 to 5 percent

*Parent material:* Loamy alluvium

### **Bethany**

*Surface layer:* Brown silt loam

*Subsoil:* Dark brown and dark grayish brown silty clay loam in the upper part and brown, reddish yellow, red, and pinkish gray silty clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Broad plane summits and plane to concave footslopes

*Slope range:* 0 to 3 percent

*Parent material:* Loamy and clayey alluvium

### **Kirkland**

*Surface layer:* Grayish brown silt loam

*Subsoil:* Dark grayish brown and grayish brown silty clay in the upper part and brown and reddish yellow silty clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Broad plane summits and plane to slightly convex footslopes

*Slope range:* 0 to 3 percent

### **Use and Management**

*Major uses:* Rangeland, cropland, and pastureland

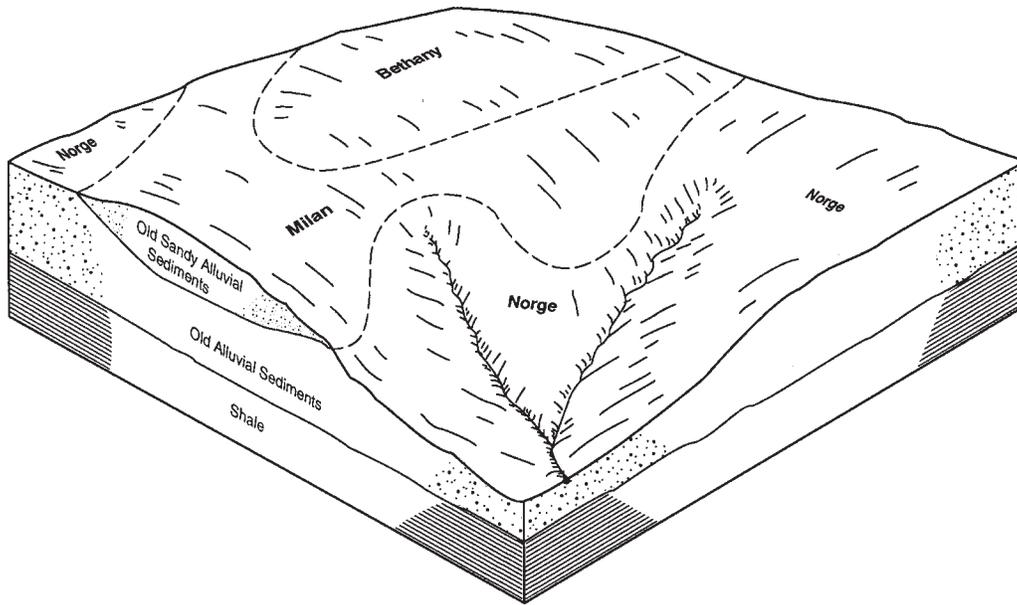


Figure 8.—Typical pattern of soils and underlying material in the Milan-Norge-Bethany general soil map unit.

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility and tilth, and restricted permeability

## 11. OK222—Milan-Norge-Bethany (Milan-Norge-Bethany)

*Very deep, well drained, nearly level to gently sloping soils that formed in old loamy, sandy, and gravelly alluvial sediment under prairie vegetation (fig. 8)*

### **Setting**

*Location in the survey area:* Central part of the county

*Primary landscape:* Plains on uplands

*Slope range:* 0 to 5 percent

### **Composition**

*Extent of map unit in the survey area:* 4 percent

*Extent of the components in the map unit:*

Milan soils—41 percent

Norge soils—18 percent

Bethany soils—6 percent

Minor soils (including Grainola, Huska, Kingfisher, Kirkland, Lovedale, Lucien, Mulhall, Pawhuska, Renfrow, Tabler, Wisby, Zaneis, Ashport, Port, and Pulaski)—35 percent

### **Soil Characteristics**

#### **Milan**

*Surface layer:* Reddish brown loam

*Subsoil:* Reddish brown loam in the upper part, reddish brown and yellowish red clay

loam and sandy clay loam in the middle part, and yellowish red sandy loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Summits and backslopes

*Slope range:* 1 to 5 percent

*Parent material:* Gravelly and loamy alluvium

### **Norge**

*Surface layer:* Brown silt loam

*Subsoil:* Reddish brown silt loam in the upper part and reddish brown, yellowish red, and red clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Summits and backslopes

*Slope range:* 0 to 5 percent

*Parent material:* Loamy alluvium

### **Bethany**

*Surface layer:* Brown silt loam

*Subsoil:* Dark brown and dark grayish brown silty clay loam in the upper part and brown, reddish yellow, red, and pinkish gray silty clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Broad plane summits and plane to concave footslopes

*Slope range:* 0 to 3 percent

*Parent material:* Loamy and clayey alluvium

### ***Use and Management***

*Major uses:* Rangeland, cropland, and pastureland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility and tilth, and restricted permeability

## **12. OK223—Vanoss-Slaughterville-Teller (Vanoss-Slaughterville)**

*Very deep, well drained, nearly level to steeply sloping soils that formed in old loamy alluvial sediment under prairie vegetation (fig. 9)*

### ***Setting***

*Location in the survey area:* Northeastern part of the county

*Primary landscape:* Stream terraces

*Slope range:* 0 to 45 percent

### ***Composition***

*Extent of map unit in the survey area:* 1 percent

*Extent of the components in the map unit:*

Vanoss soils—42 percent

Slaughterville soils—32 percent

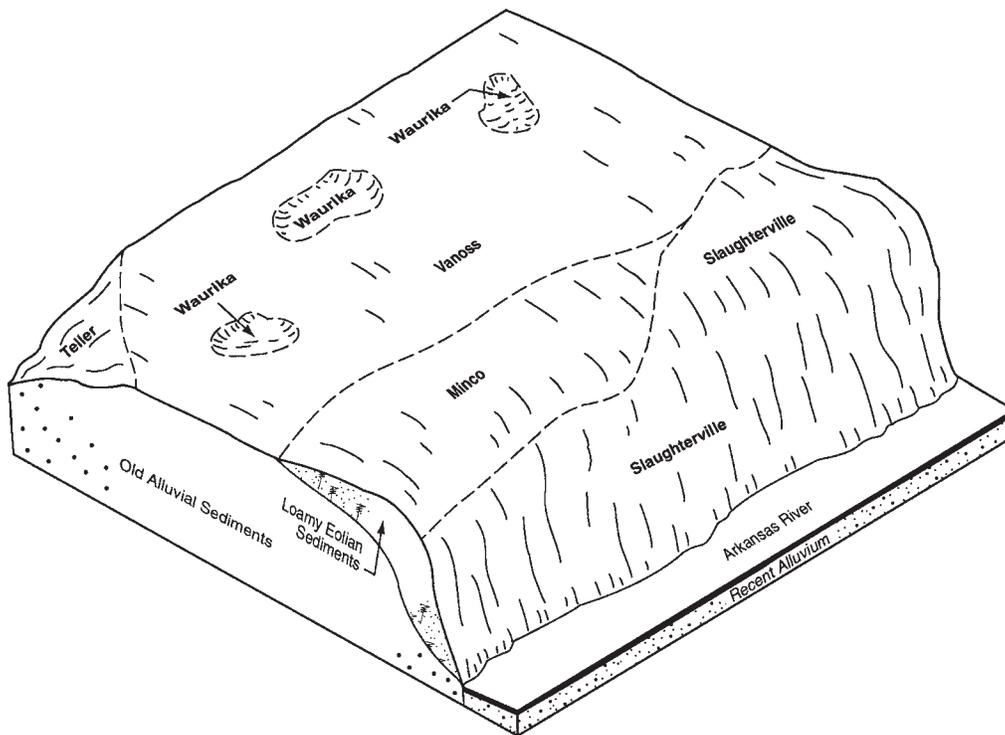


Figure 9.—Typical pattern of soils and underlying material in the Vanoss-Slaughterville general soil map unit.

Minor soils (including Bethany, Grainola, Kirkland, Minco, Norge, Teller, Waurika, Ashport, Port, and Pulaski)—26 percent

### **Soil Characteristics**

#### **Vanoss**

*Surface layer:* Dark brown silt loam

*Subsoil:* Brown silt loam in the upper part, brown and strong brown silty clay loam in the middle part, and yellowish red silty clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Terrace treads

*Slope range:* 0 to 1 percent

*Parent material:* Silty alluvium

#### **Slaughterville**

*Surface layer:* Brown fine sandy loam

*Subsoil:* Brown fine sandy loam in the upper part, strong brown fine sandy loam in the middle part, and yellowish red sandy clay loam in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Terrace steps and treads

*Slope range:* 0 to 45 percent

*Parent material:* Loamy alluvium

### ***Use and Management***

*Major uses:* Rangeland, cropland, and pastureland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility and tilth, excessive permeability, potential of ground-water pollution, and slope

## **13. OK224—Renfrow-Grainola-Kingfisher-Grant (Grainola-Renfrow-Kingfisher)**

*Very deep and moderately deep, well drained, very gently sloping to moderately sloping soils that formed in material weathered primarily from shale, siltstone, or sandstone under prairie vegetation*

### ***Setting***

*Location in the survey area:* Western and central parts of the county

*Primary landscape:* Hills

*Slope range:* 1 to 8 percent

### ***Composition***

*Extent of map unit in the survey area:* 20 percent

*Extent of the components in the map unit:*

Grainola soils—24 percent

Renfrow soils—23 percent

Kingfisher soils—11 percent

Minor soils (including Bethany, Dilworth, Grant, Huska, Kirkland, Lucien, Masham, Mulhall, Pawhuska, Wakita, Westsum, Ashport, Port, and Pulaski)—42 percent

### ***Soil Characteristics***

#### **Grainola**

*Surface layer:* Reddish brown clay loam

*Subsoil:* Red silty clay

*Bedrock:* Red shale interbedded with siltstone

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Backslopes

*Slope range:* 1 to 8 percent

*Parent material:* Shale

#### **Renfrow**

*Surface layer:* Reddish brown silt loam

*Subsoil:* Reddish brown silty clay loam in the upper part and red silty clay in the lower part

*Depth class:* Very deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Backslopes and footslopes

*Slope range:* 1 to 5 percent

*Parent material:* Clayey alluvium and shale

#### **Kingfisher**

*Surface layer:* Brown silt loam

*Subsoil:* Brown silt loam in the upper part and reddish brown silty clay loam in the lower part

*Bedrock:* Siltstone

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Seasonal high water table:* None

*Major landform:* Summits and backslopes

*Slope range:* 1 to 5 percent

*Parent material:* Siltstone

### ***Use and Management***

*Major uses:* Rangeland and cropland

*Management concerns:* Conservation of moisture, soil blowing, water erosion, soil fertility, depth to bedrock, limited available water capacity, poor tilth, and restricted permeability

## Detailed Soil Map Units

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

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. 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, are mapped without areas of minor components of other taxonomic classes. Consequently, map units are made up of the soils or miscellaneous areas for which they are named and some areas of included soils that belong to other taxonomic classes.

Most included soils have properties 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 or similar inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes 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 if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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 underlying layers, 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 underlying layers. 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, Ashport silt loam, 0 to 1 percent slopes, occasionally flooded, is a phase of the Ashport series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Newalla-Darnell complex, 8 to 45 percent slopes, very bouldery, is an example.

An *undifferentiated group* consists of two or more soils or miscellaneous areas that are not consistently associated geographically and, therefore, do not always occur together in the same map delineation. These components are included in the same named map unit because their use and management are the same or very similar for common uses. Generally, they are grouped together because some common feature determines their use and management. Each delineation has at least one of the major components, and some may have all of them. Coyle and Zaneis soils, 3 to 5 percent slopes, severely eroded, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The Urban land part of Norge-Urban land complex, 1 to 5 percent slopes, is an example.

The table "Acreage and Proportionate Extent of the Soils" 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 or miscellaneous areas.

Acreeage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
AhpA	Ashport silty clay loam, 0 to 1 percent slopes, occasionally flooded-	4,025	0.8
APPA	Ashport, Port, and Pulaski soils, 0 to 1 percent slopes, frequently flooded-----	29,133	6.1
AspA	Ashport silt loam, 0 to 1 percent slopes, occasionally flooded-----	7,040	1.5
AspB	Ashport silt loam, 1 to 3 percent slopes, occasionally flooded-----	504	0.1
BetA	Bethany silt loam, 0 to 1 percent slopes-----	8,348	1.8
BetB	Bethany silt loam, 1 to 3 percent slopes-----	21,146	4.4
BPG	Borrow pits, gravelly-----	107	*
BPR	Borrow pits, rock-----	942	0.2
BraA	Braman silt loam, 0 to 1 percent slopes, rarely flooded-----	374	*
BrwA	Brewer silt loam, 0 to 1 percent slopes, rarely flooded-----	608	0.1
CoLC	Coyle-Lucien complex, 1 to 5 percent slopes-----	5,715	1.2
CoyB	Coyle loam, 1 to 3 percent slopes-----	551	0.1
CoyC	Coyle loam, 3 to 5 percent slopes-----	654	0.1
CoyC2	Coyle loam, 3 to 5 percent slopes, eroded-----	1,337	0.3
CoZC3	Coyle and Zaneis soils, 3 to 5 percent slopes, severely eroded-----	2,682	0.6
DalA	Dale silt loam, 0 to 1 percent slopes, rarely flooded-----	1,482	0.3
DAM	Dam-----	261	*
DaUA	Dale-Urban land complex, 0 to 1 percent slopes, rarely flooded-----	369	*
DiGE	Dilworth-Grainola complex, 5 to 12 percent slopes-----	2,437	0.5
DooB	Doolin silt loam, 0 to 2 percent slopes-----	1,059	0.2
DwhC	Dilworth silty clay loam, 3 to 5 percent slopes-----	1,404	0.3
EasA	Easpor loam, 0 to 1 percent slopes, occasionally flooded-----	2,555	0.5
GadA	Gaddy loamy fine sand, 0 to 1 percent slopes, occasionally flooded---	596	0.1
GayA	Gaddy loamy fine sand, 0 to 1 percent slopes, rarely flooded-----	103	*
GMLG	Grainola-Masham-Lucien complex, 5 to 40 percent slopes, very bouldery	21,827	4.6
GohE	Goodnight loamy fine sand, 3 to 20 percent slopes-----	501	0.1
GraC	Grainola silty clay loam, 3 to 5 percent slopes-----	3,155	0.7
GrAD	Grainola-Ashport complex, 0 to 8 percent slopes-----	21,092	4.4
GrHC	Grant-Huska complex, 1 to 5 percent slopes-----	10,514	2.2
GrLC	Grainola-Lucien complex, 1 to 5 percent slopes-----	17,679	3.7
GrLE	Grainola-Lucien complex, 5 to 12 percent slopes-----	34,319	7.2
GrnC	Grant loam, 3 to 5 percent slopes-----	961	0.2
GrtB	Grant silt loam, 1 to 3 percent slopes-----	1,853	0.4
HaPE	Harrah-Pulaski complex, 0 to 12 percent slopes-----	1,738	0.4
HiRG	Highview-Rock outcrop complex, 15 to 45 percent slopes-----	2,084	0.4
KekA	Keokuk very fine sandy loam, 0 to 1 percent slopes, rarely flooded---	715	0.2
KeoA	Keokuk very fine sandy loam, 0 to 1 percent slopes, occasionally flooded-----	945	0.2
Kgfb	Kingfisher silt loam, 1 to 3 percent slopes-----	2,583	0.5
KgLC	Kingfisher-Lucien complex, 1 to 5 percent slopes-----	3,635	0.8
KgWC	Kingfisher-Wakita complex, 1 to 5 percent slopes-----	1,226	0.3
KinC2	Kingfisher loam, 3 to 5 percent slopes, eroded-----	2,643	0.6
KowB	Konawa fine sandy loam, 1 to 3 percent slopes-----	467	*
KowD	Konawa fine sandy loam, 3 to 8 percent slopes-----	815	0.2
KrdA	Kirkland silt loam, 0 to 1 percent slopes-----	10,886	2.3
KrdB	Kirkland silt loam, 1 to 3 percent slopes-----	19,230	4.0
KrdB2	Kirkland silt loam, 1 to 3 percent slopes, eroded-----	12,251	2.6
KrPB	Kirkland-Pawhuska complex, 0 to 3 percent slopes-----	4,494	0.9
LAN	Landfill-----	17	*
LelA	Lela silty clay, 0 to 1 percent slopes, occasionally flooded-----	4,188	0.9
LveB	Lovedale sandy loam, 1 to 3 percent slopes-----	67	*
M-W	Miscellaneous water-----	74	*
McaA	McLain silty clay loam, 0 to 1 percent slopes, rarely flooded-----	458	*
MilB	Milan loam, 1 to 3 percent slopes-----	7,968	1.7
MilC	Milan loam, 3 to 5 percent slopes-----	4,108	0.9
MinB	Minco very fine sandy loam, 1 to 3 percent slopes-----	251	*
MinC	Minco very fine sandy loam, 3 to 5 percent slopes-----	113	*
MirA	Miller silty clay loam, 0 to 1 percent slopes, occasionally flooded--	1,087	0.2

See footnote at end of table.

## Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
MisA	Miller silty clay loam, saline, 0 to 1 percent slopes, occasionally flooded-----	207	*
MPNC2	Milan-Pawhuska-Norge complex, 3 to 5 percent slopes, eroded-----	4,805	1.0
MulC	Mulhall loam, 3 to 5 percent slopes-----	4,218	0.9
MulD	Mulhall loam, 5 to 8 percent slopes-----	1,416	0.3
MulD4	Mulhall loam, 5 to 8 percent slopes, gullied-----	1,501	0.3
NeDG	Newalla-Darnell complex, 8 to 45 percent slopes, very bouldery-----	4,151	0.9
NorA	Norge silt loam, 0 to 1 percent slopes-----	1,137	0.2
NorB	Norge silt loam, 1 to 3 percent slopes-----	25,641	5.4
NorC	Norge silt loam, 3 to 5 percent slopes-----	7,459	1.6
NorC2	Norge silt loam, 3 to 5 percent slopes, eroded-----	13,822	2.9
NoUC	Norge-Urban land complex, 1 to 5 percent slopes-----	1,172	0.2
OWWE	Oil waste land-Westsum complex, 3 to 12 percent slopes-----	540	0.1
PoaA	Port silt loam, 0 to 1 percent slopes, frequently flooded-----	6,988	1.5
PoOA	Port-Oscar complex, 0 to 1 percent slopes, occasionally flooded-----	3,290	0.7
PorA	Port silt loam, 0 to 1 percent slopes, occasionally flooded-----	15,754	3.3
PotA	Port silty clay loam, 0 to 1 percent slopes, occasionally flooded----	3,075	0.6
PukA	Pulaski fine sandy loam, 0 to 1 percent slopes, frequently flooded---	849	0.2
PulA	Pulaski fine sandy loam, 0 to 1 percent slopes, occasionally flooded--	1,293	0.3
RefC2	Renfrow loam, 3 to 5 percent slopes, eroded-----	39	*
ReGC2	Renfrow and Grainola soils, 3 to 5 percent slopes, eroded-----	24,762	5.2
ReiA	Reinach very fine sandy loam, 0 to 1 percent slopes, rarely flooded--	249	*
RenB	Renfrow silt loam, 1 to 3 percent slopes-----	14,123	3.0
RenC	Renfrow silt loam, 3 to 5 percent slopes-----	9,611	2.0
RewC2	Renfrow silty clay loam, 3 to 5 percent slopes, eroded-----	33	*
RGPD3	Renfrow, Grainola, and Pawhuska soils, 3 to 8 percent slopes, severely eroded-----	4,511	0.9
SlaB	Slaughterville fine sandy loam, 0 to 3 percent slopes-----	770	0.2
SlaC	Slaughterville fine sandy loam, 3 to 5 percent slopes-----	220	*
SlaG	Slaughterville fine sandy loam, 8 to 45 percent slopes-----	439	*
StDD	Stephenville-Darnell complex, 3 to 8 percent slopes-----	5,011	1.1
TabA	Tabler silt loam, 0 to 1 percent slopes-----	2,155	0.5
TeaA	Tearney silty clay, 0 to 1 percent slopes, ponded-----	323	*
TelB	Teller loam, 1 to 3 percent slopes-----	3,119	0.7
TelD	Teller loam, 5 to 8 percent slopes-----	2,260	0.5
TelD2	Teller loam, 5 to 8 percent slopes, eroded-----	3,889	0.8
VanA	Vanoss silt loam, 0 to 1 percent slopes-----	2,225	0.5
W	Water-----	7,663	1.6
WauA	Waurika silt loam, 0 to 1 percent slopes-----	213	*
WesB	Westsum silty clay loam, 1 to 3 percent slopes-----	1,423	0.3
WesC	Westsum silty clay loam, 3 to 5 percent slopes-----	315	*
WiLC	Wisby-Lovedale complex, 1 to 5 percent slopes-----	373	*
ZaHC	Zaneis-Huska complex, 1 to 5 percent slopes-----	6,775	1.4
ZanB	Zaneis loam, 1 to 3 percent slopes-----	280	*
	Total-----	475,475	100.0

\* Less than 0.1 percent.

## **AhpA—Ashport silty clay loam, 0 to 1 percent slopes, occasionally flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Ashport and similar soils**

*Extent of the component in the map unit:* 89 percent  
*Geomorphic setting:* Valley flat on a flood plain in a valley  
*Parent material:* Silty alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Negligible  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 11.7 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Occasional  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—2w  
 Range site number and name—080AY050OK, Loamy Bottomland

#### *Typical profile:*

Ap—0 to 10 inches; silty clay loam  
 Bw1—10 to 25 inches; silty clay loam  
 Bw2—25 to 35 inches; silty clay loam  
 C—35 to 42 inches; stratified fine sandy loam to silty clay loam  
 Ab1—42 to 52 inches; silty clay loam  
 Ab2—52 to 80 inches; silty clay loam

*Location of representative profile:* About 800 feet west and 100 feet north of the south-eastern corner of sec. 10, T. 21 N., R. 3 E.

### ***Additional Components***

- Miller and similar soils: 5 percent
- Pulaski and similar soils: 3 percent
- Oscar and similar soils: 2 percent
- Depressions and channels: 1 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **APPA—Ashport, Port, and Pulaski soils, 0 to 1 percent slopes, frequently flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 240 days

*Note:* The composition of soils in delineations of this map unit is variable. Most areas are made up of all the named soils, but some areas may contain only one or two of the named soils.

### ***Major Component Description***

#### **Ashport and similar soils**

*Extent of the component in the map unit:* 61 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Silty alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.7 inches

*Depth to water table:* More than 6 feet

*Flooding:* Frequent

*Ponding:* None

*Interpretive groups:*

Land capability classification—5w

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

A—0 to 14 inches; silty clay loam

Bw—14 to 27 inches; silt loam

C—27 to 80 inches; stratified fine sandy loam to silty clay loam

*Location of representative profile:* About 2,525 feet south and 300 feet east of the northwestern corner of sec. 33, T. 21 N., R. 1 W.

#### **Port and similar soils**

*Extent of the component in the map unit:* 15 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Silty alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* Frequent

*Ponding:* None

*Interpretive groups:*

Land capability classification—5w

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

Ap—0 to 7 inches; fine sandy loam

A—7 to 27 inches; silt loam

Bw—27 to 46 inches; silt loam

Ab—46 to 51 inches; silt loam

Bwb—51 to 80 inches; silt loam

*Location of representative profile:* About 2,550 feet south and 200 feet east of the northwestern corner of sec. 33, T. 21 N., R. 1 W.

**Pulaski and similar soils***Extent of the component in the map unit:* 15 percent*Geomorphic setting:* Natural levee on a flood plain in a valley*Parent material:* Loamy alluvium*Slope range:* 0 to 1 percent*Runoff:* Negligible*Soil depth:* More than 60 inches*Slowest permeability class within a depth of 60 inches:* Moderately rapid*Drainage class:* Well drained*Available water capacity:* About 8.8 inches*Depth to water table:* More than 6 feet*Flooding:* Frequent*Ponding:* None*Interpretive groups:*

Land capability classification—5w

Range site number and name—084AY050OK, Loamy Bottomland

*Typical profile:*

A—0 to 9 inches; fine sandy loam

C1—9 to 25 inches; fine sandy loam

C2—25 to 80 inches; stratified loamy fine sand to loam

*Location of representative profile:* About 2,550 feet south and 400 feet east of the northwestern corner of sec. 33, T. 21 N., R. 1 W.

**Additional Components**

- Easpur and similar soils: 9 percent

**Management***Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**AspA—Ashport silt loam, 0 to 1 percent slopes, occasionally flooded****Map Unit Setting***Major land resource area:* 80A*Elevation range:* 700 to 1,500 feet*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Ashport and similar soils**

*Extent of the component in the map unit:* 90 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Silty alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* Occasional

*Ponding:* None

*Interpretive groups:*

Land capability classification—2w

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

Ap—0 to 10 inches; silt loam

Bw—10 to 32 inches; silty clay loam

Ab—32 to 45 inches; silty clay loam

Bwb1—45 to 70 inches; silty clay loam

Bwb2—70 to 80 inches; silty clay loam

*Location of representative profile:* About 2,300 feet south and 200 feet east of the northwestern corner of sec. 11, T. 21 N., R. 3 E.

### ***Additional Components***

- Oscar and similar soils: 5 percent
- Pulaski and similar soils: 3 percent
- Easpur and similar soils: 2 percent

### ***Management***

*Major uses:* Cropland and rangeland (fig. 10)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **AspB—Ashport silt loam, 1 to 3 percent slopes, occasionally flooded**

#### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days



Figure 10.—Wheat on Ashport silt loam, 0 to 1 percent slopes, occasionally flooded.

### ***Major Component Description***

#### **Ashport and similar soils**

*Extent of the component in the map unit:* 93 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Silty alluvium

*Slope range:* 1 to 3 percent

*Runoff:* Low

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* Occasional

*Ponding:* None

#### *Interpretive groups:*

Land capability classification—2w

Range site number and name—080AY0500K, Loamy Bottomland

#### *Typical profile:*

Ap—0 to 10 inches; silt loam

Bw1—10 to 21 inches; silty clay loam

Bw2—21 to 36 inches; silty clay loam

Bw3—36 to 65 inches; loam

BC—65 to 80 inches; silty clay loam

*Location of representative profile:* About 2,200 feet east and 500 feet south of the northwestern corner of sec. 35, T. 23 N., R. 1 E.

### ***Additional Components***

- Easpur and similar soils: 5 percent
- Oscar and similar soils: 2 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **BetA—Bethany silt loam, 0 to 1 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 950 to 1,250 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 220 days

### ***Major Component Description***

#### **Bethany and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit  
*Parent material:* Loess over silty Pleistocene alluvium, over residuum weathered from clayey Permian shale  
*Slope range:* 0 to 1 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Slow  
*Drainage class:* Well drained  
*Available water capacity:* About 10.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—1  
 Range site number and name—080AY056OK, Loamy Prairie

#### *Typical profile:*

Ap—0 to 9 inches; silt loam  
 BA—9 to 12 inches; silty clay loam  
 Bt—12 to 30 inches; silty clay  
 Btk—30 to 47 inches; silty clay  
 Btb1—47 to 71 inches; silty clay  
 Btb2—71 to 80 inches; silty clay

*Location of representative profile:* About 1,900 feet north and 800 feet west of the southeastern corner of sec. 17, T. 24 N., R. 1 E.

### ***Additional Components***

- Kirkland and similar soils: 5 percent



Figure 11.—Wheat baled for hay on Bethany silt loam, 0 to 1 percent slopes.

- Norge and similar soils: 5 percent
- Tabler and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland (fig. 11)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **BetB—Bethany silt loam, 1 to 3 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 950 to 1,250 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 220 days

### ***Major Component Description***

#### **Bethany and similar soils**

*Extent of the component in the map unit:* 84 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit and shoulder  
*Parent material:* Loess over silty Pleistocene alluvium, over residuum weathered from clayey Permian shale  
*Slope range:* 1 to 3 percent  
*Runoff:* High  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Slow  
*Drainage class:* Well drained  
*Available water capacity:* About 10.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—2e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

Ap—0 to 11 inches; silt loam

BA—11 to 16 inches; silty clay loam

Bt1—16 to 36 inches; silty clay loam

Bt2—36 to 60 inches; silty clay loam

Bt3—60 to 80 inches; silty clay loam

*Location of representative profile:* About 2,000 feet west and 100 feet south of the northeastern corner of sec. 9, T. 20 N., R. 1 E.

### **Additional Components**

- Kirkland and similar soils: 6 percent
- Norge and similar soils: 6 percent
- Renfrow and similar soils: 3 percent
- Pawhuska and similar soils: 1 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **BPG—Borrow pits, gravelly**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 2,500 feet

*Mean annual precipitation:* 18 to 55 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 230 days

### **Major Component Description**

#### **Borrow pits, gravelly**

*Extent of the component in the map unit:* 90 percent

*Geomorphic setting:* Hillslope on hills

*Parent material:* Sandy and gravelly Pleistocene alluvium

*Slope range:* 0 to 3 percent

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Rapid

*Available water capacity:* About 1.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—8s

Range site number and name—none assigned

*Typical profile:*

This map unit consists of areas from which soil and unconsolidated underlying materials have been removed for building roads, foundations, and other structures. The excavations, including borrow pits, gravel pits, and sand pits, have nearly vertical sides and very gently sloping or gently sloping floors. They range from 5 to 30 feet in depth and 200 to 1,000 feet in length and width. The soil material is variable in texture and content of coarse fragments. In some pits, the Permian sandstone and shale is exposed in the bottom of the pit. These pits commonly have small areas of intermittent water on the floor of the pit. A typical profile is not given due to the variability of the soil material.

*Location of a representative area:* About 4,400 feet north and 1,250 feet east of the southwestern corner of sec. 1, T. 21 N., R. 1 W.

**Additional Components**

- Water: 10 percent

**Management**

For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties."

**BPR—Borrow pits, rock****Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 500 to 2,500 feet  
*Mean annual precipitation:* 18 to 55 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 190 to 230 days

**Major Component Description****Borrow pits, rock**

*Extent of the component in the map unit:* 90 percent  
*Geomorphic setting:* Hillslope on hills  
*Parent material:* Residuum weathered from sandstone and shale  
*Slope range:* 0 to 25 percent  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—8s  
 Range site number and name—none assigned

*Typical profile:*

This map unit consists of areas from which soil and consolidated underlying materials, such as sandstone and shale, have been removed for building roads, foundations, and other structures. The excavations have sloping or strongly sloping sides and very gently sloping floors. They range from 5 to 20 feet in depth and from 200 to 1,000 feet in length and width. The floors and parts of the walls are exposed sandstone or shale in most of the pits. These pits commonly have small areas of intermittent water on the floor of the pit. A typical pedon is not given due to the variability of the soil material.

*Location of a representative area:* About 3,900 feet north and 2,400 feet east of the southwestern corner of sec. 20, T. 21 N., R. 1 W.

### ***Additional Components***

- Water: 10 percent

### ***Management***

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **BraA—Braman silt loam, 0 to 1 percent slopes, rarely flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 800 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 190 to 230 days

### ***Major Component Description***

#### **Braman and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Valley flat on a flood plain in a valley  
*Parent material:* Silty and clayey Pleistocene alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately slow  
*Drainage class:* Well drained  
*Available water capacity:* About 11.2 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Rare  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—1  
 Range site number and name—080AY0500K, Loamy Bottomland

#### *Typical profile:*

Ap—0 to 8 inches; silt loam  
 A—8 to 12 inches; silt loam  
 Bt1—12 to 23 inches; silty clay loam  
 Bt2—23 to 36 inches; silty clay loam  
 BC—36 to 48 inches; silt loam  
 C—48 to 82 inches; silty clay

*Location of representative profile:* About 1,700 feet east and 1,000 feet south of the northwestern corner of sec. 4, T. 24 N., R. 1 E.

### ***Additional Components***

- McLain and similar soils: 7 percent
- Dale and similar soils: 5 percent
- Lela and similar soils: 3 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **BrwA—Brewer silt loam, 0 to 1 percent slopes, rarely flooded**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

### **Major Component Description**

#### **Brewer and similar soils**

*Extent of the component in the map unit:* 97 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Silty and clayey Pleistocene alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Medium

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Slow

*Drainage class:* Moderately well drained

*Available water capacity:* About 10.7 inches

*Depth to water table:* More than 6 feet

*Flooding:* Rare

*Ponding:* None

*Interpretive groups:*

Land capability classification—1

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

Ap—0 to 11 inches; silt loam

A—11 to 23 inches; silt loam

Bt—23 to 40 inches; silty clay loam

Btk—40 to 48 inches; silty clay loam

BC—48 to 80 inches; silty clay loam

*Location of representative profile:* About 200 feet south and 100 feet east of the north-western corner of sec. 9, T. 23 N., R. 2 E.

### **Additional Components**

- Drummond and similar soils: 3 percent

### **Management**

*Major uses:* Cropland and rangeland (fig. 12)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”



Figure 12.—Grain sorghum on Brewer silt loam, 0 to 1 percent slopes, rarely flooded.

## CoLC—Coyle-Lucien complex, 1 to 5 percent slopes

### *Map Unit Setting*

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 230 days

*Note:* These Coyle and Lucien soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### *Major Component Description*

#### **Coyle and similar soils**

*Extent of the component in the map unit:* 61 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and shoulder

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 1 to 3 percent

*Runoff:* High

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 3.4 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3s

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 6 inches; loam

BA—6 to 11 inches; loam

Bt1—11 to 16 inches; clay loam

Bt2—16 to 21 inches; clay loam

Cr—21 to 29 inches; bedrock

*Location of representative profile:* About 2,950 feet east and 2,450 feet south of the northwestern corner of sec. 2, T. 22 N., R. 1 E.

**Lucien and similar soils***Extent of the component in the map unit:* 30 percent*Geomorphic setting:* Hillslope on hills*Landform position:* Summit and shoulder*Parent material:* Loamy residuum weathered from Permian sandstone*Slope range:* 1 to 5 percent*Runoff:* Very high*Depth to bedrock (paralithic):* 10 to 20 inches*Slowest permeability class within a depth of 60 inches:* Very slow*Drainage class:* Well drained*Available water capacity:* About 3.0 inches*Depth to water table:* More than 6 feet*Flooding:* None*Ponding:* None*Interpretive groups:*

Land capability classification—4s

Range site number and name—080AY083OK, Shallow Prairie

*Typical profile:*

A—0 to 4 inches; very fine sandy loam

BA—4 to 8 inches; very fine sandy loam

Bw—8 to 13 inches; very fine sandy loam

Cr—13 to 17 inches; bedrock

*Location of representative profile:* 3,000 feet east and 2,450 feet south of the northwestern corner of sec. 2, T. 22 N., R. 1 E.

**Additional Components**

- Huska and similar soils: 5 percent
- Grainola and similar soils: 4 percent

**Management***Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**CoyB—Coyle loam, 1 to 3 percent slopes****Map Unit Setting***Major land resource area:* 80A*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 190 to 230 days

### **Major Component Description**

#### **Coyle and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit and shoulder  
*Parent material:* Loamy residuum weathered from Permian sandstone  
*Slope range:* 1 to 3 percent  
*Runoff:* High  
*Depth to bedrock (paralithic):* 20 to 40 inches  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Drainage class:* Well drained  
*Available water capacity:* About 4.7 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—3s  
 Range site number and name—080AY056OK, Loamy Prairie

#### *Typical profile:*

A—0 to 10 inches; loam  
 Bt1—10 to 17 inches; sandy clay loam  
 Bt2—17 to 23 inches; sandy clay loam  
 BC—23 to 30 inches; sandy clay loam  
 Cr—30 to 38 inches; bedrock

*Location of representative profile:* About 1,300 feet north and 700 feet west of the southeastern corner of sec. 36, T. 20 N., R. 1 W.

### **Additional Components**

- Grainola and similar soils: 5 percent
- Huska and similar soils: 5 percent
- Lucien and similar soils: 5 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **CoyC—Coyle loam, 3 to 5 percent slopes**

#### **Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 190 to 230 days

### **Major Component Description**

#### **Coyle and similar soils**

*Extent of the component in the map unit:* 82 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and shoulder

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 3 to 5 percent

*Runoff:* High

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 4.3 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 7 inches; loam

BA—7 to 10 inches; loam

Bt—10 to 20 inches; sandy clay loam

BC—20 to 27 inches; loam

Cr—27 to 30 inches; bedrock

*Location of representative profile:* About 2,250 feet west and 150 feet north of the southeastern corner of sec. 27, T. 20 N., R. 1 W.

### **Additional Components**

- Grainola and similar soils: 5 percent
- Huska and similar soils: 5 percent
- Lucien and similar soils: 5 percent
- Mulhall and similar soils: 3 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **CoyC2—Coyle loam, 3 to 5 percent slopes, eroded**

#### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 230 days

*Note:* Areas of this map unit are or have been cultivated and are moderately eroded. In most areas, the upper part of the subsoil has been incorporated into the plow layer. In some areas, surface rills and small gullies are common.

### **Major Component Description**

#### **Coyle and similar soils**

*Extent of the component in the map unit:* 82 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 3 to 5 percent

*Runoff:* High

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 4.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—4e

Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*

Ap—0 to 5 inches; loam

BA—5 to 9 inches; loam

Bt1—9 to 16 inches; clay loam

Bt2—16 to 23 inches; clay loam

BC—23 to 31 inches; very gravelly fine sandy loam

Cr—31 to 35 inches; bedrock

*Location of representative profile:* About 800 feet west and 500 feet south of the north-eastern corner of sec. 1, T. 20 N., R. 1 E.

### **Additional Components**

- Grainola and similar soils: 5 percent
- Huska and similar soils: 5 percent
- Lucien and similar soils: 5 percent
- Mulhall and similar soils: 3 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **CoZC3—Coyle and Zaneis soils, 3 to 5 percent slopes, severely eroded**

#### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 230 days

*Note:* The composition of soils in delineations of this map unit is variable. Most areas are made up of both named soils, but some areas may contain only one of the soils.

All the areas have been cultivated. Erosion has resulted in gullies 1 to 5 feet deep, 10 to 50 feet wide, and 25 to 300 feet apart. About 50 percent of the areas not gullied land are moderately eroded.

### ***Major Component Description***

#### **Coyle and similar soils**

*Extent of the component in the map unit:* 60 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 3 to 5 percent

*Runoff:* High

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 3.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*

A—0 to 7 inches; loam

BA—7 to 10 inches; loam

Bt—10 to 21 inches; clay loam

Cr—21 to 24 inches; bedrock

*Location of representative profile:* About 650 feet west and 180 feet south of the north-eastern corner of sec. 35, T. 20 N., R. 1 E.

#### **Zaneis and similar soils**

*Extent of the component in the map unit:* 16 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 3 to 5 percent

*Runoff:* Medium

*Depth to bedrock (paralithic):* 40 to 60 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 8.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*

A—0 to 10 inches; loam

BA—10 to 14 inches; loam

Bt1—14 to 26 inches; clay loam

Bt2—26 to 40 inches; clay loam

Bt3—40 to 50 inches; clay loam

Cr—50 to 52 inches; bedrock

*Location of representative profile:* About 700 feet west and 500 feet south of the north-eastern corner of sec. 35, T. 20 N., R. 1 E.

### **Additional Components**

- Gullies: 9 percent
- Mulhall and similar soils: 9 percent
- Huska and similar soils: 3 percent
- Pawhuska and similar soils: 3 percent

### **Management**

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **DalA—Dale silt loam, 0 to 1 percent slopes, rarely flooded**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

### **Major Component Description**

#### **Dale and similar soils**

*Extent of the component in the map unit:* 90 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Loamy alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* Rare

*Ponding:* None

*Interpretive groups:*

Land capability classification—1

Range site number and name—080AY0500K, Loamy Bottomland

*Typical profile:*

Ap—0 to 7 inches; silt loam

A—7 to 21 inches; silt loam

Bw1—21 to 60 inches; silty clay loam

Bw2—60 to 80 inches; silty clay loam

*Location of representative profile:* About 1,100 feet east and 1,200 feet south of the northwestern corner of sec. 27, T. 21 N., R. 1 W.

### ***Additional Components***

- Easpur and similar soils: 5 percent
- Oscar and similar soils: 3 percent
- Port and similar soils: 2 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **DAM—Dam**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 2,000 feet  
*Mean annual precipitation:* 22 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 185 to 230 days

### ***Major Component Description***

#### **Dam**

*Extent of the component in the map unit:* 100 percent  
*Parent material:* Mine spoil or earthy fill derived from sandstone and shale  
*Slope range:* 0 to 45 percent  
*Runoff:* Very high

#### *Interpretive groups:*

Land capability classification—8s  
 Range site number and name—none assigned

*Location of a representative area:* About 1,600 feet north and 450 feet west of the southeastern corner of sec. 34, T. 20 N., R. 1 E.

### ***Management***

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **DaUA—Dale-Urban land complex, 0 to 1 percent slopes, rarely flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 2,000 feet  
*Mean annual precipitation:* 22 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 185 to 230 days  
*Note:* Areas of the Dale soil and Urban land are so intermingled that they could not be separated at a scale of 1:24,000.

### **Major Component Description**

#### **Dale and similar soils**

*Extent of the component in the map unit:* 48 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Loamy alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* Rare

*Ponding:* None

*Interpretive groups:*

Land capability classification—1

Range site number and name—none assigned

*Typical profile:*

A—0 to 13 inches; silt loam

Bw1—13 to 22 inches; silty clay loam

Bw2—22 to 34 inches; silty clay loam

Bw3—34 to 50 inches; clay loam

BC—50 to 80 inches; clay loam

*Location of representative profile:* About 3,900 feet west and 1,700 feet south of the northeastern corner of sec. 23, T. 21 N., R. 1 W.

#### **Urban land**

*Extent of the component in the map unit:* 42 percent

*Definition of the component:* Mostly residential and business areas, streets, and parking areas

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Earthy fill derived primarily from Dale and Norge soils

*Slope range:* 0 to 1 percent

*Runoff:* Very high

*Flooding:* Rare

*Interpretive groups:*

Land capability classification—8e

Range site number and name—none assigned

*Location of a representative area:* About 3,900 feet west and 1,700 feet south of the northeastern corner of sec. 23, T. 21 N., R. 1 W.

### **Additional Components**

- Easpur and similar soils: 5 percent
- Norge and similar soils: 5 percent

### **Management**

*Major uses:* Urban land

For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties."

## **DiGE—Dilworth-Grainola complex, 5 to 12 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 220 days

*Note:* These Dilworth and Grainola soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Dilworth and similar soils**

*Extent of the component in the map unit:* 64 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 5 to 12 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 3.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

A—0 to 7 inches; silty clay loam

Bt—7 to 12 inches; silty clay

Btk—12 to 22 inches; silty clay

Cr—22 to 30 inches; weathered bedrock

*Location of representative profile:* About 1,200 feet east and 1,500 feet south of the northwestern corner of sec. 33, T. 24 N., R. 1 W.

#### **Grainola and similar soils**

*Extent of the component in the map unit:* 16 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 5 to 12 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 5.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

A—0 to 7 inches; loam

Bt—7 to 17 inches; silty clay

Btk—17 to 31 inches; silty clay

Cr—31 to 44 inches; weathered bedrock

*Location of representative profile:* About 1,300 feet east and 1,700 feet south of the northwestern corner of sec. 33, T. 24 N., R. 1 W.

**Additional Components**

- Highview and similar soils: 8 percent
- Westsum and similar soils: 8 percent
- Masham and similar soils: 4 percent

**Management***Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**DooB—Doolin silt loam, 0 to 2 percent slopes****Map Unit Setting***Major land resource area:* 80A*Elevation range:* 1,000 to 1,300 feet*Mean annual precipitation:* 26 to 40 inches*Mean annual air temperature:* 57 to 64 degrees F*Frost-free period:* 200 to 230 days**Major Component Description****Doolin and similar soils***Extent of the component in the map unit:* 85 percent*Geomorphic setting:* Interfluvium on hills

*Parent material:* Silty and clayey Pleistocene alluvium over loamy residuum weathered from Permian sandstone

*Slope range:* 0 to 2 percent*Runoff:* High*Depth to bedrock (paralithic):* 60 to 80 inches*Slowest permeability class within a depth of 60 inches:* Very slow*Drainage class:* Moderately well drained*Available water capacity:* About 6.9 inches*Depth to water table:* More than 6 feet*Flooding:* None*Ponding:* None*Sodium affected:* Sodic within a depth of 30 inches*Interpretive groups:*

Land capability classification—4s

Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

Ap—0 to 10 inches; silt loam  
 Btn1—10 to 24 inches; silty clay loam  
 Btn2—24 to 36 inches; clay loam  
 2Bt1—36 to 51 inches; sandy clay loam  
 2Bt2—51 to 70 inches; sandy clay loam  
 2Cr—70 to 75 inches; bedrock

*Location of representative profile:* About 2,400 feet east and 200 feet north of the southwestern corner of sec. 24, T. 21 N., R. 3 E.

**Additional Components**

- Huska and similar soils: 5 percent
- Pawhuska and similar soils: 5 percent
- Zaneis and similar soils: 5 percent

**Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**DwhC—Dilworth silty clay loam, 3 to 5 percent slopes****Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 220 days

**Major Component Description****Dilworth and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Backslope  
*Parent material:* Gray clayey residuum weathered from clayey Permian shale  
*Slope range:* 3 to 5 percent  
*Runoff:* Very high  
*Depth to bedrock (paralithic):* 20 to 40 inches  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Drainage class:* Well drained  
*Available water capacity:* About 5.8 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

A—0 to 7 inches; silty clay loam  
 Bt—7 to 13 inches; silty clay

Btk1—13 to 18 inches; silty clay

Btk2—18 to 28 inches; silty clay

BCK—28 to 36 inches; silty clay

Cr—36 to 43 inches; bedrock

*Location of representative profile:* About 700 feet south and 1,250 feet east of the northwestern corner of sec. 33, T. 24 N., R. 1 W.

### ***Additional Components***

- Westsum and similar soils: 10 percent
- Highview and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **EasA—Easpur loam, 0 to 1 percent slopes, occasionally flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Easpur and similar soils**

*Extent of the component in the map unit:* 79 percent

*Geomorphic setting:* Natural levee on a flood plain in a valley

*Parent material:* Loamy alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 9.9 inches

*Depth to water table:* More than 6 feet

*Flooding:* Occasional

*Ponding:* None

*Interpretive groups:*

Land capability classification—2w

Range site number and name—080AY0500K, Loamy Bottomland

*Typical profile:*

A—0 to 11 inches; loam

Bw—11 to 30 inches; loam

C1—30 to 54 inches; stratified loam to silty clay loam

C2—54 to 63 inches; stratified very fine sandy loam to silt loam

Ab—63 to 80 inches; silty clay loam

*Location of representative profile:* About 1,200 feet north and 200 feet east of the southwestern corner of sec. 11, T. 21 N., R. 3 E.

### ***Additional Components***

- Pulaski and similar soils: 10 percent
- Ashport and similar soils: 5 percent
- Port and similar soils: 5 percent
- Depressions and channels: 1 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **GadA—Gaddy loamy fine sand, 0 to 1 percent slopes, occasionally flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Gaddy and similar soils**

*Extent of the component in the map unit:* 89 percent  
*Geomorphic setting:* Natural levee on a flood plain in a valley  
*Parent material:* Sandy alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Negligible  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Rapid  
*Drainage class:* Somewhat excessively drained  
*Available water capacity:* About 4.8 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Occasional  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—3e  
 Range site number and name—080AY068OK, Sandy Bottomland

#### *Typical profile:*

A—0 to 6 inches; loamy fine sand  
 C—6 to 80 inches; stratified fine sand to fine sandy loam

*Location of representative profile:* About 1,200 feet north and 200 feet east of the southwestern corner of sec. 31, T. 25 N., R. 4 E.

### ***Additional Components***

- Goodnight and similar soils: 5 percent
- Keokuk and similar soils: 5 percent
- Depressions and channels: 1 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **GayA—Gaddy loamy fine sand, 0 to 1 percent slopes, rarely flooded**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

### **Major Component Description**

#### **Gaddy and similar soils**

*Extent of the component in the map unit:* 85 percent

*Geomorphic setting:* Natural levee on a flood plain in a valley

*Parent material:* Sandy alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderately rapid

*Drainage class:* Somewhat excessively drained

*Available water capacity:* About 4.9 inches

*Depth to water table:* More than 6 feet

*Flooding:* Rare

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY068OK, Sandy Bottomland

*Typical profile:*

Ap1—0 to 6 inches; loamy fine sand

Ap2—6 to 11 inches; loamy fine sand

C1—11 to 24 inches; loamy very fine sand

C2—24 to 45 inches; loamy fine sand

Bwb—45 to 60 inches; loamy very fine sand

Cb—60 to 80 inches; stratified loamy fine sand to loamy very fine sand

*Location of representative profile:* About 450 feet east and 100 feet south of the northwestern corner of sec. 4, T. 24 N., R. 2 E.

### **Additional Components**

- Goodnight and similar soils: 10 percent
- Keokuk and similar soils: 5 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **GMLG—Grainola-Masham-Lucien complex, 5 to 40 percent slopes, very bouldery**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 230 days

*Note:* These Grainola, Masham, and Lucien soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Grainola and similar soils**

*Extent of the component in the map unit:* 37 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 5 to 25 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 4.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—7e

Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

A—0 to 5 inches; gravelly loam

Bt—5 to 24 inches; silty clay

BC—24 to 30 inches; silty clay

Cr—30 to 40 inches; bedrock

*Location of representative profile:* About 450 feet north and 250 feet east of the southwestern corner of sec. 34, T. 22 N., R. 1 E.

#### **Masham and similar soils**

*Extent of the component in the map unit:* 22 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 20 to 40 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 10 to 20 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 2.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—7e

Range site number and name—080AY080OK, Shallow Clay Prairie

*Typical profile:*

A—0 to 4 inches; silty clay loam

Bw—4 to 13 inches; silty clay

Cr—13 to 25 inches; bedrock

*Location of representative profile:* About 750 feet north and 600 feet east of the southwestern corner of sec. 34, T. 22 N., R. 1 E.

### **Lucien and similar soils**

*Extent of the component in the map unit:* 21 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 15 to 20 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 10 to 20 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 3.0 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY083OK, Shallow Prairie

*Typical profile:*

A—0 to 7 inches; very fine sandy loam

Bw—7 to 17 inches; very fine sandy loam

Cr—17 to 20 inches; bedrock

*Location of representative profile:* About 750 feet north and 700 feet east of the southwestern corner of sec. 34, T. 22 N., R. 1 E.

### **Additional Components**

- Rock outcrop: 9 percent
- Mulhall and similar soils: 6 percent
- Ashport and similar soils: 3 percent
- Highview and similar soils: 2 percent

### **Management**

*Major uses:* Rangeland (fig. 13)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”



Figure 13.—Rangeland in an area of Grainola-Masham-Lucien complex, 5 to 40 percent slopes, very bouldery.

## **GohE—Goodnight loamy fine sand, 3 to 20 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Goodnight and similar soils**

*Extent of the component in the map unit:* 95 percent  
*Geomorphic setting:* Dune on sandhills on a flood plain in a valley  
*Landform position:* Summit and backslope  
*Parent material:* Eolian sands  
*Slope range:* 5 to 15 percent  
*Runoff:* Very low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Rapid  
*Drainage class:* Excessively drained  
*Available water capacity:* About 4.2 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—6e  
 Range site number and name—080AY014OK, Deep Sand

*Typical profile:*

A—0 to 8 inches; loamy fine sand  
 AC—8 to 20 inches; loamy fine sand  
 C—20 to 80 inches; fine sand

*Location of representative profile:* About 2,350 feet east and 350 feet north of the southwestern corner of sec. 8, T. 24 N., R. 4 E.

**Additional Components**

- Gaddy and similar soils: 3 percent
- Keokuk and similar soils: 2 percent

**Management**

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**GraC—Grainola silty clay loam, 3 to 5 percent slopes****Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 800 to 1,500 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 220 days

**Major Component Description****Grainola and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Backslope  
*Parent material:* Clayey residuum weathered from clayey Permian shale  
*Slope range:* 3 to 5 percent  
*Runoff:* Very high  
*Depth to bedrock (paralithic):* 20 to 40 inches  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Drainage class:* Well drained  
*Available water capacity:* About 5.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—4e  
 Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

Ap—0 to 5 inches; silty clay loam  
 Bt1—5 to 22 inches; silty clay  
 Bt2—22 to 34 inches; silty clay  
 Cr—34 to 40 inches; bedrock

*Location of representative profile:* About 1,500 feet west and 400 feet north of the southeastern corner of sec. 27, T. 23 N., R. 2 W.

### ***Additional Components***

- Lucien and similar soils: 5 percent
- Renfrow and similar soils: 5 percent
- Kingfisher and similar soils: 3 percent
- Coyle and similar soils: 2 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **GrAD—Grainola-Ashport complex, 0 to 8 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

*Note:* These Grainola and Ashport soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Grainola and similar soils**

*Extent of the component in the map unit:* 38 percent

*Geomorphic setting:* Drainageway on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 5 to 8 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 5.7 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—4e

Range site number and name—080AY010OK, Claypan Prairie (north)

*Typical profile:*

A—0 to 4 inches; silty clay loam

Bt—4 to 14 inches; silty clay

Btk—14 to 36 inches; silty clay

Cr—36 to 40 inches; bedrock

*Location of representative profile:* About 500 feet south and 300 feet east of the north-western corner of sec. 19, T. 20 N., R. 1 W.

**Ashport and similar soils**

*Extent of the component in the map unit:* 23 percent

*Geomorphic setting:* Valley flat along a drainageway on hills

*Parent material:* Silty alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Depth to bedrock (paralithic):* 41 to 79 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 9.1 inches

*Depth to water table:* More than 6 feet

*Flooding:* Frequent

*Ponding:* None

*Interpretive groups:*

Land capability classification—5w

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

A—0 to 13 inches; silty clay loam

Bw—13 to 32 inches; silt loam

C—32 to 40 inches; silt loam

Bwb—40 to 46 inches; silty clay loam

2Cr—46 to 58 inches; bedrock

*Location of representative profile:* About 500 feet south and 350 feet east of the north-western corner of sec. 19, T. 20 N., R. 1 W.

**Additional Components**

- Mulhall and similar soils: 14 percent
- Pawhuska and similar soils: 10 percent
- Renfrow and similar soils: 8 percent
- Kingfisher and similar soils: 3 percent
- Lucien and similar soils: 3 percent
- Depressions and channels: 1 percent

**Management**

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**GrHC—Grant-Huska complex, 1 to 5 percent slopes****Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 230 days

*Note:* These Grant and Huska soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### **Major Component Description**

#### **Grant and similar soils**

*Extent of the component in the map unit:* 37 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and backslope

*Parent material:* Silty residuum weathered from Permian sandstone

*Slope range:* 3 to 5 percent

*Runoff:* Low

*Depth to bedrock (paralithic):* 40 to 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 9.9 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 7 inches; silt loam

BA—7 to 11 inches; silt loam

Bt1—11 to 17 inches; silty clay loam

Bt2—17 to 35 inches; silty clay loam

Bt3—35 to 54 inches; silty clay loam

Cr—54 to 58 inches; bedrock

*Location of representative profile:* About 2,600 feet south and 100 feet east of the northwestern corner of sec. 24, T. 23 N., R. 1 E.

#### **Huska and similar soils**

*Extent of the component in the map unit:* 35 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and backslope

*Parent material:* Residuum weathered from interbedded Permian sandstone and shale

*Slope range:* 1 to 5 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 40 to 60 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Moderately well drained

*Available water capacity:* About 4.4 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Salt affected:* Saline within a depth of 30 inches

*Sodium affected:* Sodic within a depth of 30 inches

*Interpretive groups:*

Land capability classification—6s

Range site number and name—080AY091OK, Slickspot

*Typical profile:*

A—0 to 6 inches; silt loam

Btn1—6 to 17 inches; silty clay

Btnz—17 to 32 inches; silty clay loam

Bt<sub>n</sub>2—32 to 40 inches; silty clay loam  
 BC<sub>n</sub>—40 to 50 inches; silty clay loam  
 Cr—50 to 54 inches; bedrock

*Location of representative profile:* About 2,600 feet south and 400 feet east of the northwestern corner of sec. 24, T. 23 N., R. 1 E.

### **Additional Components**

- Renfrow and similar soils: 10 percent
- Kingfisher and similar soils: 8 percent
- Grainola and similar soils: 5 percent
- Wakita and similar soils: 5 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **GrLC—Grainola-Lucien complex, 1 to 5 percent slopes**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

*Note:* These Grainola and Lucien soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### **Major Component Description**

#### **Grainola and similar soils**

*Extent of the component in the map unit:* 47 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 3 to 5 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 6.4 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY010OK, Claypan Prairie (north)

*Typical profile:*

A—0 to 6 inches; loam

BA—6 to 11 inches; clay loam

Bt—11 to 18 inches; clay  
 Btk1—18 to 33 inches; clay  
 Btk2—33 to 39 inches; silty clay  
 Cr—39 to 42 inches; bedrock

*Location of representative profile:* About 2,425 feet south and 175 feet east of the northwestern corner of sec. 32, T. 20 N., R. 1 E.

#### **Lucien and similar soils**

*Extent of the component in the map unit:* 30 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit  
*Parent material:* Loamy residuum weathered from Permian sandstone  
*Slope range:* 1 to 5 percent  
*Runoff:* Very high  
*Depth to bedrock (paralithic):* 10 to 20 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Well drained  
*Available water capacity:* About 3.3 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—4s  
 Range site number and name—080AY083OK, Shallow Prairie

#### *Typical profile:*

A—0 to 7 inches; loam  
 Bw—7 to 18 inches; loam  
 Cr—18 to 24 inches; bedrock

*Location of representative profile:* About 2,350 feet south and 200 feet east of the northwestern corner of sec. 32, T. 20 N., R. 1 E.

#### **Additional Components**

- Kingfisher and similar soils: 10 percent
- Coyle and similar soils: 5 percent
- Piedmont and similar soils: 5 percent
- Huska and similar soils: 3 percent

#### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **GrLE—Grainola-Lucien complex, 5 to 12 percent slopes**

#### **Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

*Note:* These Grainola and Lucien soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Grainola and similar soils**

*Extent of the component in the map unit:* 50 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 5 to 12 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 4.4 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY010OK, Claypan Prairie (north)

*Typical profile:*

A—0 to 8 inches; clay loam

Bt—8 to 20 inches; silty clay

BC—20 to 27 inches; silty clay

Cr—27 to 30 inches; bedrock

*Location of representative profile:* About 1,350 feet west and 75 feet north of the southeastern corner of sec. 33, T. 21 N., R. 1 W.

#### **Lucien and similar soils**

*Extent of the component in the map unit:* 26 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 5 to 12 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 10 to 20 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 2.1 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY083OK, Shallow Prairie

*Typical profile:*

A—0 to 7 inches; loam

Bw—7 to 12 inches; gravelly loam

Cr—12 to 15 inches; bedrock

*Location of representative profile:* About 1,500 feet west and 75 feet north of the southeastern corner of sec. 33, T. 21 N., R. 1 W.

### ***Additional Components***

- Masham and similar soils: 10 percent
- Piedmont and similar soils: 4 percent
- Coyle and similar soils: 3 percent
- Kingfisher and similar soils: 3 percent
- Mulhall and similar soils: 3 percent
- Rock outcrop: 1 percent

### ***Management***

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **GrnC—Grant loam, 3 to 5 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 190 to 220 days

### ***Major Component Description***

#### **Grant and similar soils**

*Extent of the component in the map unit:* 95 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Backslope  
*Parent material:* Silty residuum weathered from Permian sandstone  
*Slope range:* 3 to 5 percent  
*Runoff:* Low  
*Depth to bedrock (paralithic):* 40 to 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 10.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY056OK, Loamy Prairie

#### *Typical profile:*

A—0 to 7 inches; loam  
 BA—7 to 12 inches; loam  
 Bt1—12 to 20 inches; clay loam  
 Bt2—20 to 29 inches; clay loam  
 Bt3—29 to 44 inches; loam  
 BC—44 to 59 inches; very fine sandy loam  
 Cr—59 to 65 inches; bedrock

*Location of representative profile:* About 100 feet south and 50 feet east of the northwestern corner of sec. 5, T. 20 N., R. 2 W.

### ***Additional Components***

- Huska and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **GrtB—Grant silt loam, 1 to 3 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 220 days

### ***Major Component Description***

#### **Grant and similar soils**

*Extent of the component in the map unit:* 90 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and shoulder

*Parent material:* Silty residuum weathered from Permian sandstone

*Slope range:* 1 to 3 percent

*Runoff:* Low

*Depth to bedrock (paralithic):* 40 to 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 10.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—2e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

Ap—0 to 11 inches; silt loam

BA—11 to 21 inches; silt loam

Bt—21 to 51 inches; silty clay loam

BC—51 to 57 inches; silty clay loam

Cr—57 to 64 inches; bedrock

*Location of representative profile:* About 1,600 feet east and 50 feet south of the northwestern corner of sec. 19, T. 21 N., R. 2 W.

### ***Additional Components***

- Huska and similar soils: 5 percent
- Renfrow and similar soils: 5 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **HaPE—Harrah-Pulaski complex, 0 to 12 percent slopes**

### **Map Unit Setting**

*Major land resource area:* 84A

*Elevation range:* 700 to 1,300 feet

*Mean annual precipitation:* 30 to 40 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 240 days

*Note:* These Harrah and Pulaski soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### **Major Component Description**

#### **Harrah and similar soils**

*Extent of the component in the map unit:* 44 percent

*Geomorphic setting:* Drainageway on hills

*Landform position:* Backslope

*Parent material:* Loamy colluvium derived from Permian sandstone

*Slope range:* 5 to 8 percent

*Runoff:* Medium

*Depth to bedrock (paralithic):* 63 to 80 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 8.1 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—4e

Range site number and name—084AY076OK, Sandy Savannah (central)

*Typical profile:*

A—0 to 5 inches; fine sandy loam

E—5 to 9 inches; fine sandy loam

Bt1—9 to 24 inches; sandy clay loam

Bt2—24 to 70 inches; sandy clay loam

Bt3—70 to 80 inches; fine sandy loam

*Location of representative profile:* About 2,100 feet east and 25 feet north of the southwestern corner of sec. 26, T. 20 N., R. 1 E.

#### **Pulaski and similar soils**

*Extent of the component in the map unit:* 25 percent

*Geomorphic setting:* Valley flat along a drainageway on hills

*Parent material:* Loamy alluvium

*Slope range:* 0 to 2 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderately rapid

*Drainage class:* Well drained

*Available water capacity:* About 8.6 inches

*Depth to water table:* More than 6 feet

*Flooding:* Frequent

*Ponding:* None

*Interpretive groups:*

Land capability classification—5w

Range site number and name—084AY050OK, Loamy Bottomland

*Typical profile:*

A—0 to 6 inches; fine sandy loam

AC—6 to 12 inches; fine sandy loam

C—12 to 50 inches; stratified loamy fine sand to loam

Ab—50 to 55 inches; fine sandy loam

Cb—55 to 65 inches; stratified loamy fine sand to loam

Cr—65 to 68 inches; bedrock

*Location of representative profile:* About 2,200 feet east and 100 feet south of the northwestern corner of sec. 35, T. 20 N., R. 1 E.

### ***Additional Components***

- Darnell and similar soils: 14 percent
- Rock outcrop: 9 percent
- Stephenville and similar soils: 8 percent

### ***Management***

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **HiRG—Highview-Rock outcrop complex, 15 to 45 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 500 to 2,200 feet

*Mean annual precipitation:* 22 to 48 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 240 days

*Note:* Areas of the Highview soil and Rock outcrop occur in a regular and repeating pattern. They are so intermingled that individual areas of the named components could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Highview and similar soils**

*Extent of the component in the map unit:* 43 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope and footslope

*Parent material:* Gray clayey colluvium derived from Permian shale

*Slope range:* 20 to 45 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 10 to 20 inches  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Drainage class:* Well drained  
*Available water capacity:* About 1.7 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—7e  
 Range site number and name—080AY080OK, Shallow Clay Prairie

*Typical profile:*  
 A—0 to 6 inches; gravelly silty clay  
 Bw—6 to 17 inches; gravelly silty clay  
 Cr—17 to 25 inches; bedrock

*Location of representative profile:* About 500 feet east and 2,100 feet south of the northwestern corner of sec. 22, T. 23 N., R. 2 W.

### **Rock outcrop**

*Extent of the component in the map unit:* 33 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Shoulder  
*Parent material:* Dolomite  
*Slope range:* 20 to 45 percent  
*Runoff:* Very high  
*Depth to bedrock (paralithic):* 0 to 3 inches

*Interpretive groups:*  
 Land capability classification—8e  
 Range site number and name—none assigned

*Location of a representative area:* About 520 feet east and 2,100 feet south of the northwestern corner of sec. 22, T. 23 N., R. 2 W.

### **Additional Components**

- Masham and similar soils: 10 percent
- Dilworth and similar soils: 7 percent
- Lucien and similar soils: 4 percent
- Shidler and similar soils: 3 percent

### **Management**

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**KekA—Keokuk very fine sandy loam, 0 to 1 percent slopes, rarely flooded**

### **Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,100 feet  
*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Keokuk and similar soils**

*Extent of the component in the map unit:* 88 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Loamy alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 10.9 inches

*Depth to water table:* More than 6 feet

*Flooding:* Rare

*Ponding:* None

*Interpretive groups:*

Land capability classification—1

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

Ap—0 to 14 inches; very fine sandy loam

A—14 to 21 inches; very fine sandy loam

Bw1—21 to 31 inches; very fine sandy loam

Bw2—31 to 53 inches; very fine sandy loam

BC—53 to 70 inches; silt loam

C—70 to 80 inches; very fine sandy loam

*Location of representative profile:* About 2,200 feet east and 600 feet south of the northwestern corner of sec. 4, T. 24 N., R. 2 E.

### ***Additional Components***

- Ashport and similar soils: 5 percent
- Gaddy and similar soils: 5 percent
- Goodnight and similar soils: 2 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **KeoA—Keokuk very fine sandy loam, 0 to 1 percent slopes, occasionally flooded**

#### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,100 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

### **Major Component Description**

#### **Keokuk and similar soils**

*Extent of the component in the map unit:* 88 percent  
*Geomorphic setting:* Valley flat on a flood plain in a valley  
*Parent material:* Loamy alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Negligible  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 11.1 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Occasional  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—2w  
 Range site number and name—080AY050OK, Loamy Bottomland

#### *Typical profile:*

Ap—0 to 6 inches; very fine sandy loam  
 A—6 to 13 inches; very fine sandy loam  
 Bw—13 to 27 inches; very fine sandy loam  
 C—27 to 80 inches; very fine sandy loam

*Location of representative profile:* About 2,200 feet west and 3,050 feet south of the northeastern corner of sec. 5, T. 24 N., R. 2 E.

### **Additional Components**

- Ashport and similar soils: 5 percent
- Gaddy and similar soils: 5 percent
- Goodnight and similar soils: 2 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **KgfB—Kingfisher silt loam, 1 to 3 percent slopes**

### **Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

### **Major Component Description**

#### **Kingfisher and similar soils**

*Extent of the component in the map unit:* 90 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit and shoulder

*Parent material:* Silty residuum weathered from Permian sandstone  
*Slope range:* 1 to 3 percent  
*Runoff:* High  
*Depth to bedrock (paralithic):* 20 to 40 inches  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Drainage class:* Well drained  
*Available water capacity:* About 5.0 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—3s  
 Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*  
 A—0 to 6 inches; silt loam  
 BA—6 to 10 inches; silty clay loam  
 Bt—10 to 26 inches; silty clay loam  
 Cr—26 to 35 inches; bedrock

*Location of representative profile:* About 175 feet east and 2,800 feet north of the southwestern corner of sec. 36, T. 24 N., R. 1 E.

#### ***Additional Components***

- Lucien and similar soils: 5 percent
- Wakita and similar soils: 5 percent

#### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **KgLC—Kingfisher-Lucien complex, 1 to 5 percent slopes**

#### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

*Note:* These Kingfisher and Lucien soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

#### ***Major Component Description***

##### **Kingfisher and similar soils**

*Extent of the component in the map unit:* 53 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit and shoulder  
*Parent material:* Silty residuum weathered from Permian sandstone  
*Slope range:* 3 to 5 percent  
*Runoff:* High

*Depth to bedrock (paralithic):* 20 to 40 inches  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Drainage class:* Well drained  
*Available water capacity:* About 4.2 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—3e  
 Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*  
 A—0 to 5 inches; loam  
 BA—5 to 8 inches; loam  
 Bt—8 to 22 inches; silty clay loam  
 Cr—22 to 25 inches; bedrock

*Location of representative profile:* About 600 feet east and 150 feet north of the southwestern corner of sec. 34, T. 21 N., R. 2 W.

#### **Lucien and similar soils**

*Extent of the component in the map unit:* 29 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit and shoulder  
*Parent material:* Silty residuum weathered from Permian sandstone  
*Slope range:* 1 to 5 percent  
*Runoff:* Very high  
*Depth to bedrock (paralithic):* 10 to 20 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately slow  
*Drainage class:* Well drained  
*Available water capacity:* About 2.5 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—4s  
 Range site number and name—080AY083OK, Shallow Prairie

*Typical profile:*  
 A—0 to 7 inches; very fine sandy loam  
 Bw—7 to 14 inches; very fine sandy loam  
 Cr—14 to 17 inches; bedrock

*Location of representative profile:* About 900 feet east and 150 feet south of the northwestern corner of sec. 3, T. 20 N., R. 2 W.

#### **Additional Components**

- Grant and similar soils: 9 percent
- Wakita and similar soils: 5 percent
- Grainola and similar soils: 4 percent

#### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **KgWC—Kingfisher-Wakita complex, 1 to 5 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

*Note:* These Kingfisher and Wakita soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Kingfisher and similar soils**

*Extent of the component in the map unit:* 63 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and shoulder

*Parent material:* Silty residuum weathered from Permian sandstone

*Slope range:* 1 to 5 percent

*Runoff:* High

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 6.1 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 6 inches; silt loam

BA—6 to 10 inches; silt loam

Bt1—10 to 26 inches; silty clay loam

Bt2—26 to 32 inches; silty clay loam

Cr—32 to 40 inches; bedrock

*Location of representative profile:* About 1,200 feet north and 1,400 feet west of the southeastern corner of sec. 20, T. 23 N., R. 2 W.

#### **Wakita and similar soils**

*Extent of the component in the map unit:* 19 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and shoulder

*Parent material:* Silty residuum weathered from Permian sandstone

*Slope range:* 1 to 3 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Moderately well drained

*Available water capacity:* About 3.3 inches



Figure 14.—Native grass hay on Kingfisher-Wakita complex, 1 to 5 percent slopes.

*Water table:* Present

*Flooding:* None

*Ponding:* None

*Salt affected:* Saline within a depth of 30 inches

*Sodium affected:* Sodic within a depth of 30 inches

*Interpretive groups:*

Land capability classification—6s

Range site number and name—080AY091OK, Slickspot

*Typical profile:*

Ap—0 to 4 inches; silt loam

Btn1—4 to 25 inches; silty clay loam

Btn2—25 to 31 inches; silty clay loam

Cr—31 to 37 inches; bedrock

*Location of representative profile:* About 1,400 feet north and 1,650 feet west of the southeastern corner of sec. 20, T. 23 N., R. 2 W.

### ***Additional Components***

- Lucien and similar soils: 9 percent
- Grainola and similar soils: 6 percent
- Huska and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland (fig. 14)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **KinC2—Kingfisher loam, 3 to 5 percent slopes, eroded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

*Note:* Areas of this map unit are or have been cultivated and are moderately eroded. In most areas, the upper part of the subsoil has been incorporated into the plow layer. In some areas, surface rills and small gullies are common.

### ***Major Component Description***

#### **Kingfisher and similar soils**

*Extent of the component in the map unit:* 82 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Silty residuum weathered from Permian sandstone

*Slope range:* 3 to 5 percent

*Runoff:* High

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 4.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—4e

Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*

Ap—0 to 8 inches; loam

Bt—8 to 19 inches; clay loam

BC—19 to 22 inches; clay loam

Cr—22 to 25 inches; bedrock

*Location of representative profile:* About 1,000 feet south and 100 feet east of the northwestern corner of sec. 3, T. 22 N., R. 1 E.

### ***Additional Components***

- Lucien and similar soils: 10 percent
- Wakita and similar soils: 5 percent
- Grainola and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **KowB—Konawa fine sandy loam, 1 to 3 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 84A  
*Elevation range:* 500 to 1,500 feet  
*Mean annual precipitation:* 30 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Konawa and similar soils**

*Extent of the component in the map unit:* 80 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit  
*Parent material:* Coarse-loamy Pleistocene alluvium  
*Slope range:* 1 to 3 percent  
*Runoff:* Low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 8.7 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—2e  
 Range site number and name—084AY076OK, Sandy Savannah (central)

#### *Typical profile:*

A—0 to 6 inches; fine sandy loam  
 E—6 to 14 inches; fine sandy loam  
 Bt1—14 to 24 inches; sandy clay loam  
 Bt2—24 to 44 inches; sandy clay loam  
 BC1—44 to 60 inches; fine sandy loam  
 BC2—60 to 80 inches; loamy fine sand

*Location of representative profile:* About 600 feet west and 900 feet north of the southeastern corner of sec. 7, T. 24 N., R. 4 E.

### ***Additional Components***

- Dougherty and similar soils: 10 percent
- Slaughterville and similar soils: 5 percent
- Teller and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **KowD—Konawa fine sandy loam, 3 to 8 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 84A  
*Elevation range:* 500 to 1,500 feet  
*Mean annual precipitation:* 30 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Konawa and similar soils**

*Extent of the component in the map unit:* 78 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Backslope  
*Parent material:* Coarse-loamy Pleistocene alluvium  
*Slope range:* 5 to 8 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 8.7 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—4e  
 Range site number and name—084AY076OK, Sandy Savannah (central)

#### *Typical profile:*

A—0 to 8 inches; fine sandy loam  
 E—8 to 20 inches; fine sandy loam  
 Bt1—20 to 33 inches; sandy clay loam  
 Bt2—33 to 50 inches; fine sandy loam  
 CB—50 to 67 inches; loamy fine sand  
 C—67 to 80 inches; fine sand

*Location of representative profile:* About 50 feet north and 100 feet east of the southwestern corner of sec. 8, T. 24 N., R. 4 E.

### ***Additional Components***

- Dougherty and similar soils: 12 percent
- Slaughterville and similar soils: 5 percent
- Teller and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**KrdA—Kirkland silt loam, 0 to 1 percent slopes*****Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 1,000 to 1,300 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 230 days

***Major Component Description*****Kirkland and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit  
*Parent material:* Loess over clayey Pleistocene alluvium, over residuum weathered from clayey Permian shale  
*Slope range:* 0 to 1 percent  
*Runoff:* High  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Well drained  
*Available water capacity:* About 8.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—2s  
 Range site number and name—080AY0100K, Claypan Prairie (north)

***Typical profile:***

Ap—0 to 9 inches; silt loam  
 Bt—9 to 28 inches; silty clay  
 Btk1—28 to 40 inches; silty clay  
 Btk2—40 to 53 inches; silty clay loam  
 Btk3—53 to 80 inches; silty clay loam

*Location of representative profile:* About 1,800 feet west and 150 feet south of the northeastern corner of sec. 4, T. 24 N., R. 2 W.

***Additional Components***

- Bethany and similar soils: 10 percent
- Pawhuska and similar soils: 5 percent

***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**KrdB—Kirkland silt loam, 1 to 3 percent slopes*****Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 1,000 to 1,300 feet

*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 230 days

### **Major Component Description**

#### **Kirkland and similar soils**

*Extent of the component in the map unit:* 80 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit and backslope  
*Parent material:* Loess over clayey Pleistocene alluvium, over residuum weathered from clayey Permian shale  
*Slope range:* 1 to 3 percent  
*Runoff:* Very high  
*Depth to bedrock (paralithic):* 60 to 99 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Well drained  
*Available water capacity:* About 8.2 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY010OK, Claypan Prairie (north)

#### *Typical profile:*

Ap—0 to 7 inches; silt loam  
 Bt—7 to 14 inches; silty clay  
 Btk—14 to 33 inches; silty clay  
 BC—33 to 61 inches; silty clay loam  
 Cr—61 to 80 inches; bedrock

*Location of representative profile:* About 500 feet west and 1,900 feet south of the northeastern corner of sec. 3, T. 22 N., R. 2 W.

### **Additional Components**

- Bethany and similar soils: 10 percent
- Pawhuska and similar soils: 5 percent
- Renfrow and similar soils: 5 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **KrdB2—Kirkland silt loam, 1 to 3 percent slopes, eroded**

### **Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 1,000 to 1,300 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 230 days  
*Note:* Areas of this map unit are or have been cultivated and are moderately eroded. In

most areas, the upper part of the subsoil has been incorporated into the plow layer. In some areas, surface rills and small gullies are common.

### ***Major Component Description***

#### **Kirkland and similar soils**

*Extent of the component in the map unit:* 80 percent

*Geomorphic setting:* Terrace on plains

*Landform position:* Summit and backslope

*Parent material:* Loess over clayey Pleistocene alluvium, over residuum weathered from clayey Permian shale

*Slope range:* 1 to 3 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 60 to 99 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 8.1 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY810OK, Reseeded Claypan Prairie

*Typical profile:*

Ap—0 to 4 inches; silt loam

Bt1—4 to 25 inches; silty clay

Bt2—25 to 44 inches; silty clay loam

Bt3—44 to 61 inches; silty clay loam

Cr—61 to 80 inches; bedrock

*Location of representative profile:* About 1,750 feet west and 200 feet south of the northeastern corner of sec. 2, T. 24 N., R. 2 W.

### ***Additional Components***

- Bethany and similar soils: 10 percent
- Pawhuska and similar soils: 5 percent
- Renfrow and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **KrPB—Kirkland-Pawhuska complex, 0 to 3 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 230 days

*Note:* These Kirkland and Pawhuska soils occur in a regular and repeating pattern. They

are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Kirkland and similar soils**

*Extent of the component in the map unit:* 52 percent

*Geomorphic setting:* Terrace on plains

*Landform position:* Foothlope

*Parent material:* Loess over clayey Pleistocene alluvium, over residuum weathered from clayey Permian shale

*Slope range:* 1 to 3 percent

*Runoff:* Very high

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 8.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY010OK, Claypan Prairie (north)

*Typical profile:*

Ap—0 to 8 inches; silt loam

Bt1—8 to 21 inches; silty clay

Btk—21 to 41 inches; silty clay

Bt2—41 to 64 inches; silty clay loam

Bt3—64 to 80 inches; clay loam

*Location of representative profile:* About 1,600 feet west and 400 feet north of the southeastern corner of sec. 4, T. 22 N., R. 2 W.

#### **Pawhuska and similar soils**

*Extent of the component in the map unit:* 33 percent

*Geomorphic setting:* Terrace on plains

*Landform position:* Foothlope

*Parent material:* Loess over clayey Pleistocene alluvium, over residuum weathered from clayey Permian shale

*Slope range:* 0 to 3 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 68 to 80 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Moderately well drained

*Available water capacity:* About 7.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Salt affected:* Saline within a depth of 30 inches

*Sodium affected:* Sodic within a depth of 30 inches

*Interpretive groups:*

Land capability classification—4s

Range site number and name—080AY091OK, Slickspot



Figure 15.—Wheat on Kirkland-Pawhuska complex, 0 to 3 percent slopes. The bare area is the Pawhuska soil.

*Typical profile:*

Ap—0 to 6 inches; silt loam  
 Btn1—6 to 22 inches; silty clay  
 Btn2—22 to 43 inches; silty clay  
 Btn3—43 to 55 inches; silty clay loam  
 Btn4—55 to 72 inches; silty clay loam  
 Cr—72 to 80 inches; bedrock

*Location of representative profile:* About 500 feet west and 1,000 feet north of the southeastern corner of sec. 4, T. 22 N., R. 2 W.

***Additional Components***

- Bethany and similar soils: 7 percent
- Huska and similar soils: 4 percent
- Tabler and similar soils: 4 percent

***Management***

*Major uses:* Cropland and rangeland (fig. 15)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**LAN—Landfill**

***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 500 to 2,500 feet  
*Mean annual precipitation:* 20 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Landfill**

*Extent of the component in the map unit:* 100 percent

*Geomorphic setting:* Hillslope on hills

*Parent material:* Mine spoil or earthy fill

*Slope range:* 0 to 12 percent

*Runoff:* Very high

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Interpretive groups:*

Land capability classification—8s

Range site number and name—none assigned

*Typical profile:*

This map unit consists of areas from which soil and underlying materials have been removed and stockpiled. Areas were filled with layers of municipal waste and soil then covered with a layer of stockpiled soil about 1.5 feet thick. The soil material is variable in texture and thickness. A typical pedon is not given due to the variability of the soil material.

*Location of a representative area:* About 4,200 feet north and 1,750 feet east of the southwestern corner of sec. 14, T. 21 N., R. 1 W.

### ***Management***

*Major uses:* Urban landfill

For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties."

## **LelA—Lela silty clay, 0 to 1 percent slopes, occasionally flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 800 to 1,200 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Lela and similar soils**

*Extent of the component in the map unit:* 91 percent

*Geomorphic setting:* Backswamp on a flood plain in a valley

*Parent material:* Clayey alluvium

*Slope range:* 0 to 1 percent

*Runoff:* High

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Somewhat poorly drained

*Available water capacity:* About 7.3 inches

*Depth to water table:* More than 6 feet

*Flooding:* Occasional

*Ponding:* None

*Interpretive groups:*

Land capability classification—4w

Range site number and name—080AY045OK, Heavy Bottomland

*Typical profile:*

Ap—0 to 6 inches; silty clay

A—6 to 13 inches; silty clay

Bss1—13 to 34 inches; silty clay

Bss2—34 to 42 inches; silty clay

Bss3—42 to 53 inches; silty clay

Bkss1—53 to 61 inches; silty clay

Bkss2—61 to 72 inches; silty clay

BCss—72 to 87 inches; silty clay

*Location of representative profile:* About 2,500 feet south and 50 feet west of the northeastern corner of sec. 1, T. 24 N., R. 1 W.

### **Additional Components**

- Port and similar soils: 5 percent
- Ashport and similar soils: 3 percent
- Depressions and channels: 1 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **LveB—Lovedale sandy loam, 1 to 3 percent slopes**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 1,000 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 220 days

### **Major Component Description**

#### **Lovedale and similar soils**

*Extent of the component in the map unit:* 90 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit

*Parent material:* Sandy Pleistocene alluvium

*Slope range:* 1 to 3 percent

*Runoff:* Low

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 7.6 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—2e

Range site number and name—080AY073OK, Sandy Prairie

*Typical profile:*

A—0 to 7 inches; sandy loam

BA—7 to 12 inches; sandy loam

Bt1—12 to 18 inches; sandy clay loam

Bt2—18 to 26 inches; sandy clay loam

Bt3—26 to 46 inches; sandy clay loam

BC—46 to 80 inches; loamy coarse sand

*Location of representative profile:* About 3,100 feet west and 100 feet north of the southeastern corner of sec. 2, T. 21 N., R. 3 E.

### **Additional Components**

- Milan and similar soils: 5 percent
- Wisby and similar soils: 5 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **M-W—Miscellaneous water**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 250 to 4,000 feet

*Mean annual precipitation:* 22 to 48 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 240 days

### **Major Component Description**

#### **Miscellaneous water**

*Extent of the component in the map unit:* 100 percent

*Definition of the component:* Areas of waste water, such as sewage lagoons and industrial waste water

*Interpretive groups:*

Land capability classification—none assigned

Range site number and name—none assigned

*Location of a representative area:* About 2,200 feet north and 1,000 feet west of the southeastern corner of sec. 14, T. 21 N., R. 1 W.

### **Management**

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**McaA—McLain silty clay loam, 0 to 1 percent slopes, rarely flooded*****Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

***Major Component Description*****McLain and similar soils**

*Extent of the component in the map unit:* 95 percent  
*Geomorphic setting:* Valley flat on a flood plain in a valley  
*Parent material:* Silty and clayey Pleistocene alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Slow  
*Drainage class:* Moderately well drained  
*Available water capacity:* About 10.3 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Rare  
*Ponding:* None

*Interpretive groups:*

Land capability classification—1  
 Range site number and name—080AY045OK, Heavy Bottomland

*Typical profile:*

Ap—0 to 7 inches; silty clay loam  
 Bt1—7 to 17 inches; silty clay loam  
 Bt2—17 to 31 inches; silty clay loam  
 Bt3—31 to 46 inches; silty clay loam  
 BC—46 to 80 inches; silty clay

*Location of representative profile:* About 2,400 feet west and 400 feet south of the northeastern corner of sec. 6, T. 24 N., R. 1 E.

***Additional Components***

- Lela and similar soils: 5 percent

***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**MilB—Milan loam, 1 to 3 percent slopes*****Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 1,200 to 1,500 feet  
*Mean annual precipitation:* 28 to 32 inches

*Mean annual air temperature:* 55 to 57 degrees F

*Frost-free period:* 185 to 225 days

### ***Major Component Description***

#### **Milan and similar soils**

*Extent of the component in the map unit:* 95 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and shoulder

*Parent material:* Sandy and gravelly Pleistocene alluvium

*Slope range:* 1 to 3 percent

*Runoff:* Medium

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderately slow

*Drainage class:* Well drained

*Available water capacity:* About 9.9 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—2e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 7 inches; loam

BA—7 to 12 inches; loam

Bt1—12 to 26 inches; clay loam

Bt2—26 to 45 inches; clay loam

Bt3—45 to 72 inches; sandy clay loam

BC—72 to 80 inches; sandy loam

*Location of representative profile:* About 2,000 feet west and 2,100 feet north of the southeastern corner of sec. 2, T. 21 N., R. 3 E.

### ***Additional Components***

- Norge and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **MilC—Milan loam, 3 to 5 percent slopes**

#### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 1,200 to 1,500 feet

*Mean annual precipitation:* 28 to 32 inches

*Mean annual air temperature:* 55 to 57 degrees F

*Frost-free period:* 185 to 225 days

### ***Major Component Description***

#### **Milan and similar soils**

*Extent of the component in the map unit:* 90 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Sandy and gravelly Pleistocene alluvium

*Slope range:* 3 to 5 percent

*Runoff:* Medium

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderately slow

*Drainage class:* Well drained

*Available water capacity:* About 9.4 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 9 inches; loam

BA—9 to 15 inches; loam

Bt1—15 to 33 inches; sandy clay loam

Bt2—33 to 48 inches; clay loam

BC—48 to 62 inches; sandy loam

C—62 to 80 inches; loamy sand

*Location of representative profile:* About 1,650 feet west and 150 feet south of the northeastern corner of sec. 10, T. 21 N., R. 3 E.

### ***Additional Components***

- Norge and similar soils: 5 percent
- Wisby and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **MinB—Minco very fine sandy loam, 1 to 3 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Minco and similar soils**

*Extent of the component in the map unit:* 85 percent

*Geomorphic setting:* Stream terrace in a valley  
*Landform position:* Tread  
*Parent material:* Loess  
*Slope range:* 1 to 3 percent  
*Runoff:* Low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 11.2 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—2e  
 Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*  
 Ap—0 to 8 inches; very fine sandy loam  
 A—8 to 15 inches; very fine sandy loam  
 Bw1—15 to 32 inches; very fine sandy loam  
 Bw2—32 to 46 inches; very fine sandy loam  
 BC—46 to 62 inches; very fine sandy loam  
 C—62 to 80 inches; very fine sandy loam

*Location of representative profile:* About 3,700 feet east and 1,350 feet south of the northwestern corner of sec. 29, T. 24 N., R. 3 E.

### ***Additional Components***

- Vanoss and similar soils: 10 percent
- Slaughterville and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **MinC—Minco very fine sandy loam, 3 to 5 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Minco and similar soils**

*Extent of the component in the map unit:* 90 percent  
*Geomorphic setting:* Stream terrace in a valley  
*Landform position:* Tread  
*Parent material:* Loess  
*Slope range:* 3 to 5 percent

*Runoff:* Low

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

Ap—0 to 8 inches; very fine sandy loam

A—8 to 17 inches; very fine sandy loam

Bw1—17 to 23 inches; very fine sandy loam

Bw2—23 to 54 inches; very fine sandy loam

BC—54 to 59 inches; very fine sandy loam

Bb—59 to 80 inches; very fine sandy loam

*Location of representative profile:* About 2,900 feet east and 3,200 feet south of the northwestern corner of sec. 29, T. 24 N., R. 3 E.

### ***Additional Components***

- Slaughterville and similar soils: 10 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **MirA—Miller silty clay loam, 0 to 1 percent slopes, occasionally flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 800 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Miller and similar soils**

*Extent of the component in the map unit:* 84 percent

*Geomorphic setting:* Backswamp on a flood plain in a valley

*Parent material:* Clayey alluvium

*Slope range:* 0 to 1 percent

*Runoff:* High

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Moderately well drained

*Available water capacity:* About 9.8 inches



Figure 16.—Pecan orchard on Miller silty clay loam, 0 to 1 percent slopes, occasionally flooded.

*Depth to water table:* More than 6 feet

*Flooding:* Occasional

*Ponding:* None

*Interpretive groups:*

Land capability classification—2w

Range site number and name—080AY045OK, Heavy Bottomland

*Typical profile:*

Ap—0 to 10 inches; silty clay loam

Bw—10 to 30 inches; silty clay

Ab—30 to 44 inches; silty clay loam

Bwb—44 to 80 inches; clay loam

*Location of representative profile:* About 1,800 feet west and 400 feet south of the northeastern corner of sec. 13, T. 21 N., R. 3 E.

### ***Additional Components***

- Ashport and similar soils: 10 percent
- Port and similar soils: 5 percent
- Depressions and channels: 1 percent

### ***Management***

*Major uses:* Cropland and rangeland (fig. 16)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**MisA—Miller silty clay loam, saline, 0 to 1 percent slopes,  
occasionally flooded**

***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

***Major Component Description***

**Miller and similar soils**

*Extent of the component in the map unit:* 84 percent  
*Geomorphic setting:* Backswamp on a flood plain in a valley  
*Parent material:* Clayey alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* High  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Moderately well drained  
*Available water capacity:* About 6.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Occasional  
*Ponding:* None  
*Salt affected:* Saline within a depth of 30 inches

*Interpretive groups:*

Land capability classification—4s  
 Range site number and name—080AY001OK, Alkali Bottomland

*Typical profile:*

Ap—0 to 10 inches; silty clay loam  
 Bw1—10 to 23 inches; silty clay  
 Bw2—23 to 34 inches; silty clay loam  
 C—34 to 40 inches; stratified silty clay to fine sandy loam  
 Ab—40 to 51 inches; silty clay loam  
 Bwb—51 to 80 inches; silty clay

*Location of representative profile:* About 1,400 feet west and 2,000 feet north of the southeastern corner of sec. 11, T. 21 N., R. 2 E.

***Additional Components***

- Oscar and similar soils: 10 percent
- Ashport and similar soils: 3 percent
- Port and similar soils: 2 percent
- Depressions and channels: 1 percent

***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **MPNC2—Milan-Pawhuska-Norge complex, 3 to 5 percent slopes, eroded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 55 to 64 degrees F

*Frost-free period:* 185 to 230 days

*Note:* These Milan, Pawhuska, and Norge soils occur in a regular and repeating pattern.

They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Milan and similar soils**

*Extent of the component in the map unit:* 35 percent

*Geomorphic setting:* Terrace on plains

*Landform position:* Backslope

*Parent material:* Sandy and gravelly Pleistocene alluvium

*Slope range:* 3 to 5 percent

*Runoff:* Medium

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderately slow

*Drainage class:* Well drained

*Available water capacity:* About 10.0 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*

Ap—0 to 11 inches; loam

Bt1—11 to 16 inches; clay loam

Bt2—16 to 28 inches; clay loam

Bt3—28 to 57 inches; clay loam

BC1—57 to 65 inches; coarse sandy loam

BC2—65 to 75 inches; loamy coarse sand

*Location of representative profile:* About 2,300 feet east and 750 feet north of the southwestern corner of sec. 18, T. 21 N., R. 3 E.

#### **Pawhuska and similar soils**

*Extent of the component in the map unit:* 28 percent

*Geomorphic setting:* Terrace on plains

*Landform position:* Shoulder and backslope

*Parent material:* Silty Pleistocene alluvium

*Slope range:* 3 to 5 percent

*Runoff:* Very high

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Moderately well drained

*Available water capacity:* About 7.8 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None  
*Salt affected:* Saline within a depth of 30 inches  
*Sodium affected:* Sodic within a depth of 30 inches

*Interpretive groups:*  
 Land capability classification—4s  
 Range site number and name—080AY891OK, Reseeded Slickspot

*Typical profile:*  
 Ap—0 to 8 inches; silt loam  
 Btn1—8 to 17 inches; clay  
 Btn2—17 to 27 inches; clay  
 Btn3—27 to 40 inches; clay loam  
 Btn4—40 to 64 inches; clay loam  
 BC—64 to 80 inches; coarse sandy loam

*Location of representative profile:* About 2,000 feet east and 800 feet north of the southwestern corner of sec. 18, T. 21 N., R. 3 E.

#### **Norge and similar soils**

*Extent of the component in the map unit:* 24 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Shoulder and backslope  
*Parent material:* Silty Pleistocene alluvium  
*Slope range:* 3 to 5 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately slow  
*Drainage class:* Well drained  
*Available water capacity:* About 11.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—3e  
 Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*  
 Ap—0 to 6 inches; silt loam  
 BA—6 to 14 inches; silt loam  
 Bt1—14 to 35 inches; silty clay loam  
 Bt2—35 to 45 inches; silty clay loam  
 Bt3—45 to 80 inches; silty clay loam

*Location of representative profile:* About 200 feet south and 1,800 feet east of the northwestern corner of sec. 19, T. 21 N., R. 3 E.

#### **Additional Components**

- Huska and similar soils: 9 percent
- Kirkland and similar soils: 4 percent

#### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **MulC—Mulhall loam, 3 to 5 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Mulhall and similar soils**

*Extent of the component in the map unit:* 92 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Backslope  
*Parent material:* Loamy colluvium derived from Permian sandstone over clayey residuum weathered from Permian shale  
*Slope range:* 3 to 5 percent  
*Runoff:* Low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 9.2 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY056OK, Loamy Prairie

#### *Typical profile:*

A—0 to 7 inches; loam  
 BA—7 to 13 inches; loam  
 Bt1—13 to 26 inches; clay loam  
 Bt2—26 to 42 inches; clay loam  
 Bt3—42 to 60 inches; clay loam  
 BC—60 to 80 inches; clay loam

*Location of representative profile:* About 3,500 feet east and 2,900 feet south of the northwestern corner of sec. 2, T. 22 N., R. 1 E.

### ***Additional Components***

- Zaneis and similar soils: 5 percent
- Pawhuska and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **MuID—Mulhall loam, 5 to 8 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Mulhall and similar soils**

*Extent of the component in the map unit:* 92 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Backslope  
*Parent material:* Loamy colluvium derived from Permian sandstone, over clayey residuum weathered from Permian shale  
*Slope range:* 5 to 8 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 9.3 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—4e  
 Range site number and name—080AY056OK, Loamy Prairie

#### *Typical profile:*

A—0 to 10 inches; loam  
 BA—10 to 14 inches; loam  
 Bt1—14 to 23 inches; clay loam  
 Bt2—23 to 33 inches; clay loam  
 Bt3—33 to 42 inches; clay loam  
 Bt4—42 to 56 inches; clay loam  
 BC—56 to 80 inches; clay loam

*Location of representative profile:* About 2,400 feet west and 50 feet north of the southeastern corner of sec. 26, T. 20 N., R. 1 E.

### ***Additional Components***

- Zaneis and similar soils: 5 percent
- Pawhuska and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## MulD4—Mulhall loam, 5 to 8 percent slopes, gullied

### *Map Unit Setting*

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

*Note:* All areas of this map unit have been cultivated. Erosion has resulted in uncrossable gullies that are 4 to 8 feet deep, 30 to 50 feet wide, and 50 to 300 feet apart. The gullied land makes up about 5 percent of the unit. About 50 percent of the areas not gullied land are moderately eroded.

### *Major Component Description*

#### **Mulhall and similar soils**

*Extent of the component in the map unit:* 92 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Loamy colluvium derived from Permian sandstone, over clayey residuum weathered from Permian shale

*Slope range:* 5 to 8 percent

*Runoff:* Medium

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 9.4 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*

A—0 to 14 inches; loam

BA—14 to 19 inches; loam

Bt1—19 to 29 inches; clay loam

Bt2—29 to 44 inches; clay loam

Bt3—44 to 80 inches; sandy clay loam

*Location of representative profile:* About 1,100 feet west and 25 feet north of the southeastern corner of sec. 30, T. 21 N., R. 2 E.

### *Additional Components*

- Zaneis and similar soils: 5 percent
- Pawhuska and similar soils: 3 percent

### *Management*

*Major uses:* Rangeland (fig. 17)

For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties."



Figure 17.—Native grass and gullies on Mulhall loam, 5 to 8 percent slopes, gullied.

## **NeDG—Newalla-Darnell complex, 8 to 45 percent slopes, very bouldery**

### ***Map Unit Setting***

*Major land resource area:* 84A

*Elevation range:* 750 to 1,300 feet

*Mean annual precipitation:* 30 to 40 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 200 to 230 days

*Note:* These Newalla and Darnell soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Newalla and similar soils**

*Extent of the component in the map unit:* 41 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Sandy colluvium derived from Permian sandstone over clayey residuum weathered from Permian shale

*Slope range:* 5 to 8 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 40 to 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Moderately well drained

*Available water capacity:* About 7.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—4e

Range site number and name—084AY076OK, Sandy Savannah (central)

*Typical profile:*

A—0 to 5 inches; fine sandy loam

E—5 to 14 inches; fine sandy loam

Bt1—14 to 22 inches; sandy clay loam

2Bt2—22 to 32 inches; silty clay

2Bt3—32 to 40 inches; silty clay

2BC—40 to 54 inches; silty clay

2Cr—54 to 58 inches; bedrock

*Location of representative profile:* About 2,050 feet east and 500 feet south of the northwestern corner of sec. 34, T. 20 N., R. 1 E.

### **Darnell and similar soils**

*Extent of the component in the map unit:* 36 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Shoulder and backslope

*Parent material:* Sandy residuum weathered from Permian sandstone

*Slope range:* 8 to 45 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 10 to 20 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 1.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—7e

Range site number and name—084AY089OK, Shallow Savannah

*Typical profile:*

A—0 to 4 inches; fine sandy loam

Bw—4 to 11 inches; fine sandy loam

Cr—11 to 15 inches; bedrock

*Location of representative profile:* About 1,900 feet east and 500 feet south of the northwestern corner of sec. 34, T. 20 N., R. 1 E.

### **Additional Components**

- Rock outcrop: 9 percent
- Stephenville and similar soils: 9 percent
- Grainola and similar soils: 5 percent

### **Management**

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties" (fig. 18).



Figure 18.—A recreational area near Lake McMurry on Newalla-Darnell complex, 8 to 45 percent slopes, very bouldery.

## **NorA—Norge silt loam, 0 to 1 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 900 to 1,300 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Norge and similar soils**

*Extent of the component in the map unit:* 90 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit and shoulder  
*Parent material:* Silty Pleistocene alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately slow  
*Drainage class:* Well drained  
*Available water capacity:* About 11.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—1

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

Ap—0 to 11 inches; silt loam  
 BA—11 to 14 inches; silt loam  
 Bt1—14 to 23 inches; clay loam  
 Bt2—23 to 32 inches; clay loam  
 Bt3—32 to 38 inches; clay loam  
 2Bt4—38 to 49 inches; clay loam  
 2Bt5—49 to 58 inches; clay loam  
 2Btk—58 to 81 inches; clay loam

*Location of representative profile:* About 2,000 feet south and 1,300 feet west of the northeastern corner of sec. 7, T. 24 N., R. 1 E.

**Additional Components**

- Bethany and similar soils: 10 percent

**Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**NorB—Norge silt loam, 1 to 3 percent slopes****Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 900 to 1,300 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

**Major Component Description****Norge and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit and shoulder  
*Parent material:* Silty Pleistocene alluvium  
*Slope range:* 1 to 3 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately slow  
*Drainage class:* Well drained  
*Available water capacity:* About 11.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—2e  
 Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

Ap—0 to 9 inches; silt loam  
 A—9 to 15 inches; silt loam

BA—15 to 19 inches; silty clay loam  
 Bt1—19 to 30 inches; silty clay loam  
 Bt2—30 to 44 inches; silty clay loam  
 Bt3—44 to 67 inches; silty clay loam  
 BC—67 to 80 inches; silt loam

*Location of representative profile:* About 1,300 feet west and 50 feet north of the southeastern corner of sec. 34, T. 21 N., R. 1 E.

### ***Additional Components***

- Bethany and similar soils: 5 percent
- Milan and similar soils: 5 percent
- Pawhuska and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **NorC—Norge silt loam, 3 to 5 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 900 to 1,300 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Norge and similar soils**

*Extent of the component in the map unit:* 90 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Backslope  
*Parent material:* Silty Pleistocene alluvium  
*Slope range:* 3 to 5 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately slow  
*Drainage class:* Well drained  
*Available water capacity:* About 11.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY056OK, Loamy Prairie

#### *Typical profile:*

A—0 to 11 inches; silt loam  
 BA—11 to 16 inches; silt loam  
 Bt1—16 to 27 inches; clay loam  
 Bt2—27 to 47 inches; clay loam



Figure 19.—Terraces and conservation tillage on Norge silt loam, 3 to 5 percent slopes.

Bt3—47 to 60 inches; clay loam

Bt4—60 to 80 inches; silt loam

*Location of representative profile:* About 470 feet south and 50 feet east of the northwestern corner of sec. 33, T. 21 N., R. 1 W.

### ***Additional Components***

- Milan and similar soils: 5 percent
- Pawhuska and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties” (fig. 19).

## **NorC2—Norge silt loam, 3 to 5 percent slopes, eroded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 900 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

*Note:* Areas of this map unit are or have been cultivated and are moderately eroded. In most areas, the upper part of the subsoil has been incorporated into the plow layer. In some areas, surface rills and small gullies are common.

### ***Major Component Description***

#### **Norge and similar soils**

*Extent of the component in the map unit:* 90 percent

*Geomorphic setting:* Terrace on plains

*Landform position:* Backslope

*Parent material:* Silty Pleistocene alluvium

*Slope range:* 3 to 5 percent

*Runoff:* Medium

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderately slow

*Drainage class:* Well drained

*Available water capacity:* About 11.3 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*

Ap—0 to 9 inches; silt loam

Bt1—9 to 18 inches; silty clay loam

Bt2—18 to 30 inches; silty clay loam

Bt3—30 to 44 inches; silty clay loam

Bt4—44 to 64 inches; silty clay loam

BC—64 to 86 inches; silt loam

*Location of representative profile:* About 1,950 feet west and 1,050 feet south of the northeastern corner of sec. 11, T. 23 N., R. 1 E.

### ***Additional Components***

- Milan and similar soils: 5 percent
- Pawhuska and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **NoUC—Norge-Urban land complex, 1 to 5 percent slopes**

#### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 2,000 feet

*Mean annual precipitation:* 22 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 185 to 230 days

*Note:* Areas of the Norge soil and Urban land are so intermingled that they could not be separated at a scale of 1:24,000.

### **Major Component Description**

#### **Norge and similar soils**

*Extent of the component in the map unit:* 55 percent

*Geomorphic setting:* Terrace on plains

*Landform position:* Summit and backslope

*Parent material:* Silty Pleistocene alluvium

*Slope range:* 1 to 5 percent

*Runoff:* Medium

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderately slow

*Drainage class:* Well drained

*Available water capacity:* About 11.3 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—none assigned

*Typical profile:*

A—0 to 7 inches; silt loam

BA—7 to 10 inches; silt loam

Bt1—10 to 20 inches; silty clay loam

Bt2—20 to 39 inches; silty clay loam

Bt3—39 to 45 inches; silty clay loam

Bt4—45 to 80 inches; silty clay loam

*Location of representative profile:* About 2,300 feet north and 100 feet east of the southwestern corner of sec. 14, T. 21 N., R. 1 W.

#### **Urban land**

*Extent of the component in the map unit:* 30 percent

*Definition of the component:* Mostly residential and business areas, streets, and parking areas

*Geomorphic setting:* Terrace on plains

*Landform position:* Summit and backslope

*Parent material:* Earthy fill derived primarily from Dale and Norge soils

*Slope range:* 1 to 5 percent

*Runoff:* Very high

*Interpretive groups:*

Land capability classification—8e

Range site number and name—none assigned

*Location of a representative area:* About 2,300 feet north and 100 feet east of the southwestern corner of sec. 14, T. 21 N., R. 1 W.

### **Additional Components**

- Bethany and similar soils: 5 percent
- Dale and similar soils: 5 percent
- Milan and similar soils: 5 percent

### **Management**

*Major uses:* Urban land

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **OWWE—Oil waste land-Westsum complex, 3 to 12 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 500 to 2,200 feet  
*Mean annual precipitation:* 22 to 48 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 240 days

*Note:* Areas of oil waste land and the Westsum soil occur in a regular and repeating pattern. They are so intermingled that individual areas of the named components could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Oil waste land**

*Extent of the component in the map unit:* 69 percent  
*Geomorphic setting:* Hillslope on hills  
*Parent material:* Gray clayey residuum weathered from Permian sandstone and shale  
*Slope range:* 3 to 12 percent  
*Runoff:* Very high  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None  
*Salt affected:* Saline within a depth of 30 inches  
*Sodium affected:* Sodic within a depth of 30 inches

#### *Interpretive groups:*

Land capability classification—8s  
Range site number and name—none assigned

*Location of a representative area:* About 350 feet west and 1,400 feet north of the southeastern corner of sec. 16, T. 23 N., R. 2 W.

#### **Westsum and similar soils**

*Extent of the component in the map unit:* 25 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Foothill slope  
*Parent material:* Gray clayey residuum weathered from Permian shale  
*Slope range:* 3 to 5 percent  
*Runoff:* Very high  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Well drained  
*Available water capacity:* About 10.2 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY010OK, Claypan Prairie (north)

*Typical profile:*

A—0 to 9 inches; silty clay loam

Bt1—9 to 14 inches; silty clay

Btk1—14 to 20 inches; silty clay

Btk2—20 to 28 inches; silty clay

Bt2—28 to 45 inches; silty clay

Bt3—45 to 56 inches; silty clay

BC—56 to 72 inches; silty clay

*Location of representative profile:* About 350 feet west and 1,400 feet north of the southeastern corner of sec. 16, T. 23 N., R. 2 W.

**Additional Components**

- Dilworth and similar soils: 6 percent

**Management***Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**PoaA—Port silt loam, 0 to 1 percent slopes, frequently flooded****Map Unit Setting***Major land resource area:* 80A*Elevation range:* 700 to 1,500 feet*Mean annual precipitation:* 26 to 38 inches*Mean annual air temperature:* 57 to 63 degrees F*Frost-free period:* 200 to 230 days**Major Component Description****Port and similar soils***Extent of the component in the map unit:* 84 percent*Geomorphic setting:* Valley flat on a flood plain in a valley*Parent material:* Silty alluvium*Slope range:* 0 to 1 percent*Runoff:* Negligible*Soil depth:* More than 60 inches*Slowest permeability class within a depth of 60 inches:* Moderate*Drainage class:* Well drained*Available water capacity:* About 11.8 inches*Depth to water table:* More than 6 feet*Flooding:* Frequent*Ponding:* None*Interpretive groups:*

Land capability classification—5w

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

A1—0 to 19 inches; silt loam

A2—19 to 30 inches; silt loam  
 Bw1—30 to 43 inches; silt loam  
 Bw2—43 to 59 inches; silt loam  
 Bw3—59 to 74 inches; silty clay loam

*Location of representative profile:* About 500 feet west and 600 feet north of the southeastern corner of sec. 32, T. 23 N., R. 2 W.

### ***Additional Components***

- Easpur and similar soils: 5 percent
- Miller and similar soils: 5 percent
- Oscar and similar soils: 5 percent
- Depressions and channels: 1 percent

### ***Management***

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **PoOA—Port-Oscar complex, 0 to 1 percent slopes, occasionally flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 190 to 230 days

*Note:* These Port and Oscar soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Port and similar soils**

*Extent of the component in the map unit:* 57 percent  
*Geomorphic setting:* Valley flat on a flood plain in a valley  
*Parent material:* Silty alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Negligible  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 11.8 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Occasional  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—2w  
 Range site number and name—080AY0500K, Loamy Bottomland

#### *Typical profile:*

A1—0 to 16 inches; silt loam

A2—16 to 23 inches; silt loam  
 Bw1—23 to 40 inches; silt loam  
 Bw2—40 to 51 inches; silt loam  
 Ab—51 to 80 inches; silt loam

*Location of representative profile:* About 2,350 feet west and 100 feet north of the southeastern corner of sec. 36, T. 21 N., R. 2 E.

#### **Oscar and similar soils**

*Extent of the component in the map unit:* 40 percent  
*Geomorphic setting:* Valley flat on a flood plain in a valley  
*Parent material:* Silty alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Slow  
*Drainage class:* Moderately well drained  
*Available water capacity:* About 11.1 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Occasional  
*Ponding:* None  
*Salt affected:* Saline within a depth of 30 inches  
*Sodium affected:* Sodic within a depth of 30 inches

#### *Interpretive groups:*

Land capability classification—6s  
 Range site number and name—080AY001OK, Alkali Bottomland

#### *Typical profile:*

A1—0 to 4 inches; silt loam  
 A2—4 to 10 inches; silt loam  
 Btn—10 to 16 inches; silty clay loam  
 BC—16 to 33 inches; silt loam  
 Ab1—33 to 43 inches; silt loam  
 Ab2—43 to 80 inches; silt loam

*Location of representative profile:* About 2,300 feet west and 100 feet north of the southeastern corner of sec. 36, T. 21 N., R. 2 E.

#### **Additional Components**

- Miller and similar soils: 2 percent
- Depressions and channels: 1 percent

#### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **PorA—Port silt loam, 0 to 1 percent slopes, occasionally flooded**

#### **Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 230 days

### ***Major Component Description***

#### **Port and similar soils**

*Extent of the component in the map unit:* 92 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Silty alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* Occasional

*Ponding:* None

*Interpretive groups:*

Land capability classification—2w

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

Ap—0 to 8 inches; silt loam

Ad—8 to 14 inches; silt loam

A1—14 to 20 inches; silt loam

A2—20 to 31 inches; silt loam

Bw—31 to 40 inches; silt loam

Bk1—40 to 48 inches; silt loam

Bk2—48 to 55 inches; silty clay loam

Ab—55 to 68 inches; silty clay loam

Bwb1—68 to 74 inches; silty clay loam

Bwb2—74 to 85 inches; silty clay loam

Bwb3—85 to 93 inches; silty clay loam

*Location of representative profile:* About 1,700 feet east and 100 feet north of the southwestern corner of sec. 27, T. 22 N., R. 1 W.

### ***Additional Components***

- Easpur and similar soils: 5 percent
- Oscar and similar soils: 2 percent
- Depressions and channels: 1 percent

### ***Management***

*Major uses:* Cropland and rangeland (fig. 20)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **PotA—Port silty clay loam, 0 to 1 percent slopes, occasionally flooded**

#### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet



Figure 20.—Alfalfa on Port silt loam, 0 to 1 percent slopes, occasionally flooded.

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 230 days

### ***Major Component Description***

#### **Port and similar soils**

*Extent of the component in the map unit:* 86 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Silty alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 11.8 inches

*Depth to water table:* More than 6 feet

*Flooding:* Occasional

*Ponding:* None

*Interpretive groups:*

Land capability classification—2w

Range site number and name—080AY050OK, Loamy Bottomland

*Typical profile:*

A—0 to 10 inches; silty clay loam

Bw1—10 to 26 inches; silty clay loam

Bw2—26 to 35 inches; silty clay loam

Bw3—35 to 66 inches; silty clay loam

BC—66 to 80 inches; silty clay loam

*Location of representative profile:* About 1,050 feet north and 100 feet east of the southwestern corner of sec. 16, T. 23 N., R. 1 W.

### ***Additional Components***

- Lela and similar soils: 5 percent
- Miller and similar soils: 5 percent
- Oscar and similar soils: 3 percent
- Depressions and channels: 1 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **PukA—Pulaski fine sandy loam, 0 to 1 percent slopes, frequently flooded**

### ***Map Unit Setting***

*Major land resource area:* 84A  
*Elevation range:* 700 to 1,100 feet  
*Mean annual precipitation:* 30 to 40 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 240 days

### ***Major Component Description***

#### **Pulaski and similar soils**

*Extent of the component in the map unit:* 70 percent  
*Geomorphic setting:* Valley flat on a flood plain in a valley  
*Parent material:* Loamy alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Negligible  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately rapid  
*Drainage class:* Well drained  
*Available water capacity:* About 9.2 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Frequent  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—5w  
 Range site number and name—084AY050OK, Loamy Bottomland

#### *Typical profile:*

A1—0 to 8 inches; fine sandy loam  
 A2—8 to 20 inches; fine sandy loam  
 C1—20 to 37 inches; fine sandy loam  
 Ab—37 to 47 inches; fine sandy loam  
 C2—47 to 80 inches; stratified fine sandy loam to fine sand

*Location of representative profile:* About 1,100 feet east and 20 feet south of the northwestern corner of sec. 21, T. 19 N., R. 2 E.; Payne County, Oklahoma

### ***Additional Components***

- Ashport and similar soils: 10 percent
- Easpur and similar soils: 10 percent
- Port and similar soils: 10 percent

### ***Management***

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **PulA—Pulaski fine sandy loam, 0 to 1 percent slopes, occasionally flooded**

### ***Map Unit Setting***

*Major land resource area:* 84A  
*Elevation range:* 700 to 1,100 feet  
*Mean annual precipitation:* 30 to 40 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 240 days

### ***Major Component Description***

#### **Pulaski and similar soils**

*Extent of the component in the map unit:* 82 percent  
*Geomorphic setting:* Natural levee on a flood plain in a valley  
*Parent material:* Loamy alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Negligible  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately rapid  
*Drainage class:* Well drained  
*Available water capacity:* About 8.8 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Occasional  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—2w  
 Range site number and name—084AY0500K, Loamy Bottomland

#### *Typical profile:*

A—0 to 9 inches; fine sandy loam  
 C1—9 to 27 inches; fine sandy loam  
 C2—27 to 80 inches; stratified loamy fine sand to loam

*Location of representative profile:* About 3,050 feet south and 2,800 feet east of the northwestern corner of sec. 11, T. 21 N., R. 3 E.

### ***Additional Components***

- Easpur and similar soils: 10 percent
- Ashport and similar soils: 5 percent
- Port and similar soils: 3 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **RefC2—Renfrow loam, 3 to 5 percent slopes, eroded**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 900 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 230 days

*Note:* Areas of this map unit are or have been cultivated and are moderately eroded. In most areas, the upper part of the subsoil has been incorporated into the plow layer. In some areas, surface rills and small gullies are common.

### **Major Component Description**

#### **Renfrow and similar soils**

*Extent of the component in the map unit:* 75 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 3 to 5 percent

*Runoff:* Very high

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 10.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY8100K, Reseeded Claypan Prairie

*Typical profile:*

Ap—0 to 6 inches; loam

Bt1—6 to 35 inches; silty clay

Bt2—35 to 73 inches; silty clay

*Location of representative profile:* About 2,500 feet south and 900 feet west of the northeastern corner of sec. 24, T. 20 N., R. 2 E.; Payne County, Oklahoma

### **Additional Components**

- Grainola and similar soils: 10 percent
- Piedmont and similar soils: 5 percent
- Zaneis and similar soils: 5 percent
- Pawhuska and similar soils: 3 percent
- Huska and similar soils: 2 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **ReGC2—Renfrow and Grainola soils, 3 to 5 percent slopes, eroded**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 800 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 230 days

*Note:* The composition of soils in delineations of this map unit is variable. Most areas are made up of both soils, but some areas may be only the Renfrow soil. Areas of this map unit are or have been cultivated and are moderately eroded. In most areas, the upper part of the subsoil has been incorporated into the plow layer. In some areas, surface rills and small gullies are common.

### **Major Component Description**

#### **Renfrow and similar soils**

*Extent of the component in the map unit:* 60 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 3 to 5 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 61 to 80 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 10.3 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY810OK, Reseeded Claypan Prairie

*Typical profile:*

Ap—0 to 8 inches; silty clay loam

BA—8 to 12 inches; silty clay loam

Bt1—12 to 30 inches; silty clay

Bt2—30 to 44 inches; silty clay

BC—44 to 63 inches; silty clay

Cr—63 to 80 inches; bedrock

*Location of representative profile:* About 1,900 feet west and 850 feet north of the southeastern corner of sec. 8, T. 20 N., R. 1 W.

#### **Grainola and similar soils**

*Extent of the component in the map unit:* 20 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 3 to 5 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 5.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—4e

Range site number and name—080AY8100K, Reseeded Claypan Prairie

*Typical profile:*

Ap—0 to 7 inches; silty clay loam

BA—7 to 12 inches; silty clay loam

Bt—12 to 26 inches; silty clay

BC—26 to 33 inches; silty clay

Cr—33 to 40 inches; bedrock

*Location of representative profile:* About 1,900 feet west and 1,000 feet north of the southeastern corner of sec. 8, T. 20 N., R. 1 W.

### ***Additional Components***

- Renthin and similar soils: 8 percent
- Kirkland and similar soils: 3 percent
- Lucien and similar soils: 3 percent
- Pawhuska and similar soils: 3 percent
- Piedmont and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **ReiA—Reinach very fine sandy loam, 0 to 1 percent slopes, rarely flooded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,300 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free period:* 190 to 230 days

### ***Major Component Description***

#### **Reinach and similar soils**

*Extent of the component in the map unit:* 90 percent

*Geomorphic setting:* Valley flat on a flood plain in a valley

*Parent material:* Silty alluvium

*Slope range:* 0 to 1 percent  
*Runoff:* Negligible  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 10.6 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* Rare  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—1  
 Range site number and name—080AY0500K, Loamy Bottomland

*Typical profile:*  
 Ap—0 to 8 inches; very fine sandy loam  
 A1—8 to 23 inches; very fine sandy loam  
 A2—23 to 30 inches; very fine sandy loam  
 Bw1—30 to 42 inches; very fine sandy loam  
 Bw2—42 to 65 inches; silt loam  
 Bw3—65 to 82 inches; very fine sandy loam

*Location of representative profile:* About 250 feet south and 200 feet east of the northwestern corner of sec. 3, T. 24 N., R. 2 E.

#### ***Additional Components***

- Keokuk and similar soils: 10 percent

#### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **RenB—Renfrow silt loam, 1 to 3 percent slopes**

#### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 900 to 1,500 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 230 days

#### ***Major Component Description***

##### **Renfrow and similar soils**

*Extent of the component in the map unit:* 82 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit and backslope  
*Parent material:* Clayey residuum weathered from clayey Permian shale  
*Slope range:* 1 to 3 percent  
*Runoff:* Very high  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Well drained



Figure 21.—Rangeland on Renfrow silt loam, 1 to 3 percent slopes, in the foreground, and Grainola-Lucien complex, 1 to 5 percent slopes, in the background.

*Available water capacity:* About 10.4 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—2e

Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

Ap—0 to 9 inches; silt loam

BA—9 to 13 inches; silty clay loam

Bt1—13 to 23 inches; silty clay loam

Bt2—23 to 42 inches; silty clay

Bt3—42 to 60 inches; silty clay

BC—60 to 80 inches; silty clay

*Location of representative profile:* About 1,500 feet west and 2,600 feet south of the northeastern corner of sec. 19, T. 21 N., R. 1 W.

### ***Additional Components***

- Grainola and similar soils: 10 percent
- Pawhuska and similar soils: 5 percent
- Bethany and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland (fig. 21)

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **RenC—Renfrow silt loam, 3 to 5 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 900 to 1,500 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 230 days

### ***Major Component Description***

#### **Renfrow and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit and backslope  
*Parent material:* Clayey residuum weathered from clayey Permian shale  
*Slope range:* 3 to 5 percent  
*Runoff:* Very high  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Well drained  
*Available water capacity:* About 10.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY0100K, Claypan Prairie (north)

#### *Typical profile:*

Ap—0 to 10 inches; silt loam  
 BA—10 to 13 inches; silty clay loam  
 Bt1—13 to 28 inches; silty clay  
 Bt2—28 to 36 inches; silty clay  
 Bt3—36 to 50 inches; silty clay  
 BC1—50 to 65 inches; silty clay  
 BC2—65 to 80 inches; silty clay

*Location of representative profile:* About 1,400 feet east and 150 feet south of the northwestern corner of sec. 30, T. 21 N., R. 1 W.

### ***Additional Components***

- Grainola and similar soils: 12 percent
- Pawhuska and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **RewC2—Renfrow silty clay loam, 3 to 5 percent slopes, eroded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 900 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 230 days

*Note:* Areas of this map unit are or have been cultivated and are moderately eroded. In most areas, the upper part of the subsoil has been incorporated into the plow layer. In some areas, surface rills and small gullies are common.

### ***Major Component Description***

#### **Renfrow and similar soils**

*Extent of the component in the map unit:* 80 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 3 to 5 percent

*Runoff:* Medium

*Depth to bedrock (paralithic):* 61 to 80 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 10.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY810OK, Reseeded Claypan Prairie

*Typical profile:*

Ap—0 to 10 inches; silty clay loam

Bt1—10 to 24 inches; silty clay

Bt2—24 to 37 inches; silty clay

Bt3—37 to 54 inches; silty clay

BC—54 to 63 inches; silty clay

Cr—63 to 80 inches; bedrock

*Location of representative profile:* About 2,300 feet south and 2,200 feet east of the northwestern corner of sec. 22, T. 19 N., R. 4 W.; Logan County, Oklahoma

### ***Additional Components***

- Grainola and similar soils: 9 percent
- Huska and similar soils: 4 percent
- Zaneis and similar soils: 4 percent
- Kirkland and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **RGPD3—Renfrow, Grainola, and Pawhuska soils, 3 to 8 percent slopes, severely eroded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 190 to 230 days

*Note:* The pattern of soils in this map unit is variable from one area to another. Most areas are made up of all three named soils, but some areas may be only the Renfrow soil. Areas of this map unit have been cultivated and are severely eroded. The upper part of the subsoil has been mixed into the plow layer, and surface rills and small gullies are common. Uncrossable gullies are common in some delineations.

### ***Major Component Description***

#### **Renfrow and similar soils**

*Extent of the component in the map unit:* 45 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 3 to 5 percent

*Runoff:* Very high

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 10.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—080AY810OK, Reseeded Claypan Prairie

*Typical profile:*

Ap—0 to 10 inches; clay loam

Bt1—10 to 24 inches; silty clay

Bt2—24 to 44 inches; silty clay loam

Bt3—44 to 80 inches; silty clay loam

*Location of representative profile:* About 900 feet north and 600 feet east of the southwestern corner of sec. 5, T. 20 N., R. 1 E.

#### **Grainola and similar soils**

*Extent of the component in the map unit:* 29 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Clayey residuum weathered from clayey Permian shale

*Slope range:* 3 to 8 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained  
*Available water capacity:* About 3.5 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—6e  
 Range site number and name—080AY810OK, Reseeded Claypan Prairie

*Typical profile:*  
 Ap—0 to 5 inches; silty clay loam  
 Bt—5 to 21 inches; silty clay  
 Cr—21 to 24 inches; bedrock

*Location of representative profile:* About 600 feet north and 300 feet east of the southwestern corner of sec. 5, T. 20 N., R. 1 E.

### **Pawhuska and similar soils**

*Extent of the component in the map unit:* 15 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Backslope  
*Parent material:* Residuum weathered from Permian sandstone and shale  
*Slope range:* 3 to 5 percent  
*Runoff:* Very high  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Moderately well drained  
*Available water capacity:* About 7.7 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None  
*Salt affected:* Saline within a depth of 30 inches  
*Sodium affected:* Sodic within a depth of 30 inches

*Interpretive groups:*  
 Land capability classification—6e  
 Range site number and name—080AY891OK, Reseeded Slickspot

*Typical profile:*  
 Ap—0 to 3 inches; silt loam  
 Btn1—3 to 13 inches; silty clay  
 Btn2—13 to 42 inches; silty clay loam  
 Btn3—42 to 80 inches; silty clay loam

*Location of representative profile:* About 800 feet north and 600 feet east of the southwestern corner of sec. 5, T. 20 N., R. 1 E.

### **Additional Components**

- Mulhall and similar soils: 6 percent
- Huska and similar soils: 5 percent

### **Management**

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **SlaB—Slaughterville fine sandy loam, 0 to 3 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 800 to 1,200 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 220 days

### ***Major Component Description***

#### **Slaughterville and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Stream terrace in a valley  
*Landform position:* Tread and riser  
*Parent material:* Coarse-loamy Pleistocene alluvium  
*Slope range:* 1 to 3 percent  
*Runoff:* Very low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 7.7 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—2e  
 Range site number and name—080AY073OK, Sandy Prairie

#### *Typical profile:*

Ap—0 to 10 inches; fine sandy loam  
 Bw1—10 to 39 inches; fine sandy loam  
 Bw2—39 to 50 inches; fine sandy loam  
 Btb—50 to 80 inches; sandy clay loam

*Location of representative profile:* About 300 feet east and 700 feet south of the north-western corner of sec. 17, T. 24 N., R. 4 E.

### ***Additional Components***

- Konawa and similar soils: 10 percent
- Minco and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **SlaC—Slaughterville fine sandy loam, 3 to 5 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 800 to 1,200 feet

*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 220 days

### ***Major Component Description***

#### **Slaughterville and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Stream terrace in a valley  
*Landform position:* Riser  
*Parent material:* Coarse-loamy Pleistocene alluvium  
*Slope range:* 3 to 5 percent  
*Runoff:* Very low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately rapid  
*Drainage class:* Well drained  
*Available water capacity:* About 7.5 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY073OK, Sandy Prairie

#### *Typical profile:*

Ap—0 to 13 inches; fine sandy loam  
 Bw1—13 to 19 inches; fine sandy loam  
 Bw2—19 to 30 inches; fine sandy loam  
 Bw3—30 to 50 inches; fine sandy loam  
 C—50 to 80 inches; fine sandy loam

*Location of representative profile:* About 2,400 feet east and 300 feet south of the northwestern corner of sec. 22, T. 24 N., R. 3 E.

### ***Additional Components***

- Minco and similar soils: 10 percent
- Konawa and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **SlaG—Slaughterville fine sandy loam, 8 to 45 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 800 to 1,200 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 220 days

### **Major Component Description**

#### **Slaughterville and similar soils**

*Extent of the component in the map unit:* 78 percent

*Geomorphic setting:* Stream terrace in a valley

*Landform position:* Riser

*Parent material:* Coarse-loamy Pleistocene alluvium

*Slope range:* 8 to 45 percent

*Runoff:* Low

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderately rapid

*Drainage class:* Well drained

*Available water capacity:* About 7.2 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—7e

Range site number and name—080AY073OK, Sandy Prairie

*Typical profile:*

A—0 to 16 inches; fine sandy loam

Bw—16 to 33 inches; fine sandy loam

C—33 to 80 inches; loamy fine sand

*Location of representative profile:* About 450 feet east and 1,550 feet south of the northwestern corner of sec. 23, T. 24 N., R. 3 E.

### **Additional Components**

- Minco and similar soils: 10 percent
- Konawa and similar soils: 7 percent
- Derby and similar soils: 5 percent

### **Management**

*Major uses:* Rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **StDD—Stephenville-Darnell complex, 3 to 8 percent slopes**

#### **Map Unit Setting**

*Major land resource area:* 84A

*Elevation range:* 750 to 1,500 feet

*Mean annual precipitation:* 30 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

*Note:* These Stephenville and Darnell soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Stephenville and similar soils**

*Extent of the component in the map unit:* 45 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 3 to 5 percent

*Runoff:* Medium

*Depth to bedrock (paralithic):* 20 to 40 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 5.6 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—084AY076OK, Sandy Savannah (central)

*Typical profile:*

A—0 to 5 inches; fine sandy loam

E—5 to 9 inches; fine sandy loam

Bt—9 to 30 inches; sandy clay loam

BC—30 to 36 inches; fine sandy loam

Cr—36 to 40 inches; bedrock

*Location of representative profile:* About 1,600 feet east and 1,100 feet south of the northwestern corner of sec. 34, T. 20 N., R. 1 E.

#### **Darnell and similar soils**

*Extent of the component in the map unit:* 35 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Backslope

*Parent material:* Loamy residuum weathered from Permian sandstone

*Slope range:* 3 to 8 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 10 to 20 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 1.6 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—6e

Range site number and name—084AY089OK, Shallow Savannah

*Typical profile:*

A—0 to 4 inches; fine sandy loam

Bw—4 to 12 inches; fine sandy loam

Cr—12 to 15 inches; bedrock

*Location of representative profile:* About 1,300 feet east and 1,400 feet south of the northwestern corner of sec. 34, T. 20 N., R. 1 E.

### ***Additional Components***

- Newalla and similar soils: 10 percent
- Harrah and similar soils: 9 percent
- Rock outcrop: 1 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **TabA—Tabler silt loam, 0 to 1 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 750 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 230 days

### ***Major Component Description***

#### **Tabler and similar soils**

*Extent of the component in the map unit:* 83 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit  
*Parent material:* Loess over silty and clayey Pleistocene alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* High  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Moderately well drained  
*Available water capacity:* About 9.7 inches  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*  
 Land capability classification—2s  
 Range site number and name—080AY0100K, Claypan Prairie (north)

#### *Typical profile:*

Ap—0 to 10 inches; silt loam  
 Bt1—10 to 25 inches; silty clay  
 Bt2—25 to 43 inches; silty clay  
 Bt3—43 to 65 inches; silty clay  
 Bt4—65 to 80 inches; silty clay

*Location of representative profile:* About 1,800 feet north and 350 feet west of the southeastern corner of sec. 7, T. 24 N., R. 2 W.

### ***Additional Components***

- Kirkland and similar soils: 10 percent
- Bethany and similar soils: 5 percent
- Waurika and similar soils: 2 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **TeaA—Tearney silty clay, 0 to 1 percent slopes, ponded**

### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free period:* 200 to 230 days

### **Major Component Description**

#### **Tearney and similar soils**

*Extent of the component in the map unit:* 82 percent

*Geomorphic setting:* Interdune in a dune field on a flood plain in a valley

*Landform position:* Depression

*Parent material:* Clayey alluvium over sandy alluvium

*Slope range:* 0 to 1 percent

*Runoff:* Negligible

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Very slow

*Drainage class:* Well drained

*Available water capacity:* About 6.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* Occasional

*Ponding:* Occasional

*Interpretive groups:*

Land capability classification—4w

Range site number and name—080AY090OK, Meadow

*Typical profile:*

A—0 to 10 inches; silty clay

Bw—10 to 26 inches; silty clay loam

2C1—26 to 30 inches; loamy fine sand

2C2—30 to 80 inches; sand

*Location of representative profile:* About 3,800 feet west and 2,300 feet south of the northeastern corner of sec. 5, T. 24 N., R. 2 E.

### **Additional Components**

- Ashport and similar soils: 8 percent
- Keokuk and similar soils: 7 percent
- Depressions: 3 percent

### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **TelB—Teller loam, 1 to 3 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 800 to 1,300 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

### ***Major Component Description***

#### **Teller and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Summit and shoulder  
*Parent material:* Loamy Pleistocene alluvium  
*Slope range:* 1 to 3 percent  
*Runoff:* Low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 10.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—2e  
 Range site number and name—080AY056OK, Loamy Prairie

#### *Typical profile:*

A—0 to 8 inches; loam  
 BA—8 to 12 inches; loam  
 Bt1—12 to 20 inches; clay loam  
 Bt2—20 to 30 inches; clay loam  
 Bt3—30 to 50 inches; clay loam  
 BC—50 to 80 inches; loam

*Location of representative profile:* About 2,000 feet south and 500 feet west of the northeastern corner of sec. 12, T. 24 N., R. 3 E.

### ***Additional Components***

- Norge and similar soils: 10 percent
- Konawa and similar soils: 3 percent
- Pawhuska and similar soils: 2 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**TeID—Teller loam, 5 to 8 percent slopes*****Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 800 to 1,300 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

***Major Component Description*****Teller and similar soils**

*Extent of the component in the map unit:* 85 percent  
*Geomorphic setting:* Terrace on plains  
*Landform position:* Backslope  
*Parent material:* Loamy Pleistocene alluvium  
*Slope range:* 5 to 8 percent  
*Runoff:* Medium  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 10.5 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—4e  
 Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 12 inches; loam  
 BA—12 to 17 inches; loam  
 Bt1—17 to 27 inches; clay loam  
 Bt2—27 to 45 inches; clay loam  
 Bt3—45 to 58 inches; clay loam  
 BC—58 to 80 inches; loam

*Location of representative profile:* About 2,400 feet north and 2,500 feet west of the southeastern corner of sec. 11, T. 24 N., R. 3 E.

***Additional Components***

- Norge and similar soils: 10 percent
- Konawa and similar soils: 3 percent
- Pawhuska and similar soils: 2 percent

***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **TeID2—Teller loam, 5 to 8 percent slopes, eroded**

### ***Map Unit Setting***

*Major land resource area:* 80A

*Elevation range:* 800 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

*Note:* Areas of this map unit are or have been cultivated and are moderately eroded. In most areas, the upper part of the subsoil has been incorporated into the plow layer. In some areas, surface rills and small gullies are common.

### ***Major Component Description***

#### **Teller and similar soils**

*Extent of the component in the map unit:* 82 percent

*Geomorphic setting:* Terrace on plains

*Landform position:* Backslope

*Parent material:* Loamy Pleistocene alluvium

*Slope range:* 5 to 8 percent

*Runoff:* Medium

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 10.4 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—4e

Range site number and name—080AY856OK, Reseeded Loamy Prairie

*Typical profile:*

A—0 to 6 inches; loam

BA—6 to 11 inches; loam

Bt1—11 to 16 inches; clay loam

Bt2—16 to 31 inches; clay loam

Bt3—31 to 42 inches; clay loam

BC—42 to 72 inches; loam

C—72 to 85 inches; loam

*Location of representative profile:* About 3,150 feet east and 3,650 feet north of the southwestern corner of sec. 7, T. 24 N., R. 4 E.

### ***Additional Components***

- Norge and similar soils: 10 percent
- Pawhuska and similar soils: 5 percent
- Konawa and similar soils: 3 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties."

## VanA—Vanoss silt loam, 0 to 1 percent slopes

### *Map Unit Setting*

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,200 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

### *Major Component Description*

#### **Vanoss and similar soils**

*Extent of the component in the map unit:* 82 percent  
*Geomorphic setting:* Stream terrace in a valley  
*Landform position:* Tread  
*Parent material:* Silty Pleistocene alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* Negligible  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderate  
*Drainage class:* Well drained  
*Available water capacity:* About 11.4 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—1  
 Range site number and name—080AY056OK, Loamy Prairie

#### *Typical profile:*

A—0 to 10 inches; silt loam  
 BA—10 to 15 inches; silt loam  
 Bt1—15 to 30 inches; silty clay loam  
 Bt2—30 to 42 inches; silty clay loam  
 Bt3—42 to 52 inches; silty clay loam  
 BC—52 to 80 inches; silty clay loam

*Location of representative profile:* About 200 feet east and 1,350 feet south of the northwestern corner of sec. 29, T. 24 N., R. 3 E.

### *Additional Components*

- Bethany and similar soils: 5 percent
- Minco and similar soils: 5 percent
- Teller and similar soils: 5 percent
- Waurika and similar soils: 2 percent
- Depressions: 1 percent

### *Management*

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**W—Water*****Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 250 to 4,000 feet  
*Mean annual precipitation:* 22 to 48 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 190 to 240 days

***Major Component Description*****Water**

*Extent of the component in the map unit:* 100 percent  
*Definition of the component:* Ponds, lakes, rivers, and other bodies of water

*Interpretive groups:*

Land capability classification—none assigned  
 Range site number and name—none assigned

*Location of a representative area:* At Perry Lake; about 2,000 feet north and 1,000 feet west of the southeastern corner of sec. 31, T. 21 N., R. 1 W.

***Management***

*Major uses:* Recreation

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**WauA—Waurika silt loam, 0 to 1 percent slopes*****Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 800 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

***Major Component Description*****Waurika and similar soils**

*Extent of the component in the map unit:* 89 percent  
*Geomorphic setting:* Stream terrace in a valley  
*Landform position:* Depression on a tread  
*Parent material:* Silty and clayey Pleistocene alluvium  
*Slope range:* 0 to 1 percent  
*Runoff:* High  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Somewhat poorly drained  
*Available water capacity:* About 9.2 inches  
*Water table:* Present  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—2w

Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

A—0 to 9 inches; silt loam

E—9 to 12 inches; silt loam

Bt1—12 to 31 inches; silty clay

Bt2—31 to 39 inches; silty clay loam

Btk—39 to 61 inches; silty clay loam

BC—61 to 80 inches; silty clay loam

*Location of representative profile:* About 1,300 feet east and 1,400 feet south of the northwestern corner of sec. 20, T. 24 N., R. 3 E.

**Additional Components**

- Kirkland and similar soils: 5 percent
- Vanoss and similar soils: 5 percent
- Depressions: 1 percent

**Management***Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**WesB—Westsum silty clay loam, 1 to 3 percent slopes****Map Unit Setting***Major land resource area:* 80A*Elevation range:* 700 to 1,500 feet*Mean annual precipitation:* 26 to 38 inches*Mean annual air temperature:* 57 to 63 degrees F*Frost-free period:* 200 to 230 days**Major Component Description****Westsum and similar soils***Extent of the component in the map unit:* 85 percent*Geomorphic setting:* Hillslope on hills*Landform position:* Foothill*Parent material:* Gray clayey residuum weathered from clayey Permian shale*Slope range:* 1 to 3 percent*Runoff:* Very high*Soil depth:* More than 60 inches*Slowest permeability class within a depth of 60 inches:* Very slow*Drainage class:* Well drained*Available water capacity:* About 10.4 inches*Depth to water table:* More than 6 feet*Flooding:* None*Ponding:* None*Interpretive groups:*

Land capability classification—2e

Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

Ap—0 to 10 inches; silty clay loam  
 Bt1—10 to 16 inches; silty clay  
 Btk1—16 to 30 inches; silty clay  
 Btk2—30 to 36 inches; silty clay  
 Bt2—36 to 52 inches; silty clay  
 Bt3—52 to 65 inches; silty clay  
 BC—65 to 80 inches; silty clay

*Location of representative profile:* About 650 feet north and 150 feet west of the southeastern corner of sec. 8, T. 23 N., R. 1 W.

**Additional Components**

- Bethany and similar soils: 10 percent
- Dilworth and similar soils: 5 percent

**Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**WesC—Westsum silty clay loam, 3 to 5 percent slopes****Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 700 to 1,500 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 200 to 230 days

**Major Component Description****Westsum and similar soils**

*Extent of the component in the map unit:* 90 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Foothill  
*Parent material:* Gray clayey residuum weathered from clayey Permian shale  
*Slope range:* 3 to 5 percent  
*Runoff:* Very high  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Very slow  
*Drainage class:* Well drained  
*Available water capacity:* About 10.8 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY0100K, Claypan Prairie (north)

*Typical profile:*

A—0 to 6 inches; silty clay loam  
 BA—6 to 10 inches; silty clay loam

Btk1—10 to 17 inches; silty clay  
 Btk2—17 to 31 inches; silty clay  
 Btk3—31 to 59 inches; silty clay  
 BC1—59 to 75 inches; silty clay  
 BC2—75 to 80 inches; silty clay

*Location of representative profile:* About 200 feet west and 250 feet south of the north-eastern corner of sec. 21, T. 23 N., R. 2 W.

### ***Additional Components***

- Dilworth and similar soils: 10 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

## **WiLC—Wisby-Lovedale complex, 1 to 5 percent slopes**

### ***Map Unit Setting***

*Major land resource area:* 80A  
*Elevation range:* 1,000 to 2,000 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 190 to 220 days

*Note:* These Wisby and Lovedale soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Wisby and similar soils**

*Extent of the component in the map unit:* 48 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit and shoulder  
*Parent material:* Sandy and gravelly Pleistocene alluvium  
*Slope range:* 3 to 5 percent  
*Runoff:* Very low  
*Soil depth:* More than 60 inches  
*Slowest permeability class within a depth of 60 inches:* Moderately rapid  
*Drainage class:* Somewhat excessively drained  
*Available water capacity:* About 5.7 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

#### *Interpretive groups:*

Land capability classification—3e  
 Range site number and name—080AY073OK, Sandy Prairie

#### *Typical profile:*

A—0 to 6 inches; sandy loam  
 BA—6 to 10 inches; sandy loam  
 Bt1—10 to 17 inches; sandy loam  
 Bt2—17 to 32 inches; coarse sandy loam

BC—32 to 36 inches; loamy coarse sand

C—36 to 80 inches; loamy coarse sand

*Location of representative profile:* About 700 feet east and 800 feet south of the northwestern corner of sec. 7, T. 21 N., R. 3 E.

#### **Lovedale and similar soils**

*Extent of the component in the map unit:* 40 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and shoulder

*Parent material:* Sandy Pleistocene alluvium

*Slope range:* 1 to 3 percent

*Runoff:* Low

*Soil depth:* More than 60 inches

*Slowest permeability class within a depth of 60 inches:* Moderate

*Drainage class:* Well drained

*Available water capacity:* About 8.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—2e

Range site number and name—080AY073OK, Sandy Prairie

*Typical profile:*

A—0 to 6 inches; sandy loam

BA—6 to 10 inches; sandy loam

Bt1—10 to 15 inches; sandy clay loam

Bt2—15 to 33 inches; sandy clay loam

Bt3—33 to 46 inches; loam

BC—46 to 61 inches; sandy loam

C—61 to 80 inches; sand

*Location of representative profile:* About 700 feet east and 650 feet south of the northwestern corner of sec. 7, T. 21 N., R. 3 E.

#### **Additional Components**

- Milan and similar soils: 12 percent

#### **Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

### **ZaHC—Zaneis-Huska complex, 1 to 5 percent slopes**

#### **Map Unit Setting**

*Major land resource area:* 80A

*Elevation range:* 700 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free period:* 200 to 230 days

*Note:* These Zaneis and Huska soils occur in a regular and repeating pattern. They are so intermingled that individual areas of the named soils could not be separated at a scale of 1:24,000.

### ***Major Component Description***

#### **Zaneis and similar soils**

*Extent of the component in the map unit:* 54 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and backslope

*Parent material:* Residuum weathered from Permian sandstone and shale

*Slope range:* 1 to 5 percent

*Runoff:* Medium

*Depth to bedrock (paralithic):* 40 to 60 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Well drained

*Available water capacity:* About 7.5 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Interpretive groups:*

Land capability classification—3e

Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 7 inches; loam

BA—7 to 10 inches; loam

Bt1—10 to 28 inches; clay loam

Bt2—28 to 38 inches; clay loam

BC—38 to 46 inches; clay loam

Cr—46 to 50 inches; bedrock

*Location of representative profile:* About 1,700 feet west and 2,300 feet north of the southeastern corner of sec. 36, T. 21 N., R. 3 E.

#### **Huska and similar soils**

*Extent of the component in the map unit:* 32 percent

*Geomorphic setting:* Hillslope on hills

*Landform position:* Summit and backslope

*Parent material:* Residuum weathered from sandstone and Permian shale

*Slope range:* 1 to 5 percent

*Runoff:* Very high

*Depth to bedrock (paralithic):* 40 to 60 inches

*Slowest permeability class within a depth of 60 inches:* Impermeable

*Drainage class:* Moderately well drained

*Available water capacity:* About 4.9 inches

*Depth to water table:* More than 6 feet

*Flooding:* None

*Ponding:* None

*Salt affected:* Saline within a depth of 30 inches

*Sodium affected:* Sodic within a depth of 30 inches

*Interpretive groups:*

Land capability classification—6s

Range site number and name—080AY091OK, Slickspot

*Typical profile:*

A—0 to 8 inches; loam  
 Btn1—8 to 20 inches; clay  
 Btnz—20 to 42 inches; clay loam  
 Btn2—42 to 54 inches; clay loam  
 Cr—54 to 60 inches; bedrock

*Location of representative profile:* About 2,100 feet west and 2,500 feet north of the southeastern corner of sec. 36, T. 21 N., R. 3 E.

**Additional Components**

- Coyle and similar soils: 14 percent

**Management**

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”

**ZanB—Zaneis loam, 1 to 3 percent slopes****Map Unit Setting**

*Major land resource area:* 80A  
*Elevation range:* 900 to 1,200 feet  
*Mean annual precipitation:* 26 to 40 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 200 to 230 days

**Major Component Description****Zaneis and similar soils**

*Extent of the component in the map unit:* 80 percent  
*Geomorphic setting:* Hillslope on hills  
*Landform position:* Summit and shoulder  
*Parent material:* Loamy residuum weathered from Permian sandstone and shale  
*Slope range:* 1 to 3 percent  
*Runoff:* Medium  
*Depth to bedrock (paralithic):* 40 to 60 inches  
*Slowest permeability class within a depth of 60 inches:* Impermeable  
*Drainage class:* Well drained  
*Available water capacity:* About 8.3 inches  
*Depth to water table:* More than 6 feet  
*Flooding:* None  
*Ponding:* None

*Interpretive groups:*

Land capability classification—2e  
 Range site number and name—080AY056OK, Loamy Prairie

*Typical profile:*

A—0 to 11 inches; loam  
 BA—11 to 15 inches; clay loam  
 Bt1—15 to 30 inches; clay loam

Bt2—30 to 42 inches; clay loam

BC—42 to 50 inches; clay loam

Cr—50 to 55 inches; bedrock

*Location of representative profile:* About 200 feet north and 2,600 feet west of the southeastern corner of sec. 26, T. 21 N., R. 3 E.

### ***Additional Components***

- Coyle and similar soils: 10 percent
- Huska and similar soils: 5 percent
- Renfrow and similar soils: 5 percent

### ***Management***

*Major uses:* Cropland and rangeland

For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.”



## **Use and Management of the Soils**

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

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

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

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

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

### **Agronomy**

General management concerns affecting the production of crops and hay and pasture plants are identified in this section. 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 specific information available from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

## 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, woodland, or engineering purposes.

In the capability system, soils generally are grouped at three levels: capability class, subclass, and unit (14). These levels indicate the degree and kinds of limitations affecting mechanized farming systems that produce the more commonly grown field crops, such as corn, small grain, cotton, hay, and field-grown vegetables. Only class and subclass are used in this survey.

*Capability classes*, the broadest groups, are designated by Arabic numerals 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and woodland. The degree of the soil limitations affecting the production of cultivated crops increases progressively from class 1 to class 4. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7. The local office of the Natural Resources Conservation Service or the Cooperative Extension Service can provide guidance on the use of these soils as cropland.

Areas in class 8 are generally not suitable for crops, pasture, rangeland, or woodland. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

*Capability subclasses* identify the dominant kind of limitation in the class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2*e*. The letter *e* shows that the main hazard is the risk of erosion unless a 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.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the tables "Land Capability and Yields per Acre of Crops" and "Land Capability and Yields per Acre of Hay and Pasture" and in the "Detailed Soil Map Units" section.

Land Capability and Yields per Acre of Crops

(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)

Map symbol and soil name	Land capability	Cotton lint	Grain sorghum	Soybeans	Wheat
		<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>
AhpA: Ashport-----	2w	---	50.00	30.00	35.00
APPA: Ashport-----	5w	---	---	---	---
Port-----	5w	---	---	---	---
Pulaski-----	5w	---	---	---	---
AspA: Ashport-----	2w	---	50.00	30.00	35.00
AspB: Ashport-----	2w	---	45.00	20.00	30.00
BetaA: Bethany-----	1	400.00	50.00	---	35.00
BetaB: Bethany-----	2e	325.00	45.00	---	30.00
BPG: Borrow pits, gravelly-----	8s	---	---	---	---
BPR: Borrow pits, rock--	8s	---	---	---	---
BraA: Braman-----	1	---	50.00	---	35.00
BrwA: Brewer-----	1	500.00	55.00	---	35.00
CoLC: Coyle-----	3s	---	45.00	---	25.00
Lucien-----	4s	---	---	---	15.00
CoyB: Coyle-----	3s	---	45.00	---	25.00
CoyC: Coyle-----	3e	---	40.00	---	20.00
CoyC2: Coyle-----	4e	---	35.00	---	15.00
CoZC3: Coyle-----	6e	---	---	---	---
Zaneis-----	6e	---	---	---	---

## Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Cotton	Grain	Soybeans	Wheat
		lint	sorghum		
		<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>
DalA:					
Dale-----	1	500.00	70.00	30.00	35.00
DAM:					
Dam-----	8s	---	---	---	---
DaUA:					
Dale-----	1	---	---	---	---
Urban land-----	8e	---	---	---	---
DiGE:					
Dilworth-----	6e	---	---	---	---
Grainola-----	6e	---	---	---	---
DooB:					
Doolin-----	4s	---	30.00	---	25.00
DwhC:					
Dilworth-----	3e	---	30.00	---	20.00
EasA:					
Easpur-----	2w	---	50.00	30.00	35.00
GadA:					
Gaddy-----	3e	---	30.00	---	20.00
GayA:					
Gaddy-----	3e	---	---	---	---
GMLG:					
Grainola-----	7e	---	---	---	---
Masham-----	7e	---	---	---	---
Lucien-----	6e	---	---	---	---
GohE:					
Goodnight-----	6e	---	---	---	---
GraC:					
Grainola-----	4e	---	30.00	---	15.00
GrAD:					
Grainola-----	4e	---	---	---	---
Ashport-----	5w	---	---	---	---
GrHC:					
Grant-----	3e	325.00	40.00	---	25.00
Huska-----	6s	---	25.00	---	15.00
GrLC:					
Grainola-----	3e	---	30.00	---	15.00
Lucien-----	4s	---	---	---	15.00

## Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Cotton	Grain	Soybeans	Wheat
		lint	sorghum		
		<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>
GrLE:					
Grainola-----	6e	---	---	---	---
Lucien-----	6e	---	---	---	---
GrnC:					
Grant-----	3e	325.00	40.00	---	25.00
GrtB:					
Grant-----	2e	350.00	50.00	---	30.00
HaPE:					
Harrah-----	4e	---	35.00	---	20.00
Pulaski-----	5w	---	---	---	---
HiRG:					
Highview-----	7e	---	---	---	---
Rock outcrop-----	8e	---	---	---	---
KekA:					
Keokuk-----	1	700.00	65.00	30.00	35.00
KeoA:					
Keokuk-----	2w	600.00	60.00	25.00	30.00
KgfB:					
Kingfisher-----	3s	---	40.00	---	30.00
KgLC:					
Kingfisher-----	3e	---	35.00	---	25.00
Lucien-----	4s	---	---	---	15.00
KgWC:					
Kingfisher-----	3e	---	35.00	---	25.00
Wakita-----	6s	---	---	---	15.00
KinC2:					
Kingfisher-----	4e	---	30.00	---	20.00
KowB:					
Konawa-----	2e	450.00	50.00	28.00	30.00
KowD:					
Konawa-----	4e	400.00	40.00	---	25.00
KrdA:					
Kirkland-----	2s	300.00	40.00	---	30.00
KrdB:					
Kirkland-----	3e	250.00	35.00	---	25.00
KrdB2:					
Kirkland-----	3e	---	---	---	20.00

## Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Cotton	Grain	Soybeans	Wheat
		lint	sorghum		
		<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>
KrPB:					
Kirkland-----	3e	250.00	35.00	---	25.00
Pawhuska-----	4s	---	---	---	15.00
LAN:					
Landfill-----	8s	---	---	---	---
LelA:					
Lela-----	4w	---	45.00	25.00	30.00
LveB:					
Lovedale-----	2e	---	45.00	---	30.00
M-W.					
Miscellaneous water					
McaA:					
McLain-----	1	500.00	55.00	---	35.00
MilB:					
Milan-----	2e	---	53.00	---	35.00
MilC:					
Milan-----	3e	---	48.00	---	32.00
MinB:					
Minco-----	2e	450.00	45.00	---	30.00
MinC:					
Minco-----	3e	400.00	40.00	---	30.00
MirA:					
Miller-----	2w	450.00	60.00	---	35.00
MisA:					
Miller-----	4s	---	---	---	20.00
MPNC2:					
Milan-----	3e	---	44.00	---	28.00
Pawhuska-----	4s	---	---	---	10.00
Norge-----	3e	300.00	35.00	---	20.00
MulC:					
Mulhall-----	3e	---	35.00	---	30.00
MulD:					
Mulhall-----	4e	---	30.00	---	25.00
MulD4:					
Mulhall-----	6e	---	---	---	---
NeDG:					
Newalla-----	4e	---	---	---	---
Darnell-----	7e	---	---	---	---
NorA:					
Norge-----	1	450.00	55.00	---	35.00

Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Cotton lint	Grain sorghum	Soybeans	Wheat
		<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>
NorB: Norge-----	2e	400.00	50.00	---	30.00
NorC: Norge-----	3e	350.00	40.00	---	25.00
NorC2: Norge-----	3e	300.00	35.00	---	20.00
NoUC: Norge-----	3e	---	---	---	---
Urban land-----	8e	---	---	---	---
OWWE: Oil waste land----	8s	---	---	---	---
Westsum-----	3e	---	---	---	15.00
PoaA: Port-----	5w	---	---	---	---
PoOA: Port-----	2w	500.00	50.00	---	35.00
Oscar-----	6s	---	---	---	---
PorA, PotA: Port-----	2w	500.00	50.00	---	35.00
PukA: Pulaski-----	5w	---	---	---	---
PulA: Pulaski-----	2w	425.00	50.00	---	30.00
RefC2: Renfrow-----	3e	---	---	---	15.00
ReGC2: Renfrow-----	3e	---	---	---	15.00
Grainola-----	4e	---	---	---	10.00
ReiA: Reinach-----	1	500.00	55.00	---	35.00
RenB: Renfrow-----	2e	250.00	30.00	---	20.00
RenC, RewC2: Renfrow-----	3e	---	---	---	15.00
RGPD3: Renfrow-----	6e	---	---	---	---
Grainola-----	6e	---	---	---	---
Pawhuska-----	6e	---	---	---	---

## Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Cotton	Grain	Soybeans	Wheat
		lint	sorghum		
		<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>
SlaB: Slaughterville-----	2e	400.00	45.00	---	30.00
SlaC: Slaughterville-----	3e	350.00	40.00	---	25.00
SlaG: Slaughterville-----	7e	---	---	---	---
StDD: Stephenville-----	3e	---	---	---	20.00
Darnell-----	6e	---	---	---	12.00
TabA: Tabler-----	2s	---	50.00	---	35.00
TeaA: Tearney-----	4w	---	---	---	25.00
TelB: Teller-----	2e	400.00	50.00	---	30.00
TelD: Teller-----	4e	300.00	35.00	---	20.00
TelD2: Teller-----	4e	250.00	30.00	---	15.00
VanA: Vanoss-----	1	450.00	55.00	---	35.00
W. Water					
WauA: Waurika-----	2w	350.00	40.00	---	25.00
WesB: Westsum-----	2e	---	30.00	---	20.00
WesC: Westsum-----	3e	---	---	---	15.00
WiLC: Wisby-----	3e	---	34.00	---	20.00
Lovedale-----	2e	---	35.00	---	25.00
ZaHC: Zaneis-----	3e	350.00	40.00	---	30.00
Huska-----	6s	---	25.00	---	15.00
ZanB: Zaneis-----	2e	350.00	40.00	---	30.00

Land Capability and Yields per Acre of Hay and Pasture

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. AUM means animal unit month: the amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month)

Map symbol and soil name	Land capability	Alfalfa hay	Improved bermuda- grass	Introduced bluestem	Tall wheatgrass
		Tons	AUM	AUM	AUM
AhpA: Ashport-----	2w	5.00	8.50	---	---
APPA: Ashport-----	5w	---	8.50	---	---
Port-----	5w	---	8.50	---	---
Pulaski-----	5w	---	7.00	---	---
AspA: Ashport-----	2w	5.00	8.50	---	---
AspB: Ashport-----	2w	4.50	7.50	---	---
BetA: Bethany-----	1	3.50	5.00	5.50	---
BetB: Bethany-----	2e	---	4.50	5.00	---
BPG: Borrow pits, gravelly-----	8s	---	---	---	---
BPR: Borrow pits, rock--	8s	---	---	---	---
BraA: Braman-----	1	3.50	6.00	---	---
BrwA: Brewer-----	1	4.30	7.00	---	---
CoLC: Coyle-----	3s	2.00	5.00	---	---
Lucien-----	4s	---	3.00	---	---
CoyB: Coyle-----	3s	2.00	5.00	---	---
CoyC: Coyle-----	3e	1.50	4.50	---	---
CoyC2: Coyle-----	4e	---	4.00	---	---
CoZC3: Coyle-----	6e	---	2.50	---	---

## Land Capability and Yields per Acre of Hay and Pasture--Continued

Map symbol and soil name	Land capability	Alfalfa	Improved	Introduced	Tall
		hay	bermuda- grass	bluestem	wheatgrass
		<u>Tons</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>
CoZC3: Zaneis-----	6e	---	3.00	---	---
DalA: Dale-----	1	5.50	8.50	---	---
DAM: Dam-----	8s	---	---	---	---
DaUA: Dale-----	1	---	---	---	---
Urban land-----	8e	---	---	---	---
DiGE: Dilworth-----	6e	---	3.00	---	---
Grainola-----	6e	---	2.50	---	---
DooB: Doolin-----	4s	1.00	3.50	---	---
DwhC: Dilworth-----	3e	---	4.00	---	---
EasA: Easpur-----	2w	5.00	8.50	---	---
GadA: Gaddy-----	3e	3.00	5.50	---	---
GayA: Gaddy-----	3e	---	5.00	---	---
GMLG: Grainola-----	7e	---	2.50	---	---
Masham-----	7e	---	---	---	---
Lucien-----	6e	---	2.00	---	---
GohE: Goodnight-----	6e	---	2.50	---	---
GraC: Grainola-----	4e	---	3.50	---	---
GrAD: Grainola-----	4e	---	2.50	---	---
Ashport-----	5w	---	8.50	---	---
GrHC: Grant-----	3e	2.00	5.00	4.50	---
Huska-----	6s	---	3.00	---	---
GrLC: Grainola-----	3e	---	3.50	---	---
Lucien-----	4s	---	3.00	---	---

## Land Capability and Yields per Acre of Hay and Pasture--Continued

Map symbol and soil name	Land capability	Alfalfa	Improved	Introduced	Tall
		hay	bermuda- grass	bluestem	wheatgrass
		<u>Tons</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>
GrLE:					
Grainola-----	6e	---	2.50	---	---
Lucien-----	6e	---	2.00	---	---
GrnC:					
Grant-----	3e	2.00	5.00	4.50	---
GrtB:					
Grant-----	2e	2.30	5.50	5.00	---
HaPE:					
Harrah-----	4e	2.00	3.50	---	---
Pulaski-----	5w	---	7.00	---	---
HiRG:					
Highview-----	7e	---	---	---	---
Rock outcrop-----	8e	---	---	---	---
KekA:					
Keokuk-----	1	4.50	8.50	---	---
KeoA:					
Keokuk-----	2w	4.50	8.50	---	---
KgFB:					
Kingfisher-----	3s	---	5.00	4.50	---
KgLC:					
Kingfisher-----	3e	---	4.50	4.00	---
Lucien-----	4s	---	3.00	---	---
KgWC:					
Kingfisher-----	3e	---	4.50	4.00	---
Wakita-----	6s	---	3.00	---	---
KinC2:					
Kingfisher-----	4e	---	4.00	3.50	---
KowB:					
Konawa-----	2e	---	4.50	---	---
KowD:					
Konawa-----	4e	---	4.00	---	---
KrdA:					
Kirkland-----	2s	---	4.00	---	---
KrdB:					
Kirkland-----	3e	---	4.00	---	---
KrdB2:					
Kirkland-----	3e	---	3.50	---	---
KrPB:					
Kirkland-----	3e	---	4.00	---	---
Pawhuska-----	4s	---	3.50	---	---

## Land Capability and Yields per Acre of Hay and Pasture--Continued

Map symbol and soil name	Land capability	Alfalfa	Improved	Introduced	Tall
		hay	bermuda- grass	bluestem	wheatgrass
		<u>Tons</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>
LAN: Landfill-----	8s	---	---	---	---
LelA: Lela-----	4w	3.50	5.50	---	---
LveB: Lovedale-----	2e	2.50	5.50	---	---
M-W. Miscellaneous water					
McaA: McLain-----	1	4.50	8.50	6.50	---
MilB: Milan-----	2e	---	---	---	---
MilC: Milan-----	3e	---	---	---	---
MinB: Minco-----	2e	3.00	5.50	---	---
MinC: Minco-----	3e	2.50	5.00	---	---
MirA: Miller-----	2w	3.50	6.50	---	---
MisA: Miller-----	4s	---	---	---	4.50
MPNC2: Milan-----	3e	---	---	---	---
Pawhuska-----	4s	---	2.50	---	---
Norge-----	3e	1.50	4.50	4.00	---
MulC: Mulhall-----	3e	---	5.50	---	---
MulD: Mulhall-----	4e	---	5.00	---	---
MulD4: Mulhall-----	6e	---	3.00	---	---
NeDG: Newalla-----	4e	---	4.50	---	---
Darnell-----	7e	---	---	---	---
NorA: Norge-----	1	3.50	5.50	5.00	---
NorB: Norge-----	2e	3.00	5.50	5.00	---

Land Capability and Yields per Acre of Hay and Pasture--Continued

Map symbol and soil name	Land capability	Alfalfa hay	Improved bermuda- grass	Introduced bluestem	Tall wheatgrass
		Tons	AUM	AUM	AUM
NorC: Norge-----	3e	2.00	5.00	4.50	---
NorC2: Norge-----	3e	1.50	4.50	4.00	---
NoUC: Norge-----	3e	---	---	---	---
Urban land-----	8e	---	---	---	---
OWWE: Oil waste land-----	8s	---	---	---	---
Westsum-----	3e	---	2.50	---	---
PoaA: Port-----	5w	---	8.50	---	---
PoOA: Port-----	2w	5.00	8.50	---	---
Oscar-----	6s	---	3.50	---	---
PorA, PotA: Port-----	2w	5.00	8.50	---	---
PukA: Pulaski-----	5w	---	7.00	---	---
PulA: Pulaski-----	2w	3.50	7.00	---	---
RefC2: Renfrow-----	3e	---	2.50	---	---
ReGC2: Renfrow-----	3e	---	2.50	---	---
Grainola-----	4e	---	3.00	---	---
ReiA: Reinach-----	1	5.00	8.50	---	---
RenB: Renfrow-----	2e	---	3.00	---	---
RenC, RewC2: Renfrow-----	3e	---	2.50	---	---
RGPD3: Renfrow-----	6e	---	2.00	---	---
Grainola-----	6e	---	2.00	---	---
Pawhuska-----	6e	---	2.50	---	---
SlaB: Slaughterville-----	2e	3.00	5.00	---	---

## Land Capability and Yields per Acre of Hay and Pasture--Continued

Map symbol and soil name	Land capability	Alfalfa	Improved	Introduced	Tall
		hay	bermuda- grass	bluestem	wheatgrass
		<u>Tons</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>
SlaC: Slaughterville-----	3e	2.50	4.50	---	---
SlaG: Slaughterville-----	7e	---	3.50	---	---
StDD: Stephenville-----	3e	---	3.50	---	---
Darnell-----	6e	---	3.00	---	---
TabA: Tabler-----	2s	---	4.00	---	---
TeaA: Tearney-----	4w	---	5.00	---	---
TelB: Teller-----	2e	3.00	5.50	---	---
TelD: Teller-----	4e	1.50	4.50	---	---
TelD2: Teller-----	4e	1.00	4.00	---	---
VanA: Vanoss-----	1	3.50	5.50	---	---
W. Water					
WauA: Waurika-----	2w	---	5.00	---	---
WesB: Westsum-----	2e	---	3.00	---	---
WesC: Westsum-----	3e	---	2.50	---	---
WiLC: Wisby-----	3e	---	4.00	---	---
Lovedale-----	2e	2.00	5.00	---	---
ZaHC: Zaneis-----	3e	2.50	5.50	---	---
Huska-----	6s	---	3.00	---	---
ZanB: Zaneis-----	2e	2.50	5.50	---	---

## Estimated Yields of Crops, Hay, and Pasture

The average yields per acre that can be expected of the principal crops under a high level of management are shown in the tables “Land Capability and Yields per Acre of Crops” and “Land Capability and Yields per Acre of Hay and Pasture.” In any given year, yields may be higher or lower than those indicated in the tables because of variations in rainfall and other climatic factors.

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

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

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

Crops other than those shown in the tables are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small.

Under good pasture management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season. Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

A pasture program is needed to provide the desired amount of forage during each month of the year. A study of the growth habits of the different plants is necessary to ensure adequate forage during each month. The months that various kinds of forage plants grow are indicated in figure 22, which is in the “Range” section. The percent growth that can be safely grazed each month without substantially reducing the total yield for each kind of plant is illustrated.

Yield estimates are often indicated in animal unit months (AUM), or the amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about forage yields other than those shown in the tables.

## Cropland Limitations and Hazards

The management concerns affecting the use of the detailed map units in the survey area for crops are shown in the table “Cropland Limitations and Hazards.” The main concerns in managing nonirrigated cropland are conserving moisture, controlling soil blowing and water erosion, and maintaining soil fertility and tilth.

*Conserving moisture* primarily involves reducing the evaporation and runoff rates and increasing the rate of water infiltration. Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, and leaving crop residue on the surface conserve moisture.

Generally, a combination of several practices is needed to control *soil blowing* and *water erosion*. Conservation tillage, stripcropping, field windbreaks, tall grass barriers,

contour farming, conservation cropping systems, crop residue management, diversions, and grassed waterways help to prevent excessive soil loss.

Measures that are effective in maintaining *soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients and thus helps to maintain productivity, although the level of fertility can be reduced even in areas where erosion is controlled. All soils used for nonirrigated crops respond well to applications of fertilizer.

On irrigated soils the main management concerns are *efficient water use, nutrient management, control of erosion, soil tilth, pest and weed control, and timely planting and harvesting* for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Also, it can create drainage problems, raise the water table, and increase soil salinity.

Some of the limitations and hazards shown in the table cannot be easily overcome. These are *flooding, depth to bedrock, and ponding*.

Additional limitations and hazards are as follows:

*Areas of rock outcrop and oil waste land.*—Farming around these areas may be feasible. Subsoiling or deep ripping soft sedimentary beds increases the effective rooting depth and the rate of water infiltration.

*Excessive permeability.*—This limitation causes deep leaching of nutrients and pesticides. The capacity of the soil to retain moisture for plant use is poor.

*Potential for ground-water pollution.*—This is a hazard in soils with excessive permeability, hard bedrock, or a water table within the profile.

*Lime content, limited available water capacity, poor tilth, restricted permeability, and surface crusting.*—The adverse effects of these limitations can be reduced by incorporating green manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. Also, crops may respond well to additions of phosphate fertilizer on soils that have a high content of lime.

*Slope.*—Where the slope is more than 8 percent, water erosion and soil blowing may be accelerated unless conservation farming practices are applied.

*Salt and sodium content.*—In areas where this is a limitation, only salt- and sodium-tolerant crops should be grown.

### **Criteria for Limitations and Hazards**

Following is an explanation of the criteria used to determine the limitations or hazards.

*Areas of rock outcrop.*—Rock outcrop is a named component of the map unit.

*Areas of oil waste land.*—Oil waste land is a named component of the map unit.

*Depth to bedrock.*—Bedrock is within a depth of 40 inches.

*Water erosion.*—The surface K factor multiplied by the upper slope limit is more than 2 (same as prime farmland criteria).

*Excessive permeability.*—The upper limit of the permeability range is 6 inches or more within the soil profile.

*Flooding.*—The component of the map unit is occasionally flooded or frequently flooded.

*Lime content.*—The upper 10 inches has more than 15 percent calcium carbonate equivalent.

*Limited available water capacity.*—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 6 inches or less.

*Ponding.*—A ponding duration is assigned to the component of the map unit.

*Potential for ground-water pollution.*—The soil has a water table within a depth of 4 feet or bedrock within 40 inches of the surface, or permeability is more than 2 inches per hour within the soil profile.

*Poor tilth.*—The component of the map unit has more than 35 percent clay in the surface layer.

*Restricted permeability.*—Permeability is 0.06 inch per hour or less within the soil profile.

*Salt content.*—The component of the map unit has an electrical conductivity of more than 4 in the surface layer or more than 8 within a depth of 30 inches.

*Slope.*—The upper slope limit of the component of the map unit is more than 8 percent.

*Sodium content.*—The sodium adsorption ratio of the component of the map unit is more than 13 within a depth of 30 inches.

*Soil blowing.*—The wind erodibility group is WEG 1, WEG 2, or WEG 3.

*Surface crusting.*—The organic matter content is less than 2 percent in the surface layer.

*Water table.*—The component of the map unit has a water table within a depth of 3 feet.

## Cropland Limitations and Hazards

(See text for a description and criteria of the limitations and hazards listed in this table)

Map symbol and component name	Cropland limitations and hazards
AhpA: Ashport-----	Flooding
APPA: Ashport-----	Flooding
Port-----	Flooding Surface crusting
Pulaski-----	Flooding Potential for ground-water pollution Surface crusting
AspA, AspB: Ashport-----	Flooding
BetA, BetB: Bethany-----	None
BPG: Borrow pits, gravelly-----	Non-soil material
EPR: Borrow pits, rock-----	Non-soil material
BraA: Braman-----	None
BrwA: Brewer-----	None
CoLC: Coyle-----	Depth to bedrock Restricted permeability Limited available water capacity
Lucien-----	Soil blowing Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity
CoyB, CoyC, CoyC2: Coyle-----	Depth to bedrock Restricted permeability Limited available water capacity
CoZC3: Coyle-----	Depth to bedrock Restricted permeability Limited available water capacity
Zaneis-----	Restricted permeability
DalA: Dale-----	None

Cropland Limitations and Hazards--Continued

Map symbol and component name	Cropland limitations and hazards
DAM: Dam-----	Non-soil material
DaUA: Dale-----	None
Urban land-----	Non-soil material
DiGE: Dilworth-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope
Grainola-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope Surface crusting
DooB: Doolin-----	Restricted permeability Sodium content Surface crusting
DwhC: Dilworth-----	Depth to bedrock Restricted permeability Limited available water capacity
EasA: Easpur-----	Flooding
GadA: Gaddy-----	Flooding Excessive permeability Potential for ground-water pollution
GayA: Gaddy-----	Excessive permeability Potential for ground-water pollution
GMLG: Grainola-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope Poor tilth
Masham-----	Soil blowing Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope Surface crusting Lime content Poor tilth

## Cropland Limitations and Hazards--Continued

Map symbol and component name	Cropland limitations and hazards
GMLG: Lucien-----	Soil blowing Water erosion Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity Slope
GohE: Goodnight-----	Water erosion Excessive permeability Potential for ground-water pollution Limited available water capacity Slope
GraC: Grainola-----	Depth to bedrock Restricted permeability Limited available water capacity Surface crusting Poor tilth
GrAD: Grainola-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Surface crusting Poor tilth
Ashport-----	Flooding
GrHC: Grant-----	Restricted permeability
Huska-----	Water erosion Restricted permeability Sodium content Salt content Limited available water capacity Surface crusting Poor tilth
GrLC: Grainola-----	Water erosion Depth to bedrock Restricted permeability Surface crusting Poor tilth
Lucien-----	Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity

Cropland Limitations and Hazards--Continued

Map symbol and component name	Cropland limitations and hazards
GrLE: Grainola-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope Surface crusting
Lucien-----	Water erosion Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity Slope
GrnC, GrtB: Grant-----	Restricted permeability
HaPE: Harrah-----	None
Pulaski-----	Flooding Potential for ground-water pollution Surface crusting
HiRG: Highview-----	Soil blowing Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope Poor tilth
Rock outcrop-----	Non-soil material
KekA: Keokuk-----	None
KeoA: Keokuk-----	Flooding
KgfB: Kingfisher-----	Depth to bedrock Restricted permeability Limited available water capacity
KgLC: Kingfisher-----	Depth to bedrock Restricted permeability Limited available water capacity
Lucien-----	Soil blowing Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity

## Cropland Limitations and Hazards--Continued

Map symbol and component name	Cropland limitations and hazards
KgWC: Kingfisher-----	Depth to bedrock Restricted permeability
Wakita-----	Soil blowing Depth to bedrock Restricted permeability Sodium content Salt content Limited available water capacity Water table Surface crusting
KinC2: Kingfisher-----	Depth to bedrock Restricted permeability Limited available water capacity
KowB: Konawa-----	Potential for ground-water pollution Surface crusting
KowD: Konawa-----	Excessive permeability Potential for ground-water pollution Surface crusting
KrdA, KrdB: Kirkland-----	Restricted permeability Surface crusting
KrdB2: Kirkland-----	Restricted permeability Surface crusting Poor tilth
KrpB: Kirkland-----	Restricted permeability Surface crusting
Pawhuska-----	Restricted permeability Sodium content Salt content Surface crusting Poor tilth
LAN: Landfill-----	Non-soil material
Lela: Lela-----	Flooding Restricted permeability Potential for ground-water pollution Poor tilth
LveB: Lovedale-----	Excessive permeability Potential for ground-water pollution
M-W: Miscellaneous water-----	Non-soil material

Cropland Limitations and Hazards--Continued

Map symbol and component name	Cropland limitations and hazards
McaA: McLain-----	None
MilB, MilC: Milan-----	Potential for ground-water pollution
MinB, MinC: Minco-----	None
MirA: Miller-----	Flooding Restricted permeability Poor tilth
MisA: Miller-----	Flooding Restricted permeability Salt content Surface crusting Lime content Poor tilth
MPNC2: Milan-----	Potential for ground-water pollution
Pawhuska-----	Water erosion Restricted permeability Sodium content Salt content Surface crusting
Norge-----	None
MulC: Mulhall-----	None
MulD, MulD4: Mulhall-----	Water erosion
NeDG: Newalla-----	Water erosion Restricted permeability
Darnell-----	Water erosion Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity Slope Surface crusting
NorA, NorB, NorC, NorC2: Norge-----	None
NoUC: Norge-----	None
Urban land-----	Non-soil material
OWWE: Oil waste land-----	Non-soil material
Westsum-----	Restricted permeability

## Cropland Limitations and Hazards--Continued

Map symbol and component name	Cropland limitations and hazards
PoaA: Port-----	Flooding
PoOA: Port-----	Flooding
Oscar-----	Flooding Sodium content Salt content Surface crusting
PorA, PotA: Port-----	Flooding
PukA, Pula: Pulaski-----	Flooding Potential for ground-water pollution Surface crusting
RefC2: Renfrow-----	Water erosion Restricted permeability Poor tilth
ReGC2: Renfrow-----	Water erosion Restricted permeability
Grainola-----	Depth to bedrock Restricted permeability Limited available water capacity Surface crusting
ReiA: Reinach-----	None
RenB: Renfrow-----	Restricted permeability
RenC, RewC2: Renfrow-----	Water erosion Restricted permeability
RGPD3: Renfrow-----	Water erosion Restricted permeability
Grainola-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Surface crusting Lime content Poor tilth
Pawhuska-----	Soil blowing Water erosion Restricted permeability Sodium content Salt content Surface crusting Poor tilth

Cropland Limitations and Hazards--Continued

Map symbol and component name	Cropland limitations and hazards
SlaB: Slaughterville-----	Potential for ground-water pollution
SlaC: Slaughterville-----	Excessive permeability Potential for ground-water pollution
SlaG: Slaughterville-----	Water erosion Excessive permeability Potential for ground-water pollution Slope
StDD: Stephenville-----	Depth to bedrock Limited available water capacity Surface crusting
StDD: Darnell-----	Soil blowing Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity Surface crusting
TabA: Tabler-----	Restricted permeability Water table
TeaA: Tearney-----	Flooding Ponding Excessive permeability Restricted permeability Potential for ground-water pollution Poor tilth
TelB: Teller-----	Potential for ground-water pollution
TelD, TelD2: Teller-----	Water erosion Potential for ground-water pollution
VanA: Vanoss-----	None
W: Water-----	Non-soil material
WauA: Waurika-----	Restricted permeability Potential for ground-water pollution Water table Surface crusting
WesB, WesC: Westsum-----	Restricted permeability

## Cropland Limitations and Hazards--Continued

Map symbol and component name	Cropland limitations and hazards
WiLC: Wisby-----	Excessive permeability Potential for ground-water pollution
Lovedale-----	None
ZaHC: Zaneis-----	Restricted permeability
Huska-----	Water erosion Restricted permeability Sodium content Salt content Limited available water capacity Surface crusting
ZanB: Zaneis-----	Restricted permeability

## Prime Farmland

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, State, and Federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, rangeland, or woodland or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in National forests, National parks, military reservations, and State parks.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity and the content of salts and sodium are acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and they are not frequently flooded during the growing season or are protected from flooding. Slopes range from 0 to 8 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland where these limitations are overcome by drainage measures, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information about the criteria for prime farmland can be obtained at the local office of the Natural Resources Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 199,342 acres in the survey area, or nearly 42 percent of the total acreage, meets the requirements for prime farmland. The map units in the survey area that meet the requirements for prime farmland are listed in the table "Prime Farmland." The location of each map unit is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." The table does not constitute a recommendation for a particular land use.

## Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
AhpA	Ashport silty clay loam, 0 to 1 percent slopes, occasionally flooded
AspA	Ashport silt loam, 0 to 1 percent slopes, occasionally flooded
AspB	Ashport silt loam, 1 to 3 percent slopes, occasionally flooded
BetA	Bethany silt loam, 0 to 1 percent slopes
BetB	Bethany silt loam, 1 to 3 percent slopes
BraA	Braman silt loam, 0 to 1 percent slopes, rarely flooded
BrwA	Brewer silt loam, 0 to 1 percent slopes, rarely flooded
CoyB	Coyle loam, 1 to 3 percent slopes
CoyC	Coyle loam, 3 to 5 percent slopes
DalA	Dale silt loam, 0 to 1 percent slopes, rarely flooded
DwhC	Dilworth silty clay loam, 3 to 5 percent slopes
EasA	Easpur loam, 0 to 1 percent slopes, occasionally flooded
GraC	Grainola silty clay loam, 3 to 5 percent slopes
GrnC	Grant loam, 3 to 5 percent slopes
GrtB	Grant silt loam, 1 to 3 percent slopes
KekA	Keokuk very fine sandy loam, 0 to 1 percent slopes, rarely flooded
KeoA	Keokuk very fine sandy loam, 0 to 1 percent slopes, occasionally flooded
KgFB	Kingfisher silt loam, 1 to 3 percent slopes
KinC2	Kingfisher loam, 3 to 5 percent slopes, eroded
KowB	Konawa fine sandy loam, 1 to 3 percent slopes
KowD	Konawa fine sandy loam, 3 to 8 percent slopes
KrdA	Kirkland silt loam, 0 to 1 percent slopes
KrdB	Kirkland silt loam, 1 to 3 percent slopes
KrdB2	Kirkland silt loam, 1 to 3 percent slopes, eroded
LelA	Lela silty clay, 0 to 1 percent slopes, occasionally flooded
McaA	McLain silty clay loam, 0 to 1 percent slopes, rarely flooded
MilB	Milan loam, 1 to 3 percent slopes
MilC	Milan loam, 3 to 5 percent slopes
MinB	Minco very fine sandy loam, 1 to 3 percent slopes
MinC	Minco very fine sandy loam, 3 to 5 percent slopes
MirA	Miller silty clay loam, 0 to 1 percent slopes, occasionally flooded
MulC	Mulhall loam, 3 to 5 percent slopes
NorA	Norge silt loam, 0 to 1 percent slopes
NorB	Norge silt loam, 1 to 3 percent slopes
NorC	Norge silt loam, 3 to 5 percent slopes
NorC2	Norge silt loam, 3 to 5 percent slopes, eroded
PorA	Port silt loam, 0 to 1 percent slopes, occasionally flooded
PotA	Port silty clay loam, 0 to 1 percent slopes, occasionally flooded
PulA	Pulaski fine sandy loam, 0 to 1 percent slopes, occasionally flooded
RefC2	Renfrow loam, 3 to 5 percent slopes, eroded
ReGC2	Renfrow and Grainola soils, 3 to 5 percent slopes, eroded
ReiA	Reinach very fine sandy loam, 0 to 1 percent slopes, rarely flooded
RenB	Renfrow silt loam, 1 to 3 percent slopes
RenC	Renfrow silt loam, 3 to 5 percent slopes
RewC2	Renfrow silty clay loam, 3 to 5 percent slopes, eroded
SlaB	Slaughterville fine sandy loam, 0 to 3 percent slopes
SlaC	Slaughterville fine sandy loam, 3 to 5 percent slopes
TabA	Tabler silt loam, 0 to 1 percent slopes
TelB	Teller loam, 1 to 3 percent slopes
TelD	Teller loam, 5 to 8 percent slopes
VanA	Vanoss silt loam, 0 to 1 percent slopes
WauA	Waurika silt loam, 0 to 1 percent slopes
WesB	Westsum silty clay loam, 1 to 3 percent slopes
WesC	Westsum silty clay loam, 3 to 5 percent slopes
ZanB	Zaneis loam, 1 to 3 percent slopes

## Range

Mark Moseley, Range Conservationist, Natural Resources Conservation Service, helped prepare this section.

Range, grazed forestland, and native pasture provide forage for livestock in the survey area.

*Range* is defined as land on which the native vegetation (the climax, or natural potential, plant community) is predominantly grasses, grass-like plants, forbs, and shrubs suitable for grazing and browsing. Range includes natural grasslands, savannahs, many wetlands, some deserts, tundra, and certain shrub and forb communities. Range receives no regular or frequent cultural treatment. The composition and production of the plant community are determined by soil, climate, topography, overstory canopy, and grazing management.

*Grazed forestland* is defined as land on which the understory includes, as an integral part of the forest plant community, plants that can be grazed without significant impairment of other forest values.

*Native pasture* is defined as land on which the potential (climax) vegetation is forest but which is used and managed primarily for the production of native forage plants. Native pasture includes cutover forestland and forestland that has been cleared and is managed for native or naturalized forage plants.

The table "Rangeland Productivity and Characteristic Plant Communities" shows, for each soil, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species in the rangeland composition.

Rangeland makes up about 40 percent of Noble County. It is mainly on gently sloping to steep side slopes and on a few narrow very gently sloping to sloping summits that cannot be economically cultivated. A few native grass meadows that are managed for hay production are in the central and north-central parts of the county.

Noble County has three types of range. The first type is in the southeastern part of the county, in areas where most of the soils are loamy and are moderately deep or shallow over sandstone. These soils support an oak savannah that has low productivity due to the shallow rooting depth and low water-holding capacity.

The second type is in the northeastern and western parts of the county, in areas where the soils are loamy and are dominantly moderately deep, with some shallow or deep soils, over shale and shale interbedded with sandstone. These soils support mid and tall grasses, and productivity is moderate.

The third type is in the north-central, central, and south-central parts of the county, in areas where the soils are loamy and are moderately deep, with some shallow and deep soils, over sandstone and sandstone interbedded with shale. The soils support tall and mid grasses that are moderately productive.

Approximately 75 percent of the annual production on rangeland grows in April, May, and June, responding to spring rains and moderate temperatures. A secondary growth period generally occurs in September and October, coinciding with fall rains and cooling temperatures.

Most of the local ranches and livestock farms are cow-calf operations. There are some pure stocker enterprises and some ranchers that diversify their cow-calf operation with stockers in order to provide greater flexibility.

Several livestock operations supplement the grazing of native rangeland with introduced grasses such as bermudagrass and plains bluestem. Forage crops are also used. Protein, hay, and small grain crops are used to supplement livestock through winter.

Droughts occur in varying lengths. Short-term summer droughts are common, and longer periods of drought, some lasting several months, also occur frequently.

The pre-settlement vegetation evolved according to periodic natural fires, droughts,

migratory grazing by bison, and the impact from many other wildlife species. The bison heavily impacted an area and then moved to other grazing range.

Early settlement brought continuous grazing and eliminated much of the high-quality vegetation on some range sites. Areas that were once open savannah range sites with a mixture of grasses, forbs, and scattered trees are now covered with oak, a few tall and mid grasses, and low successional grasses and forbs. Some prairie sites are now producing low successional grasses and forbs instead of tall grasses. The amount of forage currently produced may be less than half of that originally produced. Eastern redcedar has increased significantly on some sites due to the lack of prairie fires.

Remnants of the original plant species, however, are still found on most rangeland. Progressive grazing management can allow these high-quality plants to reestablish without reseeding.

An *ecological site* is a distinctive kind of land with specific physical characteristics that make it different from other sites in its ability to produce a distinctive kind and amount of vegetation.

Many different ecological sites are in the survey area. Over time, a combination of plants best suited to a particular soil and climate becomes dominant. If the soil is not excessively disturbed, this group of plants is the natural plant community for the site. Natural plant communities are not static but vary slightly from year to year and place to place.

The relationship between soils and vegetation was ascertained during this survey; thus, ecological 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. The "Field Office Technical Guide," which is available at the local office of the Natural Resources Conservation Service, can provide specific information about ecological sites.

*Total dry-weight production* is the amount of vegetation that can be expected to grow annually on well managed rangeland. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruit 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 near the historical monthly average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Figure 22 shows a typical growth curve for native vegetation and other forage that represents the percentage of total growth that occurs each month.

*Dry weight* is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as stage of maturity, exposure, amount of shade, recent rains, and unseasonable dry periods.

*Characteristic vegetation* consists of the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil. The plants are listed by common name. Under composition, the anticipated 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.

## Similarity Index

*Similarity index* indicates, by percentages ranging from 1 to 100, the extent to which the present plant community resembles one of two other plant communities on an ecological site. A similarity index can be used to compare the present vegetation on an

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
IMPROVED BERMUDAGRASS				5	25	35	20	10	5			
WEeping LOVEGRASS			3	20	25	20	15	6	11			
INTRODUCED BLUESTEM				3	15	28	22	18	10	1		
SMALL GRAIN GRAZEOUT	3	9	29	27	18				1	4	6	3
FORAGE SORGHUM						14	33	33	20			
NATIVE GRASS	1	1	2	10	20	27	16	8	5	2	2	1

Figure 22.—Typical growth curves for various kinds of forage in Noble County. The growth curve for each kind of forage indicates the percentage of the total annual growth that occurs each month.

ecological site to the presumed historic vegetation for that site. This comparison provides a basis for ascertaining the extent and direction of changes that have differentiated the current vegetation from the historic vegetation. A similarity index of 70 would suggest that the present plant community has 70 percent of the presumed historic plant community for the site.

The management goal is not necessarily a present plant community that has as similarity index of 100 when compared to the historic plant community. A similarity index can be used as a measure of how near the current plant community is to the goal of the landowner, that is, the percentage of the present plant community that resembles a desired plant community.

Abnormal disturbances that change the natural plant community include repeated overuse by livestock, excessive burning, erosion, and cultivation. Grazing animals select the most palatable plants. These plants will eventually die if they are continually grazed at a severity that does not allow for recovery. A very severe disturbance can completely destroy the natural community. Under these conditions, the less desirable plants, such as annuals and weed-like plants, can increase. If the plant community and the soils have not deteriorated significantly, the plant community eventually can return to predominantly natural plants if proper range management is applied.

Knowledge of the ecological site is necessary as a basis for planning and applying the management needed to maintain or improve the desired plant community for selected uses. Such information is needed to support or maintain management objectives, planned grazing systems, proper stocking rates, suitable wildlife management practices, recreational uses, and the condition of watersheds.

### Rangeland Management

Rangeland management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the similarity index.

Effective range management conserves rainfall, enhances water quality, reduces the hazard of downstream flooding, improves yields, provides forage for livestock and

wildlife, enhances recreational opportunities, and protects the soil. The main management concern is recognizing important changes in the plant cover or the range trend. These changes take place gradually and may be overlooked.

Each range manager should evaluate the type of plant community that best supports the ranch and then apply management and ecological principles to achieve the goals. The desired plant community should be within the capabilities of the land.

The primary range management practices used in Noble County include prescribed grazing, stock-water developments, and fences. If undesirable plants become dominant, range seeding, brush management, or prescribed burning are commonly used.

Range management includes four major considerations:

1. *Proper grazing distribution*, which is achieved by managing livestock so that all parts of the grazing unit are grazed equally.
2. *Selective grazing*, which occurs because animals graze preferred plants to balance their diets. If selective grazing occurs repeatedly, the preferred plants are damaged.
3. *A proper stocking rate*, which is achieved by balancing animal numbers with forage production.
4. *Rest periods* during which grazed plants are given enough rest to recover and to maintain their growth.

It is important to remember that forage production is controlled by rainfall while composition is determined by grazing management.

Setting the stocking rate is not an exact science because there are influences from grazing management systems, season of use, mix of livestock, and seasonal forage production. Some rules of thumb, however, can be helpful. To maintain a nutritional cover of plants, about 50 percent of the annual growth of the key or most important grazing plants should remain at the end of the grazing season. Plants can be removed not only through grazing by livestock but also through grazing by rodents, insects, and wildlife and through the deterioration caused by climatic variations. Because of these factors, a safe initial stocking rate for livestock should be calculated on the basis of 25 percent of the total annual growth, by weight, of the vegetation.

For example, production could be 3,500 pounds per acre of air-dry grasses, forbs, and limited woody species during an average season on a Loamy Prairie ecological site where the similarity between the present plant community and the historic plant community is more than 70 percent. Twenty-five percent of this production is 875 pounds per acre.

A 1,000-pound cow and her calf is equivalent to one animal unit (AU) and will consume about 2.6 percent of her body weight (26 pounds) of forage per day. So, in one month, an animal unit will consume 790 pounds of native vegetation, depending on the quality and stage of growth of the plants (26 pounds per day times 365 days per year divided by 12 months per year).

Dividing 875 pounds (forage allocation) by 26 pounds (forage required per day for one animal unit) suggests that 1 acre of Loamy Prairie ecological site with a similarity index of 70 will feed one cow for 33.6 days. To convert forage available from 1 acre to an animal unit month (AUM), the available forage (875 pounds) is divided by the amount required to feed an animal unit for 1 month (790 pounds). One acre will provide 1.1 AUM of grazing. Therefore, 10.9 acres will feed one cow for 12 months in this example. Another approach is to calculate the annual forage needs of an animal unit (790 pounds per month times 12 months equals 9,490 pounds). Dividing the 875 pounds of usable forage per acre into the 9,490 pounds needed by the cow reveals that approximately 10.9 acres is needed for one cow annually. Stocking rate calculation should be adjusted for animal size, grazing system, and grazing season.

More information about planning a grazing program is available from the local office of the Natural Resources Conservation Service.

## Ecological Sites

Twenty-five ecological sites are recognized in Noble County. The ecological site identifier has eleven characters. The “R” indicates an ecological site. The next four characters identify the major land resource area, the sixth character identifies the major land resource unit subdivision, the next three characters identify the individual ecological site number, and the final two characters identify the state. The ecological site identifier is followed by the proper name for the ecological site. The following paragraphs describe the ecological sites in Noble County and list the plants that are characteristic of each site. Detailed ecological site descriptions are available at the local office of the Natural Resources Conservation Service.

**R080AY010OK, Claypan Prairie (north).**—This site is in areas of nearly level to gently sloping, deep and very deep, loamy soils. These soils have a dense clayey subsoil that absorbs water slowly and restricts root penetration. Under good management, the important plants are little bluestem, switchgrass, leadplant, and perennial sunflowers. As the site deteriorates, sideoats grama, blue grama, tall dropseed, wild alfalfa, and buckbrush increase in abundance. Forage production is moderate.

**R080AY014OK, Deep Sand.**—This site is in areas of nearly level to sloping, very deep, sandy soils. Forage production is moderate. Areas consist of rolling hills separated by narrow valleys. Under good management, the important plants are sand bluestem, indiagrass, switchgrass, little bluestem, and sand lovegrass. As the site deteriorates, tall dropseed, blue grama, sandbur, prairie sagewort, skunkbush, and sand plum increase in abundance.

**R080AY022OK, Dune.**—This site is in areas of very deep, strongly sloping to steep, sandy soils. Forage production is low. Areas consist of choppy high dunes separated by narrow valleys. Careful grazing management is needed to prevent the development of blowout areas. Under good management, the important plants are sand bluestem, little bluestem, giant sandreed, and sand lovegrass. If this site is abused, Texas bluegrass, sand paspalum, sandlily, bush morningglory, and skunkbush increase in abundance.

**R080AY045OK, Heavy Bottomland.**—This site is in areas of nearly level, very gently sloping, very deep, clayey soils on flood plains. These soils absorb water slowly. Large cracks are common during droughty periods. Under good management, the important plants are big bluestem, indiagrass, prairie cordgrass, switchgrass, and perennial sunflowers. If abused, tall dropseed, goldenrods, sedges, and persimmon increase in abundance. Forage production is moderate.

**R080AY050OK, Loamy Bottomland.**—This site is in areas of nearly level to sloping, very deep, loamy soils on flood plains or terraces. Forage production is high. Under good management, the important plants are big bluestem, indiagrass, eastern gamagrass, compassplant, and switchgrass. If this site is abused, beaked panicum, tall dropseed, heath aster, sedges, elm, and greenbrier increase in abundance.

**R080AY056OK, Loamy Prairie.**—This site is in areas where the climax vegetation is primarily little bluestem, big bluestem, indiagrass, and switchgrass. These plants, together with Canada wildrye, make up about 70 percent of the vegetation. Under continuous heavy grazing, the principal grasses are sideoats grama and blue grama. Leadplant, wildindigo, scurfpea, and prairie acacia are the common legumes.

**R080AY068OK, Sandy Bottomland.**—This site is in areas of nearly level, very gently sloping, very deep, sandy soils on flood plains or terraces. These soils are droughty and subject to soil blowing. Forage production is low. Under good management, the important plants are switchgrass, sand bluestem, indiagrass, and perennial sunflowers. If this site is abused, beaked panicum, Texas bluegrass, goldenrods, willow, and cottonwood increase in abundance.

**R080AY073OK, Sandy Prairie.**—This site is in areas of very gently sloping to undulating, deep, moderately sandy soils on uplands. Forage production is high. The soils have a moderate water-holding capacity, which benefits root development and

moisture storage. Under good management, the important plants are sand bluestem, little bluestem, and indiagrass. If this site is subject to continual heavy grazing, sideoats grama, blue grama, and sand dropseed increase in abundance.

**R080AY080OK, Shallow Clay Prairie.**—This site is in areas of severely eroded, gently sloping to strongly sloping, shallow, raw, clayey soils that are underlain by shale. The shale is commonly exposed on the steeper slopes. Vegetation is difficult to establish. Under good management, the important plants are sideoats grama, little bluestem, and hairy grama. If this site is subject to continual heavy grazing, grass cover is reduced and areas of bare soil increase. Carefully managed grazing can prevent erosion. Forage production is very low. This site has some natural erosion.

**R080AY083OK, Shallow Prairie.**—This site is in areas where the potential plant community is tall grasses. Species composition, by weight, is 75 percent grasses, 20 percent forbs, and 5 percent woody plants. Big bluestem, indiagrass, switchgrass, little bluestem, tephrosia, catclaw sensitivebrier, perennial sunflowers, and skunkbush are preferred plants and make up 65 percent of livestock forage when the site is in excellent condition. If the site is subject to continuous heavy grazing, these plants are replaced by less palatable plants, such as dropseeds, jointtail, Scribner panicum, buffalograss, wildindigo, milkweeds, sagewort, sumacs, and indigobush. As the site deteriorates, other plants, such as broomsedge bluestem, splitbeard, Japanese brome, showy partridgepea, common broomweed, ragweeds, bitter sneezeweed, crotons, persimmon, and hawthorn, dominate the site.

**R080AY090OK, Meadow.**—This site is in areas where the vegetation includes grasses, sedges, rushes, buttonbush, and various broadleaf plants. Willow and cottonwood trees are common. In these areas, water is ponded for long or very long periods but the areas typically do not have standing water during the growing season. For a considerable part of the year, the water table is within a depth of a few inches.

**R080AY091OK, Slickspot.**—This site is in areas of gently sloping, deep and very deep, loamy soils on uplands. These soils have a clayey, alkali subsoil with blocky structure. Forage production is low because of a slow rate of water intake, salt content, and poor aeration. Under good management, the important plants, which are alkali sacaton, switchgrass, western wheatgrass, tall dropseed, white tridens, and blue grama, make up 50 percent of the vegetation. Other plants include dotted gayfeather, whorled dropseed, gummy lovegrass, fall witchgrass, yellow neptunia, mourning lovegrass, purple threeawn, curlycup gumweed, goldenweed, and hairy goldaster. If the site is abused, blue grama, silver bluestem, wild alfalfa, lanceleaf ragweed, threeawn, and western ragweed increase in abundance.

**R080AY095OK, Subirrigated.**—This site is in areas of deep, nearly level, very gently sloping, sandy soils on uplands or flood plains. These soils have a high water table, which is beneficial to plant growth. Forage production is high. Under good management, the important plants are switchgrass, big bluestem, indiagrass, and eastern gamagrass. If the site is abused, tall dropseed, sideoats grama, sedges, willow, and cottonwood increase in abundance.

**R080AY099OK, Depressional Upland.**—This site is in areas where, depending upon the degree of inundation, the dominant plants are willow, switchgrass, prairie cordgrass, indiagrass, cattails, western wheatgrass, sedges, bristlegrass, Illinois bundleflower, duckweed, sedges, and other forbs.

**R080AY810OK, Reseeded Claypan Prairie.**—This site is in areas of formerly cultivated land that typically are seeded to sideoats grama, blue grama, little bluestem, sand bluestem, and indiagrass. The site may have been damaged by erosion, and soil fertility is inherently low. If the site is abused, broomweeds and threeawn dominate.

**R080AY856OK, Reseeded Loamy Prairie.**—This site is in areas where the plant cover includes big bluestem, switchgrass, little bluestem, indiagrass, and other seeded species. Native legumes can be abundant. Other important grasses include jointtail,

meadow dropseed, tall dropseed, and hairy grama. Production is much lower than the Loamy Prairie ecological site due to a lower quality of soil health.

**R080AY880OK, Reseeded Clay.**—This site is in areas of severely eroded, deep, loamy, upland soils that were formerly cultivated and have a clay subsoil. When reseeded and well managed, this site can support little bluestem, big bluestem, indiagrass, switchgrass, and sideoats grama. If the site is abused, annual threeawn, western ragweed, blue grama, buffalograss, and common broomweed dominate. Carefully managing grazing can prevent erosion. Forage production is very low.

**R080AY883OK, Reseeded Shallow Prairie.**—This site is in areas where the seeded grasses include sideoats grama and native bluestem mixes. If the site is heavily grazed, the dominant plants are hairy grama, buffalograss, dropseed, silver bluestem, cheatgrass, broomweed, western ragweed, and other weedy grasses and forbs. Because of past use and erosion, this site is not productive.

**R084AY018OK, Deep Sand Savannah.**—This site is in areas of very gently sloping to moderately steep, very deep, sandy soils on uplands. Under good management, the important plants consist of an overstory of post oak and blackjack oak and an understory of big bluestem, sand lovegrass, and switchgrass. The trees occur in thick stands or in scattered stands. As trees thicken, herbaceous vegetation decreases in abundance. If the site is abused, tall dropseed, purpletop, Scribner panicum, heathaster, white snakeroot, splitbeard bluestem, broomsedge bluestem, winged elm, hickory, buckbrush, sumac, and shrubby oak increase in abundance. Eastern redcedar can increase in abundance if the site is not subject to fires.

**R084AY050OK, Loamy Bottomland.**—This site is in areas where the pristine plant community is tall grasses. Species composition, by weight, is 70 percent grasses, 20 percent forbs, and 10 percent woody plants. Eastern gamagrass, Florida paspalum, prairie cordgrass, big bluestem, indiagrass, switchgrass, switchcane, leadplant, Illinois bundleflower, compassplant, gayfeather, and passion vine are the major plants and make up 75 percent of the production when the site is in top ecological condition. If the site is heavily grazed, these plants are replaced by such plants as little bluestem, tall dropseed, Scribner panicum, sedges, rushes, wildindigo, perennial sunflowers, goldenrods, trumpetvine, winged elm, sumacs, and indigobush. As the site deteriorates, unpalatable plants, such as silver bluestem, splitbeard bluestem, broomsedge bluestem, sideoats grama, Japanese brome, threeawns, showy partridgepea, ragweeds, bitter sneezeweed, ironweed, white snakeroot, persimmon, hawthorn, post oak, and blackjack oak, dominate.

**R084AY076OK, Sandy Savannah (central).**—This site is in areas where the decreaser grasses are little bluestem, indiagrass, big bluestem, and switchgrass. These grasses make up at least 45 percent of the total vegetation. Canada wildrye, Virginia wildrye, Texas bluegrass, and flatsedge are cool-season species. Woody species include post oak, blackjack oak, hickory, ash, elm, bumelia, coralberry, persimmon, poison ivy, grape, and hackberry. These species should not exceed 20 percent of the total cover.

**R084AY089OK, Shallow Savannah.**—This site is in areas that have a savannah where 15 percent of the coverage is post oak, blackjack oak, and other scrub woody species of little commercial value. The principal grasses, which make up 55 to 65 percent of the vegetation, include little bluestem, big bluestem, switchgrass, indiagrass, and Canada wildrye. The less dominant grasses are hairy grama, tall dropseed, and meadow dropseed. Invader plants include splitbeard, silver bluestem, eastern redcedar, and threeawn.

**R084AY095OK, Subirrigated.**—This site is in an area of very deep, nearly level and very gently sloping, sandy soils on flood plains. These soils have a high water table, which is beneficial to plant growth. Forage production is high. Under good management, the important plants are switchgrass, big bluestem, indiagrass, and eastern

gamagrass. If the site is subject to continual abuse, tall dropseed, sideoats grama, sedges, willow, and cottonwood increase in abundance.

**R084AY876OK, Reseeded Sandy Savannah.**—This site is in areas where former cropland is typically seeded to a mixture of big bluestem, little bluestem, indiagrass, switchgrass, sideoats grama, and other grasses. If the land is abused, these plants are replaced by red lovegrass, gummy lovegrass, dropseeds, Scribner panicum, fall witchgrass, wild buckwheat, ragweed, and sandbur.

**R084AY889OK, Reseeded Shallow Savannah.**—This site is in areas where the principal seeded grasses are little bluestem, blue grama, and sideoats grama. Other grasses include big bluestem, indiagrass, and switchgrass. As the site deteriorates, grasses such as red lovegrass, mourning lovegrass, and splitbeard bluestem increase in abundance.

Rangeland Productivity and Characteristic Plant Communities

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
AhpA: Ashport-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem-----	25
					indiangrass-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gamagrass-----	5
miscellaneous trees-----	5					
APPA: Ashport-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem-----	25
					indiangrass-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gamagrass-----	5
miscellaneous trees-----	5					
Port-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem-----	25
					indiangrass-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gamagrass-----	5
miscellaneous trees-----	5					
Pulaski-----	Loamy Bottomland R084AY0500K	7,000	4,900	3,500	big bluestem-----	25
					indiangrass-----	15
					switchgrass-----	15
					miscellaneous trees-----	10
					beaked panicum-----	5
					eastern gamagrass-----	5
					miscellaneous perennial forbs--	5
					prairie cordgrass-----	5
sedge-----	5					

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
AspA, AspB: Ashport-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5
BetA, BetB: Bethany-----	Loamy Prairie R080AY0560K	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
BPG. Borrow pits, gravelly						
BPR. Borrow pits, rock						
BraA: Braman-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5
BrwA: Brewer-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
CoLC: Coyle-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
Lucien-----	Shallow Prairie R080AY083OK	3,000	2,100	1,500	little bluestem----- sideoats grama----- big bluestem----- blue grama----- miscellaneous perennial forbs-- miscellaneous perennial grasses buffalograss----- sand dropseed----- threeawn-----	30 15 10 10 10 10 5 5 5
CoyB, CoyC: Coyle-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
CoyC2: Coyle-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---
CoZC3: Coyle-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---
Zaneis-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
DalA: Dale-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5
DAM. Dam						
DaUA. Dale-Urban land						
DiGE: Dilworth-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- indiangrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5
Grainola-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- indiangrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5
DocB: Doolin-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- indiangrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
DwhC: Dilworth-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					indiangrass-----	10
					blue grama-----	5
					buffalograss-----	5
EasA: Easpur-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	sideoats grama-----	5
					big bluestem-----	25
					indiangrass-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gamagrass-----	5
miscellaneous trees-----	5					
GadA, GayA: Gaddy-----	Sandy Bottomland R080AY0680K	3,800	2,700	2,000	switchgrass-----	30
					indiangrass-----	15
					big bluestem-----	15
					annual grasses-----	10
					Texas bluegrass-----	5
					little bluestem-----	5
					miscellaneous perennial forbs--	5
					miscellaneous perennial grasses	5
					miscellaneous trees-----	5
					threeawn-----	5
GMLG: Grainola-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					indiangrass-----	10
					blue grama-----	5
					buffalograss-----	5
sideoats grama-----	5					

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
GMLG: Masham-----	Shallow Clay Prairie R080AY0800K	2,400	1,700	1,200	sideoats grama----- buffalograss----- alkali sacaton----- blue grama----- miscellaneous perennial grasses hairy grama----- little bluestem----- miscellaneous perennial forbs-- silver bluestem----- vine mesquite----- meadow dropseed----- fourwing saltbush-----	25 15 10 10 10 5 5 5 5 5 4 1
Lucien-----	Shallow Prairie R080AY0830K	3,000	2,100	1,500	little bluestem----- sideoats grama----- big bluestem----- blue grama----- miscellaneous perennial forbs-- miscellaneous perennial grasses buffalograss----- sand dropseed----- threeawn-----	30 15 10 10 10 10 5 5 5
GohE: Goodnight-----	Deep Sand (30 to 39 in.) R080AY0140K	4,000	2,700	1,800	big bluestem----- little bluestem----- miscellaneous shrubs----- switchgrass----- indiangrass----- blue grama----- miscellaneous perennial forbs-- miscellaneous perennial grasses sand lovegrass----- sand sagebrush----- sideoats grama-----	25 20 10 10 5 5 5 5 5 5 5
GraC: Grainola-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- indiangrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre	Pct	
GrAD: Grainola-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					indiangrass-----	10
					blue grama-----	5
					buffalograss-----	5
					sideoats grama-----	5
Ashport-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem-----	25
					indiangrass-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gamagrass-----	5
miscellaneous trees-----	5					
GrHC: Grant-----	Loamy Prairie R080AY0560K	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					indiangrass-----	10
					switchgrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
tall dropseed-----	5					
Huska-----	Slickspot (annual pre- cipitation 29 to 35 in.) R080AY0910K	2,000	1,400	1,000	alkali sacaton-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					blue grama-----	10
					sideoats grama-----	10
					tall dropseed-----	10
					Scribner panicum-----	5
					dotted gayfeather-----	5
					miscellaneous perennial forbs--	5
					silver bluestem-----	5
					whorled dropseed-----	5
GrLC, GrLE: Grainola-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					indiangrass-----	10
					blue grama-----	5
					buffalograss-----	5
					sideoats grama-----	5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
GrLC, GrLE: Lucien-----	Shallow Prairie R080AY083OK	3,000	2,100	1,500	little bluestem----- sideoats grama----- big bluestem----- blue grama----- miscellaneous perennial forbs-- miscellaneous perennial grasses buffalograss----- sand dropseed----- threeawn-----	30 15 10 10 10 10 5 5 5
GrnC, GrtB: Grant-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
HaPE: Harrah-----	Sandy Savannah (central) R084AY076OK	5,000	3,500	2,500	little bluestem----- big bluestem----- blackjack oak----- post oak----- Scribner panicum----- miscellaneous perennial forbs-- miscellaneous trees----- purple lovegrass----- purpletop tridens----- sand lovegrass----- switchgrass-----	25 20 10 10 5 5 5 5 5 5 5
Pulaski-----	Loamy Bottomland R084AY050OK	7,000	4,900	3,500	big bluestem----- indiangrass----- switchgrass----- miscellaneous trees----- beaked panicum----- eastern gamagrass----- miscellaneous perennial forbs-- prairie cordgrass----- sedge-----	25 15 15 10 5 5 5 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
HiRG: Highview-----	Shallow Clay Prairie R080AY0800K	2,400	1,700	1,200	sideoats grama----- buffalograss----- alkali sacaton----- blue grama----- miscellaneous perennial grasses hairy grama----- little bluestem----- miscellaneous perennial forbs-- silver bluestem----- vine mesquite----- meadow dropseed----- fourwing saltbush-----	25 15 10 10 10 5 5 5 5 5 4 1
Rock outcrop.						
KekA, KeoA: Keokuk-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5
KgfB: Kingfisher-----	Loamy Prairie R080AY0560K	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
KgLC: Kingfisher-----	Loamy Prairie R080AY0560K	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
KgLC: Lucien-----	Shallow Prairie R080AY083OK	3,000	2,100	1,500	little bluestem-----	30
					sideoats grama-----	15
					big bluestem-----	10
					blue grama-----	10
					miscellaneous perennial forbs--	10
					miscellaneous perennial grasses	10
					buffalograss-----	5
					sand dropseed-----	5
threeawn-----	5					
KgWC: Kingfisher-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					indiangrass-----	10
					switchgrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
					tall dropseed-----	5
Wakita-----	Slickspot (annual pre- cipitation 29 to 35 in.) R080AY091OK	2,000	1,400	1,000	alkali sacaton-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					blue grama-----	10
					sideoats grama-----	10
					tall dropseed-----	10
					Scribner panicum-----	5
					dotted gayfeather-----	5
					miscellaneous perennial forbs--	5
					silver bluestem-----	5
whorled dropseed-----	5					
KinC2: Kingfisher-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
KowB, KowD: Konawa-----	Sandy Savannah (central) R084AY076OK	5,000	3,500	2,500	little bluestem-----	25
					big bluestem-----	20
					blackjack oak-----	10
					post oak-----	10
					Scribner panicum-----	5
					miscellaneous perennial forbs--	5
					miscellaneous trees-----	5
					purple lovegrass-----	5
					purpletop tridens-----	5
					sand lovegrass-----	5
switchgrass-----	5					
KrdA, KrdB: Kirkland-----	Claypan Prairie (north) R080AY010OK	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					indiangrass-----	10
					blue grama-----	5
					buffalograss-----	5
					sideoats grama-----	5
KrdB2: Kirkland-----	Reseeded Claypan Prairie R080AY810OK	3,300	2,300	1,600	---	---
KrPB: Kirkland-----	Claypan Prairie (north) R080AY010OK	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					indiangrass-----	10
					blue grama-----	5
					buffalograss-----	5
					sideoats grama-----	5
Pawhuska-----	Slickspot (annual pre- cipitation 29 to 35 in.) R080AY091OK	2,000	1,400	1,000	alkali sacaton-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					blue grama-----	10
					sideoats grama-----	10
					tall dropseed-----	10
					Scribner panicum-----	5
					dotted gayfeather-----	5
					miscellaneous perennial forbs--	5
					silver bluestem-----	5
whorled dropseed-----	5					

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
LAN. Landfill						
Lela: Lela-----	Heavy Bottomland R080AY045OK	5,500	3,700	2,500	switchgrass----- blue grama----- meadow dropseed----- miscellaneous perennial grasses sideoats grama----- western wheatgrass----- Canada wildrye----- alkali sacaton----- buffalograss----- fourwing saltbush----- miscellaneous perennial forbs-- prairie cordgrass----- vine mesquite-----	15 10 10 10 10 10 5 5 5 5 5 5 5
LveB: Lovedale-----	Sandy Prairie R080AY073OK	4,500	3,200	2,000	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- sand sagebrush----- sideoats grama----- sand lovegrass----- skunkbush sumac-----	30 25 10 10 5 5 5 3 2
M-W. Miscellaneous water						
McaA: McLain-----	Heavy Bottomland R080AY045OK	5,500	3,700	2,500	switchgrass----- blue grama----- meadow dropseed----- miscellaneous perennial grasses sideoats grama----- western wheatgrass----- Canada wildrye----- alkali sacaton----- buffalograss----- fourwing saltbush----- miscellaneous perennial forbs-- prairie cordgrass----- vine mesquite-----	15 10 10 10 10 10 5 5 5 5 5 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
MilB, MilC: Milan-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					indiangrass-----	10
					switchgrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
tall dropseed-----	5					
MinB, MinC: Minco-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					indiangrass-----	10
					switchgrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
tall dropseed-----	5					
MirA: Miller-----	Heavy Bottomland R080AY045OK	5,500	3,700	2,500	switchgrass-----	15
					blue grama-----	10
					meadow dropseed-----	10
					miscellaneous perennial grasses	10
					sideoats grama-----	10
					western wheatgrass-----	10
					Canada wildrye-----	5
					alkali sacaton-----	5
					buffalograss-----	5
					fourwing saltbush-----	5
					miscellaneous perennial forbs--	5
					prairie cordgrass-----	5
vine mesquite-----	5					
MisA: Miller-----	Alkali Bottomland R080AY001OK	5,000	3,200	2,000	alkali sacaton-----	20
					switchgrass-----	20
					indiangrass-----	10
					miscellaneous perennial forbs--	10
					miscellaneous perennial grasses	10
					western wheatgrass-----	10
					inland saltgrass-----	5
					sedge-----	5
					sideoats grama-----	5
vine mesquite-----	5					

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
MPNC2:						
Milan-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---
Pawhuska-----	Reseeded Slickspot R080AY891OK	2,000	1,400	1,000	---	---
Norge-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---
MulC, MulD:						
Mulhall-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
MulD4:						
Mulhall-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---
NeDG:						
Newalla-----	Sandy Savannah (central) R084AY076OK	5,000	3,500	2,500	little bluestem----- big bluestem----- blackjack oak----- post oak----- Scribner panicum----- miscellaneous perennial forbs-- miscellaneous trees----- purple lovegrass----- purpletop tridens----- sand lovegrass----- switchgrass-----	25 20 10 10 5 5 5 5 5 5 5
Darnell-----	Shallow Savannah (33 to 39 in.) R084AY089OK	3,200	2,100	1,400	little bluestem----- big bluestem----- blackjack oak----- miscellaneous perennial grasses post oak----- indiangrass----- miscellaneous perennial forbs-- miscellaneous shrubs----- sideoats grama-----	30 20 10 10 10 5 5 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
NorA, NorB, NorC: Norge-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
NorC2: Norge-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---
NoUC. Norge-Urban land						
OWWE: Oil waste land.						
Westsum-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- indiangrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5
PoaA: Port-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5
PoOA: Port-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
PoOA: Oscar-----	Alkali Bottomland R080AY001OK	5,000	3,200	2,000	alkali sacaton----- switchgrass----- indiangrass----- miscellaneous perennial forbs-- miscellaneous perennial grasses western wheatgrass----- inland saltgrass----- sedge----- sideoats grama----- vine mesquite-----	20 20 10 10 10 10 5 5 5 5
PorA, PotA: Port-----	Loamy Bottomland R080AY050OK	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5
PukA, Pula: Pulaski-----	Loamy Bottomland R084AY050OK	7,000	4,900	3,500	big bluestem----- indiangrass----- switchgrass----- miscellaneous trees----- beaked panicum----- eastern gamagrass----- miscellaneous perennial forbs-- prairie cordgrass----- sedge-----	25 15 15 10 5 5 5 5 5
RefC2: Renfrow-----	Reseeded Claypan Prairie R080AY810OK	3,300	2,300	1,600	---	---
ReGC2: Renfrow-----	Reseeded Claypan Prairie R080AY810OK	3,300	2,300	1,600	---	---
Grainola-----	Reseeded Claypan Prairie R080AY810OK	3,300	2,300	1,600	---	---

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
ReiA: Reinach-----	Loamy Bottomland R080AY0500K	8,500	6,100	4,500	big bluestem----- indiangrass----- miscellaneous perennial grasses switchgrass----- little bluestem----- miscellaneous perennial forbs-- eastern gamagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5
RenB, RenC: Renfrow-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- indiangrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5
RewC2: Renfrow-----	Reseeded Claypan Prairie R080AY8100K	3,300	2,300	1,600	---	---
RGPD3: Renfrow-----	Reseeded Claypan Prairie R080AY8100K	3,300	2,300	1,600	---	---
Grainola-----	Reseeded Claypan Prairie R080AY8100K	3,300	2,300	1,600	---	---
Pawhuska-----	Reseeded Slickspot R080AY8910K	2,000	1,400	1,000	---	---
SlaB, SlaC, SlaG: Slaughterville-----	Sandy Prairie R080AY0730K	4,500	3,200	2,000	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- sand sagebrush----- sideoats grama----- sand lovegrass----- skunkbush sumac-----	30 25 10 10 5 5 5 3 2

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
StDD: Stephenville-----	Sandy Savannah (central) R084AY076OK	5,000	3,500	2,500	little bluestem-----	25
					big bluestem-----	20
					blackjack oak-----	10
					post oak-----	10
					Scribner panicum-----	5
					miscellaneous perennial forbs--	5
					miscellaneous trees-----	5
					purple lovegrass-----	5
					purpletop tridens-----	5
					sand lovegrass-----	5
					switchgrass-----	5
Darnell-----	Shallow Savannah (33 to 39 in.) R084AY089OK	3,200	2,100	1,400	little bluestem-----	30
					big bluestem-----	20
					blackjack oak-----	10
					miscellaneous perennial grasses	10
					post oak-----	10
					indiangrass-----	5
					miscellaneous perennial forbs--	5
					miscellaneous shrubs-----	5
					sideoats grama-----	5
TabA: Tabler-----	Claypan Prairie (north) R080AY010OK	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					indiangrass-----	10
					blue grama-----	5
					buffalograss-----	5
					sideoats grama-----	5
TeaA: Tearney-----	Meadow R080AY090OK	6,500	4,500	2,500	sedge-----	40
					rush-----	25
					prairie cordgrass-----	10
					miscellaneous perennial grasses	8
					miscellaneous perennial forbs--	5
					switchgrass-----	5
					miscellaneous shrubs-----	3
					inland ceanothus-----	2
					miscellaneous trees-----	2

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
TelB, TelD: Teller-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
TelD2: Teller-----	Reseeded Loamy Prairie R080AY856OK	3,300	2,300	1,650	---	---
VanA: Vanoss-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- indiangrass----- switchgrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
W. Water						
WauA: Waurika-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- indiangrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5
WesB, WesC: Westsum-----	Claypan Prairie (north) R080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- indiangrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
WiLC: Wisby-----	Sandy Prairie R080AY073OK	4,500	3,200	2,000	little bluestem-----	30
					big bluestem-----	25
					indiangrass-----	10
					switchgrass-----	10
					blue grama-----	5
					sand sagebrush-----	5
					sideoats grama-----	5
					sand lovegrass-----	3
skunkbush sumac-----	2					
Lovedale-----	Sandy Prairie R080AY073OK	4,500	3,200	2,000	little bluestem-----	30
					big bluestem-----	25
					indiangrass-----	10
					switchgrass-----	10
					blue grama-----	5
					sand sagebrush-----	5
					sideoats grama-----	5
					sand lovegrass-----	3
skunkbush sumac-----	2					
ZaHC: Zaneis-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					indiangrass-----	10
					switchgrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
					tall dropseed-----	5
Huska-----	Slickspot (annual pre- cipitation 29 to 35 in.) R080AY091OK	2,000	1,400	1,000	alkali sacaton-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					blue grama-----	10
					sideoats grama-----	10
					tall dropseed-----	10
					Scribner panicum-----	5
					dotted gayfeather-----	5
					miscellaneous perennial forbs--	5
					silver bluestem-----	5
whorled dropseed-----	5					

Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland
		Favorable year	Normal year	Unfavorable year		composition
		Lb/acre	Lb/acre	Lb/acre		Pct
ZanB: Zaneis-----	Loamy Prairie R080AY056OK	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					indiangrass-----	10
					switchgrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
					tall dropseed-----	5

## Windbreaks and Environmental Plantings

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.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of trees that have been planted and have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or grow poorly, depending on the characteristics of the soil. Each tree or shrub has definable potential heights in a given physiographic area and under given climatic conditions. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The table "Windbreaks and Environmental Plantings" shows the height that locally grown trees and shrubs are expected to reach in 20 years on the soils in Noble County. The estimates in this table 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 the local office of the Natural Resources Conservation Service or the Cooperative Extension Service or from a local nursery.

Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AhpA: Ashport-----	---	common lilac, shrub lespedeza, Amur honeysuckle, American plum	eastern redbud, Rocky Mountain juniper, oriental arborvitae, Austrian pine, bur oak	Osage-orange, red mulberry, common hackberry, green ash, lacebark elm, black locust	---
APPA: Ashport-----	---	common lilac, shrub lespedeza, Amur honeysuckle, American plum	eastern redbud, Rocky Mountain juniper, oriental arborvitae, Austrian pine, bur oak	Osage-orange, red mulberry, common hackberry, green ash, lacebark elm, black locust	---
Port-----	---	common lilac, shrub lespedeza, Amur honeysuckle, American plum	eastern redbud, Rocky Mountain juniper, oriental arborvitae, Austrian pine, bur oak	Osage-orange, red mulberry, common hackberry, green ash, lacebark elm, black locust	---
Pulaski-----	---	shrub lespedeza, Amur honeysuckle, American plum	Rocky Mountain juniper, eastern redbud, ponderosa pine, oriental arborvitae, Scotch pine	Austrian pine, bur oak, Osage-orange, red mulberry, common hackberry, green ash, lacebark elm	black locust
AspA, AspB: Ashport-----	---	common lilac, shrub lespedeza, Amur honeysuckle, American plum	eastern redbud, Rocky Mountain juniper, oriental arborvitae, Austrian pine, bur oak	Osage-orange, red mulberry, common hackberry, green ash, lacebark elm, black locust	---
BetA, BetB: Bethany-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BPG. Borrow pits, gravelly					
BPR. Borrow pits, rock					
BraA: Braman-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
BrwA: Brewer-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
CoLC: Coyle-----	American plum	eastern redbud, oriental arborvitae	Austrian pine, Rocky Mountain juniper, common hackberry, lacebark elm, Osage-orange, ponderosa pine, red mulberry, bur oak, green ash, black locust, loblolly pine	---	---
Lucien. CoyB, CoyC, CoyC2: Coyle-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
CoZC3: Coyle-----	American plum	eastern redbud, oriental arborvitae	Austrian pine, Rocky Mountain juniper, common hackberry, lacebark elm, Osage-orange, ponderosa pine, red mulberry, bur oak, green ash, black locust, loblolly pine	---	---
Zaneis-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
DalA: Dale-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
DAM. Dam					
DaUA: Dale-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
Urban land.					

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
DiGE: Dilworth-----	American plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	common hackberry, lacebark elm, Osage-orange, ponderosa pine, bur oak, black locust, green ash	---	---
Grainola-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---
DooB: Doolin.					
DwhC: Dilworth-----	American plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	common hackberry, lacebark elm, Osage-orange, ponderosa pine, bur oak, black locust, green ash	---	---
EasA: Easpur-----	---	common lilac, shrub lespedeza, Amur honeysuckle, American plum	eastern redbud, Rocky Mountain juniper, oriental arborvitae, Austrian pine, bur oak	Osage-orange, red mulberry, common hackberry, green ash, lacebark elm, black locust	---
GadA: Gaddy-----	sand plum	---	Rocky Mountain juniper, bur oak, oriental arborvitae, ponderosa pine, Austrian pine, Osage-orange, common hackberry, green ash, lacebark elm, loblolly pine	black locust	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
GayA: Gaddy-----	American plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	Austrian pine, bur oak, common hackberry, lacebark elm, ponderosa pine, green ash, black locust, loblolly pine	---	---
GMLG: Grainola-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---
Masham.					
Lucien.					
GohE: Goodnight-----	sand plum	---	Rocky Mountain juniper, bur oak, oriental arborvitae, ponderosa pine, Austrian pine, Osage-orange, common hackberry, green ash, lacebark elm, loblolly pine	black locust	---
GraC: Grainola-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---
GrAD: Grainola-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
GrAD: Ashport-----	---	common lilac, shrub lespedeza, Amur honeysuckle, American plum	eastern redbud, Rocky Mountain juniper, oriental arborvitae, Austrian pine, bur oak	Osage-orange, red mulberry, common hackberry, green ash, lacebark elm, black locust	---
GrHC: Grant-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
Huska.					
GrLC, GrLE: Grainola-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---
Lucien.					
GrnC: Grant-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
GrtB: Grant-----	American plum, Amur honeysuckle, common lilac	eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
HaPE: Harrah-----	skunkbush sumac	common lilac, American plum, Amur honeysuckle	---	Austrian pine, Osage-orange	Chinese elm
Pulaski-----	---	shrub lespedeza, Amur honeysuckle, American plum	Rocky Mountain juniper, eastern redbud, ponderosa pine, oriental arborvitae, Scotch pine	Austrian pine, bur oak, Osage-orange, red mulberry, common hackberry, green ash, lacebark elm	black locust
HiRG. Highview-Rock outcrop					
KekA, KeoA: Keokuk-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
KgfB: Kingfisher-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---
KgLC: Kingfisher-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---
Lucien.					

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
KgWC: Kingfisher----- sand plum		eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---
Wakita.					
KinC2: Kingfisher----- sand plum		eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---
KowB: Konawa----- ---		American plum, Amur honeysuckle	oriental arborvitae, red mulberry	Austrian pine, Chinese elm, black locust, green ash	---
KowD: Konawa----- sand plum		Rocky Mountain juniper, eastern redbud	oriental arborvitae, Austrian pine, bur oak, lacebark elm, common hackberry, green ash, black locust	loblolly pine	---
KrdA, KrdB, KrdB2: Kirkland----- American plum, Amur honeysuckle, common lilac		eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
KrPB: Kirkland----- American plum, Amur honeysuckle, common lilac		eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
Pawhuska.					

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
LAN. Landfill					
Lela: Lela-----	American plum, Amur honeysuckle, common lilac	eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
LveB: Lovedale-----	American plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	Austrian pine, bur oak, common hackberry, lacebark elm, ponderosa pine, green ash, black locust, loblolly pine	---	---
M-W. Miscellaneous water					
McaA: McLain-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
MilB: Milan-----	---	American plum, Amur honeysuckle, common lilac, eastern redbud, oriental arborvitae	ponderosa pine, bur oak, red mulberry, Osage-orange, common hackberry, lacebark elm, loblolly pine	black locust	---
MilC: Milan-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MinB, MinC: Minco-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
MirA: Miller-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
MisA. Miller					
MPNC2: Milan-----	---	American plum, Amur honeysuckle, common lilac, eastern redbud, oriental arborvitae	ponderosa pine, bur oak, red mulberry, Osage-orange, common hackberry, lacebark elm, loblolly pine	black locust	---
Pawhuska. Norge-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
MulC, MulD, MulD4: Mulhall-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
NeDG: Newalla-----	---	American plum, Amur honeysuckle	Austrian pine, bur oak, green ash, Osage-orange	Chinese elm, black locust	---
Darnell.					
NorA, NorB, NorC, NorC2: Norge-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
NoUC: Norge-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
Urban land.					
OWWE: Oil waste land.					
Westsum-----	American plum, Amur honeysuckle, common lilac	eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
PoaA: Port-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
PoOA: Port-----	---	common lilac, shrub lespedeza, Amur honeysuckle, American plum	eastern redbud, Rocky Mountain juniper, oriental arborvitae, Austrian pine, bur oak	Osage-orange, red mulberry, common hackberry, green ash, lacebark elm, black locust	---
Oscar.					
PorA, PotA: Port-----	---	common lilac, shrub lespedeza, Amur honeysuckle, American plum	eastern redbud, Rocky Mountain juniper, oriental arborvitae, Austrian pine, bur oak	Osage-orange, red mulberry, common hackberry, green ash, lacebark elm, black locust	---
PukA, Pula: Pulaski-----	---	shrub lespedeza, Amur honeysuckle, American plum	Rocky Mountain juniper, eastern redbud, ponderosa pine, oriental arborvitae, Scotch pine	Austrian pine, bur oak, Osage-orange, red mulberry, common hackberry, green ash, lacebark elm	black locust
RefC2: Renfrow-----	American plum, Amur honeysuckle, common lilac	eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
ReGC2: Renfrow-----	American plum, Amur honeysuckle, common lilac	eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
Grainola-----	sand plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	bur oak, common hackberry, lacebark elm, Osage-orange, ponderosa pine, green ash, black locust	---	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
ReiA: Reinach-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
RenB, RenC, RewC2: Renfrow-----	American plum, Amur honeysuckle, common lilac	eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
RGPD3: Renfrow-----	American plum, Amur honeysuckle, common lilac	eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
Grainola-----	American plum	eastern redbud, oriental arborvitae	Austrian pine, Rocky Mountain juniper, common hackberry, lacebark elm, Osage-orange, ponderosa pine, red mulberry, bur oak, green ash, black locust, loblolly pine	---	---
Pawhuska.					
SlaB: Slaughterville-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
SlaC, SlaG: Slaughterville-----	American plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	Austrian pine, bur oak, common hackberry, lacebark elm, ponderosa pine, green ash, black locust, loblolly pine	---	---
StDD: Stephenville-----	Amur honeysuckle	---	red mulberry, black locust, green ash, Osage-orange, Austrian pine	Siberian elm	---
Darnell.					
TabA. Tabler					
TeaA. Tearney					
TelB, TelD, TelD2: Teller-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
VanA: Vanoss-----	shrub lespedeza	Amur honeysuckle, American plum	eastern redbud, Scotch pine, Rocky Mountain juniper, oriental arborvitae, red mulberry, Austrian pine, ponderosa pine	Osage-orange, bur oak, common hackberry, green ash, lacebark elm, black locust	---
W. Water					
WauA: Waurika.					

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
WesB, WesC: Westsum-----	American plum, Amur honeysuckle, common lilac	eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
WiLC: Wisby-----	American plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	Austrian pine, bur oak, common hackberry, lacebark elm, ponderosa pine, green ash, black locust, loblolly pine	---	---
Lovedale-----	American plum	eastern redbud, oriental arborvitae, Rocky Mountain juniper	Austrian pine, bur oak, common hackberry, lacebark elm, ponderosa pine, green ash, black locust, loblolly pine	---	---
ZaHC: Zaneis-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---
Huska.					
ZanB: Zaneis-----	American plum	common lilac, Amur honeysuckle, eastern redbud, oriental arborvitae	bur oak, Osage-orange, ponderosa pine, red mulberry, black locust, common hackberry, lacebark elm	loblolly pine	---

## Recreation

The soils of the survey area are rated in tables "Recreational Development, Part I" and "Recreational Development, Part II" according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses.

*Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.

*Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

*Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00). The ratings in the tables are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered.

Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are 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.

The information in tables "Recreational Development, Part I" and "Recreational Development, Part II" can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, sanitary facilities, and water management.

*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 ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Playgrounds* require soils that are nearly level, are free of stones, and can withstand intensive foot traffic. The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of playgrounds. For good trafficability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Paths and trails* should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

*Off-road motorcycle trails* require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a water table, ponding, flooding, and texture of the surface layer.

*Golf fairways* are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer. The suitability of the soil for traps, tees, roughs, and greens is not considered in the ratings.

## Recreational Development, Part I

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AhpA: Ashport-----	89	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60
APPA: Ashport-----	61	Very limited Flooding	1.00	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
Port-----	15	Very limited Flooding	1.00	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
Pulaski-----	15	Very limited Flooding	1.00	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
AspA: Ashport-----	90	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60
AspB: Ashport-----	93	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60
BetA: Bethany-----	85	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41
BetB: Bethany-----	84	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41
BPG: Borrow pits, gravelly----	90	Not rated		Not rated		Not rated	
BPR: Borrow pits, rock-----	90	Not rated		Not rated		Not rated	
BraA: Braman-----	85	Very limited Flooding	1.00	Not limited		Not limited	
BrwA: Brewer-----	97	Very limited Flooding Restricted permeability	1.00 0.41	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41

Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CoLC: Coyle-----	61	Not limited		Not limited		Not limited	
Lucien-----	30	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Slope Content of large stones	1.00 0.12 0.03
CoyB: Coyle-----	85	Not limited		Not limited		Not limited	
CoyC: Coyle-----	82	Not limited		Not limited		Somewhat limited Depth to bedrock Slope	0.71 0.50
CoyC2: Coyle-----	82	Not limited		Not limited		Somewhat limited Slope Depth to bedrock	0.50 0.35
CoZC3: Coyle-----	60	Not limited		Not limited		Somewhat limited Depth to bedrock Slope	0.99 0.50
Zaneis-----	16	Not limited		Not limited		Somewhat limited Slope	0.50
DalA: Dale-----	90	Very limited Flooding	1.00	Not limited		Not limited	
DAM: Dam-----	100	Not rated		Not rated		Not rated	
DaUA: Dale-----	48	Very limited Flooding	1.00	Not limited		Not limited	
Urban land---	42	Not rated		Not rated		Not rated	
DiGE: Dilworth-----	64	Somewhat limited Restricted permeability Slope	0.41 0.04	Somewhat limited Restricted permeability Slope	0.41 0.04	Very limited Slope Depth to bedrock Restricted permeability Gravel content	1.00 0.97 0.41 0.04
Grainola-----	16	Somewhat limited Restricted permeability Slope	0.41 0.04	Somewhat limited Restricted permeability Slope	0.41 0.04	Very limited Slope Restricted permeability Depth to bedrock Content of large stones	1.00 0.41 0.35 0.08

## Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
DooB: Doolin-----	85	Very limited Sodium content Restricted permeability	1.00 0.45	Very limited Sodium content Restricted permeability	1.00 0.45	Very limited Sodium content Restricted permeability	1.00 0.45
DwhC: Dilworth-----	85	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41	Somewhat limited Slope Restricted permeability Depth to bedrock Gravel content	0.50 0.41 0.06 0.04
EasA: Easpur-----	79	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60
GadA: Gaddy-----	89	Very limited Flooding Too sandy	1.00 0.79	Somewhat limited Too sandy	0.79	Somewhat limited Too sandy Flooding	0.79 0.60
GayA: Gaddy-----	85	Very limited Flooding Too sandy	1.00 0.79	Somewhat limited Too sandy	0.79	Somewhat limited Too sandy	0.79
GMLG: Grainola-----	37	Very limited Slope Too stony Restricted permeability Gravel content Content of large stones	1.00 0.76 0.41 0.02 0.01	Very limited Slope Too stony Restricted permeability Gravel content Content of large stones	1.00 0.76 0.41 0.02 0.01	Very limited Slope Gravel content Content of large stones Too stony Depth to bedrock	1.00 1.00 0.95 0.76 0.46
Masham-----	22	Very limited Slope Depth to bedrock Too stony Restricted permeability	1.00 1.00 0.76 0.45	Very limited Slope Depth to bedrock Too stony Restricted permeability	1.00 1.00 0.76 0.45	Very limited Slope Depth to bedrock Too stony Restricted permeability	1.00 1.00 0.76 0.45
Lucien-----	21	Very limited Slope Depth to bedrock	1.00 1.00	Very limited Slope Depth to bedrock	1.00 1.00	Very limited Slope Depth to bedrock Content of large stones	1.00 1.00 0.03
GohE: Goodnight----	95	Somewhat limited Too sandy Slope	0.87 0.16	Somewhat limited Too sandy Slope	0.87 0.16	Very limited Slope Too sandy	1.00 0.87

Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrAC: Grainola-----	85	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41	Somewhat limited Slope Restricted permeability Depth to bedrock Content of large stones Gravel content	0.50 0.41 0.16 0.05 0.02
GrAD: Grainola-----	38	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41	Very limited Slope Restricted permeability Depth to bedrock Content of large stones Gravel content	1.00 0.41 0.06 0.05 0.02
Ashport-----	23	Very limited Flooding	1.00	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
GrHC: Grant-----	37	Not limited		Not limited		Somewhat limited Slope	0.50
Huska-----	35	Very limited Sodium content Restricted permeability Salinity	1.00 0.45 0.01	Very limited Sodium content Restricted permeability Salinity	1.00 0.45 0.01	Very limited Sodium content Restricted permeability Slope Salinity	1.00 0.45 0.12 0.01
GrLC: Grainola-----	47	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41	Somewhat limited Slope Restricted permeability Content of large stones Gravel content Depth to bedrock	0.50 0.41 0.05 0.02 0.01
Lucien-----	30	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Slope Content of large stones	1.00 0.12 0.03
GrLE: Grainola-----	50	Somewhat limited Restricted permeability Slope	0.41 0.04	Somewhat limited Restricted permeability Slope	0.41 0.04	Very limited Slope Depth to bedrock Restricted permeability Content of large stones Gravel content	1.00 0.74 0.41 0.05 0.02

## Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrLE: Lucien-----	26	Very limited Depth to bedrock Slope	1.00 0.04	Very limited Depth to bedrock Slope	1.00 0.04	Very limited Depth to bedrock Slope Content of large stones	1.00 1.00 0.03
GrnC: Grant-----	95	Not limited		Not limited		Somewhat limited Slope	0.50
GrtB: Grant-----	90	Not limited		Not limited		Not limited	
HaPE: Harrah-----	44	Not limited		Not limited		Very limited Slope	1.00
Pulaski-----	25	Very limited Flooding	1.00	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
HiRG: Highview-----	43	Very limited Slope Depth to bedrock Too clayey Restricted permeability Gravel content	1.00 1.00 0.50 0.41 0.13	Very limited Slope Depth to bedrock Too clayey Restricted permeability Gravel content	1.00 1.00 0.50 0.41 0.13	Very limited Slope Depth to bedrock Gravel content Too clayey Restricted permeability	1.00 1.00 1.00 0.50 0.41
Rock outcrop-	33	Not rated		Not rated		Not rated	
KekA: Keokuk-----	88	Very limited Flooding	1.00	Not limited		Not limited	
KeoA: Keokuk-----	88	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60
KgfB: Kingfisher---	90	Not limited		Not limited		Not limited	
KgLC: Kingfisher---	53	Not limited		Not limited		Somewhat limited Depth to bedrock Slope	0.97 0.50
Lucien-----	29	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Slope Content of large stones	1.00 0.12 0.03

Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KgWC: Kingfisher---	63	Not limited		Not limited		Somewhat limited Depth to bedrock Slope	0.29 0.12
Wakita-----	19	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.41	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.41	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.41
KinC2: Kingfisher---	82	Not limited		Not limited		Somewhat limited Depth to bedrock Slope	0.97 0.50
KowB: Konawa-----	80	Not limited		Not limited		Not limited	
KowD: Konawa-----	78	Not limited		Not limited		Very limited Slope	1.00
KrdA: Kirkland-----	85	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45
KrdB: Kirkland-----	80	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45
KrdB2: Kirkland-----	80	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45
KrPB: Kirkland-----	52	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45
Pawhuska-----	33	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.45	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.45	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.45
LAN: Landfill-----	100	Not rated		Not rated		Not rated	
LelA: Lela-----	91	Very limited Flooding Too clayey Restricted permeability	1.00 0.50 0.45	Somewhat limited Too clayey Restricted permeability	0.50 0.45	Somewhat limited Flooding Too clayey Restricted permeability	0.60 0.50 0.45

## Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LveB: Lovedale-----	90	Not limited		Not limited		Not limited	
M-W: Miscellaneous Water-----	100	Not rated		Not rated		Not rated	
McaA: McLain-----	95	Very limited Flooding Restricted permeability	1.00 0.41	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41
MilB: Milan-----	95	Not limited		Not limited		Not limited	
MilC: Milan-----	90	Not limited		Not limited		Somewhat limited Slope	0.50
MinB: Minco-----	85	Not limited		Not limited		Not limited	
MinC: Minco-----	90	Not limited		Not limited		Somewhat limited Slope	0.50
MirA, MisA: Miller-----	84	Very limited Flooding Restricted permeability	1.00 0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Flooding Restricted permeability	0.60 0.45
MPNC2: Milan-----	35	Not limited		Not limited		Somewhat limited Slope	0.50
Pawhuska-----	28	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.45	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.45	Very limited Sodium content Salinity Slope Restricted permeability	1.00 1.00 0.50 0.45
Norge-----	24	Not limited		Not limited		Somewhat limited Slope	0.50
MulC: Mulhall-----	92	Not limited		Not limited		Somewhat limited Slope	0.50
MulD, MulD4: Mulhall-----	92	Not limited		Not limited		Very limited Slope	1.00

Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NeDG: Newalla-----	41	Somewhat limited Too stony Restricted permeability	0.76 0.45	Somewhat limited Too stony Restricted permeability	0.76 0.45	Very limited Slope Too stony Restricted permeability	1.00 0.76 0.45
Darnell-----	36	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Slope Depth to bedrock	1.00 1.00
NorA: Norge-----	90	Not limited		Not limited		Not limited	
NorB: Norge-----	85	Not limited		Not limited		Not limited	
NorC: Norge-----	90	Not limited		Not limited		Somewhat limited Slope	0.50
NorC2: Norge-----	90	Not limited		Not limited		Somewhat limited Slope	0.50
NoUC: Norge-----	55	Not limited		Not limited		Not limited	
Urban land---	30	Not rated		Not rated		Not rated	
OWWE: Oil waste land-----	69	Not rated		Not rated		Not rated	
Westsum-----	25	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Slope Restricted permeability	0.50 0.45
PoaA: Port-----	84	Very limited Flooding	1.00	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
PoOA: Port-----	57	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60
Oscar-----	40	Very limited Sodium content Flooding Salinity Restricted permeability	1.00 1.00 1.00 0.41	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.41	Very limited Sodium content Salinity Flooding Restricted permeability	1.00 1.00 0.60 0.41
PorA: Port-----	92	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60
PotA: Port-----	86	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60

## Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
PukA: Pulaski-----	70	Very limited Flooding	1.00	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
PulA: Pulaski-----	82	Very limited Flooding	1.00	Not limited		Somewhat limited Flooding	0.60
RefC2: Renfrow-----	75	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Slope Restricted permeability	0.50 0.45
ReGC2: Renfrow-----	60	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Slope Restricted permeability	0.50 0.45
Grainola-----	20	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41	Somewhat limited Slope Restricted permeability Depth to bedrock Content of large stones Gravel content	0.50 0.41 0.20 0.05 0.02
ReiA: Reinach-----	90	Very limited Flooding	1.00	Not limited		Not limited	
RenB: Renfrow-----	82	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45
RenC: Renfrow-----	85	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Slope Restricted permeability	0.50 0.45
RewC2: Renfrow-----	80	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Slope Restricted permeability	0.50 0.45
RGPD3: Renfrow-----	45	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Slope Restricted permeability	0.50 0.45

Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
RGPD3: Grainola-----	29	Somewhat limited Restricted permeability	0.41	Somewhat limited Restricted permeability	0.41	Very limited Slope Depth to bedrock Restricted permeability Content of large stones Gravel content	1.00 0.99 0.41 0.05 0.02
Pawhuska-----	15	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.45	Very limited Sodium content Salinity Restricted permeability	1.00 1.00 0.45	Very limited Sodium content Salinity Slope Restricted permeability	1.00 1.00 0.50 0.45
SlaB: Slaughter- ville-----	85	Not limited		Not limited		Not limited	
SlaC: Slaughter- ville-----	85	Not limited		Not limited		Somewhat limited Slope	0.50
SlaG: Slaughter- ville-----	78	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
StDD: Stephenville-	45	Not limited		Not limited		Somewhat limited Slope Depth to bedrock Content of large stones	0.50 0.06 0.03
Darnell-----	35	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Slope Content of large stones	1.00 0.50 0.03
TabA: Tabler-----	83	Very limited Depth to saturated zone Restricted permeability	1.00 0.45	Very limited Depth to saturated zone Restricted permeability	1.00 0.45	Very limited Depth to saturated zone Restricted permeability	1.00 0.45
TeaA: Tearney-----	82	Very limited Flooding Restricted permeability Too clayey Ponding	1.00 1.00 1.00 1.00	Very limited Restricted permeability Too clayey Ponding	1.00 1.00 1.00 1.00	Very limited Restricted permeability Too clayey Ponding Flooding	1.00 1.00 1.00 1.00 0.60
TelB: Teller-----	85	Not limited		Not limited		Not limited	

## Recreational Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
TelD: Teller-----	85	Not limited		Not limited		Very limited Slope	1.00
TelD2: Teller-----	82	Not limited		Not limited		Very limited Slope	1.00
VanA: Vanoss-----	82	Not limited		Not limited		Not limited	
W: Water-----	100	Not rated		Not rated		Not rated	
WauA: Waurika-----	89	Very limited Depth to saturated zone Restricted permeability Sodium content	1.00 1.00 1.00	Very limited Depth to saturated zone Restricted permeability Sodium content	1.00 1.00 1.00	Very limited Depth to saturated zone Restricted permeability Sodium content	1.00 1.00 1.00
WesB: Westsum-----	85	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45
WesC: Westsum-----	90	Somewhat limited Restricted permeability	0.45	Somewhat limited Restricted permeability	0.45	Somewhat limited Slope Restricted permeability	0.50 0.45
WiLC: Wisby-----	48	Not limited		Not limited		Somewhat limited Slope Gravel content	0.50 0.06
Lovedale-----	40	Not limited		Not limited		Not limited	
ZaHC: Zaneis-----	54	Not limited		Not limited		Not limited	
Huska-----	32	Very limited Sodium content Restricted permeability Salinity	1.00 0.45 0.01	Very limited Sodium content Restricted permeability Salinity	1.00 0.45 0.01	Very limited Sodium content Restricted permeability Salinity	1.00 0.45 0.01
ZanB: Zaneis-----	80	Not limited		Not limited		Not limited	

Recreational Development, Part II

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AhpA: Ashport-----	89	Not limited		Not limited		Somewhat limited Flooding	0.60
APPA: Ashport-----	61	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
Port-----	15	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
Pulaski-----	15	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
AspA: Ashport-----	90	Not limited		Not limited		Somewhat limited Flooding	0.60
AspB: Ashport-----	93	Not limited		Not limited		Somewhat limited Flooding	0.60
BetA: Bethany-----	85	Not limited		Not limited		Not limited	
BetB: Bethany-----	84	Not limited		Not limited		Not limited	
BPG: Borrow pits, gravelly----	90	Not rated		Not rated		Not rated	
BPR: Borrow pits, rock-----	90	Not rated		Not rated		Not rated	
BraA: Braman-----	85	Not limited		Not limited		Not limited	
BrwA: Brewer-----	97	Not limited		Not limited		Not limited	
CoLC: Coyle-----	61	Not limited		Not limited		Very limited Depth to bedrock Droughty	0.99 0.19
Lucien-----	30	Not limited		Not limited		Very limited Depth to bedrock Droughty Content of large stones	1.00 0.97 0.03

## Recreational Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CoyB: Coyle-----	85	Not limited		Not limited		Somewhat limited Depth to bedrock	0.46
CoyC: Coyle-----	82	Not limited		Not limited		Somewhat limited Depth to bedrock	0.71
CoyC2: Coyle-----	82	Not limited		Not limited		Somewhat limited Depth to bedrock	0.35
CoZC3: Coyle-----	60	Not limited		Not limited		Very limited Depth to bedrock Droughty	0.99 0.12
Zaneis-----	16	Not limited		Not limited		Not limited	
DalA: Dale-----	90	Not limited		Not limited		Not limited	
DAM: Dam-----	100	Not rated		Not rated		Not rated	
DaUA: Dale-----	48	Not limited		Not limited		Not limited	
Urban land---	42	Not rated		Not rated		Not rated	
DiGE: Dilworth----	64	Not limited		Not limited		Somewhat limited Depth to bedrock Slope Droughty	0.97 0.04 0.02
Grainola-----	16	Very limited Water erosion	1.00	Very limited Water erosion	1.00	Somewhat limited Depth to bedrock Content of large stones Slope	0.35 0.08 0.04
DooB: Doolin-----	85	Not limited		Not limited		Very limited Sodium content	1.00
DwhC: Dilworth----	85	Not limited		Not limited		Somewhat limited Depth to bedrock	0.06
EasA: Easpur-----	79	Not limited		Not limited		Somewhat limited Flooding	0.60
GadA: Gaddy-----	89	Somewhat limited Too sandy	0.79	Somewhat limited Too sandy	0.79	Somewhat limited Flooding Droughty	0.60 0.29

Recreational Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GayA: Gaddy-----	85	Somewhat limited Too sandy	0.79	Somewhat limited Too sandy	0.79	Somewhat limited Droughty	0.27
GMLG: Grainola-----	37	Somewhat limited Too stony Content of large stones	0.76 0.01	Somewhat limited Too stony Content of large stones	0.76 0.01	Very limited Slope Content of large stones Depth to bedrock Gravel content	1.00 0.95 0.46 0.02
Masham-----	22	Very limited Water erosion Slope Too stony	1.00 1.00 0.76	Very limited Water erosion Too stony Slope	1.00 0.76 0.22	Very limited Depth to bedrock Slope Droughty	1.00 1.00 0.97
Lucien-----	21	Somewhat limited Slope	0.18	Not limited		Very limited Depth to bedrock Slope Droughty Content of large stones	1.00 1.00 0.49 0.03
GohE: Goodnight----	95	Somewhat limited Too sandy	0.87	Somewhat limited Too sandy	0.87	Somewhat limited Droughty Slope	0.63 0.16
GraC: Grainola-----	85	Not limited		Not limited		Somewhat limited Depth to bedrock Content of large stones	0.16 0.05
GrAD: Grainola-----	38	Not limited		Not limited		Somewhat limited Depth to bedrock Content of large stones	0.06 0.05
Ashport-----	23	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
GrHC: Grant-----	37	Not limited		Not limited		Not limited	
Huska-----	35	Not limited		Not limited		Very limited Sodium content Droughty Salinity	1.00 0.08 0.01
GrLC: Grainola-----	47	Not limited		Not limited		Somewhat limited Content of large stones Depth to bedrock	0.05 0.01

## Recreational Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrLC: Lucien-----	30	Not limited		Not limited		Very limited Depth to bedrock Droughty Content of large stones	1.00 0.25 0.03
GrLE: Grainola-----	50	Very limited Water erosion	1.00	Very limited Water erosion	1.00	Somewhat limited Depth to bedrock Content of large stones Slope	0.74 0.05 0.04
Lucien-----	26	Not limited		Not limited		Very limited Depth to bedrock Droughty Slope Content of large stones	1.00 0.99 0.04 0.03
GrnC: Grant-----	95	Not limited		Not limited		Not limited	
GrtB: Grant-----	90	Not limited		Not limited		Not limited	
HaPE: Harrah-----	44	Not limited		Not limited		Not limited	
Pulaski-----	25	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
HiRG: Highview-----	43	Very limited Slope Too clayey	1.00 0.50	Somewhat limited Slope Too clayey	0.56 0.50	Very limited Depth to bedrock Slope Droughty Too clayey Content of large stones	1.00 1.00 1.00 1.00 0.38
Rock outcrop-	33	Not rated		Not rated		Not rated	
KekA: Keokuk-----	88	Not limited		Not limited		Not limited	
KeoA: Keokuk-----	88	Not limited		Not limited		Somewhat limited Flooding	0.60
KgfB: Kingfisher---	90	Not limited		Not limited		Somewhat limited Depth to bedrock	0.80
KgLC: Kingfisher---	53	Not limited		Not limited		Somewhat limited Depth to bedrock	0.97

Recreational Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KgLC: Lucien-----	29	Not limited		Not limited		Very limited Depth to bedrock Droughty Content of large stones	1.00 0.87 0.03
KgWC: Kingfisher---	63	Not limited		Not limited		Somewhat limited Depth to bedrock	0.29
Wakita-----	19	Not limited		Not limited		Very limited Sodium content Salinity Depth to bedrock Droughty	1.00 1.00 0.35 0.22
KinC2: Kingfisher---	82	Not limited		Not limited		Somewhat limited Depth to bedrock	0.97
KowB: Konawa-----	80	Not limited		Not limited		Not limited	
KowD: Konawa-----	78	Not limited		Not limited		Not limited	
KrdA: Kirkland-----	85	Not limited		Not limited		Not limited	
KrdB, KrdB2: Kirkland-----	80	Not limited		Not limited		Not limited	
KrPB: Kirkland-----	52	Not limited		Not limited		Not limited	
Pawhuska-----	33	Not limited		Not limited		Very limited Sodium content Salinity	1.00 1.00
LAN: Landfill-----	100	Not rated		Not rated		Not rated	
LelA: Lela-----	91	Somewhat limited Too clayey	0.50	Somewhat limited Too clayey	0.50	Very limited Too clayey Flooding	1.00 0.60
LveB: Lovedale-----	90	Not limited		Not limited		Not limited	
M-W: Miscellaneous water-----	100	Not rated		Not rated		Not rated	
McaA: McLain-----	95	Not limited		Not limited		Not limited	

## Recreational Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
MilB: Milan-----	95	Not limited		Not limited		Not limited	
MilC: Milan-----	90	Not limited		Not limited		Not limited	
MinB: Minco-----	85	Not limited		Not limited		Not limited	
MinC: Minco-----	90	Not limited		Not limited		Not limited	
MirA, MisA: Miller-----	84	Not limited		Not limited		Somewhat limited Flooding	0.60
MPNC2: Milan-----	35	Not limited		Not limited		Not limited	
Pawhuska----	28	Not limited		Not limited		Very limited Sodium content Salinity	1.00 1.00
Norge-----	24	Not limited		Not limited		Not limited	
MulC, MulD, MulD4: Mulhall-----	92	Not limited		Not limited		Not limited	
NeDG: Newalla-----	41	Somewhat limited Too stony	0.76	Somewhat limited Too stony	0.76	Not limited	
Darnell-----	36	Very limited Slope	1.00	Somewhat limited Slope	0.04	Very limited Depth to bedrock Droughty Slope	1.00 1.00 1.00
NorA: Norge-----	90	Not limited		Not limited		Not limited	
NorB: Norge-----	85	Not limited		Not limited		Not limited	
NorC, NorC2: Norge-----	90	Not limited		Not limited		Not limited	
NoUC: Norge-----	55	Not limited		Not limited		Not limited	
Urban land---	30	Not rated		Not rated		Not rated	
OWWE: Oil waste land-----	69	Not rated		Not rated		Not rated	
Westsum-----	25	Not limited		Not limited		Not limited	

Recreational Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
PoaA: Port-----	84	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
PoOA: Port-----	57	Not limited		Not limited		Somewhat limited Flooding	0.60
Oscar-----	40	Not limited		Not limited		Very limited Sodium content Salinity Flooding	1.00 1.00 0.60
PorA: Port-----	92	Not limited		Not limited		Somewhat limited Flooding	0.60
PotA: Port-----	86	Not limited		Not limited		Somewhat limited Flooding	0.60
PukA: Pulaski-----	70	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Very limited Flooding	1.00
PulA: Pulaski-----	82	Not limited		Not limited		Somewhat limited Flooding	0.60
RefC2: Renfrow-----	75	Not limited		Not limited		Not limited	
ReGC2: Renfrow-----	60	Not limited		Not limited		Not limited	
Grainola-----	20	Not limited		Not limited		Somewhat limited Depth to bedrock Content of large stones	0.20 0.05
ReiA: Reinach-----	90	Not limited		Not limited		Not limited	
RenB: Renfrow-----	82	Not limited		Not limited		Not limited	
RenC: Renfrow-----	85	Not limited		Not limited		Not limited	
RewC2: Renfrow-----	80	Not limited		Not limited		Not limited	

## Recreational Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
RGPD3: Renfrow-----	45	Not limited		Not limited		Not limited	
Grainola-----	29	Not limited		Not limited		Very limited Depth to bedrock Droughty Content of large stones	0.99 0.12 0.05
Pawhuska-----	15	Not limited		Not limited		Very limited Sodium content Salinity	1.00 1.00
SlaB, SlaC: Slaughter- ville-----	85	Not limited		Not limited		Not limited	
SlaG: Slaughter- ville-----	78	Very limited Slope	1.00	Not limited		Very limited Slope	1.00
StDD: Stephenville-	45	Not limited		Not limited		Somewhat limited Depth to bedrock Content of large stones	0.06 0.03
Darnell-----	35	Not limited		Not limited		Very limited Depth to bedrock Droughty Content of large stones	1.00 1.00 0.03
TabA: Tabler-----	83	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
TeaA: Tearney-----	82	Very limited Too clayey Ponding	1.00 1.00	Very limited Too clayey Ponding	1.00 1.00	Very limited Too clayey Ponding Flooding	1.00 1.00 0.60
TelB, TelD: Teller-----	85	Not limited		Not limited		Not limited	
TelD2: Teller-----	82	Not limited		Not limited		Not limited	
VanA: Vanoss-----	82	Not limited		Not limited		Not limited	
W: Water-----	100	Not rated		Not rated		Not rated	

Recreational Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
WauA: Waurika-----	89	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone Sodium content	1.00 1.00
WesB: Westsum-----	85	Not limited		Not limited		Not limited	
WesC: Westsum-----	90	Not limited		Not limited		Not limited	
WiLC: Wisby-----	48	Not limited		Not limited		Not limited	
Lovedale-----	40	Not limited		Not limited		Not limited	
ZaHC: Zaneis-----	54	Not limited		Not limited		Not limited	
Huska-----	32	Not limited		Not limited		Very limited Sodium content Droughty Salinity	1.00 0.04 0.01
ZanB: Zaneis-----	80	Not limited		Not limited		Not limited	

## 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 sanitary facilities, waste management, building site development, 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 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.*

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds 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.

### Sanitary Facilities

The tables "Sanitary Facilities, Part I" and "Sanitary Facilities, Part II" show the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses.

*Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.

*Somewhat limited* indicates that the soil has features that are moderately favorable

for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

*Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*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 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

*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. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter. Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, 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. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

*Trench sanitary landfill* is an area where solid waste is placed in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil excavated at the site. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. The ratings in the table are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include permeability, depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, onsite investigation may be needed. Hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or directly below the proposed trench bottom can affect the ease of excavation and the hazard of ground-water pollution.

Slope affects construction of the trenches and the movement of surface water around the landfill. It also affects the construction and performance of roads in areas of the landfill. Soil texture and consistence affect the ease with which the trench is dug and the ease with which the soil can be used as daily or final cover. They determine the workability of the soil when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and are difficult to place as a uniformly thick cover over a layer of refuse. The soil material used as the final cover for a trench landfill should be suitable for plants. It should not have excess sodium or salts and should not be too acid. The surface layer generally has the best workability, the highest content of organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

*Area sanitary landfill* is an area where solid 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. A final cover of soil material at least 2 feet thick is placed over the completed landfill. The ratings in the table are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, permeability, depth to a water table, ponding, slope, and depth to bedrock or a cemented pan. Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If permeability is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

*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. The ratings in the table also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime. Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion. Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area. 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. It should not have excess sodium, salts, or lime and should not be too acid.

Sanitary Facilities, Part I

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
AhpA: Ashport-----	89	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
APPA: Ashport-----	61	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
Port-----	15	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
Pulaski-----	15	Very limited Flooding	1.00	Very limited Flooding Seepage	1.00 1.00
AspA: Ashport-----	90	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
AspB: Ashport-----	93	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
BetA: Bethany-----	85	Very limited Restricted permeability	1.00	Not limited	
BetB: Bethany-----	84	Very limited Restricted permeability	1.00	Not limited	
BPG: Borrow pits, gravelly-----	90	Not rated		Not rated	
BPR: Borrow pits, rock---	90	Not rated		Not rated	

## Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BraA: Braman-----	85	Very limited Restricted permeability Flooding	1.00 0.40	Somewhat limited Seepage Flooding	0.53 0.40
BrwA: Brewer-----	97	Very limited Restricted permeability Flooding	1.00 0.40	Somewhat limited Flooding	0.40
CoLC: Coyle-----	61	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Seepage	1.00 0.53
Lucien-----	30	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Seepage Slope	1.00 1.00 0.08
CoyB: Coyle-----	85	Very limited Depth to bedrock Restricted permeability	1.00 0.46	Very limited Depth to soft bedrock Seepage	1.00 0.53
CoyC, CoyC2: Coyle-----	82	Very limited Depth to bedrock Restricted permeability	1.00 0.46	Very limited Depth to soft bedrock Seepage Slope	1.00 0.53 0.32
CoZC3: Coyle-----	60	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Seepage Slope	1.00 0.53 0.32
Zaneis-----	16	Very limited Restricted permeability Depth to bedrock	1.00 0.78	Somewhat limited Seepage Depth to soft bedrock Slope	0.53 0.42 0.32
DalA: Dale-----	90	Somewhat limited Restricted permeability Flooding	0.46 0.40	Somewhat limited Seepage Flooding	0.53 0.40
DAM: Dam-----	100	Not rated		Not rated	

Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
DaUA: Dale-----	48	Somewhat limited Restricted permeability Flooding	0.46 0.40	Somewhat limited Seepage Flooding	0.53 0.40
Urban land-----	42	Not rated		Not rated	
DiGE: Dilworth-----	64	Very limited Depth to bedrock Slope	1.00 0.04	Very limited Depth to soft bedrock Slope	1.00 1.00
Grainola-----	16	Very limited Restricted permeability Depth to bedrock Slope	1.00 1.00 0.04	Very limited Depth to soft bedrock Slope	1.00 1.00
DooB: Doolin-----	85	Very limited Restricted permeability Depth to bedrock	1.00 0.01	Not limited	
DwhC: Dilworth-----	85	Very limited Restricted permeability Depth to bedrock	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 0.32
EasA: Easpur-----	79	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
GadA: Gaddy-----	89	Very limited Flooding Filtering capacity	1.00 1.00	Very limited Flooding Seepage	1.00 1.00
GayA: Gaddy-----	85	Very limited Filtering capacity Flooding	1.00 0.40	Very limited Seepage Flooding	1.00 0.40
GMLG: Grainola-----	37	Very limited Restricted permeability Depth to bedrock Slope	1.00 1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 1.00

## Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
GMLG: Masham-----	22	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 1.00
Lucien-----	21	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to soft bedrock Slope Seepage	1.00 1.00 1.00
GohE: Goodnight-----	95	Very limited Filtering capacity Slope	1.00 0.16	Very limited Seepage Slope	1.00 1.00
GraC: Grainola-----	85	Very limited Restricted permeability Depth to bedrock	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 0.32
GrAD: Grainola-----	38	Very limited Restricted permeability Depth to bedrock	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 1.00
Ashport-----	23	Very limited Flooding Depth to bedrock Restricted permeability	1.00 0.91 0.46	Very limited Flooding Depth to soft bedrock Seepage	1.00 0.77 0.53
GrHC: Grant-----	37	Somewhat limited Depth to bedrock Restricted permeability	0.59 0.46	Somewhat limited Seepage Slope Depth to soft bedrock	0.53 0.32 0.13
Huska-----	35	Very limited Restricted permeability Depth to bedrock	1.00 0.78	Somewhat limited Depth to soft bedrock Slope	0.42 0.08
GrLC: Grainola-----	47	Very limited Restricted permeability Depth to bedrock	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 0.32
Lucien-----	30	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Seepage Slope	1.00 1.00 0.08

Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
GrLE: Grainola-----	50	Very limited Restricted permeability Depth to bedrock Slope	1.00 1.00 0.04	Very limited Depth to soft bedrock Slope	1.00 1.00
Lucien-----	26	Very limited Depth to bedrock Slope	1.00 0.04	Very limited Depth to soft bedrock Slope	1.00 1.00
GrnC: Grant-----	95	Somewhat limited Restricted permeability Depth to bedrock	0.46 0.30	Somewhat limited Seepage Slope	0.53 0.32
GrtB: Grant-----	90	Somewhat limited Restricted permeability Depth to bedrock	0.46 0.41	Somewhat limited Seepage Depth to soft bedrock	0.53 0.02
HaPE: Harrah-----	44	Somewhat limited Restricted permeability	0.46	Very limited Slope Seepage	1.00 0.53
Pulaski-----	25	Very limited Flooding Depth to bedrock	1.00 0.09	Very limited Flooding Seepage	1.00 1.00
HiRG: Highview-----	43	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 1.00
Rock outcrop-----	33	Not rated		Not rated	
KekA: Keokuk-----	88	Somewhat limited Restricted permeability Flooding	0.46 0.40	Somewhat limited Seepage Flooding	0.53 0.40
KeoA: Keokuk-----	88	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
KgFB: Kingfisher-----	90	Very limited Depth to bedrock Restricted permeability	1.00 1.00	Very limited Depth to soft bedrock	1.00

## Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
KgLC: Kingfisher-----	53	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Slope	1.00 0.32
Lucien-----	29	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Seepage Slope	1.00 1.00 0.08
KgWC: Kingfisher-----	63	Very limited Depth to bedrock Restricted permeability	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 0.08
Wakita-----	19	Very limited Restricted permeability Depth to bedrock Depth to saturated zone	1.00 1.00 1.00	Very limited Depth to soft bedrock Depth to saturated zone	1.00 0.19
KinC2: Kingfisher-----	82	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Slope	1.00 0.32
KowB: Konawa-----	80	Not limited		Very limited Seepage	1.00
KowD: Konawa-----	78	Very limited Filtering capacity	1.00	Very limited Seepage Slope	1.00 1.00
KrdA: Kirkland-----	85	Very limited Restricted permeability	1.00	Not limited	
KrdB: Kirkland-----	80	Very limited Restricted permeability Depth to bedrock	1.00 0.20	Not limited	
KrdB2: Kirkland-----	80	Very limited Restricted permeability Depth to bedrock	1.00 0.22	Not limited	

Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
KrPB: Kirkland-----	52	Very limited Restricted permeability	1.00	Not limited	
Pawhuska-----	33	Very limited Restricted permeability	1.00	Not limited	
LAN: Landfill-----	100	Not rated		Not rated	
Lela: Lela-----	91	Very limited Flooding Restricted permeability	1.00 1.00	Very limited Flooding	1.00
LveB: Lovedale-----	90	Very limited Filtering capacity Restricted permeability	1.00 0.46	Very limited Seepage	1.00
M-W: Miscellaneous water-	100	Not rated		Not rated	
McaA: McLain-----	95	Very limited Restricted permeability Flooding	1.00 0.40	Somewhat limited Flooding	0.40
MilB: Milan-----	95	Very limited Restricted permeability	1.00	Very limited Seepage	1.00
MilC: Milan-----	90	Not limited		Very limited Seepage Slope	1.00 0.32
MinB: Minco-----	85	Somewhat limited Restricted permeability	0.46	Somewhat limited Seepage	0.53
MinC: Minco-----	90	Somewhat limited Restricted permeability	0.46	Somewhat limited Seepage Slope	0.53 0.32
MirA, MisA: Miller-----	84	Very limited Flooding Restricted permeability	1.00 1.00	Very limited Flooding	1.00

## Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
MPNC2: Milan-----	35	Very limited Restricted permeability	1.00	Very limited Seepage Slope	1.00 0.32
Pawhuska-----	28	Very limited Restricted permeability	1.00	Somewhat limited Slope	0.32
Norge-----	24	Very limited Restricted permeability	1.00	Somewhat limited Slope Seepage	0.32 0.28
MulC: Mulhall-----	92	Somewhat limited Restricted permeability	0.46	Somewhat limited Seepage Slope	0.53 0.32
MulD, MulD4: Mulhall-----	92	Somewhat limited Restricted permeability	0.46	Very limited Slope Seepage	1.00 0.53
NeDG: Newalla-----	41	Very limited Restricted permeability Depth to bedrock	1.00 0.59	Very limited Slope Seepage Depth to soft bedrock	1.00 0.53 0.13
Darnell-----	36	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 1.00
NorA: Norge-----	90	Very limited Restricted permeability	1.00	Somewhat limited Seepage	0.28
NorB: Norge-----	85	Very limited Restricted permeability	1.00	Somewhat limited Seepage	0.53
NorC: Norge-----	90	Very limited Restricted permeability	1.00	Somewhat limited Slope Seepage	0.32 0.28
NorC2: Norge-----	90	Very limited Restricted permeability	1.00	Somewhat limited Slope	0.32

Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
NoUC: Norge-----	55	Very limited Restricted permeability	1.00	Not limited	
Urban land-----	30	Not rated		Not rated	
OWWE: Oil waste land-----	69	Not rated		Not rated	
Westsum-----	25	Very limited Restricted permeability	1.00	Somewhat limited Slope	0.32
PoaA: Port-----	84	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
PoOA: Port-----	57	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
Oscar-----	40	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
PorA: Port-----	92	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
PotA: Port-----	86	Very limited Flooding Restricted permeability	1.00 0.46	Very limited Flooding Seepage	1.00 0.53
PukA: Pulaski-----	70	Very limited Flooding	1.00	Very limited Flooding Seepage	1.00 1.00
PulA: Pulaski-----	82	Very limited Flooding	1.00	Very limited Flooding Seepage	1.00 1.00
RefC2: Renfrow-----	75	Very limited Restricted permeability	1.00	Somewhat limited Slope	0.32

## Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
ReGC2: Renfrow-----	60	Very limited Restricted permeability Depth to bedrock	1.00 0.14	Somewhat limited Slope	0.32
Grainola-----	20	Very limited Restricted permeability Depth to bedrock	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 0.32
ReiA: Reinach-----	90	Somewhat limited Restricted permeability Flooding	0.46 0.40	Somewhat limited Seepage Flooding	0.53 0.40
RenB: Renfrow-----	82	Very limited Restricted permeability	1.00	Not limited	
RenC: Renfrow-----	85	Very limited Restricted permeability	1.00	Somewhat limited Slope	0.32
RewC2: Renfrow-----	80	Very limited Restricted permeability Depth to bedrock	1.00 0.14	Somewhat limited Slope	0.32
RGPD3: Renfrow-----	45	Very limited Restricted permeability	1.00	Somewhat limited Slope	0.32
Grainola-----	29	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Slope	1.00 0.92
Pawhuska-----	15	Very limited Restricted permeability	1.00	Somewhat limited Slope	0.32
SlaB: Slaughterville-----	85	Not limited		Very limited Seepage	1.00
SlaC: Slaughterville-----	85	Very limited Filtering capacity	1.00	Very limited Seepage Slope	1.00 0.32

Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
SlaG: Slaughterville-----	78	Very limited Filtering capacity Slope	1.00 1.00	Very limited Slope Seepage	1.00 1.00
StDD: Stephenville-----	45	Very limited Depth to bedrock Restricted permeability	1.00 0.46	Very limited Depth to soft bedrock Seepage Slope	1.00 0.53 0.32
Darnell-----	35	Very limited Depth to bedrock	1.00	Very limited Depth to soft bedrock Slope	1.00 0.32
TabA: Tabler-----	83	Very limited Restricted permeability Depth to saturated zone	1.00 1.00	Very limited Depth to saturated zone	1.00
TeaA: Tearney-----	82	Very limited Flooding Restricted permeability Filtering capacity Ponding	1.00 1.00 1.00 1.00	Very limited Flooding Seepage Ponding	1.00 1.00 1.00
TelB: Teller-----	85	Somewhat limited Restricted permeability	0.46	Very limited Seepage	1.00
TelD: Teller-----	85	Somewhat limited Restricted permeability	0.46	Very limited Seepage Slope	1.00 1.00
TelD2: Teller-----	82	Somewhat limited Restricted permeability	0.46	Very limited Seepage Slope	1.00 1.00
VanA: Vanoss-----	82	Somewhat limited Restricted permeability	0.46	Somewhat limited Seepage	0.53
W: Water-----	100	Not rated		Not rated	

## Sanitary Facilities, Part I--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
WauA: Waurika-----	89	Very limited Restricted permeability Depth to saturated zone	1.00 1.00	Very limited Depth to saturated zone	1.00
WesB: Westsum-----	85	Very limited Restricted permeability	1.00	Not limited	
WesC: Westsum-----	90	Very limited Restricted permeability	1.00	Somewhat limited Slope	0.32
WiLC: Wisby-----	48	Very limited Filtering capacity	1.00	Very limited Seepage Slope	1.00 0.32
Lovedale-----	40	Very limited Filtering capacity Restricted permeability	1.00 0.46	Somewhat limited Seepage	0.53
ZaHC: Zaneis-----	54	Very limited Restricted permeability Depth to bedrock	1.00 0.91	Somewhat limited Depth to soft bedrock Seepage	0.77 0.53
Huska-----	32	Very limited Restricted permeability Depth to bedrock	1.00 0.59	Somewhat limited Depth to soft bedrock	0.13
ZanB: Zaneis-----	80	Very limited Restricted permeability Depth to bedrock	1.00 0.78	Somewhat limited Seepage Depth to soft bedrock	0.53 0.42

Sanitary Facilities, Part II

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AhpA: Ashport-----	89	Very limited Flooding Too clayey	1.00 0.50	Very limited Flooding	1.00	Somewhat limited Too clayey	0.50
APPA: Ashport-----	61	Very limited Flooding	1.00	Very limited Flooding	1.00	Not limited	
Port-----	15	Very limited Flooding	1.00	Very limited Flooding	1.00	Not limited	
Pulaski-----	15	Very limited Flooding Seepage Too sandy	1.00 1.00 0.50	Very limited Flooding Seepage	1.00 1.00	Somewhat limited Seepage Too sandy	0.52 0.50
AspA: Ashport-----	90	Very limited Flooding Too clayey	1.00 0.50	Very limited Flooding	1.00	Somewhat limited Too clayey	0.50
AspB: Ashport-----	93	Very limited Flooding	1.00	Very limited Flooding	1.00	Not limited	
BetA: Bethany-----	85	Very limited Too clayey	1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
BetB: Bethany-----	84	Somewhat limited Too clayey	0.50	Not limited		Very limited Hard to compact Too clayey	1.00 0.50
BPG: Borrow pits, gravelly----	90	Not rated		Not rated		Not rated	
BPR: Borrow pits, rock-----	90	Not rated		Not rated		Not rated	
BraA: Braman-----	85	Very limited Too clayey Flooding	1.00 0.40	Somewhat limited Flooding	0.40	Very limited Hard to compact Too clayey	1.00 0.50
BrwA: Brewer-----	97	Somewhat limited Too clayey Flooding	0.50 0.40	Somewhat limited Flooding	0.40	Very limited Hard to compact Too clayey	1.00 0.50

## Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CoLC: Coyle-----	61	Very limited Depth to bedrock Too clayey	1.00 0.50	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey	1.00 0.50
Lucien-----	30	Very limited Depth to bedrock Seepage	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Seepage	1.00 0.52
CoyB: Coyle-----	85	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00
CoyC, CoyC2: Coyle-----	82	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00
CoZC3: Coyle-----	60	Very limited Depth to bedrock Too clayey	1.00 0.50	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey	1.00 0.50
Zaneis-----	16	Very limited Depth to bedrock Too clayey	1.00 0.50	Somewhat limited Depth to bedrock	0.42	Somewhat limited Too clayey Depth to bedrock	0.50 0.42
DalA: Dale-----	90	Somewhat limited Too clayey Flooding	0.50 0.40	Somewhat limited Flooding	0.40	Somewhat limited Too clayey	0.50
DAM: Dam-----	100	Not rated		Not rated		Not rated	
DaUA: Dale-----	48	Somewhat limited Too clayey Flooding	0.50 0.40	Somewhat limited Flooding	0.40	Somewhat limited Too clayey	0.50
Urban land---	42	Not rated		Not rated		Not rated	
DiGE: Dilworth-----	64	Very limited Depth to bedrock Too clayey Slope	1.00 1.00 0.04	Very limited Depth to bedrock Slope	1.00 0.04	Very limited Depth to bedrock Too clayey Hard to compact Slope	1.00 1.00 1.00 0.04
Grainola-----	16	Very limited Depth to bedrock Too clayey Slope	1.00 1.00 0.04	Very limited Depth to bedrock Slope	1.00 0.04	Very limited Depth to bedrock Too clayey Hard to compact Slope	1.00 1.00 1.00 0.04
DooB: Doolin-----	85	Very limited Depth to bedrock Sodium content	1.00 1.00	Not limited		Very limited Sodium content	1.00

Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
DwhC: Dilworth-----	85	Very limited Depth to bedrock Too clayey	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey Hard to compact	1.00 1.00 1.00
EasA: Easpur-----	79	Very limited Flooding	1.00	Very limited Flooding	1.00	Not limited	
GadA: Gaddy-----	89	Very limited Flooding Seepage Too sandy	1.00 1.00 1.00	Very limited Flooding Seepage	1.00 1.00	Very limited Too sandy Seepage	1.00 1.00
GayA: Gaddy-----	85	Very limited Seepage Too sandy Flooding	1.00 0.50 0.40	Very limited Seepage Flooding	1.00 0.40	Very limited Seepage Too sandy	1.00 1.00 0.50
GMLG: Grainola-----	37	Very limited Depth to bedrock Too clayey Slope	1.00 1.00 1.00	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to bedrock Too clayey Hard to compact Slope	1.00 1.00 1.00 1.00
Masham-----	22	Very limited Slope Depth to bedrock Too clayey	1.00 1.00 1.00	Very limited Slope Depth to bedrock	1.00 1.00	Very limited Depth to bedrock Slope Too clayey Hard to compact	1.00 1.00 1.00 1.00
Lucien-----	21	Very limited Slope Depth to bedrock Seepage	1.00 1.00 1.00	Very limited Slope Depth to bedrock	1.00 1.00	Very limited Depth to bedrock Slope Seepage	1.00 1.00 0.52
GohE: Goodnight----	95	Very limited Seepage Too sandy Slope	1.00 1.00 0.16	Very limited Seepage Slope	1.00 0.16	Very limited Too sandy Seepage Slope	1.00 1.00 0.16
GraC: Grainola-----	85	Very limited Depth to bedrock Too clayey	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey Hard to compact	1.00 1.00 1.00
GrAD: Grainola-----	38	Very limited Depth to bedrock Too clayey	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey Hard to compact	1.00 1.00 1.00

## Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrAD: Ashport-----	23	Very limited Flooding Depth to bedrock	1.00 1.00	Very limited Flooding Depth to bedrock	1.00 0.77	Somewhat limited Depth to bedrock	0.77
GrHC: Grant-----	37	Very limited Depth to bedrock Too clayey	1.00 0.50	Somewhat limited Depth to bedrock	0.14	Somewhat limited Too clayey Depth to bedrock	0.50 0.14
Huska-----	35	Very limited Depth to bedrock Sodium content Too clayey	1.00 1.00 0.50	Somewhat limited Depth to bedrock	0.42	Very limited Sodium content Hard to compact Too clayey Depth to bedrock	1.00 1.00 0.50 0.42
GrLC: Grainola-----	47	Very limited Depth to bedrock Too clayey	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey Hard to compact	1.00 1.00 1.00
Lucien-----	30	Very limited Depth to bedrock Seepage	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Seepage	1.00 0.52
GrLE: Grainola-----	50	Very limited Depth to bedrock Too clayey Slope	1.00 1.00 0.04	Very limited Depth to bedrock Slope	1.00 0.04	Very limited Depth to bedrock Too clayey Hard to compact Slope	1.00 1.00 1.00 0.04
Lucien-----	26	Very limited Depth to bedrock Seepage Slope	1.00 1.00 0.04	Very limited Depth to bedrock Slope	1.00 0.04	Very limited Depth to bedrock Seepage Slope	1.00 0.52 0.04
GrnC: Grant-----	95	Very limited Depth to bedrock	1.00	Not limited		Not limited	
GrtB: Grant-----	90	Very limited Depth to bedrock Too clayey	1.00 0.50	Somewhat limited Depth to bedrock	0.02	Somewhat limited Too clayey Depth to bedrock	0.50 0.02
HaPE: Harrah-----	44	Not limited		Not limited		Not limited	
Pulaski-----	25	Very limited Flooding Depth to bedrock Seepage Too sandy	1.00 1.00 1.00 0.50	Very limited Flooding Seepage	1.00 1.00	Somewhat limited Seepage Too sandy	0.52 0.50

Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
HiRG: Highview-----	43	Very limited Slope Depth to bedrock Too clayey	1.00 1.00 1.00	Very limited Slope Depth to bedrock	1.00 1.00	Very limited Depth to bedrock Slope Too clayey Hard to compact Gravel content	1.00 1.00 1.00 1.00 0.02
Rock outcrop-	33	Not rated		Not rated		Not rated	
KekA: Keokuk-----	88	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Not limited	
KeoA: Keokuk-----	88	Very limited Flooding	1.00	Very limited Flooding	1.00	Not limited	
KgfB: Kingfisher---	90	Very limited Depth to bedrock Too clayey	1.00 0.50	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey	1.00 0.50
KgLC: Kingfisher---	53	Very limited Depth to bedrock Too clayey	1.00 0.50	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey	1.00 0.50
Lucien-----	29	Very limited Depth to bedrock Seepage	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Seepage	1.00 0.52
KgWC: Kingfisher---	63	Very limited Depth to bedrock Too clayey	1.00 0.50	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey	1.00 0.50
Wakita-----	19	Very limited Depth to bedrock Sodium content Depth to saturated zone Too clayey	1.00 1.00 0.86 0.50	Very limited Depth to bedrock Depth to saturated zone	1.00 0.19	Very limited Depth to bedrock Sodium content Too clayey Depth to saturated zone	1.00 1.00 0.50 0.47
KinC2: Kingfisher---	82	Very limited Depth to bedrock Too clayey	1.00 0.50	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey	1.00 0.50
KowB: Konawa-----	80	Very limited Seepage	1.00	Very limited Seepage	1.00	Somewhat limited Seepage	0.52
KowD: Konawa-----	78	Very limited Seepage Too sandy	1.00 0.50	Very limited Seepage	1.00	Somewhat limited Seepage Too sandy	0.52 0.50

## Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KrdA: Kirkland-----	85	Very limited Too clayey	1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
KrdB, KrdB2: Kirkland-----	80	Very limited Depth to bedrock Too clayey	1.00 0.50	Not limited		Very limited Hard to compact Too clayey	1.00 0.50
KrPB: Kirkland-----	52	Somewhat limited Too clayey	0.50	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
Pawhuska-----	33	Very limited Sodium content Too clayey	1.00 1.00	Not limited		Very limited Sodium content Too clayey Hard to compact	1.00 1.00 1.00
LAN: Landfill-----	100	Not rated		Not rated		Not rated	
LelA: Lela-----	91	Very limited Flooding Too clayey	1.00 1.00	Very limited Flooding	1.00	Very limited Too clayey Hard to compact	1.00 1.00
LveB: Lovedale-----	90	Very limited Seepage Too sandy	1.00 0.50	Not limited		Very limited Seepage Too sandy	1.00 0.50
M-W: Miscellaneous water-----	100	Not rated		Not rated		Not rated	
McaA: McLain-----	95	Very limited Too clayey Flooding	1.00 0.40	Somewhat limited Flooding	0.40	Very limited Hard to compact Too clayey	1.00 0.50
MilB: Milan-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Somewhat limited Too clayey Seepage	0.50 0.16
MilC: Milan-----	90	Very limited Seepage	1.00	Very limited Seepage	1.00	Somewhat limited Seepage	0.16
MinB: Minco-----	85	Not limited		Not limited		Not limited	
MinC: Minco-----	90	Not limited		Not limited		Not limited	

Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
MirA, MisA: Miller-----	84	Very limited Flooding Too clayey	1.00 0.50	Very limited Flooding	1.00	Very limited Too clayey Hard to compact	1.00 1.00
MPNC2: Milan-----	35	Very limited Seepage Too clayey	1.00 0.50	Very limited Seepage	1.00	Somewhat limited Too clayey Seepage	0.50 0.16
Pawhuska-----	28	Very limited Sodium content Seepage Too clayey	1.00 1.00 0.50	Not limited		Very limited Sodium content Hard to compact Too clayey	1.00 1.00 0.50
Norge-----	24	Somewhat limited Too clayey	0.50	Not limited		Somewhat limited Too clayey	0.50
MulC, MulD: Mulhall-----	92	Somewhat limited Too clayey	0.50	Not limited		Somewhat limited Too clayey	0.50
MulD4: Mulhall-----	92	Not limited		Not limited		Somewhat limited Too clayey	0.50
NeDG: Newalla-----	41	Very limited Depth to bedrock Too clayey	1.00 1.00	Somewhat limited Depth to bedrock	0.14	Very limited Too clayey Hard to compact Depth to bedrock	1.00 1.00 0.14
Darnell-----	36	Very limited Depth to bedrock Seepage Slope	1.00 1.00 1.00	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to bedrock Slope Seepage	1.00 1.00 0.52
NorA: Norge-----	90	Somewhat limited Too clayey	0.50	Not limited		Somewhat limited Too clayey	0.50
NorB: Norge-----	85	Somewhat limited Too clayey	0.50	Not limited		Somewhat limited Too clayey	0.50
NorC, NorC2: Norge-----	90	Somewhat limited Too clayey	0.50	Not limited		Somewhat limited Too clayey	0.50
NoUC: Norge-----	55	Somewhat limited Too clayey	0.50	Not limited		Somewhat limited Too clayey	0.50
Urban land---	30	Not rated		Not rated		Not rated	

## Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
OWWE: Oil waste land-----	69	Not rated		Not rated		Not rated	
Westsum-----	25	Very limited Too clayey	1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
PoaA: Port-----	84	Very limited Flooding	1.00	Very limited Flooding	1.00	Not limited	
PoOA: Port-----	57	Very limited Flooding	1.00	Very limited Flooding	1.00	Not limited	
Oscar-----	40	Very limited Flooding Sodium content	1.00 1.00	Very limited Flooding	1.00	Very limited Sodium content	1.00
PorA: Port-----	92	Very limited Flooding Too clayey	1.00 0.50	Very limited Flooding	1.00	Not limited	
PotA: Port-----	86	Very limited Flooding Too clayey	1.00 0.50	Very limited Flooding	1.00	Somewhat limited Too clayey	0.50
PukA: Pulaski-----	70	Very limited Flooding Seepage Too sandy	1.00 1.00 1.00	Very limited Flooding Seepage	1.00 1.00	Very limited Too sandy Seepage	1.00 0.52
PulA: Pulaski-----	82	Very limited Flooding Seepage Too sandy	1.00 1.00 0.50	Very limited Flooding Seepage	1.00 1.00	Somewhat limited Seepage Too sandy	0.52 0.50
RefC2: Renfrow-----	75	Very limited Too clayey	1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
ReGC2: Renfrow-----	60	Very limited Depth to bedrock Too clayey	1.00 1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
Grainola-----	20	Very limited Depth to bedrock Too clayey	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey Hard to compact	1.00 1.00 1.00
ReiA: Reinach-----	90	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40	Not limited	

Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
RenB: Renfrow-----	82	Very limited Too clayey	1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
RenC: Renfrow-----	85	Very limited Too clayey	1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
RewC2: Renfrow-----	80	Very limited Depth to bedrock Too clayey	1.00 1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
RGPD3: Renfrow-----	45	Somewhat limited Too clayey	0.50	Not limited		Very limited Hard to compact Too clayey	1.00 0.50
Grainola-----	29	Very limited Depth to bedrock Too clayey	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Too clayey Hard to compact	1.00 1.00 1.00
Pawhuska-----	15	Very limited Sodium content Too clayey	1.00 0.50	Not limited		Very limited Sodium content Hard to compact Too clayey	1.00 1.00 0.50
SlaB: Slaughter-ville-----	85	Very limited Seepage	1.00	Very limited Seepage	1.00	Somewhat limited Seepage	0.52
SlaC: Slaughter-ville-----	85	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Seepage	1.00
SlaG: Slaughter-ville-----	78	Very limited Seepage Slope Too sandy	1.00 1.00 0.50	Very limited Seepage Slope	1.00 1.00	Very limited Seepage Slope Too sandy	1.00 1.00 0.50
StDD: Stephenville-	45	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00
Darnell-----	35	Very limited Depth to bedrock Seepage	1.00 1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock Seepage	1.00 0.52
TabA: Tabler-----	83	Very limited Depth to saturated zone Too clayey	1.00 1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone Too clayey Hard to compact	1.00 1.00 1.00

## Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
TeaA: Tearney-----	82	Very limited Flooding Seepage Too sandy Ponding	1.00 1.00 1.00 1.00	Very limited Flooding Seepage Ponding	1.00 1.00 1.00	Very limited Too sandy Seepage Ponding	1.00 1.00 1.00
TelB: Teller-----	85	Very limited Seepage	1.00	Not limited		Somewhat limited Seepage Too clayey	0.52 0.50
TelD: Teller-----	85	Very limited Seepage Too clayey	1.00 0.50	Not limited		Somewhat limited Seepage Too clayey	0.52 0.50
TelD2: Teller-----	82	Very limited Seepage	1.00	Not limited		Somewhat limited Seepage	0.52
VanA: Vanoss-----	82	Somewhat limited Too clayey	0.50	Not limited		Somewhat limited Too clayey	0.50
W: Water-----	100	Not rated		Not rated		Not rated	
WauA: Waurika-----	89	Very limited Depth to saturated zone Sodium content Too clayey	1.00 1.00 0.50	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone Hard to compact Sodium content Too clayey	1.00 1.00 1.00 0.50
WesB: Westsum-----	85	Very limited Too clayey	1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
WesC: Westsum-----	90	Very limited Too clayey	1.00	Not limited		Very limited Too clayey Hard to compact	1.00 1.00
WiLC: Wisby-----	48	Very limited Seepage Too sandy	1.00 0.50	Very limited Seepage	1.00	Very limited Seepage Too sandy	1.00 0.50
Lovedale-----	40	Very limited Seepage	1.00	Not limited		Very limited Seepage	1.00
ZaHC: Zaneis-----	54	Very limited Depth to bedrock Too clayey	1.00 0.50	Somewhat limited Depth to bedrock	0.77	Somewhat limited Depth to bedrock Too clayey	0.77 0.50

Sanitary Facilities, Part II--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
ZaHC: Huska-----	32	Very limited Depth to bedrock Sodium content Too clayey	1.00 1.00 0.50	Somewhat limited Depth to bedrock	0.14	Very limited Sodium content Hard to compact Too clayey Depth to bedrock	1.00 1.00 0.50 0.14
ZanB: Zaneis-----	80	Very limited Depth to bedrock Too clayey	1.00 0.50	Somewhat limited Depth to bedrock	0.42	Somewhat limited Too clayey Depth to bedrock	0.50 0.42

## Building Site Development

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. The tables "Building Site Development, Part I" and "Building Site Development, Part II" show the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping. The ratings in the tables are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development.

*Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.

*Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

*Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected. Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*Dwellings* are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

*Small commercial buildings* are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

*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 soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-

supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

*Shallow excavations* are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

*Lawns and landscaping* require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

## Building Site Development, Part I

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AhpA: Ashport-----	89	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50
APPA: Ashport-----	61	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50
Port-----	15	Very limited Flooding	1.00	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding	1.00
Pulaski-----	15	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
AspA: Ashport-----	90	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50
AspB: Ashport-----	93	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50
BetaA: Bethany-----	85	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
BetaB: Bethany-----	84	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
BPG: Borrow pits, gravelly---	90	Not rated		Not rated		Not rated	
BPR: Borrow pits, rock-----	90	Not rated		Not rated		Not rated	
BraA: Braman-----	85	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50
BrwA: Brewer-----	97	Very limited Flooding Shrink-swell	1.00 1.00	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 1.00

Building Site Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CoLC: Coyle-----	61	Not limited		Very limited Depth to soft bedrock	0.99	Not limited	
Lucien-----	30	Somewhat limited Depth to soft bedrock	1.00	Very limited Depth to soft bedrock	1.00	Somewhat limited Depth to soft bedrock	1.00
CoyB: Coyle-----	85	Not limited		Somewhat limited Depth to soft bedrock	0.46	Not limited	
CoyC: Coyle-----	82	Not limited		Somewhat limited Depth to soft bedrock	0.71	Not limited	
CoyC2: Coyle-----	82	Not limited		Somewhat limited Depth to soft bedrock	0.35	Not limited	
CoZC3: Coyle-----	60	Not limited		Very limited Depth to soft bedrock	0.99	Not limited	
Zaneis-----	16	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50
DalA: Dale-----	90	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50
DAM: Dam-----	100	Not rated		Not rated		Not rated	
DaUA: Dale-----	48	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50
Urban land--	42	Not rated		Not rated		Not rated	
DiGE: Dilworth----	64	Very limited Shrink-swell Slope	1.00 0.04	Very limited Shrink-swell Depth to soft bedrock Slope	1.00 0.97 0.04	Very limited Shrink-swell Slope	1.00 1.00
Grainola----	16	Very limited Shrink-swell Slope	1.00 0.04	Very limited Shrink-swell Depth to soft bedrock Slope	1.00 0.35 0.04	Very limited Shrink-swell Slope	1.00 1.00

## Building Site Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
DooB: Doolin-----	85	Very limited Shrink-swell	1.00	Somewhat limited Shrink-swell	0.50	Very limited Shrink-swell	1.00
DwhC: Dilworth----	85	Very limited Shrink-swell	1.00	Very limited Shrink-swell Depth to soft bedrock	1.00 0.06	Very limited Shrink-swell	1.00
EasA: Easpur-----	79	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
GadA: Gaddy-----	89	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
GayA: Gaddy-----	85	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
GMLG: Grainola----	37	Very limited Shrink-swell Slope	1.00 1.00	Very limited Shrink-swell Slope Depth to soft bedrock	1.00 1.00 0.46	Very limited Shrink-swell Slope	1.00 1.00
Masham-----	22	Very limited Slope Depth to soft bedrock Shrink-swell	1.00 1.00 1.00	Very limited Slope Shrink-swell Depth to soft bedrock	1.00 1.00 1.00	Very limited Slope Depth to soft bedrock Shrink-swell	1.00 1.00 1.00
Lucien-----	21	Very limited Slope Depth to soft bedrock	1.00 1.00	Very limited Slope Depth to soft bedrock	1.00 1.00	Very limited Slope Depth to soft bedrock	1.00 1.00
GohE: Goodnight---	95	Somewhat limited Slope	0.16	Somewhat limited Slope	0.16	Very limited Slope	1.00
GraC: Grainola----	85	Very limited Shrink-swell	1.00	Very limited Shrink-swell Depth to soft bedrock	1.00 0.15	Very limited Shrink-swell	1.00
GrAD: Grainola----	38	Very limited Shrink-swell	1.00	Very limited Shrink-swell Depth to soft bedrock	1.00 0.06	Very limited Shrink-swell Slope	1.00 0.88
Ashport-----	23	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50

Building Site Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrHC: Grant-----	37	Not limited		Not limited		Not limited	
Huska-----	35	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
GrLC: Grainola----	47	Very limited Shrink-swell	1.00	Very limited Shrink-swell Depth to soft bedrock	1.00 0.01	Very limited Shrink-swell	1.00
Lucien-----	30	Somewhat limited Depth to soft bedrock	1.00	Very limited Depth to soft bedrock	1.00	Somewhat limited Depth to soft bedrock	1.00
GrLE: Grainola----	50	Very limited Shrink-swell Slope	1.00 0.04	Very limited Shrink-swell Depth to soft bedrock Slope	1.00 0.74 0.04	Very limited Shrink-swell Slope	1.00 1.00
Lucien-----	26	Somewhat limited Depth to soft bedrock Slope	1.00 0.04	Very limited Depth to soft bedrock Slope	1.00 0.04	Very limited Depth to soft bedrock Slope	1.00 1.00
GrnC: Grant-----	95	Not limited		Not limited		Not limited	
GrtB: Grant-----	90	Not limited		Not limited		Not limited	
HaPE: Harrah-----	44	Not limited		Not limited		Somewhat limited Slope	0.88
Pulaski-----	25	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
HiRG: Highview----	43	Very limited Slope Depth to soft bedrock Shrink-swell	1.00 1.00 1.00	Very limited Slope Shrink-swell Depth to soft bedrock	1.00 1.00 1.00 1.00	Very limited Slope Depth to soft bedrock Shrink-swell	1.00 1.00 1.00
Rock outcrop	33	Not rated		Not rated		Not rated	
KekA, KeoA: Keokuk-----	88	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
KgfB: Kingfisher--	90	Somewhat limited Shrink-swell	0.50	Somewhat limited Depth to soft bedrock Shrink-swell	0.79 0.50	Somewhat limited Shrink-swell	0.50

## Building Site Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KgLC: Kingfisher--	53	Somewhat limited Shrink-swell	0.50	Somewhat limited Depth to soft bedrock Shrink-swell	0.97 0.50	Somewhat limited Shrink-swell	0.50
Lucien-----	29	Somewhat limited Depth to soft bedrock	1.00	Very limited Depth to soft bedrock	1.00	Somewhat limited Depth to soft bedrock	1.00
KgWC: Kingfisher--	63	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell Depth to soft bedrock	0.50 0.29	Somewhat limited Shrink-swell	0.50
Wakita-----	19	Somewhat limited Shrink-swell	0.50	Very limited Depth to saturated zone Shrink-swell Depth to soft bedrock	1.00 0.50 0.35	Somewhat limited Shrink-swell	0.50
KinC2: Kingfisher--	82	Somewhat limited Shrink-swell	0.50	Somewhat limited Depth to soft bedrock Shrink-swell	0.97 0.50	Somewhat limited Shrink-swell	0.50
KowB: Konawa-----	80	Not limited		Not limited		Not limited	
KowD: Konawa-----	78	Not limited		Not limited		Somewhat limited Slope	0.88
KrdA: Kirkland----	85	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
KrdB, KrdB2: Kirkland----	80	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
KrPB: Kirkland----	52	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
Pawhuska----	33	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
LAN: Landfill----	100	Not rated		Not rated		Not rated	
Lela: Lela-----	91	Very limited Flooding Shrink-swell	1.00 1.00	Very limited Flooding Shrink-swell	1.00 1.00	Very limited Flooding Shrink-swell	1.00 1.00

Building Site Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LveB: Lovedale----	90	Not limited		Not limited		Not limited	
M-W: Miscellane- ous water--	100	Not rated		Not rated		Not rated	
McaA: McLain-----	95	Very limited Flooding Shrink-swell	1.00 1.00	Very limited Flooding Shrink-swell	1.00 1.00	Very limited Flooding Shrink-swell	1.00 1.00
MilB: Milan-----	95	Somewhat limited Shrink-swell	0.50	Not limited		Somewhat limited Shrink-swell	0.50
MilC: Milan-----	90	Not limited		Not limited		Not limited	
MinB: Minco-----	85	Not limited		Not limited		Not limited	
MinC: Minco-----	90	Not limited		Not limited		Not limited	
MirA, MisA: Miller-----	84	Very limited Flooding Shrink-swell	1.00 1.00	Very limited Flooding Shrink-swell	1.00 1.00	Very limited Flooding Shrink-swell	1.00 1.00
MPNC2: Milan-----	35	Somewhat limited Shrink-swell	0.50	Not limited		Somewhat limited Shrink-swell	0.50
Pawhuska----	28	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
Norge-----	24	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50
MulC: Mulhall-----	92	Not limited		Not limited		Not limited	
MulD, MulD4: Mulhall-----	92	Not limited		Not limited		Somewhat limited Slope	0.88
NeDG: Newalla-----	41	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell Slope	1.00 0.88
Darnell-----	36	Very limited Depth to soft bedrock Slope	1.00 1.00	Very limited Depth to soft bedrock Slope	1.00 1.00	Very limited Slope Depth to soft bedrock	1.00 1.00
NorA: Norge-----	90	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50

## Building Site Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NorB: Norge-----	85	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50
NorC, NorC2: Norge-----	90	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50
NoUC: Norge-----	55	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50
Urban land--	30	Not rated		Not rated		Not rated	
OWWE: Oil waste land-----	69	Not rated		Not rated		Not rated	
Westsum-----	25	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
PoaA: Port-----	84	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
PoOA: Port-----	57	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
Oscar-----	40	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
PorA: Port-----	92	Very limited Flooding	1.00	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding	1.00
PotA: Port-----	86	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50	Very limited Flooding Shrink-swell	1.00 0.50
PukA: Pulaski-----	70	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
PulA: Pulaski-----	82	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
RefC2: Renfrow-----	75	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00

Building Site Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
ReGC2: Renfrow-----	60	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
Grainola----	20	Very limited Shrink-swell	1.00	Very limited Shrink-swell Depth to soft bedrock	1.00 0.20	Very limited Shrink-swell	1.00
ReiA: Reinach-----	90	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
RenB: Renfrow-----	82	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
RenC: Renfrow-----	85	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
RewC2: Renfrow-----	80	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
RGPD3: Renfrow-----	45	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
Grainola----	29	Very limited Shrink-swell	1.00	Very limited Shrink-swell Depth to soft bedrock	1.00 0.99	Very limited Shrink-swell Slope	1.00 0.50
Pawhuska----	15	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
SlaB, SlaC: Slaughter- ville-----	85	Not limited		Not limited		Not limited	
SlaG: Slaughter- ville-----	78	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
StDD: Stephenville	45	Not limited		Somewhat limited Depth to soft bedrock	0.06	Not limited	
Darnell-----	35	Somewhat limited Depth to soft bedrock	1.00	Very limited Depth to soft bedrock	1.00	Somewhat limited Depth to soft bedrock	1.00
TabA: Tabler-----	83	Very limited Depth to saturated zone Shrink-swell	1.00 1.00	Very limited Depth to saturated zone Shrink-swell	1.00 1.00	Very limited Depth to saturated zone Shrink-swell	1.00 1.00

## Building Site Development, Part I--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
TeaA: Tearney-----	82	Very limited Flooding Shrink-swell Ponding	1.00 1.00 1.00	Very limited Flooding Ponding	1.00 1.00	Very limited Flooding Shrink-swell Ponding	1.00 1.00 1.00
TelB: Teller-----	85	Not limited		Not limited		Not limited	
TelD, TelD2: Teller-----	85	Not limited		Not limited		Somewhat limited Slope	0.88
VanA: Vanoss-----	82	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50
W: Water-----	100	Not rated		Not rated		Not rated	
WauA: Waurika-----	89	Very limited Depth to saturated zone Shrink-swell	1.00 1.00	Very limited Depth to saturated zone Shrink-swell	1.00 1.00	Very limited Depth to saturated zone Shrink-swell	1.00 1.00
WesB: Westsum-----	85	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
WesC: Westsum-----	90	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
WilC: Wisby-----	48	Not limited		Not limited		Not limited	
Lovedale----	40	Not limited		Not limited		Not limited	
ZaHC: Zaneis-----	54	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50	Somewhat limited Shrink-swell	0.50
Huska-----	32	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00	Very limited Shrink-swell	1.00
ZanB: Zaneis-----	80	Not limited		Not limited		Not limited	

Building Site Development, Part II

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AhpA: Ashport-----	89	Very limited Flooding Low strength Shrink-swell	 1.00 1.00 0.50	Somewhat limited Flooding Cutbanks cave	 0.60 0.10	Somewhat limited Flooding	 0.60
APPA: Ashport-----	61	Very limited Flooding Low strength Shrink-swell	 1.00 1.00 0.50	Somewhat limited Flooding Cutbanks cave	 0.80 0.10	Very limited Flooding	 1.00
Port-----	15	Very limited Flooding Low strength	 1.00 1.00	Somewhat limited Flooding Cutbanks cave	 0.80 0.10	Very limited Flooding	 1.00
Pulaski-----	15	Very limited Flooding	 1.00	Very limited Cutbanks cave Flooding	 1.00 0.80	Very limited Flooding	 1.00
AspA: Ashport-----	90	Very limited Flooding Low strength Shrink-swell	 1.00 1.00 0.50	Somewhat limited Flooding Cutbanks cave	 0.60 0.10	Somewhat limited Flooding	 0.60
AspB: Ashport-----	93	Very limited Flooding Low strength Shrink-swell	 1.00 1.00 0.50	Somewhat limited Flooding Cutbanks cave	 0.60 0.10	Somewhat limited Flooding	 0.60
BetA: Bethany-----	85	Very limited Low strength Shrink-swell	 1.00 1.00	Somewhat limited Cutbanks cave Too clayey	 0.10 0.03	Not limited	
BetB: Bethany-----	84	Very limited Low strength Shrink-swell	 1.00 1.00	Somewhat limited Cutbanks cave	 0.10	Not limited	
BPG: Borrow pits, gravelly---	90	Not rated		Not rated		Not rated	
BPR: Borrow pits, rock-----	90	Not rated		Not rated		Not rated	

## Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BraA: Braman-----	85	Very limited Low strength Shrink-swell Flooding	1.00 0.50 0.40	Somewhat limited Cutbanks cave Too clayey	0.10 0.03	Not limited	
BrwA: Brewer-----	97	Very limited Low strength Shrink-swell Flooding	1.00 1.00 0.40	Somewhat limited Cutbanks cave	0.10	Not limited	
CoLC: Coyle-----	61	Not limited		Somewhat limited Depth to soft bedrock Dense layer Cutbanks cave	0.99 0.50 0.10	Very limited Depth to bedrock Droughty	0.99 0.19
Lucien-----	30	Somewhat limited Depth to soft bedrock	1.00	Very limited Depth to soft bedrock Dense layer Cutbanks cave	1.00 0.50 0.10	Very limited Depth to bedrock Droughty Content of large stones	1.00 0.97 0.03
CoyB: Coyle-----	85	Not limited		Somewhat limited Dense layer Depth to soft bedrock Cutbanks cave	0.50 0.46 0.10	Somewhat limited Depth to bedrock	0.46
CoyC: Coyle-----	82	Not limited		Somewhat limited Depth to soft bedrock Dense layer Cutbanks cave	0.71 0.50 0.10	Somewhat limited Depth to bedrock	0.71
CoyC2: Coyle-----	82	Not limited		Very limited Cutbanks cave Dense layer Depth to soft bedrock	1.00 0.50 0.35	Somewhat limited Depth to bedrock	0.35
CoZC3: Coyle-----	60	Not limited		Somewhat limited Depth to soft bedrock Dense layer Cutbanks cave	0.99 0.50 0.10	Very limited Depth to bedrock Droughty	0.99 0.12
Zaneis-----	16	Somewhat limited Shrink-swell	0.50	Somewhat limited Dense layer Cutbanks cave	0.50 0.10	Not limited	

Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
DalA: Dale-----	90	Very limited Low strength Shrink-swell Flooding	1.00 0.50 0.40	Somewhat limited Cutbanks cave	0.10	Not limited	
DAM: Dam-----	100	Not rated		Not rated		Not rated	
DaUA: Dale-----	48	Very limited Low strength Shrink-swell Flooding	1.00 0.50 0.40	Somewhat limited Cutbanks cave	0.10	Not limited	
Urban land--	42	Not rated		Not rated		Not rated	
DiGE: Dilworth----	64	Very limited Low strength Shrink-swell Slope	1.00 1.00 0.04	Somewhat limited Depth to soft bedrock Dense layer Too clayey Cutbanks cave Slope	0.97 0.50 0.28 0.10 0.04	Somewhat limited Depth to bedrock Slope Droughty	0.97 0.04 0.02
Grainola----	16	Very limited Low strength Shrink-swell Slope	1.00 1.00 0.04	Somewhat limited Dense layer Depth to soft bedrock Cutbanks cave Slope Too clayey	0.50 0.35 0.10 0.04 0.03	Somewhat limited Depth to bedrock Content of large stones Slope	0.35 0.08 0.04
DooB: Doolin-----	85	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Cutbanks cave	0.10	Very limited Sodium content	1.00
DwhC: Dilworth----	85	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave Depth to soft bedrock	0.28 0.10 0.06	Somewhat limited Depth to bedrock	0.06
EasA: Easpur-----	79	Very limited Flooding	1.00	Somewhat limited Flooding Cutbanks cave	0.60 0.10	Somewhat limited Flooding	0.60
GadA: Gaddy-----	89	Very limited Flooding	1.00	Very limited Cutbanks cave Flooding	1.00 0.60	Somewhat limited Flooding Droughty	0.60 0.29
GayA: Gaddy-----	85	Somewhat limited Flooding	0.40	Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.27

## Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GMLG: Grainola----	37	Very limited Shrink-swell Slope Low strength	1.00 1.00 1.00	Very limited Slope Dense layer Depth to soft bedrock Too clayey Cutbanks cave	1.00 0.50 0.46 0.28 0.10	Very limited Slope Content of large stones Depth to bedrock Gravel content	1.00 0.95 0.46 0.02
Masham-----	22	Very limited Slope Depth to soft bedrock Low strength Shrink-swell	1.00 1.00 1.00 1.00	Very limited Depth to soft bedrock Slope Dense layer Cutbanks cave	1.00 1.00 1.00 0.50 0.10	Very limited Depth to bedrock Slope Droughty	1.00 1.00 0.97
Lucien-----	21	Very limited Slope Depth to soft bedrock	1.00 1.00	Very limited Depth to soft bedrock Slope Dense layer Cutbanks cave	1.00 1.00 1.00 0.50 0.10	Very limited Depth to bedrock Slope Droughty Content of large stones	1.00 1.00 0.49 0.03
GohE: Goodnight---	95	Somewhat limited Slope	0.16	Very limited Cutbanks cave Slope	1.00 0.16	Somewhat limited Droughty Slope	0.63 0.16
GraC: Grainola----	85	Very limited Shrink-swell Low strength	1.00 1.00	Somewhat limited Dense layer Too clayey Depth to soft bedrock Cutbanks cave	0.50 0.28 0.15 0.10	Somewhat limited Depth to bedrock Content of large stones	0.16 0.05
GrAD: Grainola----	38	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Dense layer Too clayey Cutbanks cave Depth to soft bedrock	0.50 0.28 0.10 0.06	Somewhat limited Depth to bedrock Content of large stones	0.06 0.05
Ashport-----	23	Very limited Flooding Low strength Shrink-swell	1.00 1.00 0.50	Somewhat limited Flooding Cutbanks cave	0.80 0.10	Very limited Flooding	1.00
GrHC: Grant-----	37	Very limited Low strength	1.00	Somewhat limited Dense layer Cutbanks cave	0.50 0.10	Not limited	
Huska-----	35	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Dense layer Cutbanks cave	0.50 0.10	Very limited Sodium content Droughty Salinity	1.00 0.08 0.01

Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrLC: Grainola----	47	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Dense layer Too clayey Cutbanks cave Depth to soft bedrock	0.50 0.28 0.10 0.01	Somewhat limited Content of large stones Depth to bedrock	0.05 0.01
Lucien-----	30	Somewhat limited Depth to soft bedrock	1.00	Very limited Depth to soft bedrock Dense layer Cutbanks cave	1.00 0.50 0.10	Very limited Depth to bedrock Droughty Content of large stones	1.00 0.25 0.03
GrLE: Grainola----	50	Very limited Shrink-swell Low strength Slope	1.00 1.00 0.04	Somewhat limited Depth to soft bedrock Dense layer Too clayey Cutbanks cave Slope	0.74 0.50 0.28 0.10 0.04	Somewhat limited Depth to bedrock Content of large stones Slope	0.74 0.05 0.04
Lucien-----	26	Somewhat limited Depth to soft bedrock Slope	1.00 0.04	Very limited Depth to soft bedrock Dense layer Cutbanks cave Slope	1.00 0.50 0.10 0.04	Very limited Depth to bedrock Droughty Slope Content of large stones	1.00 0.99 0.04 0.03
GrnC: Grant-----	95	Not limited		Somewhat limited Cutbanks cave	0.10	Not limited	
GrtB: Grant-----	90	Very limited Low strength	1.00	Somewhat limited Dense layer Cutbanks cave	0.50 0.10	Not limited	
HaPE: Harrah-----	44	Not limited		Somewhat limited Cutbanks cave	0.10	Not limited	
Pulaski-----	25	Very limited Flooding	1.00	Very limited Cutbanks cave Flooding	1.00 0.80	Very limited Flooding	1.00
HiRG: Highview----	43	Very limited Slope Depth to soft bedrock Shrink-swell Low strength	1.00 1.00 1.00 1.00	Very limited Depth to soft bedrock Slope Dense layer Cutbanks cave	1.00 1.00 1.00 0.50 0.10	Very limited Depth to bedrock Slope Droughty Too clayey Content of large stones	1.00 1.00 1.00 1.00 0.38
Rock outcrop	33	Not rated		Not rated		Not rated	

## Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KekA: Keokuk-----	88	Somewhat limited Flooding	0.40	Somewhat limited Cutbanks cave	0.10	Not limited	
KeoA: Keokuk-----	88	Very limited Flooding	1.00	Somewhat limited Flooding Cutbanks cave	0.60 0.10	Somewhat limited Flooding	0.60
KgfbB: Kingfisher--	90	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Depth to soft bedrock Dense layer Cutbanks cave	0.79 0.50 0.10	Somewhat limited Depth to bedrock	0.80
KgLC: Kingfisher--	53	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Depth to soft bedrock Dense layer Cutbanks cave	0.97 0.50 0.10	Somewhat limited Depth to bedrock	0.97
Lucien-----	29	Somewhat limited Depth to soft bedrock	1.00	Very limited Depth to soft bedrock Dense layer Cutbanks cave	1.00 0.50 0.10	Very limited Depth to bedrock Droughty Content of large stones	1.00 0.87 0.03
KgWC: Kingfisher--	63	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Dense layer Depth to soft bedrock Cutbanks cave	0.50 0.29 0.10	Somewhat limited Depth to bedrock	0.29
Wakita-----	19	Very limited Low strength Shrink-swell	1.00 0.50	Very limited Depth to saturated zone Dense layer Depth to soft bedrock Cutbanks cave	1.00 0.50 0.35 0.10	Very limited Sodium content Salinity Depth to bedrock Droughty	1.00 1.00 0.35 0.22
KinC2: Kingfisher--	82	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Depth to soft bedrock Dense layer Cutbanks cave	0.97 0.50 0.10	Somewhat limited Depth to bedrock	0.97
KowB: Konawa-----	80	Not limited		Very limited Cutbanks cave	1.00	Not limited	
KowD: Konawa-----	78	Not limited		Very limited Cutbanks cave	1.00	Not limited	

Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KrdA: Kirkland----	85	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.50 0.10	Not limited	
KrdB, KrdB2: Kirkland----	80	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.50 0.10	Not limited	
KrPB: Kirkland----	52	Very limited Shrink-swell Low strength	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.50 0.10	Not limited	
Pawhuska----	33	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Cutbanks cave Too clayey	0.10 0.03	Very limited Sodium content Salinity	1.00 1.00
LAN: Landfill----	100	Not rated		Not rated		Not rated	
Lela: Lela-----	91	Very limited Flooding Shrink-swell Low strength	1.00 1.00 1.00	Very limited Cutbanks cave Flooding Too clayey	1.00 0.60 0.50	Very limited Too clayey Flooding	1.00 0.60
LveB: Lovedale----	90	Not limited		Very limited Cutbanks cave	1.00	Not limited	
M-W: Miscellane- ous water--	100	Not rated		Not rated		Not rated	
McaA: McLain-----	95	Very limited Low strength Shrink-swell Flooding	1.00 1.00 0.40	Somewhat limited Cutbanks cave Too clayey	0.10 0.03	Not limited	
MilB: Milan-----	95	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Cutbanks cave	0.10	Not limited	
MilC: Milan-----	90	Not limited		Very limited Cutbanks cave	1.00	Not limited	
MinB: Minco-----	85	Not limited		Somewhat limited Cutbanks cave	0.10	Not limited	
MinC: Minco-----	90	Not limited		Somewhat limited Cutbanks cave	0.10	Not limited	

## Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
MirA: Miller-----	84	Very limited Flooding Low strength Shrink-swell	1.00 1.00 1.00	Somewhat limited Flooding Too clayey Cutbanks cave	0.60 0.28 0.10	Somewhat limited Flooding	0.60
MisA: Miller-----	84	Very limited Flooding Low strength Shrink-swell	1.00 1.00 1.00	Somewhat limited Flooding Too clayey Cutbanks cave	0.60 0.50 0.10	Somewhat limited Flooding	0.60
MPNC2: Milan-----	35	Very limited Low strength Shrink-swell	1.00 0.50	Very limited Cutbanks cave	1.00	Not limited	
Pawhuska----	28	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Cutbanks cave Too clayey	0.10 0.03	Very limited Sodium content Salinity	1.00 1.00
Norge-----	24	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Cutbanks cave	0.10	Not limited	
MulC, MulD, MulD4: Mulhall----	92	Not limited		Somewhat limited Cutbanks cave	0.10	Not limited	
NeDG: Newalla-----	41	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Dense layer Cutbanks cave	0.50 0.50 0.10	Not limited	
Darnell-----	36	Very limited Depth to soft bedrock Slope	1.00 1.00	Very limited Depth to soft bedrock Slope Dense layer Cutbanks cave	1.00 1.00 0.50 0.10	Very limited Depth to bedrock Droughty Slope	1.00 1.00 1.00
NorA: Norge-----	90	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Cutbanks cave	0.10	Not limited	
NorB: Norge-----	85	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Cutbanks cave	0.10	Not limited	
NorC, NorC2: Norge-----	90	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Cutbanks cave	0.10	Not limited	

Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NoUC: Norge-----	55	Very limited Low strength Shrink-swell	1.00 0.50	Somewhat limited Cutbanks cave	0.10	Not limited	
Urban land--	30	Not rated		Not rated		Not rated	
OWWE: Oil waste land-----	69	Not rated		Not rated		Not rated	
Westsum-----	25	Very limited Shrink-swell Low strength	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.15 0.10	Not limited	
PoaA: Port-----	84	Very limited Flooding Low strength	1.00 1.00	Somewhat limited Flooding Cutbanks cave	0.80 0.10	Very limited Flooding	1.00
PoOA: Port-----	57	Very limited Flooding Low strength	1.00 1.00	Somewhat limited Flooding Cutbanks cave	0.60 0.10	Somewhat limited Flooding	0.60
Oscar-----	40	Very limited Flooding Low strength	1.00 1.00	Somewhat limited Flooding Cutbanks cave	0.60 0.10	Very limited Sodium content Salinity Flooding	1.00 1.00 0.60
PorA: Port-----	92	Very limited Flooding Low strength	1.00 1.00	Somewhat limited Flooding Cutbanks cave	0.60 0.10	Somewhat limited Flooding	0.60
PotA: Port-----	86	Very limited Flooding Low strength Shrink-swell	1.00 1.00 0.50	Somewhat limited Flooding Cutbanks cave	0.60 0.10	Somewhat limited Flooding	0.60
PukA: Pulaski-----	70	Very limited Flooding	1.00	Very limited Cutbanks cave Flooding	1.00 0.80	Very limited Flooding	1.00
PulA: Pulaski-----	82	Very limited Flooding	1.00	Very limited Cutbanks cave Flooding	1.00 0.60	Somewhat limited Flooding	0.60
RefC2: Renfrow-----	75	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.12 0.10	Not limited	

## Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
ReGC2: Renfrow-----	60	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.12 0.10	Not limited	
Grainola----	20	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Dense layer Too clayey Depth to soft bedrock Cutbanks cave	0.50 0.28 0.20 0.10	Somewhat limited Depth to bedrock Content of large stones	0.20 0.05
ReiA: Reinach-----	90	Somewhat limited Flooding	0.40	Somewhat limited Cutbanks cave	0.10	Not limited	
RenB: Renfrow-----	82	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.12 0.10	Not limited	
RenC: Renfrow-----	85	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.12 0.10	Not limited	
RewC2: Renfrow-----	80	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.12 0.10	Not limited	
RGPD3: Renfrow-----	45	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Too clayey Cutbanks cave	0.12 0.10	Not limited	
Grainola----	29	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Depth to soft bedrock Dense layer Too clayey Cutbanks cave	0.99 0.50 0.28 0.10	Very limited Depth to bedrock Droughty Content of large stones	0.99 0.12 0.05
Pawhuska----	15	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Cutbanks cave	0.10	Very limited Sodium content Salinity	1.00 1.00
SlaB, SlaC: Slaughter- ville-----	85	Not limited		Somewhat limited Cutbanks cave	0.10	Not limited	
SlaG: Slaughter- ville-----	78	Very limited Slope	1.00	Very limited Cutbanks cave Slope	1.00 1.00	Very limited Slope	1.00

Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
StDD: Stephenville	45	Not limited		Somewhat limited Dense layer	0.50	Somewhat limited Depth to bedrock	0.06
				Cutbanks cave	0.10	Content of large stones	0.03
				Depth to soft bedrock	0.06		
Darnell-----	35	Somewhat limited Depth to soft bedrock	1.00	Very limited Depth to soft bedrock	1.00	Very limited Depth to bedrock	1.00
				Dense layer	0.50	Droughty	1.00
				Cutbanks cave	0.10	Content of large stones	0.03
TabA: Tabler-----	83	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
		Low strength	1.00	Too clayey	0.28		
		Shrink-swell	1.00	Cutbanks cave	0.10		
TeaA: Tearney-----	82	Very limited Flooding	1.00	Very limited Cutbanks cave	1.00	Very limited Too clayey	1.00
		Low strength	1.00	Ponding	1.00	Ponding	1.00
		Shrink-swell	1.00	Flooding	0.60	Flooding	0.60
		Ponding	1.00				
TelB, TelD: Teller-----	85	Not limited		Somewhat limited Cutbanks cave	0.10	Not limited	
TelD2: Teller-----	82	Not limited		Somewhat limited Cutbanks cave	0.10	Not limited	
VanA: Vanoss-----	82	Very limited Low strength	1.00	Somewhat limited Cutbanks cave	0.10	Not limited	
		Shrink-swell	0.50				
W: Water-----	100	Not rated		Not rated		Not rated	
WauA: Waurika-----	89	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
		Low strength	1.00	Too clayey	0.50	Sodium content	1.00
		Shrink-swell	1.00	Cutbanks cave	0.10		
WesB: Westsum-----	85	Very limited Shrink-swell	1.00	Somewhat limited Too clayey	0.15	Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
WesC: Westsum-----	90	Very limited Shrink-swell	1.00	Somewhat limited Too clayey	0.15	Not limited	
		Low strength	1.00	Cutbanks cave	0.10		

## Building Site Development, Part II--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
WiLC: Wisby-----	48	Not limited		Very limited Cutbanks cave	1.00	Not limited	
Lovedale----	40	Not limited		Very limited Cutbanks cave	1.00	Not limited	
ZaHC: Zaneis-----	54	Somewhat limited Shrink-swell	0.50	Somewhat limited Dense layer Cutbanks cave	0.50 0.10	Not limited	
Huska-----	32	Very limited Low strength Shrink-swell	1.00 1.00	Somewhat limited Dense layer Cutbanks cave	0.50 0.10	Very limited Sodium content Droughty Salinity	1.00 0.04 0.01
ZanB: Zaneis-----	80	Not limited		Somewhat limited Dense layer Cutbanks cave	0.50 0.10	Not limited	

## Construction Materials

The tables "Construction Materials, Part I" and "Construction Materials, Part II" give information about the soils as potential sources of gravel, sand, reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

*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 the table "Construction Materials, Part I," only the likelihood 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 Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness. The soils are rated good, fair, or poor as potential sources of sand and gravel. A rating of good or fair means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The soils are rated good, fair, or poor as potential sources of topsoil, reclamation material, and roadfill. The features that limit the soils as sources of these materials are specified in the table "Construction Materials, Part II." The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

*Reclamation material* is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

*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 whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread. The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a 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 AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

*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. The ratings are based on the soil properties

that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material. 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.

Construction Materials, Part I

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
AhpA: Ashport-----	89	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Bottom layer Thickest layer	 0.00 0.00
APPA: Ashport-----	61	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Bottom layer Thickest layer	 0.00 0.00
Port-----	15	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Bottom layer Thickest layer	 0.00 0.00
Pulaski-----	15	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Thickest layer Bottom layer	 0.00 0.00
AspA: Ashport-----	90	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Bottom layer Thickest layer	 0.00 0.00
AspB: Ashport-----	93	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Bottom layer Thickest layer	 0.00 0.00
BetA: Bethany-----	85	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Bottom layer Thickest layer	 0.00 0.00
BetB: Bethany-----	84	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Bottom layer Thickest layer	 0.00 0.00
BPG: Borrow pits, gravelly-----	90	Not rated		Not rated	
BPR: Borrow pits, rock---	90	Not rated		Not rated	
BraA: Braman-----	85	Poor Bottom layer Thickest layer	 0.00 0.00	Poor Bottom layer Thickest layer	 0.00 0.00

## Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
BrwA: Brewer-----	97	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
CoLC: Coyle-----	61	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Lucien-----	30	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
CoyB: Coyle-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
CoyC, CoyC2: Coyle-----	82	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
CoZC3: Coyle-----	60	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Zaneis-----	16	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
DalA: Dale-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
DAM: Dam-----	100	Not rated		Not rated	
DaUA: Dale-----	48	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Urban land-----	42	Not rated		Not rated	
DiGE: Dilworth-----	64	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Grainola-----	16	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
DooB: Doolin-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
DwhC: Dilworth-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
EasA: Easpur-----	79	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
GadA: Gaddy-----	89	Poor Bottom layer Thickest layer	0.00 0.00	Fair Bottom layer Thickest layer	0.01 0.06
GayA: Gaddy-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.05 0.22
GMLG: Grainola-----	37	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Masham-----	22	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Lucien-----	21	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
GohE: Goodnight-----	95	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.07 0.12
GraC: Grainola-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
GrAD: Grainola-----	38	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Ashport-----	23	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
GrHC: Grant-----	37	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Huska-----	35	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

## Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
GrLC: Grainola-----	47	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Lucien-----	30	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
GrLE: Grainola-----	50	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Lucien-----	26	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
GrnC: Grant-----	95	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
GrtB: Grant-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
HaPE: Harrah-----	44	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Pulaski-----	25	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
HiRG: Highview-----	43	Poor Thickest layer Bottom layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Rock outcrop-----	33	Not rated		Not rated	
KekA, KeoA: Keokuk-----	88	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
KgfB: Kingfisher-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
KgLC: Kingfisher-----	53	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Lucien-----	29	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
KgWC: Kingfisher-----	63	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Wakita-----	19	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
KinC2: Kingfisher-----	82	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
KowB: Konawa-----	80	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.08
KowD: Konawa-----	78	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.07 0.16
KrdA: Kirkland-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
KrdB, KrdB2: Kirkland-----	80	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
KrPB: Kirkland-----	52	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Pawhuska-----	33	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
LAN: Landfill-----	100	Not rated		Not rated	
LelA: Lela-----	91	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

## Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
LveB: Lovedale-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.20
M-W: Miscellaneous water-	100	Not rated		Not rated	
McaA: McLain-----	95	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
MilB: Milan-----	95	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.04
MilC: Milan-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.10
MinB: Minco-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
MinC: Minco-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
MirA, MisA: Miller-----	84	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
MPNC2: Milan-----	35	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.15
Pawhuska-----	28	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.05
Norge-----	24	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
MulC, MulD, MulD4: Mulhall-----	92	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
NeDG: Newalla-----	41	Poor Thickest layer Bottom layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Darnell-----	36	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
NorA: Norge-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
NorB: Norge-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
NorC, NorC2: Norge-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
NoUC: Norge-----	55	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Urban land-----	30	Not rated		Not rated	
OWWE: Oil waste land-----	69	Not rated		Not rated	
Westsum-----	25	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
PoaA: Port-----	84	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
PoOA: Port-----	57	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Oscar-----	40	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
PorA: Port-----	92	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
PotA: Port-----	86	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

## Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
PukA: Pulaski-----	70	Poor Bottom layer Thickest layer	0.00 0.00	Poor Thickest layer Bottom layer	0.00 0.00
PulA: Pulaski-----	82	Poor Bottom layer Thickest layer	0.00 0.00	Poor Thickest layer Bottom layer	0.00 0.00
RefC2: Renfrow-----	75	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
ReGC2: Renfrow-----	60	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Grainola-----	20	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
ReiA: Reinach-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
RenB: Renfrow-----	82	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
RenC: Renfrow-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
RewC2: Renfrow-----	80	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
RGPD3: Renfrow-----	45	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Grainola-----	29	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Pawhuska-----	15	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
SlaB, SlaC: Slaughterville-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
SlaG: Slaughterville-----	78	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.07
StDD: Stephenville-----	45	Poor Bottom layer Thickest layer	0.00 0.00	Poor Thickest layer Bottom layer	0.00 0.00
Darnell-----	35	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
TabA: Tabler-----	83	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
TeaA: Tearney-----	82	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.31
TelB, TelD: Teller-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
TelD2: Teller-----	82	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
VanA: Vanoss-----	82	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
W: Water-----	100	Not rated		Not rated	
WauA: Waurika-----	89	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
WesB: Westsum-----	85	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
WesC: Westsum-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

## Construction Materials, Part I--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
WiLC: Wisby-----	48	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.06 0.13
Lovedale-----	40	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.00 0.51
ZaHC: Zaneis-----	54	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Huska-----	32	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
ZanB: Zaneis-----	80	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00

Construction Materials, Part II

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AhpA: Ashport-----	90	Fair Low content of organic matter Water erosion	0.88  0.99	Poor Low strength Shrink-swell	0.00  0.87	Good	
APPA: Ashport-----	61	Fair Low content of organic matter Too clayey Water erosion	0.88  0.98 0.99	Poor Low strength Shrink-swell	0.00  0.87	Fair Too clayey	0.93
Port-----	15	Fair Water erosion	0.99	Poor Low strength Shrink-swell	0.00 0.99	Good	
Pulaski-----	15	Fair Low content of organic matter	0.50	Good		Good	
AspA: Ashport-----	90	Fair Low content of organic matter Water erosion	0.88  0.99	Poor Low strength Shrink-swell	0.00  0.87	Good	
AspB: Ashport-----	93	Fair Low content of organic matter Water erosion	0.88  0.99	Poor Low strength Shrink-swell	0.00  0.87	Good	
Beta: Bethany-----	85	Poor Too clayey Low content of organic matter Water erosion	0.00 0.50 0.90	Poor Low strength Shrink-swell	0.00 0.15	Poor Too clayey	0.00
BetaB: Bethany-----	84	Fair Too clayey Low content of organic matter Water erosion	0.12 0.50 0.90	Poor Low strength Shrink-swell	0.00 0.21	Fair Too clayey	0.10
BPG: Borrow pits, gravelly---	90	Not rated		Not rated		Not rated	

## Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BPR: Borrow pits, rock-----	90	Not rated		Not rated		Not rated	
BraA: Braman-----	85	Fair Low content of organic matter Too clayey Water erosion	0.12 0.98 0.99	Poor Low strength Shrink-swell	0.00 0.98	Fair Too clayey	0.76
BrwA: Brewer-----	97	Fair Too clayey Low content of organic matter Water erosion	0.08 0.88 0.90	Poor Low strength Shrink-swell	0.00 0.49	Fair Too clayey	0.08
CoLC: Coyle-----	61	Fair Depth to bedrock Droughty Water erosion	0.01 0.04 0.99	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock	0.00 0.01
Lucien-----	30	Poor Depth to bedrock Droughty	0.00 0.00	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock Rock fragments	0.00 0.00 0.88
CoyB: Coyle-----	85	Fair Depth to bedrock Droughty Water erosion	0.54 0.68 0.99	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock	0.00 0.54
CoyC: Coyle-----	82	Fair Depth to bedrock Droughty Low content of organic matter Water erosion	0.29 0.45 0.88 0.99	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock	0.00 0.29
CoyC2: Coyle-----	82	Fair Low content of organic matter Depth to bedrock Droughty Water erosion	0.12 0.65 0.71 0.99	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Rock fragments Depth to bedrock	0.00 0.02 0.65
CoZC3: Coyle-----	60	Fair Depth to bedrock Droughty Low content of organic matter Too clayey Water erosion	0.01 0.06 0.88 0.89 0.99	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock Too clayey	0.00 0.01 0.64

Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CoZC3: Zaneis-----	16	Fair Low content of organic matter Water erosion	0.88  0.99	Fair Depth to bedrock Shrink-swell	0.58 0.99	Poor Hard to reclaim, dense layer	0.00
DalA: Dale-----	90	Fair Water erosion	0.99	Poor Low strength Shrink-swell	0.00 0.96	Good	
DAM: Dam-----	100	Not rated		Not rated		Not rated	
DaUA: Dale-----	48	Fair Water erosion	0.99	Poor Low strength Shrink-swell	0.00 0.90	Good	
Urban land--	42	Not rated		Not rated		Not rated	
DiGE: Dilworth----	64	Poor Too clayey Depth to bedrock Droughty Low content of organic matter Water erosion	0.00 0.03 0.15 0.88 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Too clayey Hard to reclaim, dense layer Depth to bedrock Slope	0.00 0.00  0.03 0.96
Grainola----	16	Poor Too clayey Low content of organic matter Depth to bedrock Droughty Water erosion	0.00 0.12  0.65 0.87 0.90	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Hard to reclaim, dense layer Too clayey Depth to bedrock Slope	0.00  0.00 0.65 0.96
DooB: Doolin-----	85	Poor Sodium content Too clayey Water erosion	0.00 0.08 0.68	Poor Low strength Shrink-swell	0.00 0.47	Poor Sodium content Too clayey Hard to reclaim, dense layer	0.00 0.07 0.94
DwhC: Dilworth----	85	Poor Too clayey Low content of organic matter Depth to bedrock Water erosion Droughty	0.00 0.88  0.93 0.99 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Too clayey Hard to reclaim, dense layer Depth to bedrock	0.00 0.00  0.93
EasA: Easpur-----	80	Fair Low content of organic matter Water erosion	0.88  0.99	Good		Good	

## Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GadA: Gaddy-----	90	Poor Wind erosion Low content of organic matter Too sandy	0.00 0.12 0.28	Good		Fair Too sandy	0.28
GayA: Gaddy-----	85	Poor Too sandy Wind erosion Low content of organic matter	0.00 0.00 0.12	Good		Poor Too sandy	0.00
GMLG: Grainola----	37	Poor Too clayey Low content of organic matter Droughty Depth to bedrock Water erosion	0.00 0.12 0.36 0.54 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Too clayey Slope Hard to reclaim, dense layer Depth to bedrock	0.00 0.00 0.10 0.54
Masham-----	22	Poor Droughty Depth to bedrock Too clayey Low content of organic matter Water erosion	0.00 0.00 0.00 0.12 0.90	Poor Depth to bedrock Low strength Slope Shrink-swell	0.00 0.00 0.00 0.12	Poor Slope Hard to reclaim, dense layer Depth to bedrock Too clayey	0.00 0.00 0.00 0.00
Lucien-----	21	Poor Depth to bedrock Droughty	0.00 0.00	Poor Depth to bedrock Slope	0.00 0.82	Poor Slope Hard to reclaim, dense layer Depth to bedrock Rock fragments	0.00 0.00 0.00 0.88
GohE: Goodnight---	95	Poor Wind erosion Too sandy Low content of organic matter Droughty	0.00 0.00 0.12 0.99	Good		Poor Too sandy Slope	0.00 0.84
GraC: Grainola----	85	Poor Too clayey Low content of organic matter Depth to bedrock Droughty Water erosion	0.00 0.12 0.84 0.94 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Too clayey Hard to reclaim, dense layer Depth to bedrock Rock fragments	0.00 0.03 0.84 0.97

Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrAD: Grainola----	38	Poor Too clayey Low content of organic matter Depth to bedrock Water erosion Droughty	0.00 0.12 0.93 0.99 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Hard to reclaim, dense layer Too clayey Depth to bedrock	0.00 0.00 0.00 0.93
Ashport-----	23	Fair Low content of organic matter Water erosion	0.88 0.99	Poor Low strength Depth to bedrock Shrink-swell	0.00 0.23 0.87	Fair Hard to reclaim, dense layer	0.71
GrHC: Grant-----	37	Fair Low content of organic matter Water erosion	0.88 0.99	Fair Depth to bedrock	0.87	Fair Hard to reclaim, dense layer	0.90
Huska-----	35	Poor Sodium content Too clayey Droughty Low content of organic matter Water erosion Salinity	0.00 0.08 0.49 0.50 0.68 0.97	Poor Low strength Shrink-swell Depth to bedrock	0.00 0.12 0.58	Poor Hard to reclaim, dense layer Sodium content Salinity Too clayey	0.00 0.00 0.00 0.05
GrLC: Grainola----	47	Poor Too clayey Low content of organic matter Water erosion Depth to bedrock	0.00 0.12 0.90 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Hard to reclaim, dense layer Too clayey Depth to bedrock	0.00 0.00 0.00 0.99
Lucien-----	30	Poor Depth to bedrock Droughty	0.00 0.02	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock Rock fragments	0.00 0.00 0.88
GrLE: Grainola----	50	Poor Too clayey Low content of organic matter Depth to bedrock Droughty Water erosion	0.00 0.12 0.26 0.48 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Too clayey Hard to reclaim, dense layer Depth to bedrock Slope Rock fragments	0.00 0.00 0.26 0.96 0.97
Lucien-----	26	Poor Droughty Depth to bedrock	0.00 0.00	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock Rock fragments Slope	0.00 0.00 0.95 0.96

## Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrnC: Grant-----	95	Fair Low content of organic matter Water erosion	0.50 0.99	Good		Fair Hard to reclaim, dense layer	0.42
GrtB: Grant-----	90	Fair Low content of organic matter Water erosion	0.88 0.99	Poor Low strength Depth to bedrock	0.00 0.98	Good	
HaPE: Harrah-----	44	Fair Low content of organic matter Too acid	0.50 0.88	Good		Good	
Pulaski-----	25	Fair Low content of organic matter	0.50	Good		Poor Hard to reclaim, dense layer	0.00
HiRG: Highview----	43	Poor Depth to bedrock Droughty Too clayey Low content of organic matter	0.00 0.00 0.00 0.12	Poor Depth to bedrock Slope Low strength Shrink-swell	0.00 0.00 0.00 0.12	Poor Slope Hard to reclaim, dense layer Depth to bedrock Too clayey Rock fragments	0.00 0.00 0.00 0.00 0.00 0.00
Rock outcrop	33	Not rated		Not rated		Not rated	
KekA, KeoA: Keokuk-----	88	Fair Low content of organic matter Water erosion	0.88 0.99	Good		Good	
KgfB: Kingfisher--	90	Fair Low content of organic matter Depth to bedrock Droughty Too clayey Water erosion	0.12 0.21 0.83 0.98 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.87	Poor Hard to reclaim, dense layer Depth to bedrock Too clayey	0.00 0.21 0.57
KgLC: Kingfisher--	53	Fair Depth to bedrock Low content of organic matter Droughty Too clayey Water erosion	0.03 0.12 0.34 0.98 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.87	Poor Hard to reclaim, dense layer Depth to bedrock Too clayey	0.00 0.03 0.57
Lucien-----	29	Poor Depth to bedrock Droughty	0.00 0.00	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock Rock fragments	0.00 0.00 0.95

Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KgWC: Kingfisher--	63	Fair Low content of organic matter Depth to bedrock Too clayey Water erosion	0.12 0.71 0.98 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.87	Poor Hard to reclaim, dense layer Too clayey Depth to bedrock	0.00 0.57 0.71
Wakita-----	19	Poor Sodium content Droughty Depth to bedrock Low content of organic matter Water erosion	0.00 0.03 0.65 0.88 0.90	Poor Depth to bedrock Low strength Shrink-swell Depth to saturated zone	0.00 0.00 0.87 0.89	Poor Sodium content Salinity Hard to reclaim, dense layer Depth to bedrock Depth to saturated zone	0.00 0.00 0.16 0.65 0.89
KinC2: Kingfisher--	82	Fair Depth to bedrock Droughty Low content of organic matter Water erosion	0.03 0.37 0.50 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.87	Poor Hard to reclaim, dense layer Depth to bedrock	0.00 0.03
KowB: Konawa-----	80	Fair Low content of organic matter Too acid	0.32 0.84	Good		Good	
KowD: Konawa-----	78	Fair Low content of organic matter Too acid	0.32 0.84	Good		Good	
KrdA: Kirkland----	85	Poor Too clayey Water erosion	0.00 0.68	Poor Low strength Shrink-swell	0.00 0.00	Poor Too clayey	0.00
KrdB: Kirkland----	80	Poor Too clayey Water erosion Sodium content Low content of organic matter	0.00 0.68 0.78 0.88	Poor Low strength Shrink-swell	0.00 0.00	Poor Too clayey Sodium content Hard to reclaim, dense layer	0.00 0.78 0.80
KrdB2: Kirkland----	80	Poor Too clayey Water erosion	0.00 0.68	Poor Low strength Shrink-swell	0.00 0.00	Poor Too clayey	0.00
KrPB: Kirkland----	52	Poor Too clayey Water erosion Low content of organic matter	0.00 0.68 0.88	Poor Low strength Shrink-swell	0.00 0.00	Poor Too clayey Sodium content	0.00 0.78

## Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KrPB: Pawhuska----	33	Poor Sodium content Too clayey Water erosion Low content of organic matter Salinity	0.00 0.00 0.68 0.88 0.97	Poor Low strength Shrink-swell	0.00 0.12	Poor Sodium content Too clayey Salinity Hard to reclaim, dense layer	0.00 0.00 0.00 0.03
LAN: Landfill----	100	Not rated		Not rated		Not rated	
LelA: Lela-----	92	Poor Too clayey Water erosion	0.00 0.99	Poor Low strength Shrink-swell	0.00 0.12	Poor Too clayey Rock fragments	0.00 0.94
LveB: Lovedale----	90	Fair Low content of organic matter	0.12	Good		Good	
M-W: Miscellane- ous water--	100	Not rated		Not rated		Not rated	
McaA: McLain-----	95	Fair Too clayey Water erosion	0.02 0.99	Poor Low strength Shrink-swell	0.00 0.12	Fair Too clayey	0.02
MilB: Milan-----	95	Fair Low content of organic matter	0.12	Good		Good	
MilC: Milan-----	90	Fair Low content of organic matter	0.12	Good		Good	
MinB: Minco-----	85	Fair Low content of organic matter Water erosion	0.50 0.99	Good		Good	
MinC: Minco-----	90	Fair Low content of organic matter Water erosion	0.50 0.99	Good		Good	
MirA: Miller-----	85	Poor Too clayey Low content of organic matter Water erosion	0.00 0.88 0.90	Poor Low strength Shrink-swell	0.00 0.12	Poor Too clayey	0.00

Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
MisA: Miller-----	85	Poor Too clayey Salinity Low content of organic matter Water erosion Sodium content	0.00 0.88 0.88 0.90 0.97	Poor Low strength Shrink-swell	0.00 0.12	Poor Too clayey Salinity	0.00 0.00
MPNC2: Milan-----	35	Fair Low content of organic matter	0.12	Good		Good	
Pawhuska----	28	Poor Sodium content Too clayey Low content of organic matter Water erosion Salinity	0.00 0.02 0.12 0.68 0.97	Poor Low strength Shrink-swell	0.00 0.12	Poor Sodium content Salinity Too clayey	0.00 0.00 0.01
Norge-----	24	Fair Low content of organic matter Too clayey Water erosion	0.88 0.98 0.99	Poor Low strength Shrink-swell	0.00 0.87	Fair Too clayey	0.70
MulC, MulD, MulD4: Mulhall----	92	Fair Low content of organic matter Water erosion	0.12 0.99	Good		Good	
NeDG: Newalla-----	41	Poor Too clayey Low content of organic matter Too acid Water erosion	0.00 0.12 0.88 0.90	Poor Low strength Shrink-swell Depth to bedrock	0.00 0.55 0.87	Poor Too clayey Hard to reclaim, dense layer Hard to reclaim, rock fragments	0.00 0.03 0.82
Darnell-----	36	Poor Droughty Depth to bedrock Low content of organic matter Too acid	0.00 0.00 0.12 0.97	Poor Depth to bedrock Slope	0.00 0.00	Poor Hard to reclaim, dense layer Depth to bedrock Slope Rock fragments	0.00 0.00 0.00 0.88
NorA: Norge-----	90	Fair Low content of organic matter Water erosion	0.88 0.99	Poor Low strength Shrink-swell	0.00 0.89	Good	
NorB: Norge-----	85	Fair Low content of organic matter Too clayey Water erosion	0.88 0.98 0.99	Poor Low strength Shrink-swell	0.00 0.92	Fair Too clayey	0.70

## Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NorC: Norge-----	90	Fair Low content of organic matter Too clayey Water erosion	0.88 0.98 0.99	Poor Low strength Shrink-swell	0.00 0.89	Fair Too clayey	0.70
NorC2: Norge-----	90	Fair Low content of organic matter Too clayey Water erosion	0.88 0.98 0.99	Poor Low strength Shrink-swell	0.00 0.87	Fair Too clayey	0.70
NoUC: Norge-----	55	Fair Low content of organic matter Too clayey Water erosion	0.88 0.98 0.99	Poor Low strength Shrink-swell	0.00 0.87	Fair Too clayey	0.70
Urban land--	30	Not rated		Not rated		Not rated	
OWWE: Oil waste land-----	69	Not rated		Not rated		Not rated	
Westsum-----	25	Poor Too clayey Low content of organic matter Water erosion	0.00 0.50 0.99	Poor Low strength Shrink-swell	0.00 0.00	Poor Too clayey	0.00
PoaA: Port-----	84	Fair Water erosion	0.99	Poor Low strength	0.00	Good	
PoOA: Port-----	58	Fair Water erosion	0.99	Poor Low strength	0.00	Good	
Oscar-----	40	Poor Sodium content Water erosion Salinity	0.00 0.37 0.88	Poor Low strength	0.00	Good	
PorA: Port-----	93	Fair Water erosion	0.99	Poor Low strength	0.00	Good	
PotA: Port-----	87	Fair Low content of organic matter Too clayey Water erosion	0.50 0.98 0.99	Poor Low strength Shrink-swell	0.00 0.87	Fair Too clayey	0.93
PukA: Pulaski-----	70	Fair Low content of organic matter	0.50	Good		Good	

Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
PulA: Pulaski-----	82	Fair Low content of organic matter	0.50	Good		Good	
RefC2: Renfrow-----	75	Poor Too clayey Water erosion Low content of organic matter	0.00 0.68 0.88	Poor Low strength Shrink-swell	0.00 0.12	Poor Too clayey	0.00
ReGC2: Renfrow-----	60	Poor Too clayey Low content of organic matter Water erosion	0.00 0.88 0.90	Poor Low strength Shrink-swell	0.00 0.15	Poor Hard to reclaim, dense layer Too clayey	0.00 0.00
Grainola-----	20	Poor Too clayey Low content of organic matter Depth to bedrock Droughty Water erosion	0.00 0.12 0.79 0.95 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Hard to reclaim, dense layer Too clayey Depth to bedrock	0.00 0.00 0.00 0.79
ReiA: Reinach-----	90	Fair Low content of organic matter Water erosion	0.88 0.99	Good		Good	
RenB: Renfrow-----	82	Poor Too clayey Water erosion Low content of organic matter	0.00 0.68 0.88	Poor Low strength Shrink-swell	0.00 0.16	Poor Too clayey	0.00
RenC: Renfrow-----	85	Poor Too clayey Water erosion Low content of organic matter	0.00 0.68 0.88	Poor Low strength Shrink-swell	0.00 0.16	Poor Too clayey	0.00
RewC2: Renfrow-----	80	Poor Too clayey Low content of organic matter Water erosion	0.00 0.88 0.90	Poor Low strength Shrink-swell	0.00 0.12	Poor Too clayey Hard to reclaim	0.00 0.10
RGPD3: Renfrow-----	45	Fair Too clayey Low content of organic matter Water erosion	0.02 0.88 0.90	Poor Low strength Shrink-swell	0.00 0.12	Fair Too clayey	0.01

## Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
RGPD3: Grainola----	29	Poor Too clayey Depth to bedrock Droughty Low content of organic matter Water erosion	0.00 0.01 0.07 0.12 0.99	Poor Depth to bedrock Low strength Shrink-swell	0.00 0.00 0.12	Poor Too clayey Hard to reclaim, dense layer Depth to bedrock	0.00 0.01 0.01
Pawhuska----	15	Poor Sodium content Too clayey Low content of organic matter Water erosion Salinity	0.00 0.02 0.50 0.68 0.97	Poor Low strength Shrink-swell	0.00 0.12	Poor Sodium content Salinity Too clayey	0.00 0.00 0.01
SlaB: Slaughter- ville-----	85	Fair Low content of organic matter	0.88	Good		Good	
SlaC: Slaughter- ville-----	85	Fair Low content of organic matter	0.50	Good		Good	
SlaG: Slaughter- ville-----	78	Fair Low content of organic matter	0.50	Poor Slope	0.00	Poor Slope	0.00
StDD: Stephenville	45	Fair Too acid Low content of organic matter Depth to bedrock Droughty	0.54 0.88 0.93 0.98	Poor Depth to bedrock	0.00	Fair Hard to reclaim, dense layer Depth to bedrock Too acid	0.54 0.93 0.98
Darnell-----	35	Poor Droughty Depth to bedrock Low content of organic matter Too acid	0.00 0.00 0.12 0.97	Poor Depth to bedrock	0.00	Poor Hard to reclaim, dense layer Depth to bedrock Rock fragments	0.00 0.00 0.88
TabA: Tabler-----	83	Poor Too clayey Water erosion Low content of organic matter	0.00 0.68 0.88	Poor Depth to saturated zone Low strength Shrink-swell	0.00 0.00 0.12	Poor Too clayey Depth to saturated zone	0.00 0.00
TeaA: Tearney-----	82	Fair Too clayey Low content of organic matter Water erosion	0.02 0.12 0.99	Fair Shrink-swell	0.99	Fair Too clayey	0.01

Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
TelB, TelD: Teller-----	85	Fair Low content of organic matter Water erosion	0.88 0.99	Good		Good	
TelD2: Teller-----	82	Fair Low content of organic matter Water erosion	0.88 0.99	Good		Good	
VanA: Vanoss-----	82	Fair Low content of organic matter Too acid Too clayey Water erosion	0.88 0.97 0.98 0.99	Poor Low strength Shrink-swell	0.00 0.87	Fair Too clayey	0.70
W: Water-----	100	Not rated		Not rated		Not rated	
WauA: Waurika-----	89	Poor Too clayey Low content of organic matter Water erosion Sodium content	0.00 0.50 0.68 0.78	Poor Depth to saturated zone Low strength Shrink-swell	0.00 0.00 0.17	Poor Too clayey Depth to saturated zone Sodium content	0.00 0.00 0.78
WesB: Westsum-----	85	Poor Too clayey Low content of organic matter Water erosion	0.00 0.50 0.99	Poor Low strength Shrink-swell	0.00 0.00	Poor Too clayey	0.00
WesC: Westsum-----	90	Poor Too clayey Low content of organic matter Water erosion	0.00 0.50 0.99	Poor Shrink-swell Low strength	0.00 0.00	Poor Too clayey	0.00
WiLC: Wisby-----	48	Fair Low content of organic matter	0.12	Good		Fair Hard to reclaim, rock fragments Rock fragments	0.92 0.97
Lovedale----	40	Fair Low content of organic matter	0.50	Good		Good	

## Construction Materials, Part II--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
ZaHC: Zaneis-----	54	Fair Low content of organic matter Water erosion	0.88 0.99	Fair Depth to bedrock Shrink-swell	0.23 0.96	Poor Hard to reclaim, dense layer	0.00
Huska-----	32	Poor Sodium content Too clayey Low content of organic matter Water erosion Droughty Salinity	0.00 0.02 0.50 0.68 0.75 0.97	Poor Low strength Shrink-swell Depth to bedrock	0.00 0.12 0.87	Poor Sodium content Salinity Hard to reclaim, dense layer Too clayey	0.00 0.00 0.00 0.01
ZanB: Zaneis-----	80	Fair Water erosion	0.99	Fair Depth to bedrock	0.58	Poor Hard to reclaim, dense layer	0.00

## Water Management

The table "Water Management" 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 ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses.

*Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.

*Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

*Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*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. Embankments that have zoned construction (core and shell) are not considered. 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.

## Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AhpA: Ashport-----	89	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.65	Very limited Depth to water	1.00
APPA: Ashport-----	61	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.64	Very limited Depth to water	1.00
Port-----	15	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.89	Very limited Depth to water	1.00
Pulaski-----	15	Very limited Seepage	1.00	Very limited Piping Seepage	1.00 0.01	Very limited Depth to water	1.00
AspA: Ashport-----	90	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.80	Very limited Depth to water	1.00
AspB: Ashport-----	93	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.80	Very limited Depth to water	1.00
BetA: Bethany-----	85	Not limited		Not limited		Very limited Depth to water	1.00
BetB: Bethany-----	84	Not limited		Not limited		Very limited Depth to water	1.00
BPG: Borrow pits, gravelly----	90	Not rated		Not rated		Not rated	
BPR: Borrow pits, rock-----	90	Not rated		Not rated		Not rated	
BraA: Braman-----	85	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.49	Very limited Depth to water	1.00
BrwA: Brewer-----	97	Somewhat limited Seepage	0.04	Not limited		Very limited Depth to water	1.00

Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CoLC: Coyle-----	61	Somewhat limited Seepage Depth to bedrock	0.72 0.42	Very limited Piping Thin layer	1.00 1.00	Very limited Depth to water	1.00
Lucien-----	30	Somewhat limited Depth to bedrock	0.74	Very limited Thin layer Piping	1.00 1.00	Very limited Depth to water	1.00
CoyB: Coyle-----	85	Somewhat limited Seepage Depth to bedrock	0.72 0.11	Very limited Piping Thin layer	0.99 0.86	Very limited Depth to water	1.00
CoyC: Coyle-----	82	Somewhat limited Seepage Depth to bedrock	0.72 0.19	Very limited Piping Thin layer	0.99 0.93	Very limited Depth to water	1.00
CoyC2: Coyle-----	82	Somewhat limited Seepage Depth to bedrock	0.72 0.09	Very limited Piping Thin layer	0.99 0.83	Very limited Depth to water	1.00
CoZC3: Coyle-----	60	Somewhat limited Seepage Depth to bedrock	0.72 0.42	Very limited Thin layer Piping	1.00 0.99	Very limited Depth to water	1.00
Zaneis-----	16	Somewhat limited Seepage Depth to bedrock	0.72 0.01	Somewhat limited Piping Thin layer	0.90 0.11	Very limited Depth to water	1.00
DalA: Dale-----	90	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.79	Very limited Depth to water	1.00
DAM: Dam-----	100	Not rated		Not rated		Not rated	
DaUA: Dale-----	48	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.75	Very limited Depth to water	1.00
Urban land---	42	Not rated		Not rated		Not rated	
DiGE: Dilworth----	64	Somewhat limited Depth to bedrock	0.37	Very limited Thin layer Hard to pack	0.99 0.03	Very limited Depth to water	1.00
Grainola-----	16	Somewhat limited Depth to bedrock	0.09	Somewhat limited Thin layer	0.83	Very limited Depth to water	1.00
DooB: Doolin-----	85	Somewhat limited Seepage	0.04	Very limited Piping	1.00	Very limited Depth to water	1.00

## Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
DwhC: Dilworth-----	85	Somewhat limited Depth to bedrock	0.03	Somewhat limited Thin layer Hard to pack	0.66 0.07	Very limited Depth to water	1.00
EasA: Easpur-----	79	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.99	Very limited Depth to water	1.00
GadA: Gaddy-----	89	Very limited Seepage	1.00	Somewhat limited Seepage	0.06	Very limited Depth to water	1.00
GayA: Gaddy-----	85	Very limited Seepage	1.00	Somewhat limited Seepage	0.22	Very limited Depth to water	1.00
GMLG: Grainola-----	37	Somewhat limited Depth to bedrock Slope	0.11 0.03	Somewhat limited Thin layer	0.86	Very limited Depth to water	1.00
Masham-----	22	Somewhat limited Depth to bedrock Slope	0.74 0.50	Very limited Thin layer	1.00	Very limited Depth to water	1.00
Lucien-----	21	Somewhat limited Depth to bedrock Slope	0.58 0.08	Very limited Thin layer Piping	1.00 1.00	Very limited Depth to water	1.00
GohE: Goodnight----	95	Very limited Seepage	1.00	Somewhat limited Seepage	0.12	Very limited Depth to water	1.00
GraC: Grainola-----	85	Somewhat limited Depth to bedrock	0.05	Somewhat limited Thin layer	0.74	Very limited Depth to water	1.00
GrAD: Grainola-----	38	Somewhat limited Depth to bedrock	0.03	Somewhat limited Thin layer	0.66	Very limited Depth to water	1.00
Ashport-----	23	Somewhat limited Seepage Depth to bedrock	0.72 0.01	Somewhat limited Piping Thin layer	0.61 0.22	Very limited Depth to water	1.00
GrHC: Grant-----	37	Somewhat limited Seepage Depth to bedrock	0.72 0.01	Very limited Piping Thin layer	1.00 0.03	Very limited Depth to water	1.00
Huska-----	35	Somewhat limited Depth to bedrock	0.01	Very limited Piping Thin layer Salinity	1.00 0.11 0.03	Very limited Depth to water	1.00

Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GrLC: Grainola-----	47	Somewhat limited Depth to bedrock	0.01	Somewhat limited Thin layer	0.52	Very limited Depth to water	1.00
Lucien-----	30	Somewhat limited Depth to bedrock	0.53	Very limited Thin layer Piping	1.00 1.00	Very limited Depth to water	1.00
GrLE: Grainola-----	50	Somewhat limited Depth to bedrock	0.20	Somewhat limited Thin layer	0.94	Very limited Depth to water	1.00
Lucien-----	26	Somewhat limited Depth to bedrock	0.78	Very limited Thin layer Piping	1.00 1.00	Very limited Depth to water	1.00
GrnC: Grant-----	95	Somewhat limited Seepage	0.72	Very limited Piping	1.00	Very limited Depth to water	1.00
GrtB: Grant-----	90	Somewhat limited Seepage Depth to bedrock	0.72 0.01	Somewhat limited Piping Thin layer	0.99 0.01	Very limited Depth to water	1.00
HaPE: Harrah-----	44	Somewhat limited Seepage	0.72	Not limited		Very limited Depth to water	1.00
Pulaski-----	25	Very limited Seepage	1.00	Very limited Piping Seepage	1.00 0.01	Very limited Depth to water	1.00
HiRG: Highview-----	43	Somewhat limited Slope Depth to bedrock	0.64 0.58	Very limited Thin layer Hard to pack	1.00 0.50	Very limited Depth to water	1.00
Rock outcrop-	33	Not rated		Not rated		Not rated	
KekA, KeoA: Keokuk-----	88	Somewhat limited Seepage	0.72	Very limited Piping	1.00	Very limited Depth to water	1.00
KgfB: Kingfisher---	90	Somewhat limited Depth to bedrock Seepage	0.23 0.04	Somewhat limited Thin layer Piping	0.95 0.75	Very limited Depth to water	1.00
KgLC: Kingfisher---	53	Somewhat limited Depth to bedrock Seepage	0.37 0.04	Very limited Thin layer Piping	0.99 0.69	Very limited Depth to water	1.00
Lucien-----	29	Somewhat limited Depth to bedrock	0.69	Very limited Thin layer Piping	1.00 1.00	Very limited Depth to water	1.00

## Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
KgWC: Kingfisher---	63	Somewhat limited Depth to bedrock Seepage	0.08 0.04	Somewhat limited Thin layer Piping	0.81 0.43	Very limited Depth to water	1.00
Wakita-----	19	Somewhat limited Depth to bedrock	0.09	Very limited Piping Depth to saturated zone Thin layer	1.00 0.86 0.83	Very limited Depth to water	1.00
KinC2: Kingfisher---	82	Somewhat limited Depth to bedrock Seepage	0.37 0.04	Very limited Thin layer Piping	0.99 0.94	Very limited Depth to water	1.00
KowB: Konawa-----	80	Very limited Seepage	1.00	Somewhat limited Seepage	0.08	Very limited Depth to water	1.00
KowD: Konawa-----	78	Very limited Seepage	1.00	Somewhat limited Seepage	0.16	Very limited Depth to water	1.00
KrdA: Kirkland-----	85	Not limited		Somewhat limited Hard to pack	0.78	Very limited Depth to water	1.00
KrdB: Kirkland-----	80	Not limited		Somewhat limited Piping	0.22	Very limited Depth to water	1.00
KrdB2: Kirkland-----	80	Not limited		Somewhat limited Hard to pack	0.82	Very limited Depth to water	1.00
KrPB: Kirkland-----	52	Not limited		Somewhat limited Hard to pack	0.86	Very limited Depth to water	1.00
Pawhuska-----	33	Not limited		Very limited Hard to pack Salinity	1.00 0.03	Very limited Depth to water	1.00
LAN: Landfill-----	100	Not rated		Not rated		Not rated	
LelA: Lela-----	91	Not limited		Somewhat limited Hard to pack	0.41	Very limited Depth to water	1.00
LveB: Lovedale-----	90	Very limited Seepage	1.00	Somewhat limited Seepage	0.20	Very limited Depth to water	1.00
M-W: Miscellaneous water-----	100	Not rated		Not rated		Not rated	

Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
McaA: McLain-----	95	Somewhat limited Seepage	0.02	Not limited		Very limited Depth to water	1.00
MilB: Milan-----	95	Very limited Seepage	1.00	Somewhat limited Piping Seepage	0.45 0.04	Very limited Depth to water	1.00
MilC: Milan-----	90	Very limited Seepage	1.00	Somewhat limited Piping Seepage	0.97 0.10	Very limited Depth to water	1.00
MinB: Minco-----	85	Somewhat limited Seepage	0.72	Very limited Piping	1.00	Very limited Depth to water	1.00
MinC: Minco-----	90	Somewhat limited Seepage	0.72	Very limited Piping	1.00	Very limited Depth to water	1.00
MirA: Miller-----	84	Not limited		Not limited		Very limited Depth to water	1.00
MisA: Miller-----	84	Not limited		Somewhat limited Salinity Piping	0.12 0.02	Very limited Depth to water	1.00
MPNC2: Milan-----	35	Very limited Seepage	1.00	Somewhat limited Piping Seepage	0.51 0.15	Very limited Depth to water	1.00
Pawhuska-----	28	Very limited Seepage	1.00	Very limited Hard to pack Seepage Salinity	1.00 0.05 0.03	Very limited Depth to water	1.00
Norge-----	24	Somewhat limited Seepage	0.04	Somewhat limited Piping	0.41	Very limited Depth to water	1.00
MulC: Mulhall-----	92	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.90	Very limited Depth to water	1.00
MulD: Mulhall-----	92	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.91	Very limited Depth to water	1.00
MulD4: Mulhall-----	92	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.92	Very limited Depth to water	1.00

## Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NeDG: Newalla-----	41	Somewhat limited Seepage Depth to bedrock	0.72 0.01	Somewhat limited Piping Thin layer	0.11 0.03	Very limited Depth to water	1.00
Darnell-----	36	Somewhat limited Depth to bedrock Slope	0.80 0.36	Very limited Thin layer	1.00	Very limited Depth to water	1.00
NorA: Norge-----	90	Somewhat limited Seepage	0.04	Somewhat limited Piping	0.45	Very limited Depth to water	1.00
NorB: Norge-----	85	Somewhat limited Seepage	0.04	Somewhat limited Piping	0.56	Very limited Depth to water	1.00
NorC: Norge-----	90	Somewhat limited Seepage	0.04	Somewhat limited Piping	0.58	Very limited Depth to water	1.00
NorC2: Norge-----	90	Somewhat limited Seepage	0.04	Somewhat limited Piping	0.43	Very limited Depth to water	1.00
NoUC: Norge-----	55	Somewhat limited Seepage	0.04	Somewhat limited Piping	0.39	Very limited Depth to water	1.00
Urban land---	30	Not rated		Not rated		Not rated	
OWWE: Oil waste land-----	69	Not rated		Not rated		Not rated	
Westsum-----	25	Not limited		Not limited		Very limited Depth to water	1.00
PoaA: Port-----	84	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.95	Very limited Depth to water	1.00
PoOA: Port-----	57	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.98	Very limited Depth to water	1.00
Oscar-----	40	Somewhat limited Seepage	0.72	Very limited Piping Salinity	1.00 0.12	Very limited Depth to water	1.00
PorA: Port-----	92	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.90	Very limited Depth to water	1.00
PotA: Port-----	86	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.57	Very limited Depth to water	1.00

Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
PukA: Pulaski-----	70	Very limited Seepage	1.00	Very limited Piping Seepage	1.00 0.01	Very limited Depth to water	1.00
PulA: Pulaski-----	82	Very limited Seepage	1.00	Very limited Piping Seepage	1.00 0.01	Very limited Depth to water	1.00
RefC2: Renfrow-----	75	Not limited		Not limited		Very limited Depth to water	1.00
ReGC2: Renfrow-----	60	Not limited		Not limited		Very limited Depth to water	1.00
Grainola-----	20	Somewhat limited Depth to bedrock	0.06	Somewhat limited Thin layer	0.77	Very limited Depth to water	1.00
ReiA: Reinach-----	90	Somewhat limited Seepage	0.72	Very limited Piping	1.00	Very limited Depth to water	1.00
RenB: Renfrow-----	82	Not limited		Not limited		Very limited Depth to water	1.00
RenC: Renfrow-----	85	Not limited		Not limited		Very limited Depth to water	1.00
RewC2: Renfrow-----	80	Not limited		Not limited		Very limited Depth to water	1.00
RGPD3: Renfrow-----	45	Not limited		Not limited		Very limited Depth to water	1.00
Grainola-----	29	Somewhat limited Depth to bedrock	0.42	Very limited Thin layer	1.00	Very limited Depth to water	1.00
Pawhuska-----	15	Not limited		Very limited Hard to pack Salinity	1.00 0.03	Very limited Depth to water	1.00
SlaB, SlaC: Slaughter- ville-----	85	Very limited Seepage	1.00	Not limited		Very limited Depth to water	1.00
SlaG: Slaughter- ville-----	78	Very limited Seepage Slope	1.00 0.28	Somewhat limited Seepage	0.07	Very limited Depth to water	1.00

## Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
StDD: Stephenville-	45	Somewhat limited Seepage Depth to bedrock	0.72 0.03	Somewhat limited Thin layer Seepage	0.66 0.01	Very limited Depth to water	1.00
Darnell-----	35	Somewhat limited Depth to bedrock	0.78	Very limited Thin layer	1.00	Very limited Depth to water	1.00
TabA: Tabler-----	83	Not limited		Very limited Depth to saturated zone Hard to pack	1.00 0.06	Very limited Depth to water	1.00
TeaA: Tearney-----	82	Very limited Seepage	1.00	Very limited Ponding Seepage	1.00 0.31	Very limited Depth to water	1.00
TelB, TelD: Teller-----	85	Very limited Seepage	1.00	Very limited Piping	1.00	Very limited Depth to water	1.00
TelD2: Teller-----	82	Very limited Seepage	1.00	Very limited Piping	1.00	Very limited Depth to water	1.00
VanA: Vanoss-----	82	Somewhat limited Seepage	0.72	Somewhat limited Piping	0.65	Very limited Depth to water	1.00
W: Water-----	100	Not rated		Not rated		Not rated	
WauA: Waurika-----	89	Not limited		Very limited Depth to saturated zone Piping	1.00 1.00	Very limited Depth to water	1.00
WesB: Westsum-----	85	Not limited		Not limited		Very limited Depth to water	1.00
WesC: Westsum-----	90	Not limited		Not limited		Very limited Depth to water	1.00
WiLC: Wisby-----	48	Very limited Seepage	1.00	Somewhat limited Seepage	0.13	Very limited Depth to water	1.00
Lovedale-----	40	Very limited Seepage	1.00	Somewhat limited Seepage	0.51	Very limited Depth to water	1.00

Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
ZaHC: Zaneis-----	54	Somewhat limited Seepage Depth to bedrock	0.72 0.01	Somewhat limited Piping Thin layer	0.92 0.22	Very limited Depth to water	1.00
Huska-----	32	Somewhat limited Depth to bedrock	0.01	Very limited Piping Thin layer Salinity	1.00 0.03 0.03	Very limited Depth to water	1.00
ZanB: Zaneis-----	80	Somewhat limited Seepage Depth to bedrock	0.72 0.01	Somewhat limited Piping Thin layer	0.93 0.11	Very limited Depth to water	1.00



# Soil Properties

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

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

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

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

## Engineering Index Properties

The table "Engineering Index Properties" 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 in the section "Soil Series and Their Morphology."

*Texture* is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 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 system adopted by the American Association of State Highway and Transportation Officials (1) and the Unified soil classification system (2).

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

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil

that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

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

*Rock fragments* larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

*Percentage (of soil particles) passing designated sieves* is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry 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.

Engineering Index Properties

(Absence of an entry indicates that data were not estimated. The symbol > means greater than; < means less than)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10 inches Pct	3-10 inches Pct	4	10	40	200		
AhpA:												
Ashport-----	0-10	Silty clay loam	CL	A-6, A-7	0	0	100	100	98-100	90-98	33-42	12-19
	10-25	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	25-35	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	35-42	Stratified fine sandy loam to silty clay loam, silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	42-52	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	52-80	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
APPA:												
Ashport-----	0-14	Silty clay loam	CL	A-6, A-7	0	0	100	100	98-100	90-98	33-42	12-19
	14-27	Silt loam, loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	27-80	Stratified fine sandy loam to silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
Port-----	0-7	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	7-27	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	27-46	Silt loam, clay loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	46-51	Silt loam, clay loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	51-80	Silt loam, clay loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
APPA: Pulaski-----	0-9	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	9-25	Fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-7
	25-80	Stratified loamy fine sand to loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	94-100	15-85	0-29	NP-7
AspA: Ashport-----	0-10	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	70-97	22-37	2-13
	10-32	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	32-45	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	45-70	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	70-80	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
AspB: Ashport-----	0-10	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	70-97	22-37	2-13
	10-21	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	21-36	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	36-65	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	65-80	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
BetA: Bethany-----	0-9	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-98	21-37	2-13
	9-12	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-26
	12-30	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
	30-47	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
	47-71	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
	71-80	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
BetB: Bethany-----	0-11	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-98	21-37	2-13
	11-16	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-26
	16-36	Silty clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
	36-60	Silty clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
	60-80	Silty clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
BPG: Borrow pits, gravelly-----	0-10	Extremely gravelly sand	GW	A-1	---	0-25	10-25	5-25	0-15	0-5	0-14	NP
	10-80	Extremely gravelly sand, extremely gravelly coarse sand, very gravelly coarse sand	GP, GW, SP, SW	A-1	---	0-25	10-55	5-50	0-15	0-5	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches Pct	3-10 inches Pct	4	10	40	200		
	In										Pct	
BPR: Borrow pits, rock-----	0-80	Bedrock			---	---	---	---	---	---	0-14	---
BraA: Braman-----	0-8	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	80-97	30-37	8-13
	8-12	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	80-97	30-37	8-13
	12-23	Silty clay loam, silt loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	30-42	12-20
	23-36	Silty clay loam, silt loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	30-42	12-20
	36-48	Silt loam, very fine sandy loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	94-100	51-97	14-37	NP-13
	48-82	Silty clay, loam, silt loam	CH, CL	A-4, A-6, A-7	0	0	100	100	94-100	51-99	24-60	4-34
BrwA: Brewer-----	0-11	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	80-98	30-37	8-13
	11-23	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	80-98	30-37	8-13
	23-40	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-70	16-38
	40-48	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-70	16-38
	48-80	Silty clay loam, loam, clay loam	CH, CL	A-4, A-6, A-7	0	0	100	100	96-100	80-98	30-70	8-38
CoLC: Coyle-----	0-6	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-85	25-35	4-13
	6-11	Loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	100	98-100	94-100	36-85	22-35	4-13
	11-16	Clay loam, sandy clay loam	CL, SC	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	16-21	Clay loam, sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-6, A-2, A-4	0	0-45	55-100	55-100	50-100	20-90	22-40	4-18
	21-38	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10 inches Pct	3-10 inches Pct	4	10	40	200		
CoLC: Lucien-----	<u>In</u>											
	0-4	Very fine sandy loam	SC-SM, CL-ML, ML, SM	A-4	0	0-15	85-100	85-100	80-100	36-75	14-28	NP-7
	4-8	Very fine sandy loam, loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0-20	85-100	85-100	80-100	30-97	14-37	NP-14
	8-13	Very fine sandy loam, loam, fine sandy loam			0	0-20	85-100	85-100	80-100	30-97	14-37	NP-14
	13-17	Bedrock			---	---	---	---	---	---	---	---
CoyB: Coyle-----	0-10	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-85	25-35	4-13
	10-17	Sandy clay loam, clay loam	CL, SC	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	17-23	Sandy clay loam, clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-6, A-2, A-4	0	0-5	55-100	55-100	50-100	20-90	22-40	4-18
	23-30	Sandy clay loam, clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0-4	55-100	55-100	50-100	20-90	22-40	4-18
	30-38	Bedrock			---	---	---	---	---	---	---	---
CoyC: Coyle-----	0-7	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-85	25-35	4-13
	7-10	Loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	100	98-100	94-100	36-85	22-35	4-13
	10-20	Clay loam, sandy clay loam	CL, SC	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	20-27	Loam, clay loam, sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0-5	55-100	55-100	50-100	20-90	22-40	4-18
	27-30	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
		In			Pct	Pct					Pct	
CoyC2: Coyle-----	0-5	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-85	25-35	4-13
	5-9	Loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	100	98-100	94-100	36-85	22-35	4-13
	9-16	Clay loam, sandy clay loam	CL, SC	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	16-23	Clay loam, sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0-45	55-100	55-100	50-100	20-90	22-40	4-18
	23-31	Very gravelly fine sandy loam, fine sandy loam, sandy clay loam, clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0-45	55-100	55-100	50-100	20-90	22-40	4-18
	31-35	Bedrock				---	---	---	---	---	---	---
CoZC3: Coyle-----	0-7	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-85	25-35	4-13
	7-10	Loam, fine sandy loam	CL-ML, SC, SC-SM, CL	A-4, A-6	0	0	100	98-100	94-100	36-85	22-35	4-13
	10-21	Clay loam, sandy clay loam	CL, SC	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	21-24	Bedrock				---	---	---	---	---	---	
Zaneis-----	0-10	Loam	CL	A-4, A-6	0	0	100	98-100	91-100	65-85	30-35	9-13
	10-14	Loam, clay loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	14-26	Clay loam, loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	26-40	Clay loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	40-50	Clay loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	50-52	Bedrock				---	---	---	---	---	---	

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
DalA:												
Dale-----	0-7	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	70-97	22-31	8-14
	7-21	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	70-97	22-31	8-14
	21-60	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
	60-80	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
DAM. Dam												
DaUA:												
Dale-----	0-13	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	70-97	22-31	8-14
	13-22	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
	22-34	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
	34-50	Clay loam, silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
	50-80	Clay loam, silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
Urban land.												
DiGE:												
Dilworth-----	0-7	Silty clay loam	CL	A-6, A-7	0	0-5	75-100	75-100	70-100	60-98	33-42	12-19
	7-12	Silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	15-34
	12-22	Silty clay	CH, CL	A-7	0	0	100	100	98-100	90-99	41-60	19-34
	22-30	Weathered bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
DiGE: Grainola-----	0-7	Loam	CL, SC	A-4, A-6	0-25	0-25	90-100	90-100	72-100	49-97	30-37	8-14
	7-17	Silty clay, clay loam, clay	CH, CL, SC	A-6, A-7	0-25	0-25	90-100	90-100	72-100	49-98	37-60	15-34
	17-31	Clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	31-44	Weathered bedrock			---	---	---	---	---	---	---	---
DooB: Doolin-----	0-10	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-97	22-37	2-13
	10-24	Silty clay loam, clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	24-36	Clay loam, silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	36-51	Sandy clay loam, clay loam	CL, SC	A-4, A-6, A-7	0	0	100	95-100	90-100	36-90	25-50	7-26
	51-70	Sandy clay loam, clay loam	CL, SC	A-4, A-6, A-7	0	0	100	95-100	90-100	36-90	25-50	7-26
	70-75	Bedrock			---	---	---	---	---	---	---	---
DwhC: Dilworth-----	0-7	Silty clay loam	CL	A-6, A-7	0	0-5	75-100	75-100	70-100	60-98	33-42	12-19
	7-13	Silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	15-34
	13-18	Silty clay	CH, CL	A-7	0	0	100	100	98-100	90-99	41-60	19-34
	18-28	Silty clay	CH, CL	A-7	0	0	100	100	98-100	90-99	41-60	18-34
	28-36	Silty clay	CH, CL	A-7	0	0	100	100	98-100	90-99	41-60	18-34
	36-43	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
EasA:												
Easpur-----	0-11	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-37	3-14
	11-30	Loam, clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	94-100	36-90	20-40	3-18
	30-54	Stratified loam to silty clay loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	94-100	36-90	20-40	3-18
	54-63	Stratified very fine sandy loam to silt loam, clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	94-100	36-90	20-40	3-18
	63-80	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-42	8-19
GadA:												
Gaddy-----	0-6	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	80-100	5-35	0-14	NP
	6-80	Stratified fine sand to fine sandy loam	CL, ML, SM, SP-SM	A-2, A-3, A-4, A-6	0	0	100	98-100	80-100	5-90	0-40	NP-18
GayA:												
Gaddy-----	0-6	Loamy fine sand	SM, SP-SM	A-3, A-2	0	0	100	98-100	80-100	5-35	0-14	NP
	6-11	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	80-100	5-35	0-14	NP
	11-24	Loamy very fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	80-100	5-35	0-14	NP
	24-45	Fine sand, sand, loamy fine sand	SM, SP-SM	A-2, A-3	0	0	90-100	85-100	82-100	3-35	0-0	NP
	45-60	Loamy very fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	80-100	5-35	0-14	NP
	60-80	Stratified loamy fine sand to loamy very fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	80-100	5-35	0-37	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
GMLG: Grainola-----	0-5	Gravelly loam	CL, GC, SC	A-2, A-4, A-6	0-25	0-25	55-80	50-75	48-75	32-73	30-37	8-14
	5-24	Silty clay, clay loam, clay	CL, GC, SC, CH	A-6, A-7	0-25	0-25	55-100	50-100	48-75	40-75	37-60	15-34
	24-30	Silty clay, clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	30-40	Bedrock			---	---	---	---	---	---	---	---
Masham-----	0-4	Silty clay loam	CL	A-6, A-7	0	0	90-100	85-100	80-100	70-98	37-50	15-26
	4-13	Silty clay, silty clay loam, clay	CH, CL	A-6, A-7	0	0	90-100	90-100	85-100	80-99	37-60	15-34
	13-25	Bedrock			---	---	---	---	---	---	---	---
Lucien-----	0-7	Very fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0-15	85-100	85-100	80-100	36-75	14-28	NP-7
	7-17	Very fine sandy loam, loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0-20	85-100	85-100	80-100	30-97	14-37	NP-14
	17-20	Bedrock			---	---	---	---	---	---	---	---
GohE: Goodnight-----	0-8	Loamy fine sand	SM	A-2	0	0	100	98-100	90-100	15-35	0-14	NP
	8-20	Loamy fine sand, fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	3-35	0-14	NP
	20-80	Fine sand, loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	3-35	0-14	NP
GraC: Grainola-----	0-5	Silty clay loam	CL	A-6, A-7	0-6	0-10	80-100	75-100	72-100	60-98	33-43	12-20
	5-22	Silty clay, clay loam, clay	CH, CL, SC	A-6, A-7	0-5	0-5	80-100	75-100	72-100	49-98	37-60	15-34
	22-34	Silty clay, clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	34-40	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10 inches Pct	3-10 inches Pct	4	10	40	200		
GrAD: Grainola-----	In											
	0-4	Silty clay loam	CL	A-6, A-7	0-6	0-10	80-100	75-100	72-100	60-98	33-43	12-20
	4-14	Silty clay, clay loam, clay	CH, CL, SC	A-6, A-7	0-5	0-5	80-100	75-100	72-100	49-98	37-60	15-34
	14-36	Silty clay, clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	36-40	Bedrock			---	---	---	---	---	---	---	---
Ashport-----	0-13	Silty clay loam	CL	A-6, A-7	0	0	100	100	98-100	90-98	33-42	12-19
	13-32	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	32-40	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	40-46	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
	46-58	Bedrock	CL	A-4, A-6, A-7	0	0	100	100	96-100	75-98	30-43	8-20
GrHC: Grant-----	0-7	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	7-11	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	100	100	90-100	51-90	20-32	1-10
	11-17	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	90-100	70-90	30-42	8-19
	17-35	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	90-100	70-90	30-42	8-19
	35-54	Silty clay loam, clay loam, loam, silt loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10
	54-58	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
		In			Pct	Pct					Pct	
GrHC: Huska-----	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	100	94-100	51-97	24-37	5-14
	6-17	Silty clay, silty clay loam, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	17-32	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	32-40	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	40-50	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	50-54	Bedrock				---	---	---	---	---	---	---
GrLC: Grainola-----	0-6	Loam	CL, SC	A-4, A-6	0-6	0-10	80-100	75-100	72-100	49-97	30-37	8-14
	6-11	Clay loam, silty clay, clay	CH, CL, SC	A-6, A-7	0-5	0-5	80-100	75-100	72-100	49-98	37-60	15-34
	11-18	Clay, clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	18-33	Clay, clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	33-39	Silty clay, clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	39-42	Bedrock				---	---	---	---	---	---	---
Lucien-----	0-7	Loam	CL, CL-ML, ML, SM	A-4, A-6	0	0-15	85-100	85-100	80-100	42-97	22-31	2-13
	7-18	Loam, very fine sandy loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0-20	85-100	85-100	80-100	30-97	14-37	NP-14
	18-24	Bedrock				---	---	---	---	---	---	

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
GrLE: Grainola-----	0-8	Clay loam	CL	A-6, A-7	0-6	0-10	80-100	75-100	72-100	60-98	33-43	12-20
	8-20	Silty clay, clay loam, clay	CH, CL, SC	A-6, A-7	0-5	0-5	80-100	75-100	72-100	49-98	37-60	15-34
	20-27	Silty clay, clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	27-30	Bedrock			---	---	---	---	---	---	---	---
Lucien-----	0-7	Loam	CL, CL-ML, ML, SM	A-4, A-6	0	0-15	85-100	85-100	80-100	42-97	22-31	2-13
	7-12	Gravelly loam, very fine sandy loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	5-20	75-100	75-100	70-100	30-97	14-37	NP-14
	12-15	Bedrock			---	---	---	---	---	---	---	---
GrnC: Grant-----	0-7	Loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	7-12	Loam, very fine sandy loam	ML, CL, CL-ML	A-4	0	0	100	100	90-100	51-90	20-32	1-10
	12-20	Clay loam, loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	90-100	70-90	30-42	8-19
	20-29	Clay loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10
	29-44	Loam, very fine sandy loam	ML, CL, CL-ML	A-4	0	0	97-100	95-100	90-100	55-90	20-32	1-10
	44-59	Very fine sandy loam			0-3	0-2	97-100	95-100	89-95	60-85	14-28	NP-7
	59-65	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
GrtB: Grant-----	0-11	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	11-21	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	100	100	90-100	51-90	20-32	1-10
	21-51	Silty clay loam, loam, silt loam	CL	A-4, A-6, A-7	0	0	100	100	90-100	70-90	30-42	8-19
	51-57	Silty clay loam, silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10
	57-64	Bedrock			---	---	---	---	---	---	---	---
HaPE: Harrah-----	0-5	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	95-100	95-100	94-100	36-60	15-26	NP-7
	5-9	Fine sandy loam, loamy fine sand	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	95-100	95-100	94-100	15-60	0-26	NP-7
	9-24	Sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	95-100	95-100	90-100	36-65	20-37	5-16
	24-70	Sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	95-100	95-100	90-100	36-65	20-37	5-16
	70-80	Fine sandy loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	70-100	70-100	60-100	25-65	20-37	5-16
Pulaski-----	0-6	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	6-12	Fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-7
	12-50	Stratified loamy fine sand to loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	94-100	15-85	0-29	NP-7
	50-55	Fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-7
	55-65	Stratified loamy fine sand to loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	94-100	15-85	0-29	NP-7
	65-68	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10 inches Pct	3-10 inches Pct	4	10	40	200		
	<u>In</u>											
HiRG: Highview-----	0-6	Gravelly silty clay	CH, CL, GC, SC	A-2, A-7	0-1	0-30	40-85	40-85	38-85	33-84	41-70	20-40
	6-17	Gravelly silty clay, very gravelly silty clay, gravelly silty clay loam	CH, CL, GC, SC	A-2, A-7	0-1	0-30	40-100	40-100	38-100	33-99	41-70	20-40
	17-25	Bedrock			---	---	---	---	---	---	---	---
Rock outcrop.												
KekA: Keokuk-----	0-14	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	65-90	14-28	NP-7
	14-21	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	65-97	14-31	NP-10
	21-31	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	65-97	14-31	NP-10
	31-53	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	65-97	14-31	NP-10
	53-70	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	65-97	14-31	NP-10
	70-80	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	65-97	14-31	NP-10
KeoA: Keokuk-----	0-6	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	65-90	14-28	NP-7
	6-13	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	65-97	14-31	NP-10
	13-27	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	65-97	14-31	NP-10
	27-80	Very fine sandy loam, loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	65-97	14-31	NP-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
KgfB: Kingfisher-----	0-6	Silt loam	ML, CL, CL-ML	A-4, A-6	0	0	100	100	96-100	80-97	22-37	2-13
	6-10	Silt loam, silty clay loam, clay loam	CL	A-4, A-6	0	0	100	100	96-100	80-98	30-40	8-17
	10-26	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	26-35	Bedrock			---	---	---	---	---	---	---	---
KgLC: Kingfisher-----	0-5	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-85	24-37	4-14
	5-8	Loam, silt loam, silty clay loam, clay loam	CL	A-4, A-6	0	0	100	100	96-100	80-98	30-40	8-17
	8-22	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	22-25	Bedrock			---	---	---	---	---	---	---	---
Lucien-----	0-7	Very fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0-15	85-100	85-100	80-100	36-75	14-28	NP-7
	7-14	Loam, very fine sandy loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0-20	85-100	85-100	80-100	30-97	14-37	NP-14
	14-17	Bedrock			---	---	---	---	---	---	---	---
KgWC: Kingfisher-----	0-6	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-97	22-37	2-13
	6-10	Silt loam, silty clay loam, clay loam	CL	A-4, A-6	0	0	100	100	96-100	80-98	30-40	8-17
	10-26	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	26-32	Silty clay loam, clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	33-60	12-35
	32-40	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
KgWC: Wakita-----	0-4	Silt loam	CL	A-4, A-6	0	0	100	95-100	90-100	75-97	30-37	8-13
	4-25	Silty clay loam, silt loam	CL	A-6, A-7	0	0	100	80-100	75-100	65-98	30-42	10-20
	25-31	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	80-100	75-100	70-95	60-93	30-42	10-20
	31-37	Bedrock			---	---	---	---	---	---	---	---
KinC2: Kingfisher-----	0-8	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-85	24-37	4-14
	8-19	Clay loam, silty clay loam, silt loam	CL	A-4, A-6	0	0	100	100	96-100	80-98	30-40	8-17
	19-22	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	22-25	Bedrock			---	---	---	---	---	---	---	---
KowB: Konawa-----	0-6	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	6-14	Fine sandy loam, loamy fine sand, fine sand	CL-ML, ML, SC-SM, SM	A-2, A-3, A-4	0	0	100	98-100	82-100	3-60	0-26	NP-7
	14-24	Sandy clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	14-37	NP-16
	24-44	Sandy clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	14-37	NP-16
	44-60	Fine sandy loam, sandy clay loam, loamy fine sand	CL-ML, ML, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	90-100	15-65	0-37	NP-16
	60-80	Loamy fine sand, sandy clay loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	90-100	15-65	0-37	NP-16

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
KowD: Konawa-----	0-8	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	8-20	Fine sandy loam, loamy fine sand, fine sand	CL-ML, ML, SC-SM, SM	A-2, A-3, A-4	0	0	100	98-100	82-100	3-60	0-26	NP-7
	20-33	Sandy clay loam, fine sandy loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	14-37	NP-16
	33-50	Fine sandy loam, sandy clay loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	90-100	36-65	14-37	NP-16
	50-67	Loamy fine sand, sandy clay loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	90-100	15-65	0-37	NP-16
	67-80	Fine sand, loamy fine sand, fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-3, A-4	0	0	100	98-100	82-100	3-60	0-26	NP-7
KrdA: Kirkland-----	0-9	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-97	22-37	2-13
	9-28	Silty clay, clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-65	18-38
	28-40	Silty clay, clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	39-70	26-45
	40-53	Silty clay loam, silty clay, clay loam, clay	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	39-70	26-45
	53-80	Silty clay loam, clay, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	39-70	26-45

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
KrdB: Kirkland-----	0-7	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-97	22-37	2-13
	7-14	Silty clay, clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-65	18-38
	14-33	Silty clay, clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-65	18-38
	33-61	Silty clay loam, silty clay, clay loam, clay	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	37-70	15-45
	61-80	Bedrock			---	---	---	---	---	---	---	---
KrdB2: Kirkland-----	0-4	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-97	22-37	2-13
	4-25	Silty clay, clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-65	18-38
	25-44	Silty clay loam, clay, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	35-70	26-45
	44-61	Silty clay loam, clay loam, silty clay, clay	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	35-70	26-45
	61-80	Bedrock			---	---	---	---	---	---	---	---
KrPB: Kirkland-----	0-8	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-97	22-37	2-13
	8-21	Silty clay, clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-65	18-38
	21-41	Silty clay, clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	37-70	26-45
	41-64	Silty clay loam, silty clay, clay loam, clay	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	37-70	26-45
	64-80	Clay loam, silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	37-70	26-45

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
KrPB:												
Pawhuska-----	0-6	Silt loam	CL-ML, ML	A-4	0	0	100	100	96-100	80-97	22-30	2-7
	6-22	Silty clay, silty clay loam, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	22-43	Silty clay, silty clay loam, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	43-55	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	55-72	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	72-80	Bedrock			---	---	---	---	---	---	---	---
LAN. Landfill												
Lela:												
Lela-----	0-6	Silty clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-70	20-38
	6-13	Silty clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-70	20-38
	13-34	Silty clay, clay	CH, CL	A-7	0	0	75-98	75-98	70-98	52-95	41-70	20-38
	34-42	Silty clay, clay	CH, CL	A-7	0	0	75-98	75-98	70-98	52-95	41-70	20-38
	42-53	Silty clay, clay	CH, CL	A-7	0	0	75-98	75-98	70-98	52-95	41-70	20-38
	53-61	Silty clay, clay	CH, CL	A-7	0	0	75-98	75-98	70-98	52-95	41-70	20-38
	61-72	Silty clay, clay	CH, CL	A-7	0	0	75-98	75-98	70-98	52-95	41-70	20-38
	72-87	Silty clay, clay	CH, CL	A-7	0	0	75-98	75-98	70-98	52-95	41-70	20-38

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
					Pct	Pct					Pct	
LveB: Lovedale-----	In											
	0-7	Sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	95-100	95-100	85-100	34-60	14-26	NP-7
	7-12	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-2, A-4, A-6	0	0	95-100	85-100	80-100	30-65	25-37	7-16
	12-18	Sandy clay loam, sandy loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0	95-100	85-100	80-100	30-65	14-37	NP-16
	18-26	Sandy clay loam, sandy loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0	95-100	85-100	80-100	30-65	14-37	NP-16
	26-46	Sandy clay loam, sandy loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0	95-100	85-100	80-100	30-65	14-37	NP-16
	46-80	Loamy coarse sand, coarse sandy loam, fine sandy loam, sand	SC-SM, SM, SP-SM	A-2, A-4	0	0	80-100	70-100	60-75	11-45	0-26	NP-7
M-W. Miscellaneous water												
McaA: McLain-----	0-7	Silty clay loam	CL	A-7, A-6	0	0	100	100	96-100	80-99	33-43	13-19
	7-17	Silty clay loam, clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	17-31	Silty clay loam, clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	31-46	Silty clay loam, clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	46-80	Silty clay, silty clay loam, silt loam, loam	CH, CL	A-4, A-6, A-7	0	0	100	95-100	95-100	65-99	27-60	7-34

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
MilB: Milan-----	0-7	Loam	CL, CL-ML	A-4, A-6	0	0	95-100	95-100	95-100	65-85	20-35	5-15
	7-12	Loam, sandy clay loam, clay loam	CL, ML, SC, SM	A-6, A-7-6	0	0	95-100	95-100	65-100	45-80	35-55	11-25
	12-26	Clay loam, sandy clay loam, loam	CL, ML, SC, SM	A-6, A-7-6	0	0	95-100	95-100	65-100	45-80	35-55	11-25
	26-45	Clay loam, sandy clay loam, sandy loam	CL, SC, SM	A-2-6, A-4, A-6	0	0	95-100	95-100	65-100	30-80	14-40	NP-20
	45-72	Sandy clay loam, clay loam, sandy loam	CL, SC, SM	A-4, A-6, A-2-6	0	0	95-100	95-100	65-100	30-80	14-40	NP-20
	72-80	Sandy loam, sandy clay loam, clay loam	CL, SC, SM	A-2, A-4, A-6	0	0	95-100	95-100	60-90	15-70	14-40	NP-20
MilC: Milan-----	0-9	Loam	CL, CL-ML	A-4, A-6	0	0	95-100	95-100	95-100	65-85	20-35	5-15
	9-15	Loam, sandy clay loam, clay loam	CL, ML, SC, SM	A-6, A-7-6	0	0	95-100	95-100	65-100	45-80	35-55	11-25
	15-33	Sandy clay loam, clay loam, sandy loam	CL, SC, SM	A-2-6, A-4, A-6	0	0	95-100	95-100	65-100	30-80	14-40	NP-20
	33-48	Clay loam, sandy clay loam, sandy loam	CL, SC, SM	A-4, A-6, A-2-6	0	0	95-100	95-100	65-100	30-80	14-40	NP-20
	48-62	Sandy loam, sandy clay loam, clay loam	CL, SC, SM	A-2, A-6, A-4	0	0	95-100	95-100	60-90	15-70	14-40	NP-20
	62-80	Loamy sand, sandy loam, sandy clay loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0	95-100	95-100	60-90	15-65	0-37	NP-16

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10 inches Pct	3-10 inches Pct	4	10	40	200		
MinB: Minco-----	In											
	0-8	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	51-75	14-28	NP-7
	8-15	Very fine sandy loam, silt loam, loam	ML, CL-ML, CL	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	15-32	Very fine sandy loam, silt loam, loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	32-46	Very fine sandy loam, silt loam, loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	46-62	Very fine sandy loam, silt loam, loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	62-80	Very fine sandy loam, loam, silt loam, fine sandy loam	CL, ML, SC, SM	A-4	0	0	100	98-100	94-100	36-97	14-31	NP-10
MinC: Minco-----												
	0-8	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	51-75	14-28	NP-7
	8-17	Very fine sandy loam, silt loam, loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	17-23	Very fine sandy loam, silt loam, loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	23-54	Very fine sandy loam, silt loam, loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	54-59	Very fine sandy loam, silt loam, loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	59-80	Very fine sandy loam, silt loam, loam	CL, ML, SC, SM	A-4	0	0	100	98-100	94-100	36-97	14-31	NP-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
MirA: Miller-----	0-10	Silty clay loam	CL	A-6, A-7	0	0	100	98-100	96-100	90-98	37-50	15-25
	10-30	Silty clay, clay, silty clay loam	CH, CL	A-7	0	0	100	98-100	96-100	90-99	41-65	20-40
	30-44	Silty clay loam, silty clay, clay	CH, CL	A-7, A-6	0	0	100	98-100	96-100	80-99	35-60	15-35
	44-80	Clay loam, silty clay, silty clay loam, clay	CH, CL	A-6, A-7	0	0	100	98-100	96-100	80-99	35-60	15-35
MisA: Miller-----	0-10	Silty clay loam	CL	A-7, A-6	0	0	100	98-100	96-100	90-98	37-50	15-25
	10-23	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	100	98-100	96-100	90-99	41-65	20-40
	23-34	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	100	98-100	96-100	90-99	41-65	20-40
	34-40	Silty clay loam, stratified silty clay to fine sandy loam, clay	CH, CL	A-6, A-7	0	0	100	98-100	96-100	80-99	35-60	15-35
	40-51	Silty clay loam, silty clay, clay	CH, CL	A-6, A-7	0	0	100	98-100	96-100	80-99	35-60	15-35
	51-80	Silty clay loam, silty clay, clay	CH, CL	A-6, A-7	0	0	100	98-100	96-100	80-99	35-60	15-35

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
MPNC2: Milan-----	0-11	Loam	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	95-100	65-85	20-35	5-15
	11-16	Clay loam, sandy clay loam, loam	CL, ML, SC, SM	A-6, A-7-6	0	0	95-100	95-100	65-100	45-80	35-55	11-25
	16-28	Clay loam, sandy clay loam, loam	CL, ML, SC, SM	A-6, A-7-6	0	0	95-100	95-100	65-100	45-80	35-55	11-25
	28-57	Clay loam, sandy clay loam, sandy loam	CL, SC, SM	A-2-6, A-4, A-6	0	0	95-100	95-100	65-100	30-80	14-40	NP-20
	57-65	Coarse sandy loam, sandy loam, sandy clay loam, clay loam	CL, SC, SM	A-2, A-4, A-6	0	0	95-100	95-100	60-90	15-70	14-40	NP-20
	65-75	Loamy coarse sand, sandy loam, sandy clay loam, clay loam	CL, SC, SM	A-2, A-4, A-6	0	0	95-100	95-100	60-90	15-70	14-40	NP-20
Pawhuska-----	0-8	Silt loam	CL-ML, ML	A-4	0	0	100	100	96-100	80-97	22-30	2-7
	8-17	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	17-27	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	27-40	Clay loam, silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	40-64	Clay loam, silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	64-80	Coarse sandy loam, sandy loam, sandy clay loam, clay loam	CL, SC, SM	A-2, A-4, A-6	0	0	95-100	95-100	60-90	15-70	14-40	NP-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
MPNC2: Norge-----	0-6	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	2-14
	6-14	Silt loam, clay loam, silty clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	0	100	100	96-100	65-98	22-43	2-20
	14-35	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	35-45	Silty clay loam, clay loam, silty clay	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-22
	45-80	Silty clay loam, clay loam, silty clay	CL	A-7, A-6	0	0	100	100	96-100	80-98	33-49	12-22
MulC: Mulhall-----	0-7	Loam	CL-ML, CL	A-4, A-6	0	0	100	100	96-100	65-85	25-35	5-13
	7-13	Loam, clay loam	CL	A-4, A-6	0	0	100	100	96-100	65-90	30-40	9-18
	13-26	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	26-42	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	42-60	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	60-80	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18

Engineering Index Properties--Continued

Map symbol and soil name	Depth  In	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit  Pct	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
MulD: Mulhall-----	0-10	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-85	25-35	5-13
	10-14	Loam, clay loam	CL	A-4, A-6	0	0	100	100	96-100	65-90	30-40	9-18
	14-23	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	23-33	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	33-42	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	42-56	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	56-80	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
MulD4: Mulhall-----	0-14	Loam	CL, CL-ML	A-6, A-4	0	0	100	100	96-100	65-85	25-35	5-13
	14-19	Loam, clay loam	CL	A-4, A-6	0	0	100	100	96-100	65-90	30-40	9-18
	19-29	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	29-44	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	85-100	85-100	80-100	30-90	25-40	7-18
	44-80	Clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-6, A-2, A-4	0	0	85-100	85-100	80-100	30-90	25-40	7-18

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
NeDG: Newalla-----	0-5	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	5-14	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	14-22	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	96-100	36-85	25-40	7-18
	22-32	Clay, silty clay	CH, CL	A-7	0	0	100	100	96-100	80-99	41-60	18-34
	32-40	Clay, silty clay	CH, CL	A-7	0	0	100	100	96-100	80-99	41-60	18-34
	40-54	Silty clay, very gravelly silty clay, clay	CH, CL, GC, SC	A-6, A-7, A-2	0	0	40-100	35-100	30-100	15-99	35-60	14-34
	54-58	Bedrock			---	---	---	---	---	---	---	---
Darnell-----	0-4	Fine sandy loam	CL, ML, SC, SM	A-4, A-2	0-3	0-10	90-100	90-100	85-100	30-60	15-30	NP-10
	4-11	Fine sandy loam, loam, gravelly fine sandy loam	CL, ML, SC, SM	A-2, A-4	0-3	0-10	70-100	70-100	60-100	25-60	15-30	NP-10
	11-15	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
NorA: Norge-----	0-11	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	2-14
	11-14	Silty clay loam, clay loam, silt loam	CL, CL-ML, ML	A-4, A-6, A-7	0	0	100	100	96-100	65-98	22-43	2-20
	14-23	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	23-32	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	32-38	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	38-49	Silty clay loam, clay loam, silty clay	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-22
	49-58	Silty clay loam, clay loam, silty clay	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-22
	58-81	Silty clay loam, clay loam, silty clay	CL	A-7, A-6	0	0	100	100	96-100	80-98	33-49	12-22

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
NorB: Norge-----	0-9	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	2-14
	9-15	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	2-14
	15-19	Silty clay loam, clay loam, silt loam	CL, CL-ML, ML	A-4, A-7, A-6	0	0	100	100	96-100	65-98	22-43	2-20
	19-30	Silty clay loam, clay loam	CL	A-7, A-6	0	0	100	100	96-100	80-98	33-43	12-20
	30-44	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	44-67	Silty clay loam, clay loam, silty clay	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-22
	67-80	Silt loam, silty clay loam, clay loam, silty clay	CL	A-7, A-6	0	0	100	100	96-100	80-98	33-49	12-22
	NorC: Norge-----	0-11	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35
11-16		Silty clay loam, clay loam, silt loam	CL, CL-ML, ML	A-4, A-6, A-7	0	0	100	100	96-100	65-98	22-43	2-20
16-27		Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
27-47		Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
47-60		Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
60-80		Silt loam, silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10 inches Pct	3-10 inches Pct	4	10	40	200		
NorC2: Norge-----	In											
	0-9	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	2-14
	9-18	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	18-30	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	30-44	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	44-64	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	64-86	Silt loam, silty clay loam, clay loam, silty clay	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-22
NoUC: Norge-----												
	0-7	Silt loam	CL, CL-ML, ML	A-6, A-4	0	0	100	100	96-100	65-97	22-35	2-14
	7-10	Silty clay loam, clay loam, silt loam	CL, CL-ML, ML	A-6, A-7, A-4	0	0	100	100	96-100	65-98	22-43	2-20
	10-20	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	20-39	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	39-45	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	45-80	Silty clay loam, clay loam, silty clay	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-22
Urban land.												

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
OWWE: Oil waste land--	0-60	Variable			---	---	---	---	---	---	---	---
Westsum-----	0-9	Silty clay loam	CL	A-6, A-7	0	0	100	100	98-100	90-98	33-42	12-19
	9-14	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	33-60	12-34
	14-20	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	26-45
	20-28	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	26-45
	28-45	Silty clay	CH, CL	A-7	0	0	100	100	98-100	93-99	41-60	26-45
	45-56	Silty clay	CH, CL	A-7	0	0	100	100	98-100	93-99	41-60	26-45
	56-72	Silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	26-45
PoaA: Port-----	0-19	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	19-30	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	30-43	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	43-59	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	59-74	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
PoOA: Port-----	0-16	Silt loam	CL	A-6, A-4	0	0	100	100	96-100	65-97	27-37	8-14
	16-23	Silt loam	CL	A-6, A-4	0	0	100	100	96-100	65-97	27-37	8-14
	23-40	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	40-51	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	51-80	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
Oscar-----	0-4	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	4-10	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	10-16	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	32-43	12-20
	16-33	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	33-43	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	43-80	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14

Engineering Index Properties--Continued

Map symbol and soil name	Depth  In	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit  Pct	Plasticity index
			Unified	AASHTO	>10 inches  Pct	3-10 inches  Pct	4	10	40	200		
PorA: Port-----	0-8	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	8-14	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	14-20	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	20-31	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	31-40	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	40-48	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	48-55	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	55-68	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	68-74	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	74-85	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	85-93	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
PotA: Port-----	0-10	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	10-26	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	26-35	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	35-66	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	66-80	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
PukA: Pulaski-----	0-8	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	8-20	Fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-7
	20-37	Fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-7
	37-47	Fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-7
	47-80	Stratified fine sandy loam to fine sand	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	94-100	15-85	0-29	NP-7

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
PulA: Pulaski-----	0-9	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	9-27	Fine sandy loam, loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-7
	27-80	Stratified loamy fine sand to loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	94-100	15-85	0-29	NP-7
RefC2: Renfrow-----	0-6	Loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	6-35	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	35-73	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
ReGC2: Renfrow-----	0-8	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	8-12	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	30-50	15-26
	12-30	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	30-44	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	44-63	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	63-80	Bedrock			---	---	---	---	---	---	---	---
Grainola-----	0-7	Silty clay loam	CL	A-6, A-7	0-6	0-10	80-100	75-100	72-100	60-98	33-43	12-20
	7-12	Silty clay loam, silty clay, clay loam, clay	CH, CL, SC	A-6, A-7	0-5	0-5	80-100	75-100	72-100	49-98	37-60	15-34
	12-26	Clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	26-33	Clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	33-40	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
ReiA: Reinach-----	0-8	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	51-75	14-28	NP-7
	8-23	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	51-75	14-28	NP-7
	23-30	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	51-75	14-28	NP-7
	30-42	Loam, very fine sandy loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	42-65	Loam, very fine sandy loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	65-82	Loam, very fine sandy loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
RenB: Renfrow-----	0-9	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	9-13	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	30-50	15-26
	13-23	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	23-42	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	42-60	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	60-80	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
RenC: Renfrow-----	0-10	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	10-13	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	30-50	15-26
	13-28	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	28-36	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	36-50	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	50-65	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	65-80	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
RewC2: Renfrow-----	0-10	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	10-24	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	24-37	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	37-54	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	54-63	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	63-80	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
RGPD3:												
Renfrow-----	0-10	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	10-24	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	24-44	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	44-80	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
Grainola-----	0-5	Silty clay loam	CL	A-6, A-7	0-6	0-10	80-100	75-100	72-100	60-98	33-43	12-20
	5-21	Clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	21-24	Bedrock			---	---	---	---	---	---	---	---
Pawhuska-----	0-3	Silt loam	CL-ML, ML	A-4	0	0	100	100	96-100	80-97	22-30	2-7
	3-13	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	13-42	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	42-80	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40
Slab:												
Slaughterville--	0-10	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	10-39	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	39-50	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	50-80	Sandy clay loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
SlaC: Slaughterville--	0-13	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	13-19	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	19-30	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	30-50	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	50-80	Fine sandy loam, loamy fine sand	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	90-100	15-60	15-26	NP-7
SlaG: Slaughterville--	0-16	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	16-33	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	33-80	Fine sandy loam, loamy fine sand	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	90-100	15-60	15-26	NP-7
StDD: Stephenville----	0-5	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0-15	83-100	83-100	80-100	11-60	14-26	NP-7
	5-9	Fine sandy loam, loamy fine sand	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0-15	85-100	85-100	76-100	12-60	0-26	NP-7
	9-30	Fine sandy loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	100	98-100	90-100	36-65	20-37	7-16
	30-36	Fine sandy loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	100	98-100	90-100	36-65	20-37	7-16
	36-40	Bedrock			---	---	---	---	---	---	---	---
Darnell-----	0-4	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0-15	90-100	88-100	83-100	30-60	0-26	NP-7
	4-12	Fine sandy loam, loam, gravelly fine sandy loam	CL, ML, SC, SM	A-2, A-4	0	0-10	70-100	70-100	60-100	25-60	15-30	NP-10
	12-15	Bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
TabA: Tabler-----	0-10	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-97	22-37	2-13
	10-25	Silty clay, clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-65	18-35
	25-43	Silty clay, clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-65	18-35
	43-65	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	38-60	15-35
	65-80	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	38-60	15-35
TeaA: Tearney-----	0-10	Silty clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-60	18-34
	10-26	Silty clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	15-34
	26-30	Loamy fine sand, sand, fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	3-35	0-0	NP
	30-80	Sand, loamy fine sand, fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	3-35	0-0	NP
TelB: Teller-----	0-8	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	7-13
	8-12	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	7-13
	12-20	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	20-30	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	30-50	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	50-80	Fine sandy loam, very fine sandy loam, loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	94-100	36-85	14-35	NP-13

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
TelD: Teller-----	0-12	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	7-13
	12-17	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	7-13
	17-27	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	27-45	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	45-58	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	58-80	Fine sandy loam, very fine sandy loam, loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	94-100	36-85	14-35	NP-13
TelD2: Teller-----	0-6	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	7-13
	6-11	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	96-100	65-97	22-35	7-13
	11-16	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	16-31	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	31-42	Sandy clay loam, clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-85	25-40	7-18
	42-72	Fine sandy loam, very fine sandy loam, loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	94-100	36-85	14-35	NP-13
	72-85	Fine sandy loam, very fine sandy loam, loam	CL, ML, SC, SM	A-4, A-6	0	0	100	98-100	94-100	36-85	14-35	NP-13

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
VanA: Vanoss-----	0-10	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-95	22-35	2-14
	10-15	Loam, silt loam, clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
	15-30	Clay loam, silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	30-42	Clay loam, silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	42-52	Clay loam, silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	52-80	Silty clay loam, loam, silt loam, clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
W. Water												
WauA: Waurika-----	0-9	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	80-97	30-37	9-14
	9-12	Silt loam, loam	ML, CL, CL-ML	A-4, A-6	0	0	100	100	96-100	60-95	22-35	2-14
	12-31	Clay, silty clay	CH, CL	A-7	0	0	95-100	95-100	90-100	80-98	41-66	20-40
	31-39	Silty clay loam, clay loam, clay	CH, CL	A-6, A-7	0	0	90-100	90-100	85-100	80-98	38-55	16-30
	39-61	Silty clay loam, clay loam, clay	CH, CL	A-6, A-7	0	0	90-100	90-100	85-100	80-98	38-55	16-30
	61-80	Clay loam, silty clay loam	CL	A-6, A-7	0	0	90-100	90-100	80-100	70-98	33-43	12-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
WesB:												
Westsum-----	0-10	Silty clay loam	CL	A-6, A-7	0	0	100	100	98-100	90-98	33-42	12-19
	10-16	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	33-60	12-34
	16-30	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	26-45
	30-36	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	26-45
	36-52	Silty clay	CH, CL	A-7	0	0	100	100	98-100	93-99	41-60	26-45
	52-65	Silty clay	CH, CL	A-7	0	0	100	100	98-100	93-99	41-60	26-45
	65-80	Silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	26-45
WesC:												
Westsum-----	0-6	Silty clay loam	CL	A-6, A-7	0	0	100	100	98-100	90-98	33-42	12-19
	6-10	Silty clay loam	CL	A-6, A-7	0	0	100	100	98-100	90-98	33-42	12-19
	10-17	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	26-45
	17-31	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	26-45
	31-59	Silty clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	98-100	90-99	37-60	26-45
	59-75	Silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	26-45
	75-80	Silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	26-45

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
WilC: Wisby-----	0-6	Sandy loam	ML, SM	A-2, A-4	0	0	85-100	75-100	71-100	27-60	0-25	NP-4
	6-10	Sandy loam, loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	85-100	75-100	71-100	27-60	0-29	NP-7
	10-17	Sandy loam, loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	85-100	75-100	71-100	27-60	0-29	NP-7
	17-32	Coarse sandy loam, sandy loam, loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	85-100	75-100	71-100	27-60	0-29	NP-7
	32-36	Loamy coarse sand, loamy sand, gravelly sand, sand	SM, SP-SM	A-1, A-2, A-3	0	0	85-100	40-100	37-100	7-35	0-14	NP
	36-80	Loamy coarse sand, loamy sand, gravelly sand, sand	SM, SP-SM	A-1, A-2, A-3	0	0	85-100	40-100	37-100	7-35	0-14	NP
Lovedale-----	0-6	Sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	95-100	95-100	85-100	34-60	14-26	NP-7
	6-10	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-6, A-2, A-4	0	0	95-100	85-100	80-100	30-65	25-37	7-16
	10-15	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-6, A-2, A-4	0	0	95-100	85-100	80-100	30-65	25-37	7-16
	15-33	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-6, A-2, A-4	0	0	95-100	85-100	80-100	30-65	25-37	7-16
	33-46	Loam, sandy clay loam, sandy loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0	95-100	85-100	80-100	30-65	14-37	NP-16
	46-61	Sandy clay loam, sandy loam, fine sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0	95-100	85-100	80-100	30-65	14-37	NP-16
	61-80	Coarse sandy loam, fine sandy loam, sand	SC-SM, SM, SP-SM	A-2, A-4	0	0	80-100	70-100	60-75	11-45	0-26	NP-7

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
					Pct	Pct					Pct	
ZaHC:												
Zaneis-----	0-7	Loam	CL	A-4, A-6	0	0	100	98-100	91-100	65-85	30-35	9-13
	7-10	Loam, clay loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	10-28	Clay loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	28-38	Clay loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	38-46	Clay loam, sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0-10	90-100	90-100	85-100	30-90	20-40	4-18
	46-50	Bedrock			---	---	---	---	---	---	---	---
Huska-----	0-8	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	94-100	51-97	24-37	5-14
	8-20	Clay, silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	20-42	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	42-54	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	54-60	Bedrock			---	---	---	---	---	---	---	---
ZanB:												
Zaneis-----	0-11	Loam	CL	A-4, A-6	0	0	100	98-100	91-100	65-85	30-35	9-13
	11-15	Clay loam, loam	CL	A-4, A-6	0	0	100	98-100	91-100	65-85	30-35	9-13
	15-30	Loam, clay loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	30-42	Clay loam, sandy clay loam	CL, SC	A-4, A-6	0	0	100	100	90-100	36-90	25-40	7-18
	42-50	Clay loam, sandy clay loam, fine sandy loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0-10	90-100	90-100	85-100	30-90	20-40	4-18
	50-55	Bedrock			---	---	---	---	---	---	---	---

## Engineering Index Test Data

The table "Engineering Index Test Data of Selected Soils" shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Oklahoma Department of Transportation, Materials Division.

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); group index number; mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); liquid limit—T 89 (AASHTO), D 423 (ASTM); plasticity index—T 90 (AASHTO), D 424 (ASTM), D 1883 (ASTM); shrinkage—T 92 (AASHTO), D 427 (ASTM); and volume change from field moisture equivalent (F.M.E.).

Engineering Index Test Data of Selected Soils

(All engineering data were provided by the Oklahoma Department of Transportation. LL means liquid limit; PI means plasticity index; F.M.E. means field moisture equivalent)

Soil series, sample number*, horizon, and depth in inches	Horizon depth in inches	Classification		LL	PI	Grain size distribution							Shrinkage		Volume change from F.M.E.		
		AASHTO	Group index number			Percentage passing sieve number--					Percentage smaller than			Limit		Ratio	
						4	10	40	60	200	0.05mm	0.005mm	0.002mm				
Bethany:																	
(S900K-103-005)																	
Ap, Ad, A -----	0-12	A-6	10	31	11	100	99	99	98	95	88	28	23	17	1.78	19	
Bt1, Bt2, Btk1, Btk2 -----	12-47	A-7-6	45	60	42	100	99	99	98	97	92	48	42	11	2.06	59	
Coyle:																	
(S900K-103-002)																	
A -----	0-10	A-6	11	34	13	100	100	100	99	85	76	24	20	21	1.69	12	
Bt1 -----	10-17	A-6	11	38	20	100	100	100	100	66	57	32	27	14	1.88	26	
Grainola:																	
(S900K-103-003)																	
Ap1, Ap2, Ad ---	0-9	A-7-6	20	41	23	98	97	96	96	87	80	42	38	11	2.00	38	
Btk1, Btk2 -----	9-25	A-7-6	37	59	39	99	98	94	94	88	85	55	48	8	2.12	66	
Kirkland:																	
(S900K-103-006)																	
Ap1, Ap2 -----	0-11	A-6	18	36	18	100	100	100	99	97	92	34	29	15	1.8	22	
Bt1, Bt2, Bt3, Bt4 -----	11-33	A-7-6	42	58	39	100	100	100	99	98	95	48	42	12	2.02	55	
Lela:																	
(S900K-103-007)																	
Ap1, Ap2 -----	0-6	A-7-6	31	48	29	100	100	100	100	99	97	53	44	12	1.97	43	
A2, A3, A4 -----	13-42	A-7-6	59	75	52	100	100	100	100	99	98	57	50	10	2.08	81	
Norge:																	
(S900K-103-008)																	
Ap1, Ap2 -----	0-11	A-6	10	31	11	100	100	100	99	97	90	28	24	18	1.80	13	
Port:																	
(S900K-103-004)																	
Ap1, Ap2, Ad ---	0-14	A-6	17	34	18	100	100	100	99	97	92	33	28	14	1.86	23	
Bw, Bwk1 -----	30-48	A-6	12	31	14	100	100	100	100	95	85	28	23	15	1.84	18	

See footnote at end of table.

Engineering Index Test Data of Selected Soils--Continued

Soil series, sample number*, horizon, and depth in inches	Horizon depth in inches	Classification		LL	PI	Grain size distribution							Shrinkage		Volume change from F.M.E.	
		AASHTO	Group index number			Percentage passing sieve number--					Percentage smaller than		Limit	Ratio		
						4	10	40	60	200	0.05mm	0.005mm				0.002mm
Renfrow: (S900K-103-001)																
Ap, A -----	0-7	A-6	12	29	12	100	100	100	99	80	73	28	24	14	1.85	19
Bt, Btk1 -----	11-33	A-7-6	37	58	42	100	100	100	100	85	81	50	45	9	2.08	59

\* Locations of sampled pedons are as follows:

Bethany silt loam: 1,900 feet north and 800 feet west of the southeastern corner of sec. 17, T. 24 N., R. 1 E.; lat. 36 degrees 33 minutes 21 seconds N. and long. 97 degrees 12 minutes 49 seconds W. (The surface layer is more acid than is typical for the Bethany series due to cultural practices.)

Coyle loam: 1,300 feet north and 700 feet west of the southeastern corner of sec. 36, T. 20 N., R. 1 W.; lat. 36 degrees 09 minutes 46 seconds N. and long. 97 degrees 14 minutes 56 seconds W.

Dilworth silty clay loam: 1,650 feet east and 700 feet south of the northwestern corner of sec. 33, T. 24 N., R. 1 W.; lat. 36 degrees 31 minutes 10 seconds N. and long. 97 degrees 18 minutes 46 seconds W.

Grainola silty clay loam: 1,500 feet north and 150 feet west of the southeastern corner of sec. 4, T. 21 N., R. 1 W.; lat. 36 degrees 09 minutes 46 seconds N. and long. 97 degrees 14 minutes 56 seconds W. (This pedon has a mollic epipedon and is outside the range for the Grainola series. This pedon is in the Piedmont series.)

Highview gravelly silty clay: 500 feet east and 2,100 feet south of the northwestern corner of sec. 22, T. 23 N., R. 2 W.; lat. 36 degrees 27 minutes 21 seconds N. and long. 97 degrees 24 minutes 20 seconds W.

Kirkland silt loam: 1,750 feet east and 500 feet north of the southwestern corner of sec. 17, T. 24 N., R. 1 E.; lat. 36 degrees 33 minutes 08 seconds N. and long. 97 degrees 13 minutes 23 seconds W. (The surface layer is more acid, the chroma of the Btk2b is lower than typical, and the Btk3b and Btk4b horizons are yellower than the typical conditions of the series. The acid surface layer is due to cultural practices.)

Lela silty clay: 2,500 feet south and 50 feet west of the northeastern corner of sec. 1, T. 24 N., R. 1 W.; lat. 36 degrees 35 minutes 01 second N. and long. 97 degrees 14 minutes 49 seconds W.

Lucien very fine sandy loam: 3,000 feet east and 2,450 feet south of the northwestern corner of sec. 2, T. 22 N., R. 1 E.; lat. 36 degrees 24 minutes 48 seconds N. and long. 97 degrees 09 minutes 55 seconds W.

Norge silt loam: 2,000 feet south and 1,300 feet west of the northeastern corner of sec. 7, T. 24 N., R. 1 E.; lat. 36 degrees 34 minutes 25 seconds N. and long. 97 degrees 14 minutes 01 second W. (The clay percentage in the control section is slightly higher, 0.5-0.8 percent, than what is typical for the series.)

Port silt loam: 1,700 east and 100 feet north of the southwestern corner of sec. 27, T. 22 N., R. 1 W.; lat. 36 degrees 20 minutes 52 seconds N. and long. 97 degrees 17 minutes 40 seconds W.

Renfrow silt loam: 1,000 feet east and 500 feet south of the northwestern corner of sec. 16, T. 21 N., R. 1 W.; lat. 36 degrees 18 minutes 09 seconds N. and long. 97 degrees 18 minutes 55 seconds W. (The depth to secondary carbonates is slightly less, the color of the lower Bt horizon is slightly redder, and the reaction of the surface horizon is more acid than the typical conditions of the series. The acid surface layer is due to cultural practices.)

Westsum silty clay loam: 150 feet west and 650 feet north of the southeastern corner of sec. 8, T. 23 N., R. 1 W.; lat. 36 degrees 28 minutes 49 seconds N. and long. 97 degrees 19 minutes 09 seconds W.

## Physical Properties

The table "Physical Properties of the Soils" 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.

*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 in the series descriptions section of this survey.

*Sand* as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. The estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

*Silt* as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. The estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

*Clay* as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. 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 earth-moving operations.

*Moist bulk density* is the weight of soil (oven-dry) 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 the table "Physical Properties of the Soils," 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 ( $K_{sat}$ )* refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity ( $K_{sat}$ ). The estimates in the table indicate the rate of water movement, in inches per hour, 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.

*Linear extensibility* refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at  $1/3$ - or  $1/10$ -bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent

change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

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

*Erosion factors.*—Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices.

*Erosion factor K* factor 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 rate of soil loss by sheet and rill erosion in tons per acre per year. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand, the content of sand coarser than very fine sand, the content of organic matter, soil structure, and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.64. The higher the value, the more susceptible the soil is to sheet and rill erosion.

*Erosion factor Kw* indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

*Erosion factor Kf* indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size. This is one of the factors used in the revised Universal Soil Loss Equation.

*Erosion factor T* is an estimate of the maximum annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used, depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

*Wind erodibility groups.*—Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index factor (I) is determined. This factor is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEGs) having similar percentages of dry soil aggregates larger than 0.84 millimeter.

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

WEG 1. Very fine sand, fine sand, sand, and coarse sand.

WEG 2. Loamy very fine sand, loamy fine sand, loamy sand, loamy coarse sand, ash, and sapric organic soil material.

WEG 3. Very fine sandy loam, fine sandy loam, sandy loam, and coarse sandy loam.

WEG 4. Clay, silty clay, and noncalcareous clay loam and silty clay loam with more than 35 percent clay.

WEG 4L. Calcareous loam, silt loam, clay loam, and silty clay loam characterized by a strongly or violently effervescent reaction to cold dilute (1N) HCl.

WEG 5. Noncalcareous loam and silt loam with less than 20 percent clay and sandy clay loam, sandy clay, and hemic organic soil material.

WEG 6. Noncalcareous loam and silt loam with more than 20 percent clay and noncalcareous clay loam with less than 35 percent clay.

WEG 7. Silt, noncalcareous silty clay loam with less than 35 percent clay, and fibric organic soil material.

WEG 8. Soils that are not susceptible to soil blowing because of rock fragments on the surface or because of surface wetness.

*Wind erodibility index* is a numerical value indicating the susceptibility of soil to soil blowing, or the tons per acre per year that can be expected to be lost to soil blowing. There is a close correlation between soil blowing and the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence soil blowing.

Additional information about wind erodibility groups and K, Kf, T, and I factors can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
<b>AhpA:</b>														
Ashport-----	0-10	0-20	40-73	27-35	1.30-1.60	0.6-2	0.15-0.22	3.0-5.9	1.0-3.0	.32	.32	5	7	38
	10-25	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	25-35	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	35-42	5-80	5-65	5-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	42-52	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	52-80	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
<b>APPA:</b>														
Ashport-----	0-14	0-20	40-73	27-35	1.30-1.60	0.6-2	0.15-0.22	3.0-5.9	1.0-3.0	.32	.32	5	7	38
	14-27	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	27-80	5-80	5-65	5-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
<b>Port-----</b>														
Port-----	0-7	43-85	0-50	10-18	1.40-1.65	2-6	0.13-0.19	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	7-27	0-32	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	27-46	0-45	15-82	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	46-51	0-45	15-82	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	51-80	0-45	15-82	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
<b>Pulaski-----</b>														
Pulaski-----	0-9	43-85	0-50	10-18	1.40-1.65	2-6	0.13-0.19	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	9-25	32-85	0-50	10-18	1.30-1.70	2-6	0.13-0.19	0.0-2.9	0.0-1.0	.32	.32			
	25-80	30-90	3-50	5-18	1.30-1.70	2-6	0.07-0.20	0.0-2.9	0.0-1.0	.32	.32			
<b>AspA:</b>														
Ashport-----	0-10	0-32	50-88	15-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	10-32	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	32-45	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	45-70	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	70-80	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
<b>AspB:</b>														
Ashport-----	0-10	0-32	50-88	15-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	10-21	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	21-36	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	36-65	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	65-80	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind	Wind
										Kw	Kf	T	erodi- bility group	erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
BetA:														
Bethany-----	0-9	0-35	50-88	15-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.43	.43	5	5	56
	9-12	0-45	15-65	27-35	1.45-1.70	0.2-0.6	0.16-0.22	3.0-5.9	1.0-3.0	.37	.37			
	12-30	0-45	5-65	35-50	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.5-2.0	.37	.37			
	30-47	0-45	5-65	35-50	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.5-2.0	.37	.37			
	47-71	0-45	5-65	35-50	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.0-2.0	.37	.37			
	71-80	0-45	5-65	35-50	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.0-2.0	.37	.37			
BetB:														
Bethany-----	0-11	0-34	50-88	15-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.43	.43	5	5	56
	11-16	0-45	15-65	27-35	1.45-1.70	0.2-0.6	0.16-0.22	3.0-5.9	1.0-3.0	.37	.37			
	16-36	0-45	5-65	35-50	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.5-2.0	.37	.37			
	36-60	0-45	5-65	35-50	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.0-1.0	.37	.37			
	60-80	0-45	5-65	35-50	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.0-1.0	.37	.37			
BPG:														
Borrow pits, gravelly----	0-10	---	---	0-1	---	6-20	0.01-0.02	0.0-2.9	0.0-0.1	.02	.15	--	8	0
	10-80	---	---	0-1	---	6-20	0.01-0.02	0.0-2.9	0.0-0.1	.02	.15			
BPR:														
Borrow pits, rock-----	0-80	---	---	---	---	0.0000-0.005	0.00-0.00	---	---	---	---	--	8	0
BraA:														
Braman-----	0-8	0-32	50-88	15-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	8-12	0-32	50-88	15-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.37	.37			
	12-23	0-32	40-82	18-35	1.40-1.70	0.2-2	0.16-0.24	3.0-5.9	0.0-2.0	.37	.37			
	23-36	0-32	40-88	18-35	1.40-1.70	0.2-2	0.16-0.24	3.0-5.9	0.0-2.0	.37	.37			
	36-48	0-85	0-88	15-27	1.30-1.50	0.6-2	0.13-0.24	0.0-2.9	0.0-0.5	.37	.37			
	48-82	0-52	0-88	15-50	1.25-1.50	0.2-0.6	0.13-0.18	3.0-5.9	0.0-0.5	.28	.28			
BrwA:														
Brewer-----	0-11	0-32	50-82	18-26	1.30-1.50	0.2-0.6	0.15-0.24	3.0-5.9	1.0-3.0	.43	.43	5	6	48
	11-23	0-32	50-82	18-26	1.30-1.50	0.2-0.6	0.15-0.24	3.0-5.9	1.0-3.0	.43	.43			
	23-40	0-45	0-65	35-55	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	1.0-3.0	.37	.37			
	40-48	0-45	0-65	35-55	1.40-1.70	0.06-0.2	0.12-0.22	6.0-8.9	1.0-3.0	.37	.37			
	48-80	0-53	0-50	25-40	1.40-1.70	0.06-0.6	0.12-0.22	3.0-5.9	0.5-1.0	.43	.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
CoLC:														
Coyle-----	0-6	32-52	27-50	15-26	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	3	6	48
	6-11	23-80	0-50	18-26	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-2.0	.37	.37			
	11-16	20-80	0-53	20-35	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
	16-21	20-80	0-53	18-35	1.40-1.70	0.6-2	0.07-0.20	0.0-2.9	0.0-0.5	.28	.32			
	21-38	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Lucien-----	0-4	43-85	0-50	10-18	1.30-1.55	2-6	0.13-0.20	0.0-2.9	1.0-3.0	.32	.32	2	3	86
	4-8	32-85	0-85	10-25	1.30-1.55	2-6	0.12-0.24	0.0-2.9	0.5-2.0	.32	.32			
	8-13	32-85	0-50	10-25	1.30-1.55	2-6	0.12-0.24	0.0-2.9	0.5-1.5	.32	.32			
	13-17	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
CoyB:														
Coyle-----	0-10	32-52	27-50	15-26	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	3	6	48
	10-17	20-80	0-53	20-35	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
	17-23	20-80	0-53	18-35	1.40-1.70	0.6-2	0.07-0.20	0.0-2.9	0.0-0.5	.28	.32			
	23-30	20-80	0-53	18-35	1.40-1.70	0.6-2	0.07-0.20	0.0-2.9	0.0-0.5	.28	.32			
	30-38	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
CoyC:														
Coyle-----	0-7	32-52	27-50	15-26	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	3	6	48
	7-10	32-85	0-50	18-26	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-2.0	.37	.37			
	10-20	20-80	0-53	20-35	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
	20-27	20-80	0-57	18-35	1.40-1.70	0.6-2	0.07-0.20	0.0-2.9	0.0-0.5	.28	.32			
	27-30	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
CoyC2:														
Coyle-----	0-5	32-52	27-50	15-26	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	3	6	48
	5-9	32-85	0-50	18-26	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-2.0	.37	.37			
	9-16	20-80	0-53	20-35	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
	16-23	20-80	0-53	18-35	1.40-1.70	0.6-2	0.07-0.20	0.0-2.9	0.0-0.5	.28	.32			
	23-31	20-80	0-53	18-35	1.40-1.70	0.6-2	0.07-0.20	0.0-2.9	0.0-0.5	.28	.32			
	31-35	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
CoZC3:														
Coyle-----	0-7	32-52	27-50	15-26	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	2	6	48
	7-10	43-85	0-50	10-26	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-2.0	.37	.37			
	10-21	20-80	0-53	20-35	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
	21-24	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Zaneis-----	0-10	32-52	27-50	15-26	1.30-1.60	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	3	5	56
	10-14	20-80	0-53	18-30	1.40-1.70	0.6-2	0.12-0.20	0.0-2.9	0.5-2.0	.37	.37			
	14-26	20-80	0-53	18-30	1.40-1.70	0.6-2	0.12-0.20	0.0-2.9	0.5-2.0	.37	.37			
	26-40	20-80	0-53	20-38	1.45-1.70	0.2-0.6	0.12-0.20	3.0-5.9	0.5-1.0	.32	.32			
	40-50	20-80	0-53	20-38	1.45-1.70	0.2-0.6	0.12-0.20	3.0-5.9	0.5-1.0	.32	.32			
	50-52	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
DalA:														
Dale-----	0-7	0-35	50-82	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	7-21	0-35	50-82	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	21-60	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	1.0-2.0	.37	.37			
	60-80	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-2.0	.37	.37			
DAM. Dam														
DaUA:														
Dale-----	0-13	0-35	50-82	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	13-22	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	1.0-2.0	.37	.37			
	22-34	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	1.0-2.0	.37	.37			
	34-50	0-53	15-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	1.0-2.0	.37	.37			
	50-80	0-53	15-82	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-2.0	.37	.37			
Urban land.														
DiGE:														
Dilworth----	0-7	0-20	40-73	27-35	1.30-1.60	0.2-0.6	0.18-0.22	3.0-5.9	1.0-2.0	.28	.37	3	7	38
	7-12	0-20	40-65	35-55	1.30-1.60	0.06-0.2	0.12-0.22	6.0-8.9	1.0-2.0	.37	.37			
	12-22	0-20	40-60	40-55	1.30-1.60	0.06-0.2	0.12-0.18	6.0-8.9	0.5-1.0	.32	.32			
	22-30	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Grainola-----	0-7	23-53	27-50	15-26	1.25-1.55	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.43	.43	3	5	56
	7-17	0-45	15-60	35-60	1.30-1.70	0.06-0.2	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	17-31	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	31-44	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
DooB:														
Doolin-----	0-10	0-50	50-82	15-26	1.30-1.55	0.6-2	0.10-0.20	0.0-2.9	1.0-3.0	.49	.49	2	6	48
	10-24	0-45	15-65	35-55	1.35-1.65	0.0015-0.06	0.08-0.12	6.0-8.9	0.5-2.0	.49	.49			
	24-36	0-45	15-65	35-55	1.35-1.65	0.0015-0.06	0.08-0.12	6.0-8.9	0.5-2.0	.49	.49			
	36-51	20-70	0-55	30-40	1.45-1.70	0.2-0.6	0.10-0.14	3.0-5.9	0.5-2.0	.49	.49			
	51-70	20-70	5-53	30-40	1.45-1.70	0.2-0.6	0.10-0.14	3.0-5.9	0.5-2.0	.49	.49			
	70-75	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
DwhC:														
Dilworth----	0-7	0-20	40-73	27-35	1.30-1.60	0.2-0.6	0.18-0.22	3.0-5.9	1.0-2.0	.28	.37	3	7	38
	7-13	0-20	40-65	35-55	1.30-1.60	0.06-0.2	0.12-0.22	6.0-8.9	1.0-2.0	.37	.37			
	13-18	0-20	40-60	40-55	1.30-1.60	0.06-0.2	0.12-0.18	6.0-8.9	0.5-1.0	.32	.32			
	18-28	0-20	40-60	40-55	1.30-1.60	0.06-0.2	0.12-0.18	6.0-8.9	0.5-1.0	.32	.32			
	28-36	0-20	40-60	40-55	1.30-1.60	0.06-0.2	0.12-0.18	6.0-8.9	0.5-1.0	.32	.32			
	36-43	---	---	---	---	0.0000-0.2	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
EasA:														
Easpur-----	0-11	32-52	27-50	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	--	5	56
	11-30	20-80	0-53	18-35	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.37	.37			
	30-54	0-53	27-88	18-35	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
	54-63	0-85	0-88	18-35	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.0-0.8	.37	.37			
	63-80	0-53	27-88	18-35	1.40-1.70	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.37	.37			
GadA:														
Gaddy-----	0-6	70-90	0-30	5-15	1.35-1.50	6-20	0.07-0.11	0.0-2.9	0.0-0.5	.17	.17	5	2	134
	6-80	48-100	0-50	0-20	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.17	.17			
GayA:														
Gaddy-----	0-6	70-90	0-30	5-15	1.35-1.50	6-20	0.07-0.11	0.0-2.9	0.1-1.0	.17	.17	5	2	134
	6-11	70-90	0-30	5-15	1.35-1.50	6-20	0.07-0.11	0.0-2.9	0.1-1.0	.17	.17			
	11-24	70-90	0-30	3-10	1.35-1.50	6-20	0.07-0.11	0.0-2.9	0.1-0.5	.17	.17			
	24-45	70-90	0-30	2-10	1.50-1.70	2-20	0.02-0.11	0.0-2.9	0.0-0.5	.17	.17			
	45-60	70-90	0-30	3-10	1.35-1.50	6-20	0.07-0.11	0.0-2.9	0.1-0.5	.17	.17			
	60-80	70-90	0-30	5-15	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.1-0.5	.17	.17			
GMLG:														
Grainola-----	0-5	32-52	27-50	15-26	1.30-1.55	0.6-2	0.07-0.20	0.0-2.9	0.5-1.0	.24	.43	3	7	38
	5-24	0-45	0-60	35-60	1.35-1.65	0.06-0.2	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	24-30	0-45	0-60	35-60	1.35-1.65	0.06-0.2	0.02-0.20	6.0-8.9	0.0-0.5	.37	.37			
	30-40	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Masham-----	0-4	0-20	40-73	35-39	1.30-1.55	0.06-0.2	0.15-0.22	3.0-5.9	0.5-2.0	.43	.43	2	4L	86
	4-13	0-45	0-65	35-60	1.30-1.75	0.0015-0.06	0.10-0.22	6.0-8.9	0.0-0.5	.37	.37			
	13-25	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Lucien-----	0-7	43-85	0-50	10-18	1.30-1.55	2-6	0.13-0.20	0.0-2.9	1.0-3.0	.32	.32	2	3	86
	7-17	32-85	0-50	10-25	1.30-1.55	2-6	0.12-0.24	0.0-2.9	0.5-2.0	.32	.32			
	17-20	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
GohE:														
Goodnight----	0-8	70-90	0-30	5-12	1.35-1.50	6-20	0.05-0.11	0.0-2.9	0.2-1.0	.17	.17	5	2	134
	8-20	70-100	0-30	2-12	1.50-1.70	6-20	0.02-0.11	0.0-2.9	0.0-1.0	.15	.15			
	20-80	70-100	0-30	2-12	1.50-1.70	6-20	0.02-0.11	0.0-2.9	0.0-0.5	.15	.15			
GraC:														
Grainola-----	0-5	0-20	40-73	27-35	1.30-1.55	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.37	.37	3	7	38
	5-22	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	22-34	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	34-40	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
GrAD:														
Grainola-----	0-4	0-20	40-73	27-35	1.30-1.55	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.37	.37	3	7	38
	4-14	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	14-36	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	36-40	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Ashport-----	0-13	0-20	40-73	27-35	1.30-1.60	0.6-2	0.15-0.22	3.0-5.9	1.0-3.0	.32	.32	5	7	38
	13-32	0-53	27-73	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	32-40	0-53	27-73	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	40-46	0-53	27-73	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.37	.37			
	46-58	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
GrHC:														
Grant-----	0-7	0-35	50-88	15-26	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	7-11	0-53	0-88	15-26	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	11-17	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	17-35	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	35-54	0-85	0-82	15-40	1.40-1.65	0.6-2	0.16-0.22	0.0-2.9	0.5-1.0	.37	.37			
	54-58	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
Huska-----	0-6	0-35	50-88	12-26	1.30-1.55	0.6-2	0.10-0.20	0.0-2.9	1.0-3.0	.49	.49	2	5	56
	6-17	0-45	15-65	35-45	1.50-1.70	0.0015-0.06	0.06-0.10	6.0-8.9	0.0-1.0	.43	.43			
	17-32	0-45	15-65	35-60	1.50-1.70	0.0015-0.06	0.06-0.10	6.0-8.9	0.0-1.0	.43	.43			
	32-40	0-45	15-65	35-60	1.50-1.70	0.0015-0.06	0.06-0.10	6.0-8.9	0.0-1.0	.43	.43			
	40-50	0-45	15-65	35-60	1.50-1.70	0.0015-0.06	0.06-0.10	6.0-8.9	0.0-1.0	.43	.43			
	50-54	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
GrLC:														
Grainola-----	0-6	23-53	27-50	15-26	1.25-1.55	0.6-2	0.15-0.24	0.0-2.9	0.5-1.0	.43	.43	3	5	56
	6-11	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	11-18	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	18-33	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	33-39	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	39-42	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Lucien-----	0-7	32-52	27-50	15-25	1.30-1.55	2-6	0.12-0.24	0.0-2.9	1.0-3.0	.32	.32	2	5	56
	7-18	32-85	0-50	10-25	1.30-1.55	2-6	0.12-0.24	0.0-2.9	0.5-2.0	.32	.32			
	18-24	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
GrLE:														
Grainola-----	0-8	20-45	15-45	27-35	1.30-1.55	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.37	.37	3	7	38
	8-20	0-45	15-60	35-60	1.30-1.70	0.06-0.2	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	20-27	0-45	15-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	27-30	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
GrLE:														
Lucien-----	0-7	32-52	27-50	15-25	1.30-1.55	2-6	0.12-0.24	0.0-2.9	1.0-3.0	.32	.32	2	5	56
	7-12	32-85	0-50	10-25	1.30-1.55	2-6	0.12-0.24	0.0-2.9	0.5-2.0	.32	.32			
	12-15	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
GrnC:														
Grant-----	0-7	23-53	27-50	15-26	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	7-12	23-85	0-50	15-26	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	12-20	0-53	15-73	18-35	1.40-1.70	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	20-29	20-53	0-53	15-35	1.40-1.65	0.6-2	0.16-0.22	0.0-2.9	0.5-1.0	.37	.37			
	29-44	33-53	0-50	15-26	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	0.3-0.8	.37	.37			
	44-59	43-85	0-50	8-18	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	0.3-0.8	.37	.37			
	59-65	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
GrtB:														
Grant-----	0-11	0-50	27-88	15-26	1.30-1.50	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	11-21	0-53	0-88	15-26	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	21-51	0-53	27-82	18-35	1.40-1.70	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	51-57	0-53	0-82	15-35	1.40-1.65	0.6-2	0.16-0.22	0.0-2.9	0.5-1.0	.37	.37			
	57-64	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
HaPE:														
Harrah-----	0-5	43-85	0-50	10-18	1.30-1.60	2-6	0.11-0.15	0.0-2.9	0.5-2.0	.24	.24	5	3	86
	5-9	43-85	0-50	5-18	1.30-1.60	2-6	0.07-0.15	0.0-2.9	0.5-2.0	.20	.20			
	9-24	45-80	0-53	18-35	1.40-1.70	0.6-2	0.11-0.17	0.0-2.9	0.0-1.0	.32	.32			
	24-70	45-80	0-53	18-35	1.40-1.70	0.6-2	0.11-0.17	0.0-2.9	0.0-1.0	.32	.32			
	70-80	45-80	0-53	18-35	1.40-1.70	0.6-2	0.10-0.17	0.0-2.9	0.0-1.0	.32	.32			
Pulaski-----	0-6	43-85	0-50	10-18	1.40-1.65	2-6	0.13-0.19	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	6-12	32-85	0-50	10-18	1.30-1.70	2-6	0.13-0.19	0.0-2.9	0.0-1.0	.32	.32			
	12-50	35-90	3-50	5-18	1.30-1.70	2-6	0.07-0.20	0.0-2.9	0.0-1.0	.32	.32			
	50-55	32-85	0-50	10-18	1.30-1.70	2-6	0.13-0.19	0.0-2.9	0.0-1.0	.32	.32			
	55-65	35-90	3-50	5-18	1.30-1.70	2-6	0.07-0.20	0.0-2.9	0.0-1.0	.32	.32			
	65-68	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
HiRG:														
Highview-----	0-6	0-20	40-60	40-50	1.35-1.65	0.06-0.2	0.02-0.18	6.0-8.9	0.5-1.0	.15	.28	2	4	86
	6-17	0-20	40-65	35-50	1.35-1.65	0.06-0.2	0.02-0.18	6.0-8.9	0.0-0.5	.15	.28			
	17-25	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Rock outcrop.														

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
<b>KekA:</b>														
Keokuk-----	0-14	43-85	0-50	10-18	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	14-21	33-85	0-88	10-18	1.30-1.60	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	21-31	33-85	0-88	10-18	1.30-1.60	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	31-53	0-85	0-88	10-18	1.30-1.60	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	53-70	0-85	0-88	10-18	1.30-1.60	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	70-80	0-85	0-88	10-18	1.30-1.60	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
<b>KeoA:</b>														
Keokuk-----	0-6	43-85	0-50	10-18	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	6-13	0-85	0-88	10-18	1.30-1.60	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	13-27	0-85	0-88	10-18	1.30-1.60	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	27-80	0-85	0-88	10-18	1.30-1.60	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
<b>KgfB:</b>														
Kingfisher---	0-6	0-50	50-88	15-27	1.30-1.55	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.37	.37	3	5	56
	6-10	0-45	15-82	25-35	1.40-1.70	0.2-0.6	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	10-26	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.0-0.5	.32	.32			
	26-35	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
<b>KgLC:</b>														
Kingfisher---	0-5	33-53	27-50	15-27	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	3	5	56
	5-8	0-53	27-88	25-35	1.40-1.70	0.2-0.6	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	8-22	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.0-0.5	.32	.32			
	22-25	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
<b>Lucien-----</b>														
	0-7	43-85	0-50	10-18	1.30-1.55	2-6	0.13-0.20	0.0-2.9	1.0-3.0	.32	.32	2	3	86
	7-14	32-85	0-50	10-25	1.30-1.55	2-6	0.12-0.24	0.0-2.9	0.5-2.0	.32	.32			
	14-17	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			
<b>KgWC:</b>														
Kingfisher---	0-6	0-50	50-88	15-27	1.30-1.55	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.37	.37	3	5	56
	6-10	0-45	15-88	25-35	1.40-1.70	0.2-0.6	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	10-26	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.0-0.5	.32	.32			
	26-32	0-45	15-73	27-40	1.45-1.70	0.2-0.6	0.14-0.22	3.0-5.9	0.0-0.5	.32	.32			
	32-40	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
<b>Wakita-----</b>														
	0-4	0-50	50-88	18-22	1.30-1.50	0.6-2	0.12-0.18	0.0-2.9	1.0-3.0	.43	.43	2	4	86
	4-25	0-32	40-82	25-35	1.45-1.70	0.06-0.2	0.08-0.12	3.0-5.9	0.5-1.5	.43	.55			
	25-31	0-45	15-88	25-35	1.45-1.70	0.06-0.2	0.08-0.12	3.0-5.9	0.0-0.5	.43	.55			
	31-37	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
<b>KinC2:</b>														
Kingfisher---	0-8	33-53	27-50	15-27	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	3	5	56
	8-19	0-45	15-82	25-35	1.40-1.70	0.2-0.6	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	19-22	0-32	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.0-0.5	.32	.32			
	22-25	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
KowB:														
Konawa-----	0-6	43-85	0-50	8-18	1.40-1.65	2-6	0.13-0.19	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	6-14	43-100	0-50	2-15	1.40-1.75	0.6-2	0.05-0.19	0.0-2.9	0.3-1.0	.32	.32			
	14-24	45-80	0-27	18-30	1.45-1.70	0.6-6	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	24-44	45-80	0-27	18-30	1.45-1.70	0.6-6	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	44-60	45-90	0-30	7-30	1.40-1.70	2-6	0.07-0.19	0.0-2.9	0.1-0.7	.20	.20			
	60-80	50-90	0-30	3-30	1.40-1.70	2-6	0.07-0.19	0.0-2.9	0.1-0.7	.20	.20			
KowD:														
Konawa-----	0-8	43-85	0-50	8-18	1.40-1.65	2-6	0.13-0.19	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	8-20	43-100	0-50	2-15	1.40-1.75	2-20	0.05-0.19	0.0-2.9	0.3-1.0	.32	.32			
	20-33	45-80	0-27	18-30	1.45-1.70	0.6-6	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	33-50	45-80	0-27	10-30	1.45-1.70	0.6-6	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	50-67	45-90	0-50	7-30	1.40-1.70	2-6	0.07-0.19	0.0-2.9	0.1-0.7	.20	.20			
	67-80	45-100	0-50	2-15	1.40-1.75	2-20	0.05-0.19	0.0-2.9	0.3-1.0	.32	.32			
KrdA:														
Kirkland-----	0-9	0-50	50-88	13-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.49	.49	5	5	56
	9-28	0-45	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	28-40	0-45	0-60	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	40-53	0-45	0-65	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	53-80	0-45	0-65	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
KrdB:														
Kirkland-----	0-7	0-38	50-88	13-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.49	.49	5	5	56
	7-14	0-45	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	14-33	0-45	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	33-61	0-45	0-65	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	61-80	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
KrdB2:														
Kirkland-----	0-4	0-40	50-88	13-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.49	.49	5	5	56
	4-25	0-45	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	25-44	0-45	0-65	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	44-61	0-45	0-65	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	61-80	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
KrPB:														
Kirkland-----	0-8	0-40	50-88	13-26	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.49	.49	5	5	56
	8-21	0-45	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	21-41	0-45	0-60	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	41-64	0-45	0-65	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	64-80	0-45	0-65	35-60	1.30-1.65	0.0015-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
KrPB:														
Pawhuska-----	0-6	0-40	50-88	18-27	1.30-1.50	0.6-2	0.12-0.18	0.0-2.9	0.5-3.0	.49	.49	2	6	48
	6-22	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.5-2.0	.43	.43			
	22-43	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.5-1.0	.43	.43			
	43-55	0-45	0-68	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.2-0.8	.43	.43			
	55-72	0-45	0-69	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.2-0.8	.43	.43			
	72-80	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
LAN.														
Landfill														
Lela:														
Lela-----	0-6	0-20	40-60	40-60	1.25-1.45	0.0015-0.06	0.10-0.18	6.0-8.9	1.0-3.0	.37	.37	5	4	86
	6-13	0-20	40-60	40-60	1.25-1.45	0.0015-0.06	0.10-0.18	6.0-8.9	1.0-3.0	.37	.37			
	13-34	0-20	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	34-42	0-20	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	42-53	0-20	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	53-61	0-30	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	61-72	0-20	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	72-87	0-20	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
LveB:														
Lovedale-----	0-7	43-85	0-50	8-16	1.30-1.60	0.6-2	0.10-0.15	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	7-12	45-80	0-50	10-27	1.50-1.70	0.6-2	0.12-0.17	0.0-2.9	0.0-1.0	.28	.32			
	12-18	45-80	0-50	18-27	1.50-1.70	0.6-2	0.10-0.17	0.0-2.9	0.0-0.5	.28	.32			
	18-26	45-80	0-50	18-27	1.50-1.70	0.6-2	0.10-0.17	0.0-2.9	0.0-0.5	.28	.32			
	26-46	45-80	0-50	18-27	1.50-1.70	0.6-2	0.10-0.17	0.0-2.9	0.0-0.5	.28	.32			
	46-80	45-100	0-50	3-18	1.50-1.70	2-20	0.02-0.15	0.0-2.9	0.0-0.5	.15	.20			
M-W.														
Miscellaneous water														
McaA:														
McLain-----	0-7	0-20	40-73	27-35	1.30-1.60	0.2-0.6	0.15-0.22	3.0-5.9	1.0-3.0	.37	.37	5	7	38
	7-17	0-45	15-65	35-50	1.45-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.5-2.0	.37	.37			
	17-31	0-45	15-65	35-50	1.45-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.5-2.0	.37	.37			
	31-46	0-45	15-65	35-50	1.45-1.70	0.06-0.2	0.12-0.22	6.0-8.9	0.5-2.0	.37	.37			
	46-80	0-53	27-65	20-45	1.40-1.70	0.06-0.6	0.12-0.24	6.0-8.9	0.5-2.0	.43	.43			
MilB:														
Milan-----	0-7	32-52	27-50	14-27	1.35-1.45	0.6-2	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	6	48
	7-12	20-80	27-53	25-35	1.40-1.55	0.2-0.6	0.14-0.21	3.0-5.9	0.0-0.5	.28	.32			
	12-26	20-80	27-53	25-35	1.40-1.55	0.2-0.6	0.14-0.21	3.0-5.9	0.0-0.5	.28	.32			
	26-45	20-80	0-53	10-35	1.40-1.70	0.2-6	0.10-0.20	0.0-2.9	0.0-0.5	.28	.32			
	45-72	20-80	0-50	10-35	1.40-1.70	0.2-6	0.10-0.20	0.0-2.9	0.0-0.5	.28	.32			
	72-80	20-80	0-53	5-35	1.45-1.70	0.2-6	0.06-0.20	0.0-2.9	0.0-0.5	.32	.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
MilC:														
Milan-----	0-9	32-52	27-50	14-27	1.35-1.45	0.6-2	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	6	48
	9-15	20-80	0-53	14-35	1.40-1.55	0.2-0.6	0.14-0.21	3.0-5.9	0.0-0.5	.28	.32			
	15-33	20-80	0-53	10-35	1.40-1.70	0.2-6	0.10-0.20	0.0-2.9	0.0-0.5	.28	.32			
	33-48	20-80	0-53	10-35	1.40-1.70	0.2-6	0.10-0.20	0.0-2.9	0.0-0.5	.28	.32			
	48-62	20-80	0-53	5-35	1.45-1.70	0.2-6	0.06-0.20	0.0-2.9	0.0-0.5	.32	.32			
	62-80	45-90	0-50	5-27	1.45-1.70	0.2-6	0.06-0.20	0.0-2.9	0.0-0.5	.32	.32			
MinB:														
Minco-----	0-8	43-85	0-50	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	1.0-3.0	.37	.37	5	3	86
	8-15	0-85	0-88	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	1.0-3.0	.37	.37			
	15-32	0-85	0-88	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	0.2-1.0	.37	.37			
	32-46	0-85	0-88	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	0.2-1.0	.37	.37			
	46-62	0-85	0-88	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	0.2-0.7	.37	.37			
	62-80	0-85	0-88	8-18	1.35-1.60	0.6-2	0.11-0.24	0.0-2.9	0.2-0.7	.37	.37			
MinC:														
Minco-----	0-8	43-85	0-50	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	1.0-3.0	.37	.37	5	3	86
	8-17	0-85	0-88	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	1.0-3.0	.37	.37			
	17-23	0-85	0-88	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	0.2-1.0	.37	.37			
	23-54	0-85	0-88	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	0.2-1.0	.37	.37			
	54-59	0-85	0-88	8-18	1.35-1.60	0.6-2	0.13-0.24	0.0-2.9	0.2-0.8	.37	.37			
	59-80	0-85	0-88	8-18	1.35-1.60	0.6-2	0.11-0.24	0.0-2.9	0.2-0.8	.37	.37			
MirA:														
Miller-----	0-10	0-20	40-73	35-40	1.30-1.60	0.06-0.2	0.18-0.22	3.0-5.9	1.0-3.0	.43	.43	5	7	38
	10-30	0-45	0-65	35-60	1.35-1.65	0.0015-0.06	0.12-0.19	6.0-8.9	0.5-2.0	.37	.37			
	30-44	0-45	0-65	35-60	1.35-1.65	0.06-0.2	0.12-0.19	6.0-8.9	0.5-1.0	.37	.37			
	44-80	0-45	0-65	25-50	1.35-1.65	0.06-0.2	0.12-0.19	6.0-8.9	0.5-1.0	.37	.37			
MisA:														
Miller-----	0-10	0-20	40-73	35-40	1.30-1.60	0.06-0.2	0.18-0.22	3.0-5.9	1.0-3.0	.43	.43	5	4L	86
	10-23	0-45	0-65	35-60	1.35-1.65	0.0015-0.06	0.07-0.10	6.0-8.9	0.5-2.0	.37	.37			
	23-34	0-45	0-65	35-60	1.35-1.65	0.0015-0.06	0.07-0.10	6.0-8.9	0.5-2.0	.37	.37			
	34-40	2-60	30-60	0-60	1.35-1.65	0.06-0.2	0.07-0.10	6.0-8.9	0.5-1.0	.37	.37			
	40-51	0-45	0-65	35-60	1.35-1.65	0.06-0.2	0.07-0.10	6.0-8.9	0.5-1.0	.37	.37			
	51-80	0-45	0-65	35-60	1.35-1.65	0.06-0.2	0.07-0.10	6.0-8.9	0.5-1.0	.37	.37			
MPNC2:														
Milan-----	0-11	32-52	27-50	14-27	1.35-1.45	0.6-2	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	6	48
	11-16	20-80	0-53	25-35	1.40-1.55	0.2-0.6	0.14-0.21	3.0-5.9	0.0-0.5	.28	.32			
	16-28	23-80	0-53	25-35	1.40-1.55	0.2-0.6	0.14-0.21	3.0-5.9	0.0-0.5	.28	.32			
	28-57	20-80	0-53	10-35	1.40-1.70	0.2-6	0.10-0.20	0.0-2.9	0.0-0.5	.28	.32			
	57-65	20-80	0-53	5-35	1.45-1.70	0.2-6	0.06-0.20	0.0-2.9	0.0-0.5	.32	.32			
	65-75	20-90	0-53	5-35	1.45-1.70	0.2-6	0.06-0.20	0.0-2.9	0.0-0.5	.32	.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
MPNC2:														
Pawhuska-----	0-8	0-50	50-88	18-27	1.30-1.50	0.6-2	0.12-0.18	0.0-2.9	0.5-3.0	.49	.49	2	6	48
	8-17	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.5-2.0	.43	.43			
	17-27	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.2-1.0	.43	.43			
	27-40	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.2-0.8	.43	.43			
	40-64	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.0-0.8	.43	.43			
	64-80	20-80	0-53	5-35	1.45-1.70	0.2-6	0.06-0.20	0.0-2.9	0.0-0.5	.32	.32			
Norge-----	0-6	0-40	50-88	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	6-14	0-45	15-88	18-35	1.40-1.70	0.2-2	0.15-0.24	3.0-5.9	0.5-2.0	.32	.32			
	14-35	0-45	40-82	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	35-45	0-45	40-82	27-50	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	45-80	0-45	40-82	27-50	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
MulC:														
Mulhall-----	0-7	23-53	27-50	15-26	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	7-13	20-53	15-53	18-30	1.45-1.70	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	13-26	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	26-42	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	42-60	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	60-80	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
MulD:														
Mulhall-----	0-10	23-53	27-50	15-26	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	10-14	20-53	15-53	18-30	1.45-1.70	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	14-23	30-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	23-33	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	33-42	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	42-56	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	56-80	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
MulD4:														
Mulhall-----	0-14	23-53	27-50	15-26	1.30-1.55	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	6	48
	14-19	20-53	15-53	18-30	1.45-1.70	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	19-29	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	29-44	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
	44-80	20-80	0-53	20-35	1.45-1.70	0.6-2	0.10-0.20	0.0-2.9	0.0-0.5	.32	.32			
NeDG:														
Newalla-----	0-5	43-85	0-50	7-17	1.40-1.65	0.6-2	0.13-0.19	0.0-2.9	0.5-3.0	.37	.37	4	3	86
	5-14	43-85	0-50	7-17	1.40-1.65	0.6-2	0.13-0.19	0.0-2.9	0.5-3.0	.37	.37			
	14-22	20-80	0-53	20-35	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.43	.43			
	22-32	0-45	0-60	40-60	1.30-1.60	0.0015-0.06	0.12-0.18	6.0-8.9	0.0-0.5	.37	.37			
	32-40	0-45	0-60	40-60	1.30-1.60	0.0015-0.06	0.12-0.18	6.0-8.9	0.0-0.5	.37	.37			
	40-54	0-45	0-60	40-60	1.30-1.65	0.0015-0.06	0.04-0.18	6.0-8.9	0.0-0.5	.37	.37			
	54-58	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
NeDG:														
Darnell-----	0-4	43-85	0-50	10-20	1.30-1.65	2-6	0.12-0.16	0.0-2.9	0.5-1.0	.10	.20	2	8	0
	4-11	43-85	0-50	10-25	1.40-1.70	2-6	0.12-0.16	0.0-2.9	0.0-0.5	.20	.24			
	11-15	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
NorA:														
Norge-----	0-11	0-32	50-88	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	11-14	0-45	15-88	18-35	1.40-1.70	0.2-2	0.15-0.24	3.0-5.9	0.5-2.0	.32	.32			
	14-23	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	23-32	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	32-38	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	38-49	0-45	15-73	27-50	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	49-58	0-45	15-73	27-50	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	58-81	0-45	15-73	27-50	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
NorB:														
Norge-----	0-9	0-32	50-88	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	9-15	0-32	50-88	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	15-19	0-45	15-82	18-35	1.40-1.70	0.2-2	0.15-0.24	3.0-5.9	0.5-2.0	.32	.32			
	19-30	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	30-44	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	44-67	0-45	15-73	27-50	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	67-80	0-45	15-88	12-50	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
NorC:														
Norge-----	0-11	0-32	50-88	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	11-16	0-45	15-88	18-35	1.40-1.70	0.2-2	0.15-0.24	3.0-5.9	0.5-2.0	.32	.32			
	16-27	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	27-47	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	47-60	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	60-80	0-45	15-88	18-27	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
NorC2:														
Norge-----	0-9	0-32	50-88	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	9-18	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	18-30	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	30-44	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	44-64	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	64-86	0-45	15-88	15-60	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
NoUC:														
Norge-----	0-7	0-32	50-88	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	7-10	0-45	15-88	18-35	1.40-1.70	0.2-2	0.15-0.24	3.0-5.9	0.5-2.0	.32	.32			
	10-20	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	20-39	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	39-45	0-45	15-73	27-35	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	45-80	0-45	15-73	27-50	1.45-1.70	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
Urban land.														
OWWE:														
Oil waste land-----	0-60	---	---	---	---	0.0000-0.2	---	---	---	---	---	--	8	0
Westsum-----	0-9	0-20	40-73	28-35	1.30-1.60	0.2-0.6	0.18-0.22	3.0-5.9	1.0-3.0	.37	.37	5	7	38
	9-14	0-45	40-65	30-45	1.35-1.70	0.06-0.2	0.14-0.22	6.0-8.9	1.0-2.0	.37	.37			
	14-20	0-45	40-65	35-50	1.35-1.70	0.0015-0.06	0.14-0.22	9.0-25.0	0.5-1.0	.37	.37			
	20-28	0-45	40-65	35-50	1.35-1.70	0.0015-0.06	0.14-0.22	9.0-25.0	0.2-1.0	.37	.37			
	28-45	0-20	40-60	40-50	1.45-1.60	0.0015-0.06	0.14-0.18	9.0-25.0	0.2-1.0	.37	.37			
	45-56	0-20	40-60	40-50	1.45-1.60	0.0015-0.06	0.14-0.18	9.0-25.0	0.0-1.0	.37	.37			
	56-72	0-45	15-60	35-50	1.35-1.70	0.0015-0.06	0.14-0.20	9.0-25.0	0.0-1.0	.37	.37			
PoaA:														
Port-----	0-19	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	19-30	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	30-43	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.0-1.0	.37	.37			
	43-59	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.0-1.0	.37	.37			
	59-74	0-45	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
PoOA:														
Port-----	0-16	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	16-23	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	23-40	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.0-1.0	.37	.37			
	40-51	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.0-1.0	.37	.37			
	51-80	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.5-2.0	.37	.37			
Oscar-----	0-4	0-40	50-88	15-26	1.35-1.60	0.6-2	0.13-0.21	0.0-2.9	0.5-1.0	.43	.43	2	5	56
	4-10	0-40	50-88	15-26	1.35-1.60	0.6-2	0.13-0.21	0.0-2.9	0.5-1.0	.43	.43			
	10-16	0-45	15-73	24-35	1.45-1.70	0.06-0.2	0.10-0.15	3.0-5.9	0.5-1.0	.55	.55			
	16-33	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.0-1.0	.37	.37			
	33-43	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.5-2.0	.37	.37			
	43-80	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.5-2.0	.37	.37			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
PorA: Port-----	0-8	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	8-14	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	14-20	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	20-31	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	31-40	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.0-1.0	.37	.37			
	40-48	0-40	50-88	12-26	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	0.0-1.0	.37	.37			
	48-55	4-53	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	55-68	0-53	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.5-2.0	.37	.37			
	68-74	0-53	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	74-85	0-53	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	85-93	0-53	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
PotA: Port-----	0-10	0-20	40-73	27-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	1.0-3.0	.32	.32	5	6	48
	10-26	0-20	40-73	27-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	1.0-3.0	.32	.32			
	26-35	0-45	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	35-66	0-45	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	66-80	0-45	15-73	20-35	1.30-1.60	0.6-2	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
PukA: Pulaski-----	0-8	43-85	0-50	10-18	1.40-1.65	2-6	0.13-0.19	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	8-20	32-85	0-50	10-18	1.30-1.70	2-6	0.13-0.19	0.0-2.9	0.0-1.0	.32	.32			
	20-37	32-85	0-50	10-18	1.30-1.70	2-6	0.13-0.19	0.0-2.9	0.0-1.0	.32	.32			
	37-47	32-85	0-50	10-18	1.30-1.70	2-6	0.13-0.19	0.0-2.9	0.5-2.0	.32	.32			
	47-80	43-90	0-50	5-18	1.30-1.70	2-6	0.07-0.20	0.0-2.9	0.0-1.0	.32	.32			
PulA: Pulaski-----	0-9	43-85	0-50	10-18	1.40-1.65	2-6	0.13-0.19	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	9-27	32-85	0-50	10-18	1.30-1.70	2-6	0.13-0.19	0.0-2.9	0.0-1.0	.32	.32			
	27-80	32-90	5-50	5-18	1.30-1.70	2-6	0.07-0.20	0.0-2.9	0.0-1.0	.32	.32			
RefC2: Renfrow-----	0-6	23-53	27-50	18-26	1.25-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.49	.49	5	6	48
	6-35	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	35-73	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
ReGC2: Renfrow-----	0-8	0-20	40-73	27-35	1.30-1.55	0.2-0.6	0.15-0.22	3.0-5.9	1.0-3.0	.43	.43	5	6	48
	8-12	0-45	15-82	22-40	1.30-1.75	0.2-0.6	0.15-0.24	3.0-5.9	0.5-2.0	.43	.43			
	12-30	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	30-44	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	44-63	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	63-80	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
ReGC2:														
Grainola-----	0-7	0-20	40-73	27-35	1.30-1.55	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.37	.37	3	7	38
	7-12	0-45	0-65	35-60	1.30-1.70	0.06-0.2	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	12-26	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	26-33	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	33-40	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
ReiA:														
Reinach-----	0-8	43-85	0-50	12-18	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37	5	3	86
	8-23	43-85	0-50	12-18	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	23-30	43-85	0-50	12-18	1.30-1.55	0.6-2	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	30-42	0-85	0-88	12-18	1.30-1.55	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	42-65	0-85	0-88	12-18	1.30-1.55	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	65-82	0-85	0-88	12-18	1.30-1.55	0.6-2	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
RenB:														
Renfrow-----	0-9	0-40	50-88	18-26	1.25-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.49	.49	5	6	48
	9-13	0-45	15-88	18-35	1.30-1.75	0.2-0.6	0.15-0.24	3.0-5.9	0.5-2.0	.43	.43			
	13-23	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	23-42	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	42-60	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	60-80	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
RenC:														
Renfrow-----	0-10	0-40	50-88	18-26	1.25-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.49	.49	5	6	48
	10-13	0-45	15-88	18-35	1.30-1.75	0.2-0.6	0.15-0.24	3.0-5.9	0.5-2.0	.43	.43			
	13-28	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	28-36	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	36-50	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	50-65	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	65-80	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
RewC2:														
Renfrow-----	0-10	0-20	40-73	27-35	1.30-1.55	0.2-0.6	0.15-0.22	3.0-5.9	1.0-3.0	.43	.43	5	6	48
	10-24	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	24-37	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	37-54	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	54-63	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	63-80	---	---	---	1.85-2.00	0.0015-0.06	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
RGPD3:														
Renfrow-----	0-10	20-45	15-53	27-35	1.30-1.55	0.2-0.6	0.15-0.22	3.0-5.9	1.0-3.0	.43	.43	4	6	48
	10-24	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	24-44	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
	44-80	0-45	0-65	35-55	1.30-1.75	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
Grainola-----	0-5	0-20	40-73	27-35	1.30-1.55	0.2-0.6	0.15-0.22	3.0-5.9	0.5-1.0	.37	.37	2	7	38
	5-21	0-45	0-60	35-60	1.30-1.70	0.06-0.2	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	21-24	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Pawhuska-----	0-3	0-32	50-88	18-27	1.30-1.50	0.6-2	0.12-0.18	0.0-2.9	0.5-3.0	.49	.49	1	6	48
	3-13	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.5-1.0	.43	.43			
	13-42	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.2-0.8	.43	.43			
	42-80	0-45	0-65	35-50	1.35-1.65	0.0015-0.06	0.06-0.20	6.0-8.9	0.2-0.8	.43	.43			
SlaB:														
Slaughter-														
ville-----	0-10	43-85	0-50	10-18	1.30-1.60	2-6	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	5	3	86
	10-39	43-85	0-50	10-18	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20			
	39-50	43-85	0-50	10-18	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20			
	50-80	43-85	0-50	15-30	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.0-1.0	.20	.20			
SlaC:														
Slaughter-														
ville-----	0-13	43-85	0-50	10-18	1.30-1.60	2-6	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	5	3	86
	13-19	43-85	0-50	10-18	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20			
	19-30	43-85	0-50	10-18	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20			
	30-50	43-85	0-50	10-18	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20			
	50-80	43-90	0-50	3-18	1.50-1.70	2-20	0.07-0.15	0.0-2.9	0.0-1.0	.20	.20			
SlaG:														
Slaughter-														
ville-----	0-16	43-85	0-50	10-18	1.30-1.60	2-6	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	5	3	86
	16-33	43-85	0-50	10-18	1.50-1.70	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20			
	33-80	43-90	0-50	3-18	1.50-1.70	2-20	0.07-0.15	0.0-2.9	0.0-1.0	.20	.20			
StDD:														
Stephenville-														
	0-5	43-85	0-50	10-20	1.40-1.65	2-6	0.13-0.19	0.0-2.9	0.5-1.0	.24	.24	3	3	86
	5-9	43-90	0-50	5-15	1.40-1.70	2-20	0.07-0.19	0.0-2.9	0.0-0.5	.20	.20			
	9-30	43-85	0-27	18-35	1.35-1.75	0.6-2	0.13-0.19	0.0-2.9	0.5-1.0	.32	.32			
	30-36	43-85	0-27	10-35	1.35-1.75	0.6-2	0.13-0.19	0.0-2.9	0.5-1.0	.32	.32			
	36-40	---	---	---	1.85-2.00	0.2-0.6	---	---	---	---	---			
Darnell-----	0-4	43-85	0-50	10-20	1.30-1.65	2-6	0.11-0.15	0.0-2.9	0.5-1.0	.20	.24	2	3	86
	4-12	32-85	0-50	10-25	1.40-1.70	2-6	0.12-0.16	0.0-2.9	0.0-0.5	.24	.32			
	12-15	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
TabA: Tabler-----	0-10	0-40	50-88	12-27	1.30-1.55	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.49	.49	5	6	48
	10-25	0-45	0-60	40-55	1.35-1.60	0.0015-0.06	0.12-0.18	6.0-8.9	0.0-2.0	.37	.37			
	25-43	0-45	0-60	40-55	1.35-1.60	0.0015-0.06	0.12-0.18	6.0-8.9	0.0-2.0	.37	.37			
	43-65	0-45	0-65	35-55	1.35-1.65	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.37	.37			
	65-80	0-45	0-65	35-55	1.35-1.65	0.0015-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.37	.37			
TeaA: Tearney-----	0-10	0-20	40-60	40-60	1.25-1.45	0.0015-0.06	0.12-0.18	6.0-8.9	1.0-3.0	.37	.37	4	4	86
	10-26	0-45	0-65	35-60	1.35-1.70	0.0015-0.06	0.12-0.22	6.0-8.9	0.0-0.5	.37	.37			
	26-30	70-100	0-30	2-14	1.50-1.70	6-20	0.02-0.11	0.0-2.9	0.0-0.5	.15	.15			
	30-80	70-100	0-30	2-14	1.50-1.70	6-20	0.02-0.11	0.0-2.9	0.0-0.5	.15	.15			
TelB: Teller-----	0-8	32-52	27-50	10-20	1.30-1.70	2-6	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	8-12	32-52	27-50	10-20	1.30-1.70	2-6	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	12-20	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	20-30	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	30-50	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	50-80	32-85	0-50	10-20	1.30-1.70	2-6	0.13-0.20	0.0-2.9	0.5-1.0	.32	.32			
TelD: Teller-----	0-12	32-52	27-50	10-20	1.30-1.70	2-6	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	12-17	32-52	27-50	10-20	1.30-1.70	2-6	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	17-27	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	27-45	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	45-58	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	58-80	32-85	0-50	10-20	1.30-1.70	2-6	0.13-0.20	0.0-2.9	0.5-1.0	.32	.32			
TelD2: Teller-----	0-6	32-52	27-50	10-20	1.30-1.70	2-6	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	6-11	32-52	27-50	10-20	1.30-1.70	2-6	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37			
	11-16	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	16-31	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	31-42	20-80	0-53	18-30	1.30-1.70	0.6-2	0.14-0.20	0.0-2.9	0.5-1.0	.32	.32			
	42-72	32-85	0-50	10-20	1.30-1.70	2-6	0.13-0.20	0.0-2.9	0.5-1.0	.32	.32			
	72-85	32-85	0-50	10-20	1.30-1.70	2-6	0.13-0.20	0.0-2.9	0.5-1.0	.32	.32			
VanA: Vanoss-----	0-10	0-40	50-88	15-26	1.30-1.50	0.6-2	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	10-15	0-53	15-88	18-30	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-2.0	.32	.32			
	15-30	0-45	15-73	27-35	1.45-1.70	0.6-2	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	30-42	0-45	15-73	27-35	1.45-1.70	0.6-2	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	42-52	0-45	15-73	27-35	1.45-1.70	0.6-2	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	52-80	0-45	15-88	18-35	1.40-1.70	0.6-2	0.15-0.24	3.0-5.9	0.5-1.0	.32	.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
W. Water														
WauA:														
Waurika-----	0-9	0-40	50-88	15-25	1.30-1.50	0.6-2	0.16-0.24	0.0-2.9	1.0-3.0	.49	.49	5	6	48
	9-12	0-52	27-88	15-25	1.30-1.60	0.6-2	0.15-0.20	0.0-2.9	0.5-1.0	.49	.49			
	12-31	0-45	0-60	40-60	1.35-1.60	0.0015-0.06	0.10-0.17	6.0-8.9	1.0-2.0	.37	.37			
	31-39	0-45	0-65	30-50	1.40-1.70	0.06-0.2	0.10-0.19	6.0-8.9	0.0-1.0	.37	.37			
	39-61	0-45	0-65	30-50	1.40-1.70	0.06-0.2	0.10-0.19	6.0-8.9	0.0-1.0	.37	.37			
	61-80	0-45	15-65	27-39	1.45-1.70	0.06-0.2	0.15-0.19	3.0-5.9	0.0-1.0	.43	.43			
WesB:														
Westsum-----	0-10	0-20	40-73	28-35	1.30-1.60	0.2-0.6	0.18-0.22	3.0-5.9	1.0-3.0	.37	.37	5	7	38
	10-16	0-20	40-65	30-45	1.35-1.70	0.06-0.2	0.14-0.22	6.0-8.9	1.0-2.0	.37	.37			
	16-30	0-20	40-65	35-50	1.35-1.70	0.0015-0.06	0.14-0.22	9.0-25.0	0.5-1.0	.37	.37			
	30-36	0-20	40-65	35-50	1.35-1.70	0.0015-0.06	0.14-0.22	9.0-25.0	0.2-0.8	.37	.37			
	36-52	0-20	40-60	40-50	1.45-1.60	0.0015-0.06	0.14-0.18	9.0-25.0	0.2-0.8	.37	.37			
	52-65	0-20	40-60	40-50	1.45-1.60	0.0015-0.06	0.14-0.18	9.0-25.0	0.0-0.5	.37	.37			
	65-80	0-45	15-60	35-50	1.35-1.70	0.0015-0.06	0.14-0.20	9.0-25.0	0.0-0.5	.37	.37			
WesC:														
Westsum-----	0-6	0-20	40-73	28-35	1.30-1.60	0.2-0.6	0.18-0.22	3.0-5.9	1.0-3.0	.37	.37	5	7	38
	6-10	0-20	40-65	28-35	1.30-1.60	0.2-0.6	0.18-0.22	3.0-5.9	1.0-3.0	.37	.37			
	10-17	0-20	40-65	35-50	1.35-1.70	0.0015-0.06	0.14-0.22	9.0-25.0	0.5-1.0	.37	.37			
	17-31	0-20	40-65	35-50	1.35-1.70	0.0015-0.06	0.14-0.22	9.0-25.0	0.2-0.8	.37	.37			
	31-59	0-20	40-65	35-50	1.35-1.70	0.0015-0.06	0.14-0.22	9.0-25.0	0.2-0.8	.37	.37			
	59-75	0-45	15-60	35-50	1.35-1.70	0.0015-0.06	0.14-0.20	9.0-25.0	0.0-0.5	.37	.37			
	75-80	0-45	15-60	35-50	1.35-1.70	0.0015-0.06	0.14-0.20	9.0-25.0	0.0-0.5	.37	.37			
WiLC:														
Wisby-----	0-6	43-85	0-50	7-15	1.30-1.60	2-6	0.10-0.14	0.0-2.9	1.0-2.0	.15	.20	4	3	86
	6-10	32-85	0-50	10-18	1.40-1.70	2-6	0.10-0.20	0.0-2.9	0.5-2.0	.24	.32			
	10-17	32-85	0-50	10-18	1.40-1.70	2-6	0.10-0.20	0.0-2.9	0.5-2.0	.24	.32			
	17-32	32-85	0-50	10-18	1.40-1.70	2-6	0.10-0.20	0.0-2.9	0.5-2.0	.24	.32			
	32-36	70-100	0-30	2-10	1.50-1.70	6-20	0.02-0.06	0.0-2.9	0.0-0.5	.10	.10			
	36-80	70-100	0-30	2-10	1.50-1.70	6-20	0.02-0.06	0.0-2.9	0.0-0.5	.10	.10			
Lovedale-----	0-6	43-85	0-50	8-16	1.30-1.60	0.6-2	0.10-0.15	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	6-10	43-85	0-53	18-27	1.50-1.70	0.6-2	0.12-0.17	0.0-2.9	0.0-1.0	.28	.32			
	10-15	43-85	0-50	18-27	1.50-1.70	0.6-2	0.12-0.17	0.0-2.9	0.0-1.0	.28	.32			
	15-33	43-85	0-50	18-27	1.50-1.70	0.6-2	0.12-0.17	0.0-2.9	0.0-1.0	.28	.32			
	33-46	32-85	0-50	8-27	1.50-1.70	0.6-2	0.10-0.17	0.0-2.9	0.0-0.5	.28	.32			
	46-61	43-85	0-50	8-27	1.50-1.70	0.6-2	0.10-0.17	0.0-2.9	0.0-0.5	.28	.32			
	61-80	43-100	0-50	3-18	1.50-1.70	2-20	0.02-0.15	0.0-2.9	0.0-0.5	.15	.20			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
ZaHC:														
Zaneis-----	0-7	23-53	27-50	15-26	1.30-1.60	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	7-10	20-80	0-53	18-30	1.40-1.70	0.6-2	0.12-0.20	0.0-2.9	0.5-2.0	.37	.37			
	10-28	20-80	0-53	20-38	1.45-1.70	0.2-0.6	0.12-0.20	3.0-5.9	0.5-1.0	.32	.32			
	28-38	20-80	0-53	20-38	1.45-1.70	0.2-0.6	0.12-0.20	3.0-5.9	0.5-1.0	.32	.32			
	38-46	20-85	0-53	18-30	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
	46-50	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
Huska-----	0-8	23-53	27-50	12-26	1.30-1.55	0.6-2	0.10-0.20	0.0-2.9	1.0-3.0	.49	.49	2	5	56
	8-20	0-45	0-65	35-45	1.50-1.70	0.0015-0.06	0.06-0.10	6.0-8.9	0.0-1.0	.43	.43			
	20-42	0-45	15-65	35-60	1.50-1.70	0.0015-0.06	0.06-0.10	6.0-8.9	0.0-1.0	.43	.43			
	42-54	0-45	15-65	35-60	1.50-1.70	0.0015-0.06	0.06-0.10	6.0-8.9	0.0-1.0	.43	.43			
	54-60	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			
ZanB:														
Zaneis-----	0-11	32-52	27-50	15-26	1.30-1.60	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	11-15	20-52	27-53	15-35	1.30-1.60	0.6-2	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37			
	15-30	20-80	0-53	18-35	1.40-1.70	0.6-2	0.12-0.20	0.0-2.9	0.5-2.0	.37	.37			
	30-42	20-80	0-53	20-38	1.45-1.70	0.2-0.6	0.12-0.20	3.0-5.9	0.5-1.0	.32	.32			
	42-50	20-85	0-53	18-30	1.40-1.70	0.6-2	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
	50-55	---	---	---	1.85-2.00	0.0000-0.2	---	---	---	---	---			

## Physical Analyses of Selected Soils

The results of physical analyses of several pedons are given in the table "Physical Properties of Selected Soils." The data are for soils sampled at carefully selected sites. The pedons are representative of the series described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Survey Laboratory, Lincoln, Nebraska.

Most determinations, except for those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods (10).

*Clay*—(fraction less than 0.002 mm) pipette extraction, weight percentages of all material less than 2 mm (3A1).

*Silt*—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1).

*Sand*—(0.05-2.0 mm fraction) weight percentages of material less than 2 mm (3A1).

## Physical Properties of Selected Soils

(The locations of sampled pedons are given in the "Engineering Index Test Data" table. The symbol < means less than; > means greater than. TR means trace)

Soil name and sample number	Depth in centimeters	Horizon	Total			Clay		Silt			Sand			
			Clay <0.02 mm	Silt 0.02 - .05 mm	Sand .05 -2 mm	Fine <0.0002 mm	CO3 <0.002 mm	Fine (.002-.02 mm)	Coarse (.02-.5 mm)	Very fine (.05-.10 mm)	Fine (.10-.25 mm)	Medium (.25-.50 mm)	Coarse (.5-1 mm)	Very coarse (1-2 mm)
Bethany silt loam:														
(S900K-103-005)	0-8	Ap	20.5	63.2	16.3	11.0	---	22.0	41.2	14.1	1.3	0.6	0.3	TR
	8-15	Ad	20.2	63.8	16.0	11.5	---	22.7	41.1	13.9	1.2	0.6	0.2	0.1
	15-22	A	21.0	63.1	15.9	11.8	---	22.6	40.5	13.9	1.1	0.7	0.2	---
	22-31	BA	29.7	59.4	10.9	20.0	---	23.8	35.6	9.5	0.7	0.5	0.2	TR
	31-46	Bt1	47.2	45.3	7.5	36.7	---	22.8	22.5	6.7	0.3	0.3	0.2	TR
	46-75	Bt2	43.9	47.2	8.9	33.3	---	24.4	22.8	7.8	0.5	0.3	0.2	0.1
	75-99	Btk1	41.8	49.0	9.2	21.1	---	23.9	25.1	7.0	0.6	0.6	0.5	0.5
	99-120	Btk2	43.5	45.7	10.8	26.4	---	18.8	26.9	8.3	0.7	0.7	0.5	0.6
	120-149	Bt1b	47.6	40.5	11.9	27.5	---	17.0	23.5	9.9	0.6	0.5	0.6	0.3
	149-179	Bt2b	46.8	42.8	10.4	33.4	---	14.8	28.0	9.2	0.5	0.3	0.2	0.2
	179-207	Bt3b	43.6	46.4	10.0	34.6	---	15.9	30.5	8.9	0.5	0.3	0.2	0.1
	207-253	Bt4b	41.0	48.7	10.3	32.0	---	15.2	33.5	9.2	0.5	0.3	0.2	0.1
	253-263	Btk1b	33.4	56.1	10.5	21.0	1.0	31.9	24.2	7.3	1.0	0.9	0.9	0.4
Coyle loam:														
(S900K-103-002)	0-25	A	20.7	32.8	46.5	13.1	---	9.4	23.4	33.2	12.7	0.3	0.2	0.1
	25-42	Bt1	28.6	24.2	47.2	21.2	---	6.8	17.4	30.1	16.4	0.4	0.2	0.1
	42-59	Bt2	29.8	16.5	53.7	22.2	---	5.1	11.4	29.3	23.8	0.3	0.2	0.1
	59-76	BC	22.1	5.7	72.2	16.9	---	0.7	5.0	31.4	40.4	0.2	0.1	0.1
	76-96	Cr	15.0	7.9	77.1	9.6	---	0.9	7.0	58.9	18.1	0.1	TR	---
Dilworth silty clay loam:														
(S920K-103-001)	0-22	A	44.0	44.7	11.3	---	---	19.7	25.0	7.5	0.9	0.8	1.1	1.0
	22-34	Bt	45.1	45.5	9.4	---	2.2	35.4	10.1	2.1	0.9	1.2	2.3	2.9
	34-45	Btk	40.7	52.3	7.0	---	0.9	42.1	10.2	1.8	0.9	1.2	1.5	1.6
	45-59	BCK	35.0	37.9	27.1	---	---	27.5	10.4	11.6	11.2	1.6	1.2	1.5
	59-83	Ck	35.3	36.9	27.8	---	1.3	28.9	8.0	9.0	11.2	3.7	2.0	1.9
	83-107	Cr1	27.2	20.2	52.6	---	---	14.7	5.5	9.5	27.3	14.3	1.5	TR
	107-129	Cr2	41.3	50.4	8.3	---	0.6	45.7	4.7	1.9	1.4	1.2	2.0	1.8
	129-160	Cr3	41.3	52.0	6.7	---	---	47.9	4.1	2.2	2.2	1.0	0.7	0.6

Physical Properties of Selected Soils--Continued

Soil name and sample number	Depth in centimeters	Horizon	Total			Clay		Silt			Sand				
			Clay <0.02 mm	Silt 0.02 - .05 mm	Sand .05 -2 mm	Fine <0.0002 mm	CO3 <0.0002 mm	Fine (.002-.02 mm)	Coarse (.02-.5 mm)	Very fine (.05-.10 mm)	Fine (.10-.25 mm)	Medium (.25-.50 mm)	Coarse (.5-1 mm)	Very coarse (1-2 mm)	
Grainola silty clay loam: (S900K-103-003)	0-8	Ap1	36.0	42.4	21.6	24.4	---	13.5	28.9	14.9	5.3	0.5	0.5	0.4	
	8-1	Ap2	37.8	43.0	19.2	25.8	---	13.9	29.1	13.2	4.6	0.4	0.4	0.6	
	13-22	Ad	40.8	41.6	17.6	27.7	---	15.0	26.6	11.6	4.4	0.4	0.5	0.7	
	22-37	Btk1	48.6	34.3	17.1	28.3	1	19.4	14.9	7.5	3.4	2.0	2.3	1.9	
	37-63	Btk2	49.6	36.0	14.4	29.6	1	22.4	13.6	5.7	3.1	1.8	2.2	1.6	
	63-86	Btk3	68.8	27.1	4.1	33.5	1	24.6	2.5	0.8	0.8	1.0	0.9	0.6	
	86-102	Btk4	60.6	34.1	5.3	20.8	1	30.9	3.2	1.3	1.0	0.9	1.2	0.9	
	102-116	C	58.9	35.5	5.6	----	1	31.0	4.5	3.3	1.1	0.6	0.5	0.1	
	116-140	Cr1	41.9	41.8	16.3	----	1	29.1	12.7	9.6	2.8	1.5	1.4	1.0	
	140-180	Cr2	27.5	57.8	14.7	----	TR	29.6	28.2	12.6	0.8	0.3	0.5	0.5	
	0-12	Ap*	37.6	39.6	22.8	----	---	10.8	28.8	15.0	6.5	0.5	0.4	0.4	
Highview gravelly silty clay: (S910K-103-003)	0-10	A	49.8	42.0	8.2	8.5	---	32.4	9.6	1.9	1.7	1.8	1.5	1.3	
	10-34	Bw	56.8	36.3	6.9	6.6	6.6	30.2	6.1	1.7	1.5	1.5	1.3	0.9	
	34-60	Cr	42.0	47.6	10.4	5.8	2.5	41.0	6.6	3.7	3.3	2.2	1.0	0.2	
Kirkland silt loam: (S900K-103-006)	0-12	Ap1	25.7	62.1	12.2	20.3	---	23.0	39.1	10.8	0.8	0.5	0.1	TR	
	12-27	Ap2	24.4	63.8	11.8	19.6	---	23.2	40.6	10.6	0.7	0.4	0.1	TR	
	27-37	Bt1	39.5	52.7	7.8	33.7	---	23.3	29.4	6.8	0.6	0.3	0.1	TR	
	37-51	Bt2	46.0	48.8	5.2	39.8	---	23.6	25.2	4.4	0.4	0.3	0.1	---	
	51-67	Bt3	44.2	50.7	5.1	33.9	---	24.6	26.2	4.3	0.4	0.3	0.1	---	
	67-85	Bt4	40.2	53.9	5.9	32.7	---	25.2	28.7	5.2	0.3	0.3	0.1	TR	
	85-118	Btk	30.8	54.8	14.4	21.4	---	22.6	32.2	12.5	1.1	0.5	0.2	0.1	
	118-144	Btk1b	39.3	49.6	11.1	29.1	---	19.1	30.5	9.4	0.6	0.4	0.4	0.3	
	144-174	Btk2b	42.6	47.3	10.1	31.0	---	17.9	29.4	8.7	0.6	0.3	0.2	0.3	
	174-204	Btk3b	40.1	50.7	9.2	29.0	---	19.0	31.7	8.1	0.4	0.3	0.3	0.1	
	204-238	Btk4b	39.9	49.6	10.5	31.4	---	17.9	31.7	9.6	0.4	0.3	0.1	0.1	
Lela silty clay: (S900K-103-007)	0-8	Ap1	44.1	52.8	3.1	---	---	31.3	21.5	2.4	0.4	0.2	0.1	TR	
	8-16	Ap2	44.2	52.9	2.9	---	---	31.3	21.6	2.4	0.2	0.2	0.1	TR	
	16-32	A1	54.3	42.2	3.5	---	---	24.3	17.9	2.8	0.4	0.3	TR	TR	
	32-58	A2	60.3	36.4	3.3	---	---	21.9	14.5	2.8	0.3	0.2	TR	---	
	58-87	A3	60.1	36.6	3.3	---	---	24.7	11.9	2.5	0.4	0.3	TR	0.1	
	87-107	A4	61.6	35.8	2.6	---	---	25.6	10.2	1.9	0.4	0.2	0.1	---	
	107-134	Bw1	62.6	34.9	2.5	---	---	25.0	9.9	1.6	0.3	0.3	0.1	0.2	
	134-154	Bw2	59.6	36.0	4.4	---	---	24.7	11.3	2.0	0.3	0.5	0.6	1.0	
	154-182	Bw3	58.7	36.9	4.4	---	---	26.0	10.9	2.6	0.5	0.5	0.2	0.6	
	182-222	Bw4	57.9	36.8	5.3	---	---	25.0	11.8	2.2	0.6	0.8	0.8	0.9	
		0-10	Ap*	53.7	43.8	2.5	---	---	30.8	13.0	2.0	0.2	0.2	0.1	TR

See footnote at end of table.

Physical Properties of Selected Soils--Continued

Soil name and sample number	Depth in centimeters	Horizon	Total			Clay		Silt			Sand			
			Clay <0.02 mm	Silt 0.02 - .05 mm	Sand .05 -2 mm	Fine <0.0002 mm	CO3 <0.002 mm	Fine (.002-.02 mm)	Coarse (.02-.5 mm)	Very fine (.05-.10 mm)	Fine (.10-.25 mm)	Medium (.25-.50 mm)	Coarse (.5-1 mm)	Very coarse (1-2 mm)
Lucien very fine sandy loam: (S91OK-103-001)	0-13	A	11.5	21.4	67.1	---	---	7.0	14.4	46.9	19.8	0.3	0.1	TR
	13-21	BA	11.7	21.0	67.3	---	---	4.8	16.2	48.4	18.5	0.3	0.1	TR
	21-32	Bw	11.0	18.5	70.5	---	---	4.2	14.3	40.5	29.6	0.2	0.1	0.1
	32-44	Cr	10.7	10.8	78.5	8.2	---	4.7	6.1	68.2	10.2	0.1	TR	---
Norge silt loam: (S90OK-103-008)	0-15	Ap1	20.8	65.5	13.7	15.9	---	19.0	46.5	12.0	0.9	0.6	0.2	TR
	15-27	Ap2	24.0	63.2	12.8	19.1	---	20.9	42.3	10.8	1.1	0.7	0.2	---
	27-37	BA	34.0	54.6	11.4	27.2	---	21.4	33.2	9.5	1.0	0.7	0.2	TR
	37-59	Bt1	36.1	50.3	13.6	28.7	---	19.8	30.5	11.0	1.5	0.8	0.2	0.1
	59-81	Bt2	35.4	50.5	14.1	28.8	---	19.2	31.3	12.4	0.9	0.6	0.2	TR
	81-97	Bt3	36.3	48.0	15.7	30.7	---	18.4	29.6	13.8	1.0	0.6	0.2	0.1
	97-124	2Bt4	38.3	48.1	13.6	32.4	---	17.4	30.7	11.9	1.0	0.5	0.2	TR
	124-147	2Bt5	38.7	47.7	13.6	32.2	---	15.2	32.5	12.2	0.7	0.4	0.2	0.1
	147-169	2Btk1	39.1	45.4	15.5	31.5	---	15.6	29.8	13.8	0.8	0.4	0.3	0.2
	169-205	2Btk2	39.2	47.2	13.6	25.2	---	17.6	29.6	10.3	0.7	0.6	0.9	1.1
	205-241	2Btk3	37.4	46.3	16.3	23.2	---	16.7	29.6	13.8	0.8	0.5	0.5	0.7
Port silt loam: (S90OK-103-004)	0-10	Ap1	23.9	65.6	10.5	---	---	33.9	31.7	9.1	0.8	0.4	0.1	0.1
	10-19	Ap2	24.6	67.3	8.1	---	---	34.5	32.8	7.4	0.5	0.1	0.1	TR
	19-35	Ad	23.5	65.0	11.5	---	---	31.3	33.7	10.3	0.8	0.3	0.1	TR
	35-52	A1	25.2	62.4	12.4	---	---	33.3	29.1	10.6	1.2	0.5	0.1	TR
	52-76	A2	20.1	69.8	10.1	---	---	32.9	36.9	9.1	0.7	0.2	0.1	TR
	76-101	Bw	20.3	63.4	16.3	---	---	25.6	37.8	12.7	2.3	0.9	0.3	0.1
	101-123	Bwk1	22.2	59.3	18.5	---	---	24.7	34.6	15.5	2.4	0.3	0.2	0.1
	123-139	Bwk2	23.0	54.9	22.1	---	---	23.7	31.2	18.1	3.1	0.3	0.2	0.4
	139-172	Ab	32.5	58.7	8.8	---	---	31.7	27.0	7.6	0.8	0.2	0.1	0.1
	172-187	Bw1b	31.8	62.0	6.2	---	---	34.9	27.1	5.3	0.6	0.2	0.1	TR
	187-217	Bw2b	34.5	60.0	5.5	---	---	35.8	24.2	5.0	0.3	0.1	TR	0.1
	217-237	Bw3b	33.5	55.3	11.2	---	---	31.1	24.2	8.4	0.9	0.4	0.6	0.9
	0-12	Ap*	26.0	59.4	14.6	---	---	29.8	29.6	12.8	1.2	0.4	0.1	0.1

See footnote at end of table.

## Physical Properties of Selected Soils--Continued

Soil name and sample number	Depth in centimeters	Horizon	Total			Clay		Silt			Sand			
			Clay <0.02 mm	Silt 0.02 - .05 mm	Sand .05 -2 mm	Fine <0.0002 mm	CO3 <0.002 mm	Fine (.002-.02 mm)	Coarse (.02-.5 mm)	Very fine (.05-.10 mm)	Fine (.10-.25 mm)	Medium (.25-.50 mm)	Coarse (.5-1 mm)	Very coarse (1-2 mm)
Renfrow silt loam: (S90OK-103-001)	0-9	Ap	20.2	50.3	29.5	15.3	---	17.6	32.7	15.6	12.8	0.7	0.4	TR
	9-18	A	20.5	49.8	29.7	16.0	---	17.7	32.1	15.1	13.5	0.6	0.4	0.1
	18-29	BA	31.7	44.3	24.0	25.6	---	18.9	25.4	12.6	10.5	0.5	0.3	0.1
	29-56	Bt	45.9	36.8	17.3	37.1	---	20.2	16.6	8.4	8.3	0.4	0.2	TR
	56-83	Btk1	43.4	36.7	19.9	27.9	---	21.0	15.7	9.5	9.4	0.4	0.4	0.2
	83-108	Btk2	49.4	32.5	18.1	27.8	---	21.0	11.5	7.9	8.4	0.7	0.6	0.5
	108-142	Btk3	54.4	34.5	11.1	33.4	---	24.2	10.3	5.9	4.8	0.2	0.1	0.1
	142-169	Btk4	46.6	45.7	7.7	21.1	4	35.6	10.1	3.1	2.6	0.9	0.6	0.5
	169-183	BC1	41.6	44.2	14.2	---	3	36.4	7.8	2.9	2.9	2.9	3.0	2.5
	183-201	BC2	43.4	43.9	12.7	---	2	34.2	9.7	2.5	2.9	2.4	2.5	2.4
	201-224	Cr1	45.2	50.4	4.4	---	2	42.1	8.3	1.2	0.6	0.9	1.0	0.7
	224-250	Cr2	43.7	53.5	2.8	---	---	43.8	9.7	1.2	0.3	0.3	0.4	0.6
Westsum silty clay loam: (S91OK-103-002)	0-16	Ap	41.0	49.9	9.1	27.9	---	20.8	29.1	8.1	0.5	0.3	0.1	0.1
	16-28	Bt1	47.0	46.3	6.7	32.4	---	19.6	26.7	5.5	0.4	0.3	0.3	0.2
	28-42	Btk1	47.2	44.1	8.7	25.2	---	23.1	21.0	5.0	0.9	0.8	1.1	0.9
	42-86	Btk2	45.9	43.4	10.7	22.2	4.1	26.6	16.8	5.7	1.2	1.5	1.3	1.0
	86-117	Bt2	46.7	43.7	9.6	24.0	4.0	27.0	16.7	5.7	1.2	1.0	0.8	0.9
	117-166	Bt3	47.4	46.3	6.3	----	6.5	29.0	17.3	4.2	0.7	0.5	0.5	0.4
	166-208	BC1	47.1	46.0	6.9	----	5.6	27.9	18.1	5.2	0.8	0.5	0.3	0.1
	208-236	BC2	46.8	45.3	7.9	25.2	3.4	27.4	17.9	5.3	1.0	0.7	0.6	0.3

\* Additional satellite samples of surface layers for verification.

## Chemical Properties

The table "Chemical Properties of the Soils" 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.

*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 in the series descriptions section of this survey.

*Cation-exchange capacity* is 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. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. Soils having a high cation-exchange capacity can retain cations. The ability to retain cations helps to prevent the pollution of ground water.

*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.

*Calcium carbonate equivalent* is the percent of carbonates, by weight, in the soil. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

*Gypsum* is given as the percent, by weight, of hydrated calcium sulfates in the soil. Gypsum is partially soluble in water and can be dissolved and removed by water. Soils that have a high content of gypsum (more than 10 percent) may collapse if the gypsum is removed by percolating water.

*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 (decisiemens per meter) 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 the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

*Sodium adsorption ratio* is the measure of sodium relative to calcium and magnesium in the water extract from saturated soil paste. Soils having a sodium adsorption ratio of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
		In meq/100 g	pH	Pct	Pct	mmhos/cm	
<b>AhpA:</b>							
Ashport-----	0-10	16-21	5.6-8.4	0	0	0	0
	10-25	11-21	6.1-8.4	0-1	0	0	0
	25-35	11-21	6.1-8.4	0-1	0	0	0
	35-42	11-21	6.1-8.4	0-1	0	0	0
	42-52	11-21	6.1-8.4	0-1	0	0	0
	52-80	11-21	6.1-8.4	0-1	0	0	0
<b>APPA:</b>							
Ashport-----	0-14	16-21	5.6-8.4	0	0	0	0
	14-27	11-21	6.1-8.4	0-1	0	0	0
	27-80	11-21	6.1-8.4	0-1	0	0	0
<b>Port-----</b>							
	0-7	7.0-11	5.6-7.3	0	0	0	0
	7-27	8.0-16	5.6-7.8	0-2	0	0	0
	27-46	12-21	6.1-8.4	0	0	0	0
	46-51	12-21	6.1-8.4	0	0	0	0
	51-80	12-21	6.1-8.4	0	0	0	0
<b>Pulaski-----</b>							
	0-9	7.0-11	5.6-7.3	0	0	0	0
	9-25	7.0-11	5.6-7.3	0	0	0	0
	25-80	4.0-11	5.6-8.4	0	0	0	0
<b>AspA:</b>							
Ashport-----	0-10	9.0-16	5.6-8.4	0	0	0	0
	10-32	11-21	6.1-8.4	0-1	0	0	0
	32-45	11-21	6.1-8.4	0-1	0	0	0
	45-70	11-21	6.1-8.4	0-1	0	0	0
	70-80	11-21	6.1-8.4	0-1	0	0	0
<b>AspB:</b>							
Ashport-----	0-10	9.0-16	5.6-8.4	0	0	0	0
	10-21	11-21	6.1-8.4	0-1	0	0	0
	21-36	11-21	6.1-8.4	0-1	0	0	0
	36-65	11-21	6.1-8.4	0-1	0	0	0
	65-80	11-21	6.1-8.4	0-1	0	0	0
<b>BetA:</b>							
Bethany-----	0-9	10-16	5.1-7.8	0	0	0	0
	9-12	17-21	6.1-7.8	0	0	0	0
	12-30	21-30	6.6-8.4	0-2	0	0	0
	30-47	21-30	6.6-8.4	0-2	0	0	0
	47-71	21-30	6.6-8.4	0-10	0	0.0-2.0	0-4
	71-80	21-30	6.6-8.4	0-10	0	0.0-2.0	0-4
<b>BetB:</b>							
Bethany-----	0-11	10-16	5.1-7.8	0	0	0	0
	11-16	17-21	6.1-7.8	0	0	0	0
	16-36	21-30	6.6-8.4	0-2	0	0	0
	36-60	21-30	6.6-8.4	0-2	0	0	0
	60-80	21-30	6.6-8.4	0-10	0	0.0-2.0	0-4
<b>BPG.</b>							
Borrow pits, gravelly							
<b>BPR.</b>							
Borrow pits, rock							

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
<b>BraA:</b>							
<b>Braman</b> -----	0-8	9.0-16	5.6-7.3	0	0	0	0
	8-12	9.0-16	5.6-7.3	0	0	0	0
	12-23	15-21	5.6-8.4	0	0	0	0
	23-36	15-21	5.6-8.4	0	0	0	0
	36-48	9.0-17	7.4-8.4	0-2	0	0	0
	48-82	9.0-30	7.9-8.4	0-2	0	0	0
<b>BrwA:</b>							
<b>Brewer</b> -----	0-11	11-16	5.6-7.3	0	0	0	0
	11-23	11-16	5.6-7.3	0	0	0	0
	23-40	21-33	6.1-8.4	0-2	0-1	0	0-7
	40-48	21-33	7.4-8.4	0-2	0-1	0	0-7
	48-80	15-24	6.6-8.4	0-2	0-1	0.0-8.0	0-7
<b>CoLC:</b>							
<b>Coyle</b> -----	0-6	10-16	5.6-7.8	0	0	0	0
	6-11	11-16	5.6-7.8	0	0	0	0
	11-16	13-21	5.6-7.8	0	0	0	0
	16-21	11-21	5.6-7.8	0	0	0	0
	21-38	---	---	---	---	---	---
<b>Lucien</b> -----	0-4	6.0-11	5.6-7.3	0	0	0	0
	4-8	9.0-15	5.6-7.3	0	0	0	0
	8-13	9.0-15	5.6-7.3	0	0	0	0
	13-17	---	---	---	---	---	---
<b>CoyB:</b>							
<b>Coyle</b> -----	0-10	10-16	5.6-7.8	0	0	0	0
	10-17	13-21	5.6-7.8	0	0	0	0
	17-23	11-21	5.6-7.8	0	0	0	0
	23-30	11-21	5.6-7.8	0	0	0	0
	30-38	---	---	---	---	---	---
<b>CoyC:</b>							
<b>Coyle</b> -----	0-7	10-16	5.6-7.8	0	0	0	0
	7-10	11-16	5.6-7.8	0	0	0	0
	10-20	13-21	5.6-7.8	0	0	0	0
	20-27	11-21	5.6-7.8	0	0	0	0
	27-30	---	---	---	---	---	---
<b>CoyC2:</b>							
<b>Coyle</b> -----	0-5	10-16	5.6-7.8	0	0	0	0
	5-9	11-16	5.6-7.8	0	0	0	0
	9-16	13-21	5.6-7.8	0	0	0	0
	16-23	11-21	5.6-7.8	0	0	0	0
	23-31	11-21	5.6-7.8	0	0	0	0
	31-35	---	---	---	---	---	---
<b>CoZC3:</b>							
<b>Coyle</b> -----	0-7	10-16	5.6-7.8	0	0	0	0
	7-10	11-16	5.6-7.8	0	0	0	0
	10-21	13-21	5.6-7.8	0	0	0	0
	21-24	---	---	---	---	---	---
<b>Zaneis</b> -----	0-10	10-16	5.6-7.3	0	0	0	0
	10-14	11-18	5.6-7.3	0	0	0	0
	14-26	11-18	5.6-7.3	0	0	0	0
	26-40	13-23	5.6-7.3	0	0	0	0
	40-50	13-23	5.6-7.3	0	0	0	0
	50-52	---	---	---	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
DalA:							
Dale-----	0-7	10-16	6.1-7.8	0	0	0	0
	7-21	10-16	6.1-7.8	0	0	0	0
	21-60	11-21	6.6-8.4	0-5	0	0	0
	60-80	11-21	6.6-8.4	0-5	0	0	0
DAM.							
Dam							
DaUA:							
Dale-----	0-13	10-16	6.1-7.8	0	0	0	0
	13-22	11-21	6.6-8.4	0-5	0	0	0
	22-34	11-21	6.6-8.4	0-5	0	0	0
	34-50	11-21	6.6-8.4	0-5	0	0	0
	50-80	11-21	6.6-8.4	0-5	0	0	0
Urban land.							
DiGE:							
Dilworth-----	0-7	17-21	6.6-8.4	0-1	0	0	0
	7-12	21-33	7.9-8.4	10-20	0	0	0
	12-22	24-32	7.9-8.4	10-20	0	0	0
	22-30	---	---	---	---	---	---
Grainola-----	0-7	10-16	6.6-8.4	0-2	0	0	0
	7-17	21-36	7.9-8.4	0-5	0	0	0
	17-31	21-36	7.9-8.4	0-10	0	0	0
	31-44	---	---	0	0	---	0
DooB:							
Doolin-----	0-10	9.0-17	5.6-7.8	0	0	0.0-2.0	0-10
	10-24	21-33	6.1-8.4	0	0-1	0.0-2.0	15-20
	24-36	21-33	6.1-8.4	0	0-1	0.0-2.0	15-20
	36-51	18-24	7.4-8.4	0	0-1	2.0-6.0	15-20
	51-70	18-24	7.4-8.4	0	0-1	2.0-6.0	15-20
	70-75	---	---	---	---	---	---
DwhC:							
Dilworth-----	0-7	17-21	6.6-8.4	0-1	0	0	0
	7-13	21-33	7.9-8.4	10-20	0	0	0
	13-18	24-32	7.9-8.4	10-20	0	0	0
	18-28	24-32	7.9-8.4	10-20	0	0	0
	28-36	24-32	7.9-8.4	10-20	0	0	0
	36-43	---	---	---	---	---	---
EasA:							
Easpur-----	0-11	8.0-16	5.6-8.4	0	0	0	0
	11-30	11-21	6.1-8.4	0	0	0	0
	30-54	11-21	6.1-8.4	0	0	0	0
	54-63	11-21	6.1-8.4	0	0	0	0
	63-80	11-21	6.1-8.4	0-2	0	0	0
GadA:							
Gaddy-----	0-6	4.0-10	7.4-8.4	0-2	0	0	0
	6-80	4.0-10	7.9-8.4	1-5	0	0	0

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
GayA:							
Gaddy-----	0-6	4.0-10	7.4-8.4	0-2	0	0	0
	6-11	4.0-10	7.4-8.4	0-2	0	0	0
	11-24	3.0-8.0	7.4-8.4	0-5	0	0.0-2.0	0
	24-45	2.0-7.0	7.4-8.4	0-1	0	0.0-4.0	0-2
	45-60	3.0-8.0	7.4-8.4	0-5	0	0.0-2.0	0
	60-80	3.0-10	7.9-8.4	2-15	0	0.0-2.0	0
GMLG:							
Grainola-----	0-5	9.0-15	6.6-8.4	0	0	0	0
	5-24	21-35	7.9-8.4	0	0	0	0
	24-30	21-35	7.9-8.4	0	0	0	0
	30-40	---	---	---	---	---	---
Masham-----	0-4	21-24	7.9-8.4	0-5	0	0	0
	4-13	21-36	7.9-8.4	0-5	0	0	0
	13-25	---	---	---	---	---	---
Lucien-----	0-7	6.0-11	5.6-7.3	0	0	0	0
	7-17	0.0-0.0	5.6-7.3	0	0	0	0
	17-20	---	---	---	---	---	---
GohE:							
Goodnight-----	0-8	4.0-8.0	6.1-8.4	0-2	0	0	0
	8-20	4.0-8.0	6.1-8.4	0-2	0	0	0
	20-80	4.0-8.0	6.1-8.4	0-2	0	0	0
GraC:							
Grainola-----	0-5	17-21	6.6-8.4	0-2	0	0	0
	5-22	21-36	7.9-8.4	0-5	0	0	0
	22-34	21-36	7.9-8.4	0-10	0	0	0
	34-40	---	---	0	0	---	0
GrAD:							
Grainola-----	0-4	17-21	6.6-8.4	0-2	0	0	0
	4-14	21-36	7.9-8.4	0-5	0	0	0
	14-36	21-36	7.9-8.4	0-10	0	0	0
	36-40	---	---	0	0	---	0
Ashport-----	0-13	16-21	5.6-8.4	0	0	0	0
	13-32	11-21	6.1-8.4	0-1	0	0	0
	32-40	11-21	6.1-8.4	0-1	0	0	0
	40-46	11-21	6.1-8.4	0-1	0	0	0
	46-58	11-21	6.1-8.4	0-1	0	0	0
GrHC:							
Grant-----	0-7	10-16	6.1-7.8	0	0	0	0
	7-11	10-16	6.1-7.8	0	0	0	0
	11-17	11-21	6.1-8.4	0-2	0	0	0
	17-35	11-21	6.1-8.4	0-2	0	0	0
	35-54	10-16	7.4-8.4	0-2	0	0	0
	54-58	---	---	0-5	---	---	---
Huska-----	0-6	8.0-16	5.6-7.8	0	0	0.0-8.0	8-18
	6-17	21-27	6.6-8.4	0-2	0-2	2.0-16.0	15-55
	17-32	21-36	7.4-8.4	0-2	0-2	2.0-16.0	15-55
	32-40	21-36	7.4-8.4	0-2	0-2	2.0-16.0	15-55
	40-50	21-36	7.4-8.4	0-2	0-2	2.0-16.0	15-55
	50-54	---	---	---	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
GrLC:							
Grainola-----	0-6	10-16	6.6-8.4	0-2	0	0	0
	6-11	21-36	7.9-8.4	0-5	0	0	0
	11-18	21-36	7.9-8.4	0-10	0	0	0
	18-33	21-36	7.9-8.4	0-10	0	0	0
	33-39	21-36	7.9-8.4	0-10	0	0	0
	39-42	---	---	0	0	---	0
Lucien-----	0-7	9.0-15	5.6-7.3	0	0	0	0
	7-18	0.0-0.0	5.6-7.3	0	0	0	0
	18-24	---	---	---	---	---	---
GrLE:							
Grainola-----	0-8	17-21	6.6-8.4	0-2	0	0	0
	8-20	21-36	7.9-8.4	0-5	0	0	0
	20-27	21-36	7.9-8.4	0-10	0	0	0
	27-30	---	---	0	0	---	0
Lucien-----	0-7	9.0-15	5.6-7.3	0	0	0	0
	7-12	0.0-0.0	5.6-7.3	0	0	0	0
	12-15	---	---	---	---	---	---
GrnC:							
Grant-----	0-7	10-16	6.1-7.8	0	0	0	0
	7-12	10-16	6.1-7.8	0	0	0	0
	12-20	11-21	6.1-8.4	0-2	0	0	0
	20-29	10-16	7.4-8.4	0-2	0	0	0
	29-44	10-16	7.4-8.4	0-2	0	0	0
	44-59	10-16	7.4-8.4	0-2	0	0	0
	59-65	---	---	0-5	---	---	---
GrtB:							
Grant-----	0-11	10-16	6.1-7.8	0	0	0	0
	11-21	10-16	6.1-7.8	0	0	0	0
	21-51	11-21	6.1-8.4	0-2	0	0	0
	51-57	10-16	7.4-8.4	0-2	0	0	0
	57-64	---	---	0-5	---	---	---
HaPE:							
Harrah-----	0-5	7.0-11	4.5-7.3	0	0	0	0
	5-9	4.0-11	4.5-7.3	0	0	0	0
	9-24	11-21	4.5-7.3	0	0	0	0
	24-70	11-21	4.5-7.3	0	0	0	0
	70-80	11-21	4.5-7.3	0	0	0	0
Pulaski-----	0-6	7.0-11	5.6-7.3	0	0	0	0
	6-12	7.0-11	5.6-7.3	0	0	0	0
	12-50	4.0-11	5.6-8.4	0	0	0	0
	50-55	7.0-11	5.6-7.3	0	0	0	0
	55-65	4.0-11	5.6-8.4	0	0	0	0
	65-68	---	---	0-5	---	---	---
HiRG:							
Highview-----	0-6	24-30	7.4-8.4	0	0	0	0
	6-17	21-30	7.9-8.4	0	0	0	0
	17-25	---	---	---	---	---	---
Rock outcrop.							

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
<b>KekA:</b>							
Keokuk-----	0-14	7.0-11	6.1-8.4	0	0	0	0
	14-21	7.0-11	6.1-8.4	0-1	0	0	0
	21-31	7.0-11	6.1-8.4	0-1	0	0	0
	31-53	7.0-11	6.1-8.4	0-1	0	0	0
	53-70	7.0-11	6.1-8.4	0-1	0	0	0
	70-80	7.0-11	6.1-8.4	0-1	0	0	0
<b>KeoA:</b>							
Keokuk-----	0-6	7.0-11	6.1-8.4	0	0	0	0
	6-13	7.0-11	6.1-8.4	0-1	0	0	0
	13-27	7.0-11	6.1-8.4	0-1	0	0	0
	27-80	7.0-11	6.1-8.4	0-1	0	0	0
<b>Kgfb:</b>							
Kingfisher-----	0-6	9.0-16	6.1-7.8	0	0	0	0
	6-10	15-21	6.1-7.8	0	0	0	0
	10-26	16-21	6.6-8.4	0	0	0	0
	26-35	---	---	---	---	---	---
<b>KgLC:</b>							
Kingfisher-----	0-5	9.0-16	6.1-7.8	0	0	0	0
	5-8	15-21	6.1-7.8	0	0	0	0
	8-22	16-21	6.6-8.4	0	0	0	0
	22-25	---	---	---	---	---	---
<b>Lucien-----</b>	0-7	6.0-11	5.6-7.3	0	0	0	0
	7-14	0.0-0.0	5.6-7.3	0	0	0	0
	14-17	---	---	---	---	---	---
<b>KgWC:</b>							
Kingfisher-----	0-6	9.0-16	6.1-7.8	0	0	0	0
	6-10	15-21	6.1-7.8	0	0	0	0
	10-26	16-21	6.6-8.4	0	0	0	0
	26-32	16-24	6.6-8.4	0	0	0	0
	32-40	---	---	---	---	---	---
<b>Wakita-----</b>	0-4	15-21	6.1-8.4	0	0-3	0.0-16.0	10-30
	4-25	15-21	7.4-8.5	0	0-3	0.0-16.0	13-100
	25-31	15-21	7.4-8.5	0	0-3	0.0-16.0	13-100
	31-37	---	---	---	---	---	---
<b>KinC2:</b>							
Kingfisher-----	0-8	9.0-16	6.1-7.8	0	0	0	0
	8-19	15-21	6.1-7.8	0	0	0	0
	19-22	16-21	6.6-8.4	0	0	0	0
	22-25	---	---	---	---	---	---
<b>KowB:</b>							
Konawa-----	0-6	6.0-11	5.1-6.5	0	0	0	0
	6-14	2.0-10	5.1-6.5	0	0	0	0
	14-24	11-18	5.1-7.3	0	0	0	0
	24-44	11-18	5.1-7.3	0	0	0	0
	44-60	5.0-18	5.1-6.5	0	0	0	0
	60-80	5.0-18	5.1-6.5	0	0	0	0

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
<b>KowD:</b>							
Konawa-----	0-8	6.0-11	5.1-6.5	0	0	0	0
	8-20	2.0-10	5.1-6.5	0	0	0	0
	20-33	11-18	5.1-7.3	0	0	0	0
	33-50	11-18	5.1-7.3	0	0	0	0
	50-67	5.0-18	5.1-6.5	0	0	0	0
	67-80	2.0-10	5.1-6.5	0	0	0	0
<b>KrdA:</b>							
Kirkland-----	0-9	10-16	5.6-7.3	0	0	0.0-2.0	1-4
	9-28	24-36	6.6-8.4	0-2	0	0.0-2.0	2-12
	28-40	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
	40-53	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
	53-80	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
<b>KrdB:</b>							
Kirkland-----	0-7	10-16	5.6-7.3	0	0	0.0-2.0	1-4
	7-14	24-36	6.6-8.4	0-2	0	0.0-2.0	2-10
	14-33	24-36	6.6-8.4	0-2	0	0.0-2.0	2-10
	33-61	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
	61-80	---	---	---	---	---	---
<b>KrdB2:</b>							
Kirkland-----	0-4	10-16	5.6-7.3	0	0	0.0-2.0	1-4
	4-25	24-36	6.6-8.4	0-2	0	0.0-2.0	2-10
	25-44	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
	44-61	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
	61-80	---	---	---	---	---	---
<b>KrPB:</b>							
Kirkland-----	0-8	10-16	5.6-7.3	0	0	0.0-2.0	1-4
	8-21	24-36	6.6-8.4	0-2	0	0.0-2.0	2-10
	21-41	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
	41-64	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
	64-80	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-10
<b>Pawhuska-----</b>	0-6	11-17	5.6-8.4	0	0	2.0-16.0	5-20
	6-22	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
	22-43	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
	43-55	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
	55-72	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
	72-80	---	---	---	---	---	---
<b>LAN.</b>							
Landfill							
<b>Lela:</b>							
Lela-----	0-6	24-35	6.1-8.4	0-2	0	0	0
	6-13	24-35	6.1-8.4	0-2	0	0	0
	13-34	24-35	7.4-8.4	0-2	0	0	0
	34-42	24-35	7.4-8.4	0-2	0	0	0
	42-53	24-35	7.4-8.4	0-2	0	0	0
	53-61	24-35	7.4-8.4	0-2	0	0	0
	61-72	24-35	7.4-8.4	0-2	0	0	0
	72-87	24-35	7.4-8.4	0-2	0	0	0

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
		In meq/100 g	pH	Pct	Pct	mmhos/cm	
<b>LveB:</b>							
Lovedale-----	0-7	6.0-10	5.6-7.3	0	0	0	0
	7-12	11-17	5.6-7.3	0	0	0	0
	12-18	6.0-17	6.1-8.4	0	0	0	0
	18-26	6.0-17	6.1-8.4	0	0	0	0
	26-46	6.0-17	6.1-8.4	0	0	0	0
	46-80	3.0-11	6.6-8.4	0-5	0	0	0
<b>M-W.</b>							
Miscellaneous water							
<b>McaA:</b>							
McLain-----	0-7	16-21	5.6-8.4	0	0	0	0
	7-17	21-29	6.1-8.4	0	0	0	0
	17-31	21-29	6.1-8.4	0	0	0	0
	31-46	21-29	6.1-8.4	0	0	0	0
	46-80	12-27	6.6-8.4	0	0	0	0
<b>MilB:</b>							
Milan-----	0-7	9.0-15	5.6-7.3	0	0	0	0
	7-12	15-20	5.6-7.3	0	0	0	0
	12-26	15-20	5.6-7.3	0	0	0	0
	26-45	7.0-20	5.6-7.3	0	0	0	0
	45-72	7.0-20	5.6-7.3	0	0	0	0
	72-80	3.0-20	5.6-8.4	0	0	0	0
<b>MilC:</b>							
Milan-----	0-9	9.0-15	5.6-7.3	0	0	0	0
	9-15	15-20	5.6-7.3	0	0	0	0
	15-33	7.0-20	5.6-7.3	0	0	0	0
	33-48	7.0-20	5.6-7.3	0	0	0	0
	48-62	3.0-20	5.6-7.3	0	0	0	0
	62-80	3.0-17	5.6-8.4	0	0	0	0
<b>MinB:</b>							
Minco-----	0-8	5.0-11	5.6-7.3	0	0	0	0
	8-15	5.0-11	5.6-8.4	0	0	0	0
	15-32	5.0-11	5.6-8.4	0	0	0	0
	32-46	5.0-11	5.6-8.4	0	0	0	0
	46-62	5.0-11	5.6-8.4	0	0	0	0
	62-80	5.0-11	6.1-8.4	0	0-2	0	0
<b>MinC:</b>							
Minco-----	0-8	5.0-11	5.6-7.3	0	0	0	0
	8-17	5.0-11	5.6-8.4	0	0	0	0
	17-23	5.0-11	5.6-8.4	0	0	0	0
	23-54	5.0-11	5.6-8.4	0	0	0	0
	54-59	5.0-11	5.6-8.4	0	0	0	0
	59-80	5.0-11	6.1-8.4	0	0-2	0	0
<b>MirA:</b>							
Miller-----	0-10	21-24	7.4-8.4	0	0	0	0
	10-30	21-36	7.4-8.4	0	0	0	0
	30-44	21-36	7.4-8.4	0-2	0-2	0	0
	44-80	21-36	7.4-8.4	0-2	0-2	0	0

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
<b>MisA:</b>							
Miller-----	0-10	21-24	7.4-8.4	0	0	0.0-4.0	1-8
	10-23	24-36	7.4-8.4	0	0-2	4.0-16.0	0-4
	23-34	24-36	7.4-8.4	0	0-2	4.0-16.0	0-4
	34-40	21-36	7.4-8.4	0-2	0-2	4.0-16.0	0-4
	40-51	21-36	7.4-8.4	0-2	0-2	4.0-16.0	0-4
	51-80	21-36	7.4-8.4	0-2	0-2	4.0-16.0	0-4
<b>MPNC2:</b>							
Milan-----	0-11	9.0-15	5.6-7.3	0	0	0	0
	11-16	15-20	5.6-7.3	0	0	0	0
	16-28	15-20	5.6-7.3	0	0	0	0
	28-57	7.0-20	5.6-7.3	0	0	0	0
	57-65	3.0-20	5.6-7.3	0	0	0	0
	65-75	3.0-20	5.6-7.3	0	0	0	0
<b>Pawhuska-----</b>	0-8	11-17	5.6-7.3	0	0	2.0-16.0	5-20
	8-17	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
	17-27	21-30	6.6-8.4	0-2	0-2	2.0-16.0	16-25
	27-40	21-30	6.6-8.4	0-2	0-2	2.0-16.0	16-25
	40-64	21-30	6.6-8.4	0-2	0-2	2.0-16.0	16-25
	64-80	3.0-20	7.3-8.4	0	0	0	0
<b>Norge-----</b>	0-6	10-16	5.6-7.3	0	0	0	0
	6-14	11-21	5.6-7.3	0	0	0	0
	14-35	17-21	5.6-7.8	0	0	0	0
	35-45	17-30	6.1-8.4	0-2	0	0	0
	45-80	17-30	6.1-8.4	0-2	0	0	0
<b>MulC:</b>							
Mulhall-----	0-7	10-16	5.6-7.8	0	0	0	0
	7-13	11-18	6.1-7.3	0	0	0	0
	13-26	13-21	6.1-7.8	0	0	0	0
	26-42	13-21	6.1-7.8	0	0	0	0
	42-60	13-21	6.6-8.4	0	0	0	0
	60-80	13-21	6.6-8.4	0	0	0	0
<b>MulD:</b>							
Mulhall-----	0-10	10-16	5.6-7.8	0	0	0	0
	10-14	11-18	6.1-7.3	0	0	0	0
	14-23	13-21	6.1-7.8	0	0	0	0
	23-33	13-21	6.1-7.8	0	0	0	0
	33-42	13-21	6.1-7.8	0	0	0	0
	42-56	13-21	6.6-8.4	0	0	0	0
	56-80	13-21	6.6-8.4	0	0	0	0
<b>MulD4:</b>							
Mulhall-----	0-14	10-16	5.6-7.8	0	0	0	0
	14-19	11-18	6.1-7.3	0	0	0	0
	19-29	13-21	6.1-7.8	0	0	0	0
	29-44	13-21	6.1-7.8	0	0	0	0
	44-80	13-21	6.6-8.4	0	0	0	0

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
NeDG:							
Newalla-----	0-5	5.0-11	4.5-7.3	0	0	0	0
	5-14	5.0-11	4.5-7.3	0	0	0	0
	14-22	12-21	4.5-7.3	0	0	0	0
	22-32	24-36	4.5-8.4	0-2	0	0	0-4
	32-40	24-36	4.5-8.4	0-2	0	0	0-4
	40-54	24-36	7.4-8.4	0-2	0	0	0-8
	54-58	---	---	---	---	---	---
Darnell-----	0-4	7.0-13	5.1-7.3	0	0	0	0
	4-11	7.0-16	5.1-7.3	0	0	0	0
	11-15	---	---	---	---	---	---
NorA:							
Norge-----	0-11	10-16	5.6-7.3	0	0	0	0
	11-14	11-21	5.6-7.3	0	0	0	0
	14-23	17-21	5.6-7.8	0	0	0	0
	23-32	17-21	5.6-7.8	0	0	0	0
	32-38	17-21	5.6-7.8	0	0	0	0
	38-49	17-30	6.1-8.4	0-2	0	0	0
	49-58	17-30	6.1-8.4	0-2	0	0	0
	58-81	17-30	6.1-8.4	0-2	0	0	0
NorB:							
Norge-----	0-9	10-16	5.6-7.3	0	0	0	0
	9-15	10-16	5.6-7.3	0	0	0	0
	15-19	11-21	5.6-7.3	0	0	0	0
	19-30	17-21	5.6-7.8	0	0	0	0
	30-44	17-21	5.6-7.8	0	0	0	0
	44-67	17-30	6.1-8.4	0-2	0	0	0
	67-80	17-30	6.1-8.4	0-2	0	0	0
NorC:							
Norge-----	0-11	10-16	5.6-7.3	0	0	0	0
	11-16	11-21	5.6-7.3	0	0	0	0
	16-27	17-21	5.6-7.8	0	0	0	0
	27-47	17-21	5.6-7.8	0	0	0	0
	47-60	17-21	5.6-7.8	0	0	0	0
	60-80	17-21	5.6-7.8	0	0	0	0
NorC2:							
Norge-----	0-9	10-16	5.6-7.3	0	0	0	0
	9-18	17-21	5.6-7.8	0	0	0	0
	18-30	17-21	5.6-7.8	0	0	0	0
	30-44	17-21	5.6-7.8	0	0	0	0
	44-64	17-21	5.6-7.8	0	0	0	0
	64-86	17-30	6.1-8.4	0-2	0	0	0
NoUC:							
Norge-----	0-7	10-16	5.6-7.3	0	0	0	0
	7-10	11-21	5.6-7.3	0	0	0	0
	10-20	17-21	5.6-7.8	0	0	0	0
	20-39	17-21	5.6-7.8	0	0	0	0
	39-45	17-21	5.6-7.8	0	0	0	0
	45-80	17-30	6.1-8.4	0-2	0	0	0
Urban land.							

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
OWWE: Oil waste land-----	0-60	---	---	---	---	16.0-30.0	13-20
Westsum-----	0-9	17-21	7.4-8.4	0-1	0	0	0
	9-14	18-27	7.4-8.4	0-1	0	0	0
	14-20	21-30	7.9-8.4	5-10	0	0	0
	20-28	21-30	7.9-8.4	5-10	0	0	0
	28-45	24-30	7.9-8.4	1-2	0	0	0
	45-56	24-30	7.9-8.4	1-2	0	0	0
	56-72	21-30	7.9-8.4	1-2	0	0	0
PoaA: Port-----	0-19	8.0-16	5.6-7.8	0-2	0	0	0
	19-30	8.0-16	5.6-7.8	0-2	0	0	0
	30-43	8.0-16	5.6-7.8	0-2	0	0	0
	43-59	8.0-16	5.6-7.8	0-2	0	0	0
	59-74	12-21	6.1-8.4	0	0	0	0
PoOA: Port-----	0-16	8.0-16	5.6-7.8	0-2	0	0	0
	16-23	8.0-16	5.6-7.8	0-2	0	0	0
	23-40	8.0-16	5.6-7.8	0-2	0	0	0
	40-51	8.0-16	5.6-7.8	0-2	0	0	0
	51-80	8.0-16	5.6-7.8	0-2	0	0	0
Oscar-----	0-4	9.0-15	5.6-8.4	0	0	0.0-16.0	0-75
	4-10	9.0-15	5.6-8.4	0	0	0.0-16.0	0-75
	10-16	15-21	6.6-9.0	0	0-1	4.0-16.0	15-80
	16-33	8.0-16	5.6-7.8	0-2	0	0	0
	33-43	8.0-16	5.6-7.8	0-2	0	0	0
	43-80	8.0-16	5.6-7.8	0-2	0	0	0
PorA: Port-----	0-8	8.0-16	5.6-7.8	0-2	0	0	0
	8-14	8.0-16	5.6-7.8	0-2	0	0	0
	14-20	8.0-16	5.6-7.8	0-2	0	0	0
	20-31	8.0-16	5.6-7.8	0-2	0	0	0
	31-40	8.0-16	5.6-7.8	0-2	0	0	0
	40-48	8.0-16	5.6-7.8	0-2	0	0	0
	48-55	12-21	6.1-8.4	0	0	0	0
	55-68	12-21	6.1-8.4	0	0	0	0
	68-74	12-21	6.1-8.4	0	0	0	0
	74-85	12-21	6.1-8.4	0	0	0	0
	85-93	12-21	6.1-8.4	0	0	0	0
PotA: Port-----	0-10	17-21	5.6-7.8	0-2	0	0	0
	10-26	17-21	5.6-7.8	0-2	0	0	0
	26-35	12-21	6.1-8.4	0	0	0	0
	35-66	12-21	6.1-8.4	0	0	0	0
	66-80	12-21	6.1-8.4	0	0	0	0
PukA: Pulaski-----	0-8	7.0-11	5.6-7.3	0	0	0	0
	8-20	7.0-11	5.6-7.3	0	0	0	0
	20-37	7.0-11	5.6-7.3	0	0	0	0
	37-47	7.0-11	5.6-7.3	0	0	0	0
	47-80	4.0-11	5.6-8.4	0	0	0	0

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
PulA:							
Pulaski-----	0-9	7.0-11	5.6-7.3	0	0	0	0
	9-27	7.0-11	5.6-7.3	0	0	0	0
	27-80	4.0-11	5.6-8.4	0	0	0	0
RefC2:							
Renfrow-----	0-6	11-16	6.1-7.8	0	0	0	0
	6-35	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	35-73	21-33	6.6-8.4	0	0	0.0-2.0	0-4
ReGC2:							
Renfrow-----	0-8	17-21	6.1-7.8	0	0	0	0
	8-12	14-24	6.1-7.8	0	0	0	0
	12-30	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	30-44	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	44-63	21-33	6.6-8.4	0	0	0.0-2.0	0-4
	63-80	---	---	0	0	---	0
Grainola-----	0-7	17-21	6.6-8.4	0-2	0	0	0
	7-12	21-36	7.9-8.4	0-5	0	0	0
	12-26	21-36	7.9-8.4	0-10	0	0	0
	26-33	21-36	7.9-8.4	0-10	0	0	0
	33-40	---	---	0	0	---	0
ReiA:							
Reinach-----	0-8	8.0-11	6.1-8.4	0-1	0	0	0
	8-23	8.0-11	6.1-8.4	0-1	0	0	0
	23-30	8.0-11	6.1-8.4	0-1	0	0	0
	30-42	8.0-11	7.4-8.4	0-2	0	0	0
	42-65	8.0-11	7.4-8.4	0-2	0	0	0
	65-82	8.0-11	7.4-8.4	0-2	0	0	0
RenB:							
Renfrow-----	0-9	11-16	6.1-7.8	0	0	0	0
	9-13	14-24	6.1-7.8	0	0	0	0
	13-23	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	23-42	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	42-60	21-33	6.6-8.4	0	0	0.0-2.0	0-4
	60-80	21-33	7.9-8.4	0	0	0.0-2.0	0-4
RenC:							
Renfrow-----	0-10	11-16	6.1-7.8	0	0	0	0
	10-13	14-24	6.1-7.8	0	0	0	0
	13-28	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	28-36	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	36-50	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	50-65	21-33	7.9-8.4	0	0	0.0-2.0	0-4
	65-80	21-33	7.9-8.4	0	0	0.0-2.0	0-4
RewC2:							
Renfrow-----	0-10	17-21	6.1-7.8	0	0	0	0
	10-24	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	24-37	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	37-54	21-33	6.6-8.4	0	0	0.0-2.0	0-4
	54-63	21-33	7.9-8.4	0	0	0.0-2.0	0-4
	63-80	---	---	---	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
<b>RGPD3:</b>							
Renfrow-----	0-10	17-21	6.1-7.8	0	0	0	0
	10-24	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	24-44	21-33	6.1-8.4	0	0	0.0-2.0	0-4
	44-80	21-33	6.6-8.4	0	0	0.0-2.0	0-4
<b>Grainola-----</b>	0-5	17-21	6.6-8.4	0-2	0	0	0
	5-21	21-36	7.9-8.4	0-10	0	0	0
	21-24	---	---	0	0	---	0
<b>Pawhuska-----</b>	0-3	11-17	5.6-7.3	0	0	2.0-16.0	5-20
	3-13	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
	13-42	21-30	6.6-8.4	0-2	0-2	2.0-16.0	16-25
	42-80	21-30	6.6-8.4	0-2	0-2	2.0-16.0	16-25
<b>SlaB:</b>							
Slaughterville-----	0-10	6.0-11	5.6-7.3	0	0	0	0
	10-39	6.0-11	6.1-8.4	0	0	0	0
	39-50	6.0-11	6.1-8.4	0	0	0	0
	50-80	6.0-11	6.6-8.4	0	0	0	0
<b>SlaC:</b>							
Slaughterville-----	0-13	6.0-11	5.6-7.3	0	0	0	0
	13-19	6.0-11	6.1-8.4	0	0	0	0
	19-30	6.0-11	6.1-8.4	0	0	0	0
	30-50	6.0-11	6.1-8.4	0	0	0	0
	50-80	3.0-11	6.6-8.4	0	0	0	0
<b>SlaG:</b>							
Slaughterville-----	0-16	6.0-11	5.6-7.3	0	0	0	0
	16-33	6.0-11	6.1-8.4	0	0	0	0
	33-80	3.0-11	6.6-8.4	0	0	0	0
<b>StDD:</b>							
Stephenville-----	0-5	7.0-12	5.1-6.5	0	0	0	0
	5-9	4.0-10	5.1-6.5	0	0	0	0
	9-30	11-21	4.5-6.0	0	0	0	0
	30-36	11-21	4.5-6.0	0	0	0	0
	36-40	---	---	---	---	---	---
<b>Darnell-----</b>	0-4	7.0-13	5.1-7.3	0	0	0	0
	4-12	7.0-16	5.1-7.3	0	0	0	0
	12-15	---	---	---	---	---	---
<b>TabA:</b>							
Tabler-----	0-10	7.0-16	5.6-8.4	0	0	0	0
	10-25	24-32	6.1-8.4	0	0	0	0
	25-43	24-32	6.1-8.4	0	0	0	0
	43-65	21-32	7.4-8.4	0	0	0	0
	65-80	21-32	7.4-8.4	0	0	0	0
<b>TeaA:</b>							
Tearney-----	0-10	24-36	7.4-8.4	0-2	0	0	0
	10-26	21-35	7.4-8.4	0-2	0	0	0
	26-30	2.0-9.0	7.4-8.4	0-2	0	0	0
	30-80	2.0-9.0	7.4-8.4	0-2	0	0	0

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
TelB:							
Teller-----	0-8	7.0-13	5.6-7.3	0	0	0	0
	8-12	7.0-13	5.6-7.3	0	0	0	0
	12-20	11-18	5.6-7.3	0	0	0	0
	20-30	11-18	5.6-7.3	0	0	0	0
	30-50	11-18	5.6-7.3	0	0	0	0
	50-80	7.0-13	6.1-7.8	0	0	0	0
TelD:							
Teller-----	0-12	7.0-13	5.6-7.3	0	0	0	0
	12-17	7.0-13	5.6-7.3	0	0	0	0
	17-27	11-18	5.6-7.3	0	0	0	0
	27-45	11-18	5.6-7.3	0	0	0	0
	45-58	11-18	5.6-7.3	0	0	0	0
	58-80	7.0-13	6.1-7.8	0	0	0	0
TelD2:							
Teller-----	0-6	7.0-13	5.6-7.3	0	0	0	0
	6-11	7.0-13	5.6-7.3	0	0	0	0
	11-16	11-18	5.6-7.3	0	0	0	0
	16-31	11-18	5.6-7.3	0	0	0	0
	31-42	11-18	5.6-7.3	0	0	0	0
	42-72	7.0-13	5.6-7.8	0	0	0	0
	72-85	7.0-13	5.6-7.8	0	0	0	0
VanA:							
Vanoss-----	0-10	10-16	5.1-7.3	0	0	0	0
	10-15	11-18	5.1-7.3	0	0	0	0
	15-30	17-21	5.1-7.3	0	0	0	0
	30-42	17-21	5.1-7.3	0	0	0	0
	42-52	17-21	5.1-7.3	0	0	0	0
	52-80	11-21	5.6-7.8	0	0	0	0
W.							
Water							
WauA:							
Waurika-----	0-9	9.0-15	5.6-7.3	0	0	0.0-2.0	0-4
	9-12	9.0-15	5.6-7.3	0	0	0.0-2.0	4-10
	12-31	24-35	6.1-8.4	0	0	0.0-4.0	4-10
	31-39	18-29	7.4-8.4	0	0	0.0-8.0	8-20
	39-61	18-29	7.4-8.4	0	0	0.0-8.0	8-20
	61-80	16-23	7.4-8.4	0	0	0.0-8.0	8-20
WesB:							
Westsum-----	0-10	17-21	7.4-8.4	0-1	0	0	0
	10-16	18-27	7.4-8.4	0-1	0	0	0
	16-30	21-30	7.9-8.4	5-10	0	0	0
	30-36	21-30	7.9-8.4	5-10	0	0	0
	36-52	24-30	7.9-8.4	1-2	0	0	0
	52-65	24-30	7.9-8.4	1-2	0	0	0
	65-80	21-30	7.9-8.4	1-2	0	0	0

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
<b>WesC:</b>							
Westsum-----	0-6	17-21	7.4-8.4	0-1	0	0	0
	6-10	17-21	7.4-8.4	0-1	0	0	0
	10-17	21-30	7.9-8.4	5-10	0	0	0
	17-31	21-30	7.9-8.4	5-10	0	0	0
	31-59	21-30	7.9-8.4	5-10	0	0	0
	59-75	21-30	7.9-8.4	1-2	0	0	0
	75-80	21-30	7.9-8.4	1-2	0	0	0
<b>WiLC:</b>							
Wisby-----	0-6	5.0-10	5.6-7.3	0	0	0	0
	6-10	7.0-11	6.1-7.3	0	0	0	0
	10-17	7.0-11	6.1-7.3	0	0	0	0
	17-32	7.0-11	6.1-7.3	0	0	0	0
	32-36	2.0-7.0	6.1-8.4	0	0	0	0
	36-80	2.0-7.0	6.1-8.4	0	0	0	0
<b>Lovedale-----</b>							
	0-6	6.0-10	5.6-7.3	0	0	0	0
	6-10	11-17	5.6-7.3	0	0	0	0
	10-15	11-17	6.1-8.4	0	0	0	0
	15-33	11-17	6.1-8.4	0	0	0	0
	33-46	6.0-17	6.1-8.4	0	0	0	0
	46-61	6.0-17	6.1-8.4	0	0	0	0
	61-80	3.0-11	6.1-8.4	0-5	0	0	0
<b>ZaHC:</b>							
Zaneis-----	0-7	10-16	5.6-7.3	0	0	0	0
	7-10	11-18	5.6-7.3	0	0	0	0
	10-28	13-23	5.6-7.3	0	0	0	0
	28-38	13-23	5.6-7.3	0	0	0	0
	38-46	11-18	6.1-7.8	0	0	0	0
	46-50	---	---	---	---	---	---
<b>Huska-----</b>							
	0-8	8.0-16	5.6-7.8	0	0	0.0-8.0	8-18
	8-20	21-27	6.6-8.4	0-2	0-2	2.0-16.0	15-55
	20-42	21-36	7.4-8.4	0-2	0-2	2.0-16.0	15-55
	42-54	21-36	7.4-8.4	0-2	0-2	2.0-16.0	15-55
	54-60	---	---	---	---	---	---
<b>ZanB:</b>							
Zaneis-----	0-11	10-16	5.6-7.3	0	0	0	0
	11-15	10-16	5.6-7.3	0	0	0	0
	15-30	11-18	5.6-7.3	0	0	0	0
	30-42	13-23	5.6-7.3	0	0	0	0
	42-50	11-18	6.1-7.8	0	0	0	0
	50-55	---	---	---	---	---	---

## Chemical Analyses of Selected Soils

The results of chemical analysis of several pedons are given in the table "Chemical Properties of Selected Soils" in this section. The data are for soils sampled at carefully selected sites. The pedons are representative of the series described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Survey Laboratory, Lincoln, Nebraska.

Most determinations, except for those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods.

*Extractable cations*—ammonium acetate pH 7.0, atomic absorption; calcium (6N2e), magnesium (6O2d), sodium (6P2b), potassium (6Q2b).

*Cation-exchange capacity*—ammonium acetate, pH 7.0, steam distillation (5A8b).

*Exchangeable sodium percentage*—ammonium acetate, pH 7.0 (5D2).

*Base saturation*—ammonium acetate, pH 7.0 (5C1).

*Carbonate as calcium carbonate*—Manometer, electronic (6E1g).

*Reaction (pH)*—1:1 water dilution (8C1f).

Chemical Properties of Selected Soils

(The locations of the sampled pedons are given in the table "Engineering Index Test Data." The symbol < means less than; > means greater than. TR means trace)

Soil name and sample number	Depth	Horizon	NH4OAC extractable bases				Cation-exchange capacity ammonium acetate	Exchange-able sodium	Base saturation ammonium acetate	CO <sub>3</sub> as CaCO <sub>3</sub> <2 mm	pH H <sub>2</sub> O 1:1
			Ca	Mg	Na	K					
			-----meq/100g-----				Pct	Pct	Pct	Pct	
Bethany silt loam: (S900K-103-005)	0-8	Ap	9.5	2.6	TR	0.8	14.3	TR	90	---	5.0
	8-15	Ad	9.1	2.2	---	0.4	13.8	---	85	---	5.2
	15-22	A	9.3	2.3	0.1	0.3	14.1	TR	85	---	5.4
	22-31	BA	14.5	4.2	0.2	0.3	20.3	1	95	---	6.1
	31-46	Bt1	21.8	7.9	0.6	0.4	18.1	3	100	---	7.1
	46-75	Bt2	21.4	8.3	1.1	0.4	41.9	3	74	---	7.7
	75-99	Btk1	33.1	7.8	1.8	0.4	18.8	8	100	1	8.2
	99-120	Btk2	30.1	7.6	2.5	0.4	20.7	11	100	1	8.3
	120-149	Bt1b	28.5	7.9	3.2	0.5	18.9	14	100	1	8.1
	149-179	Bt2b	19.6	7.1	3.2	0.4	39.1	7	77	---	8.1
	179-207	Bt3b	19.5	6.7	3.0	0.5	26.9	9	100	---	8.0
	207-253	Bt4b	19.1	6.1	2.9	0.5	25.5	9	100	---	7.8
	253-263	Btk1b	---	5.7	2.5	0.4	21.6	9	---	22	8.1
Coyle loam: (S900K-103-002)	0-25	A	7.1	2.6	---	0.4	11.7	---	86	---	5.7
	25-42	Bt1	9.6	4.2	---	0.1	14.8	---	94	---	5.9
	42-59	Bt2	8.5	4.9	---	0.2	15.3	---	89	---	5.8
	59-76	BC	6.9	3.8	---	0.1	11.6	---	93	---	6.3
	76-96	Cr	4.1	2.8	---	0.1	7.1	---	99	---	6.3
Dilworth silty clay loam: (S920K-103-001)	0-22	A	39.6	10.1	0.1	0.8	23.2	TR	100	10	7.6
	22-34	Bt	46.4	10.3	---	0.3	23.9	---	100	8	8.0
	34-45	Btk	46.4	12.5	0.1	0.3	24.4	TR	100	5	8.1
	45-59	Bck	37.7	13.4	0.1	0.4	24.6	1	100	6	8.1
	59-83	Ck	45.4	16.5	0.2	0.3	21.3	1	100	13	8.1
	83-107	Cr1	16.8	15.5	0.2	0.3	24.7	1	100	1	8.1
	107-129	Cr2	41.9	17.5	0.1	0.2	21.1	1	100	14	8.3
129-160	Cr3	23.3	18.4	0.3	0.9	26.5	1	100	1	8.2	

Chemical Properties of Selected Soils--Continued

Soil name and sample number	Depth	Horizon	NH4OAC extractable bases				Cation-exchange capacity ammonium acetate	Exchange-able sodium	Base saturation ammonium acetate	CO <sub>3</sub> as CaCO <sub>3</sub> <2 mm	pH H <sub>2</sub> O 1:1	
			Ca	Mg	Na	K						
	<u>Cm</u>		-----meq/100g-----				<u>Pct</u>	<u>Pct</u>	<u>Pct</u>	<u>Pct</u>		
Grainola silty clay loam: (S900K-103-003)	0-8	Ap1	18.8	6.1	0.3	0.5	22.8	1	100	---	7.1	
	8-13	Ap2	19.1	6.5	0.3	0.5	23.8	1	100	---	7.1	
	13-22	Ad	21.1	8.0	0.8	0.3	24.8	3	100	TR	7.9	
	22-37	Btk1	---	12.8	1.9	0.3	26.4	6	---	11	8.4	
	37-63	Btk2	---	14.4	3.6	0.2	25.0	11	---	14	8.4	
	63-86	Btk3	---	21.6	8.0	0.3	31.8	17	---	9	8.7	
	86-102	Btk4	---	16.5	7.7	0.3	27.4	16	---	8	7.7	
	102-116	C	---	13.5	7.0	0.3	24.1	19	---	5	8.2	
	116-140	Cr1	---	9.6	4.8	0.2	17.0	20	---	13	8.3	
	140-180	Cr2	---	4.4	4.7	2.4	TR	8.9	17	100	---	7.8
0-12	Ap*	---	13.1	4.9	---	0.6	31.3	---	59	---	5.7	
Highview gravelly silty clay: (S910K-103-003)	0-10	A	---	16.4	0.1	0.8	19.6	1	100	25	7.9	
	10-34	Bw	---	18.0	0.1	0.5	21.8	1	100	20	7.9	
	34-60	Cr	---	17.6	0.2	1.0	21.1	1	100	13	8.2	
Kirkland silt loam: (S900K-103-006)	0-12	Ap1	9.3	2.7	---	0.5	15.2	---	82	---	4.9	
	12-27	Ap2	8.8	2.5	---	0.5	15.0	---	79	---	5.0	
	27-37	Bt1	18.2	6.5	0.1	0.5	25.8	TR	98	---	6.5	
	37-51	Bt2	21.4	8.4	0.4	0.5	41.7	1	74	---	7.2	
	51-67	Bt3	20.9	8.1	0.6	0.5	39.2	2	77	---	7.4	
	67-85	Bt4	19.6	7.5	0.9	0.4	27.3	3	100	---	7.4	
	85-118	Btk	15.6	5.3	1.0	0.2	19.0	5	100	TR	7.8	
	118-144	Btk1b	23.1	6.9	2.1	0.4	25.2	7	100	1	8.4	
	144-174	Btk2b	21.5	7.3	2.7	0.4	27.7	8	100	TR	8.0	
	174-204	Btk3b	19.1	6.6	2.8	0.4	26.2	9	100	TR	8.0	
	204-238	Btk4b	18.7	6.1	2.8	0.5	36.9	6	76	---	7.9	
Lela silty clay: (S900K-103-007)	0-8	Ap1	16.2	10.2	0.1	1.1	27.2	1	100	---	6.2	
	8-16	Ap2	16.0	10.1	0.1	1.1	36.9	TR	74	---	6.0	
	16-32	A1	19.2	13.8	0.3	0.9	29.8	1	100	---	7.1	
	32-58	A2	19.5	17.6	0.6	0.7	37.4	2	100	---	7.4	
	58-87	A3	18.6	19.1	0.9	0.9	48.6	2	81	---	7.1	
	87-107	A4	18.3	20.1	1.1	0.8	31.3	3	100	---	7.7	
	107-134	Bw1	19.3	20.9	1.2	0.8	27.8	3	100	1	7.7	
	134-154	Bw2	27.0	21.3	1.1	0.8	27.9	3	100	2	8.1	
	154-182	Bw3	21.2	21.5	1.2	0.8	29.6	3	100	1	8.1	
	182-222	Bw4	32.3	21.5	1.3	0.8	21.2	5	100	2	8.2	
	0-10	Ap*	---	19.8	12.8	0.1	1.4	18.4	1	100	---	6.5

See footnote at end of table.

Chemical Properties of Selected Soils--Continued

Soil name and sample number	Depth	Horizon	NH4OAC extractable bases				Cation-exchange capacity ammonium acetate	Exchange-able sodium	Base saturation ammonium acetate	CO <sub>3</sub> as CaCO <sub>3</sub> <2 mm	pH H <sub>2</sub> O 1:1
			Ca	Mg	Na	K					
			-----meq/100g-----				Pct	Pct	Pct	Pct	
Lucien very fine sandy loam: (S91OK-103-001)	0-13	A	5.3	1.4	TR	0.4	9.4	---	76	---	5.6
	13-21	BA	4.1	1.2	TR	0.2	7.6	---	72	---	5.4
	21-32	Bw	4.2	1.4	0.1	0.1	7.3	---	79	---	5.6
	32-44	Cr	---	---	---	---	---	---	---	---	---
Norge silt loam: (S90OK-103-008)	0-15	Ap1	6.4	1.9	---	0.6	13.4	---	66	---	4.5
	15-27	Ap2	8.0	2.1	---	0.3	14.6	---	71	---	4.8
	27-37	BA	13.4	4.8	TR	0.4	18.2	TR	100	---	6.4
	37-59	Bt1	13.4	6.2	0.1	0.3	20.8	1	96	---	6.8
	59-81	Bt2	12.1	5.9	0.4	0.4	16.9	2	100	---	7.1
	81-97	Bt3	11.7	5.4	0.7	0.3	18.5	4	98	---	7.0
	97-124	2Bt4	12.6	5.7	1.2	0.4	17.4	7	100	---	7.1
	124-147	2Bt5	14.6	5.9	1.8	0.5	17.7	10	100	---	7.8
	147-169	2Btk1	17.4	6.6	2.3	0.4	23.9	10	100	---	8.2
	169-205	2Btk2	32.9	7.6	2.8	0.7	19.6	14	100	2	8.3
	205-241	2Btk3	25.3	6.9	3.0	0.5	18.3	15	100	1	8.3
Port silt loam: (S90OK-103-004)	0-10	Ap1	10.3	5.5	---	0.4	17.3	---	94	---	5.7
	10-19	Ap2	10.5	5.4	---	0.4	27.8	---	59	---	5.7
	19-35	Ad	12.6	5.2	---	0.4	17.7	---	100	---	6.8
	35-52	A1	11.3	5.6	---	0.3	17.6	---	98	---	5.9
	52-76	A2	11.8	4.0	---	0.2	15.4	---	100	---	6.9
	76-101	Bw	12.9	4.7	TR	0.3	15.2	TR	100	TR	7.6
	101-123	Bwk1	16.3	6.8	TR	0.4	16.2	TR	100	TR	8.0
	123-139	Bwk2	13.9	8.3	0.1	0.4	15.6	1	100	TR	8.2
	139-172	Ab	12.5	12.9	0.4	0.5	21.6	2	100	TR	8.2
	172-187	Bw1b	11.7	13.4	0.8	0.4	21.7	4	100	TR	8.5
	187-217	Bw2b	17.1	14.9	1.3	0.4	20.8	6	100	1	8.7
	217-237	Bw3b	29.6	15.2	1.6	0.4	31.3	4	100	2	8.7
	0-12	Ap*	9.9	5.4	---	0.6	16.0	---	99	---	5.4

See footnote at end of table.

Chemical Properties of Selected Soils--Continued

Soil name and sample number	Depth	Horizon	NH4OAC extractable bases				Cation-exchange capacity ammonium acetate	Exchange-able sodium	Base saturation ammonium acetate	CO <sub>3</sub> as CaCO <sub>3</sub> <2 mm	pH H <sub>2</sub> O 1:1
			Ca	Mg	Na	K					
	<u>Cm</u>		-----meq/100g-----				<u>Pct</u>	<u>Pct</u>	<u>Pct</u>	<u>Pct</u>	
Renfrow silt loam: (S90OK-103-001)	0-9	Ap	8.9	4.8	0.2	0.3	20.6	1	69	---	6.0
	9-18	A	8.8	4.8	0.3	0.3	15.0	2	95	---	6.2
	18-29	BA	11.1	8.4	0.7	0.4	21.3	3	97	---	6.3
	29-56	Bt	14.2	14.6	1.9	0.5	9.3	20	100	---	7.4
	56-83	Btk1	19.5	15.1	3.9	0.2	26.9	10	100	TR	8.0
	83-108	Btk2	---	18.5	6.5	0.2	13.3	24	---	2	8.0
	108-142	Btk3	---	18.5	6.6	0.2	26.7	13	---	1	7.9
	142-169	Btk4	---	17.4	4.9	0.1	21.1	13	---	19	8.1
	169-183	BC1	---	21.7	4.6	0.1	22.0	13	---	29	8.3
	183-201	BC2	---	21.2	4.4	0.2	22.3	12	---	25	8.3
	201-224	Cr1	---	24.9	5.0	0.2	28.7	12	---	9	8.1
	224-250	Cr2	26.3	15.5	4.4	0.3	28.5	11	100	2	8.3
Westsum silty clay loam: (S91OK-103-002)	0-16	Ap	---	12.8	0.1	0.7	29.2	TR	100	1	7.8
	16-28	Bt1	---	15.8	0.1	0.6	30.4	TR	100	1	7.9
	28-42	Btk1	---	15.7	0.1	0.5	26.4	1	100	9	8.0
	42-86	Btk2	---	18.3	0.1	0.4	21.2	1	100	18	8.1
	86-117	Bt2	---	23.6	0.3	0.4	20.1	1	100	20	8.2
	117-166	Bt3	---	31.4	0.7	0.4	20.0	3	100	24	8.4
	166-208	BC1	---	30.8	1.1	0.5	21.0	5	100	17	8.5
	208-236	BC2	---	27.5	1.4	0.5	21.4	5	100	14	8.6
	0-5	DB*	---	---	---	---	---	---	---	---	---
	0-10	P.D.*	---	14.6	0.1	0.8	29.0	1	100	2	8.0

\* Additional satellite samples of surface horizons for verification.

## Additional Chemical and Physical Analyses of Selected Soils

The results of chemical and physical analyses of several pedons are given in the tables "Additional Chemical and Physical Properties of Selected Soils", "Clay Mineralogy of Selected Soils", and "Sand-Silt Mineralogy of Selected Soils." The data are for soils sampled at carefully selected sites. The pedons are representative of the series described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Survey Laboratory, Lincoln, Nebraska.

Most determinations, except for those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods (10).

*Organic carbon*—wet combustion. Walkley-Black modified acid-dichromate, ferric sulfate titration (6A1c).

*Ratio*—CEC to non-carbonate clay (8D1).

*Ratio*—15-bar water to non-carbonate clay (8D1).

*Bulk density*—saran coated clods,  $\frac{1}{3}$ -bar desorption I (4A1d).

*Bulk density*—saran coated clods, oven-dry (4A1h).

*Coefficient of linear extensibility (COLE)*—air-dry or oven-dry to  $\frac{1}{3}$ -bar tension (4D1).

*Water retention*—natural clods  $\frac{1}{3}$ -bar (4B1c).

*Water retention*—natural clods 15-bar (4B1c).

*Water retention difference*—between  $\frac{1}{3}$ - and 15-bar tension (4C1).

*Clay mineralogy*—x-ray diffraction, thin film on glass, resin pretreatment II (7A2i).

Sand-silt mineralogy—optical analysis, grain mounts, epoxy (7B1a).

Additional Chemical and Physical Properties of Selected Soils

(The locations of the sampled pedons are given in the table "Engineering Index test Data." WRD represents water retention difference)

Soil name and sample number	Depth	Horizon	Organic carbon	Ratio/clay		Bulk density		COLE whole soil	Water content		WRD whole soil
				CEC	15 bar H2O	1/3 bar	Ovendry		1/3 bar	15 bar	
	Cm					g/cc	g/cc	Cm/cm	Pct	Pct	Cm/cm
Bethany silt loam: (S900K-103-005)	0-8	Ap	1.69	0.70	0.41	1.20	1.29	0.024	19.5	8.5	0.13
	8-15	Ad	1.18	0.68	0.45	1.38	1.39	0.002	29.2	9.0	0.28
	15-22	A	1.13	0.67	0.43	1.47	1.81	0.072	22.4	9.0	0.20
	22-31	BA	1.11	0.68	0.44	1.45	1.56	0.025	23.0	13.1	0.14
	31-46	Bt1	0.82	0.38	0.49	1.36	1.83	0.104	31.5	23.1	0.11
	46-75	Bt2	0.61	0.95	0.45	1.39	1.82	0.094	28.7	19.8	0.12
	75-99	Btk1	0.38	0.45	0.45	1.46	2.00	0.110	27.0	18.9	0.12
	99-120	Btk2	0.23	0.48	0.47	1.46	1.85	0.081	28.0	20.4	0.11
	120-149	Bt1b	0.13	0.40	0.48	1.34	1.85	0.114	35.2	23.0	0.16
	149-179	Bt2b	0.08	0.84	0.46	1.41	1.87	0.099	29.9	21.5	0.12
	179-207	Bt3b	0.07	0.62	0.46	1.46	1.86	0.084	27.7	20.1	0.11
	207-253	Bt4b	0.04	0.62	0.47	1.47	1.90	0.089	27.2	19.1	0.12
	253-263	Btk1b	0.04	0.65	0.46	1.48	1.81	0.066	26.8	15.2	0.16
Coyle loam: (S900K-103-002)	0-25	A	1.69	0.57	0.44	1.40	1.51	0.026	20.6	9.2	0.16
	25-42	Bt1	1.16	0.52	0.40	1.41	1.54	0.030	21.2	11.5	0.14
	42-59	Bt2	0.82	0.51	0.40	1.51	1.67	0.034	19.6	11.9	0.12
	59-76	BC	0.53	0.52	0.40	---	---	---	---	8.9	---
	76-96	Cr	0.18	0.47	0.40	---	---	---	---	6.0	---
Grainola silty clay loam: (S900K-103-003)	0-8	Ap1	1.15	0.63	0.35	---	---	---	---	12.5	---
	8-13	Ap2	1.24	0.63	0.35	1.45	1.72	0.058	22.1	13.4	0.12
	13-22	Ad	0.85	0.61	0.35	1.51	1.85	0.069	24.1	14.4	0.14
	22-37	Btk1	0.40	0.54	0.34	1.45	1.94	0.096	27.9	16.7	0.16
	37-63	Btk2	0.31	0.50	0.34	1.53	1.96	0.082	23.8	17.1	0.10
	63-86	Btk3	0.15	0.46	0.32	1.44	1.96	0.106	30.4	21.8	0.12
	86-102	Btk4	0.08	0.45	0.34	1.44	1.99	0.109	31.9	20.9	0.15
	102-116	C	0.03	0.41	0.31	1.54	1.94	0.064	26.1	18.5	0.10
	116-140	Cr1	0.01	0.41	0.33	1.59	1.99	0.078	23.7	13.7	0.16
	140-180	Cr2	0.01	0.32	0.33	1.97	2.18	0.034	12.6	9.1	0.07
	0-12	Ap*	1.26	0.83	0.32	---	---	---	---	12.1	---
Highview gravelly silty clay: (S910K-103-003)	0-10	A	1.61	0.39	0.31	---	---	---	---	15.4	---
	10-34	Bw	1.05	0.38	0.29	---	---	---	---	16.6	---
	34-60	Cr	0.25	0.50	0.46	---	---	---	---	19.3	---

See footnote at end of table.

Additional Chemical and Physical Properties of Selected Soils--Continued

Soil name and sample number	Depth	Horizon	Organic carbon	Ratio/clay		Bulk density		COLE whole soil	Water content		WRD whole soil
				CEC	15 bar H2O	1/3 bar	Ovendry		1/3 bar	15 bar	
	<u>Cm</u>					<u>g/cc</u>	<u>g/cc</u>	<u>Cm/cm</u>	<u>Pct</u>	<u>Pct</u>	<u>Cm/cm</u>
Kirkland silt loam: (S900K-103-006)	0-12	Ap1	1.26	0.59	0.40	1.44	1.71	0.059	21.2	10.2	0.16
	12-27	Ap2	1.37	0.61	0.43	1.45	1.64	0.042	22.6	10.6	0.17
	27-37	Bt1	1.09	0.65	0.46	1.33	1.69	0.083	30.2	18.1	0.16
	37-51	Bt2	0.65	0.91	0.44	1.44	1.86	0.089	24.1	20.2	0.06
	51-67	Bt3	0.52	0.89	0.44	1.41	1.80	0.085	28.7	19.4	0.13
	67-85	Bt4	0.48	0.68	0.44	1.46	1.94	0.099	26.0	17.5	0.12
	85-118	Btk	0.23	0.62	0.43	1.50	1.66	0.034	22.0	13.3	0.13
	118-144	Btk1b	0.12	0.64	0.46	1.42	1.88	0.097	30.5	18.0	0.18
	144-174	Btk2b	0.11	0.65	0.48	1.35	1.80	0.100	33.3	20.3	0.18
	174-204	Btk3b	0.07	0.65	0.48	1.50	1.93	0.087	24.7	19.4	0.08
	204-238	Btk4b	0.04	0.92	0.48	1.37	1.76	0.087	33.9	19.1	0.20
Lela silty clay: (S900K-103-007)	0-8	Ap1	1.62	0.62	0.31	1.44	1.92	0.101	26.2	13.7	0.18
	8-16	Ap2	1.71	0.83	0.41	---	---	---	---	18.2	---
	16-32	A1	1.29	0.55	0.40	1.39	1.97	0.123	29.9	21.8	0.11
	32-58	A2	1.16	0.62	0.40	1.30	1.90	0.135	35.0	4.3	0.14
	58-87	A3	1.00	0.81	0.40	1.32	1.92	0.133	34.5	24.0	0.14
	87-107	A4	0.84	0.51	0.39	1.32	1.89	0.127	34.3	24.3	0.13
	107-134	Bw1	0.66	0.44	0.39	---	---	---	---	24.2	---
	134-154	Bw2	0.42	0.47	0.39	1.34	1.89	0.121	32.4	23.0	0.13
	154-182	Bw3	0.32	0.50	0.39	1.40	1.96	0.117	27.8	22.8	0.07
	182-222	Bw4	0.27	0.37	0.35	1.30	1.88	0.131	33.8	20.0	0.18
0-10	Ap*	1.49	0.34	0.41	1.37	1.86	0.107	31.7	21.9	0.13	
Lucien very fine sandy loam: (S910K-103-001)	0-13	A	2.06	0.82	0.62	1.35	1.42	0.017	15.8	7.1	0.12
	13-21	BA	1.10	0.65	0.47	1.42	1.46	0.009	12.6	5.5	0.10
	21-32	Bw	0.90	0.66	0.49	1.40	1.41	0.002	11.4	5.4	0.08
	32-44	Cr	---	---	0.48	1.83	1.83	---	5.1	5.1	---
Norge silt loam: (S900K-103-008)	0-15	Ap1	1.29	0.64	0.45	---	---	---	---	9.4	---
	15-27	Ap2	1.13	0.61	0.41	---	---	---	---	9.8	---
	27-37	BA	1.01	0.54	0.44	1.39	1.84	0.098	25.3	14.8	0.15
	37-59	Bt1	0.59	0.58	0.44	1.45	1.69	0.052	25.1	15.9	0.13
	59-81	Bt2	0.41	0.48	0.44	1.48	1.70	0.047	24.5	15.5	0.13
	81-97	Bt3	0.35	0.51	0.45	1.48	1.73	0.053	26.0	16.2	0.15
	97-124	2Bt4	0.28	0.45	0.45	1.48	1.75	0.057	26.6	17.4	0.14
	124-147	2Bt5	0.12	0.46	0.49	1.49	1.81	0.067	27.3	18.8	0.13
	147-169	2Btk1	0.07	0.61	0.42	1.54	1.90	0.072	22.8	16.5	0.10
	169-205	2Btk2	0.05	0.50	0.49	1.51	1.90	0.080	23.4	19.3	0.06
	205-241	2Btk3	0.01	0.49	0.50	1.50	1.88	0.078	25.8	18.8	0.11

See footnote at end of table.

Additional Chemical and Physical Properties of Selected Soils--Continued

Soil name and sample number	Depth	Horizon	Organic carbon	Ratio/clay		Bulk density		COLE whole soil	Water content		WRD whole soil
				CEC	15 bar H2O	1/3 bar	Ovendry		1/3 bar	15 bar	
	Cm					g/cc	g/cc	Cm/cm	Pct	Pct	Cm/cm
Port silt loam: (S90OK-103-004)	0-10	Ap1	1.00	0.72	0.42	1.57	1.72	0.031	20.1	10.1	0.16
	10-19	Ap2	0.90	1.13	0.44	---	---	---	---	10.8	---
	19-35	Ad	0.70	0.75	0.46	1.57	1.93	0.071	21.7	10.7	0.17
	35-52	A1	0.77	0.70	0.44	1.33	1.50	0.041	26.6	11.2	0.20
	52-76	A2	0.61	0.77	0.48	1.32	1.80	0.109	27.2	9.6	0.23
	76-101	Bw	0.42	0.75	0.47	1.41	2.01	0.125	25.0	9.5	0.22
	101-123	Bwk1	0.28	0.73	0.46	1.49	1.97	0.098	22.4	10.2	0.18
	123-139	Bwk2	0.24	0.68	0.44	1.55	1.64	0.019	21.3	10.1	0.17
	139-172	AB	0.30	0.66	0.42	1.46	1.68	0.048	23.8	13.7	0.15
	172-187	Bw1b	0.22	0.68	0.44	1.62	1.81	0.038	23.8	14.0	0.16
	187-217	Bw2b	0.24	0.60	0.44	1.49	1.83	0.071	25.0	15.3	0.14
	217-237	Bw3b	0.18	0.93	0.44	1.55	1.90	0.070	26.2	14.7	0.18
	0-12	Ap*	0.99	0.62	0.38	---	---	---	---	10.0	---
Renfrow silt loam: (S90OK-103-001)	0-9	Ap	1.37	1.02	0.43	1.57	1.69	0.025	19.3	8.7	0.17
	9-18	A	1.30	0.73	0.45	1.46	1.59	0.029	22.1	9.2	0.19
	18-29	BA	1.17	0.67	0.45	1.41	1.85	0.095	27.7	14.2	0.19
	29-56	Bt	0.73	0.20	0.39	1.42	1.87	0.096	29.1	18.1	0.16
	56-83	Btk1	0.36	0.62	0.42	1.44	1.91	0.099	28.3	18.3	0.14
	83-108	Btk2	0.18	0.27	0.41	1.41	1.92	0.108	30.5	20.2	0.15
	108-142	Btk3	0.10	0.49	0.35	1.45	2.01	0.115	27.8	19.0	0.13
	142-169	Btk4	0.06	0.45	0.36	1.55	1.94	0.076	24.0	16.7	0.11
	169-183	BC1	0.06	0.53	0.37	1.56	1.95	0.073	24.1	15.5	0.13
	183-201	BC2	0.03	0.51	0.36	1.53	1.98	0.064	25.8	15.6	0.12
	201-224	Cr1	0.03	0.64	0.39	1.48	1.85	0.033	28.2	17.7	0.07
	224-250	Cr2	0.03	0.65	0.37	1.54	1.92	0.076	24.9	16.3	0.13
	Westsum silty clay loam: (S91OK-103-002)	0-16	Ap	1.64	0.71	0.43	1.37	1.64	0.062	28.1	17.8
16-28		Bt1	1.49	0.65	0.42	1.36	1.73	0.083	28.8	19.8	0.12
28-42		Btk1	1.11	0.56	0.40	1.47	1.83	0.074	25.4	18.8	0.09
42-86		Btk2	0.60	0.46	0.37	1.58	1.86	0.054	21.1	16.8	0.07
86-117		Bt2	0.39	0.43	0.36	1.38	1.51	0.030	19.8	16.9	0.04
117-166		Bt3	0.23	0.42	0.36	1.60	2.04	0.084	22.3	16.9	0.09
166-208		BC1	0.16	0.45	0.38	1.56	1.95	0.077	23.4	18.0	0.08
208-236		BC2	0.16	0.46	0.38	1.53	1.96	0.086	25.1	17.7	0.11
0-5		DB*	---	---	---	---	---	---	---	---	---
0-10		P.D.*	1.51	0.68	0.41	---	---	---	---	---	17.3

\* Additional satellite samples of surface horizons for verification.

## Clay Mineralogy of Selected Soils

(The locations of the sampled pedons are given in the table "Engineering Index Test Data." TCLY means total clay fraction (<0.002 mm particle diameter). Legends for the mineral abbreviations and the relative peak sizes are at the end of this table)

Soil name and sample number	Horizon	Depth (cm)	Fraction	Clay mineralogy (<.002 mm) and its relative peak size by x-ray
Bethany silt loam: (S900K-103-005)	Bt1	31-46	TCLY	MT 3 KK 2 MI 2 MC 2 QZ 1
	Bt2	46-75	TCLY	MT 3 KK 2 MI 2 QZ 1
	Btk2	99-120	TCLY	MT 3 KK 2 MI 2 MC 1 QZ 1
Coyle loam: (S900K-103-002)	Bt1	25-42	TCLY	KK 3 MI 2 MT 2 VM 2 CL 1
	Bt2	42-59	TCLY	MT 3 KK 3 MI 2
Grainola silty clay loam: (S900K-103-003)	Btk2	37-63	TCLY	MT 3 MI 3 KK 3 VR 2
	Btk4	86-102	TCLY	QZ 1 MT 1
	Cr2	140-180	TCLY	MI 4 KK 3 VR 3 QZ 1
Highview gravelly silty clay: (S910K-103-003)	Bw	10-34	TCLY	MI 3 KK 3 MM 2 MT 2 CL 1
	Bw	10-34	TCLY	HE 1
	Cr	34-60	TCLY	MI 4 KK 3 MM 2 MT 1 CL 1
Kirkland silt loam: (S900K-103-006)	Bt2	37-51	TCLY	MT 3 KK 2 MI 2 QZ 1
	Bt4	67-85	TCLY	MT 3 KK 2 MI 2 QZ 1
	Btk2b	144-174	TCLY	MT 3 KK 2 MI 2 QZ 1
	Btk4b	204-238	TCLY	MT 3 MI 2 KK 2 QZ 1
Lela silty clay: (S900K-103-007)	A1	16-32	TCLY	MT 3 MI 3 KK 2 QZ 1
	A2	32-58	TCLY	MI 3 MT 2 VR 2 KK 2 QZ 1
	A3	58-87	TCLY	MI 3 MT 3 KK 2 MC 1 CL 1
	A4	87-107	TCLY	MT 3 MI 3 KK 2 CL 1 QZ 1
Lucien very fine sandy loam: (S910K-103-001)	Bw	21-32	TCLY	KK 3 MI 2 MT 2 MM 2
	Cr	32-44	TCLY	KK 3 MI 3
Norge silt loam: (S900K-103-008)	Bt1	37-59	TCLY	MT 3 MI 3 KK 2 MC 1 CL 1
	Bt3	81-97	TCLY	MI 3 KK 3 MT 2 MC 1 QZ 1
Port silt loam: (S900K-103-004)	A2	52-76	TCLY	MT 3 MI 3 KK 3
	Bw	76-101	TCLY	MI 3 KK 3 MT 3 VM 2
Renfrow silt loam: (S900K-103-001)	Bt	29-56	TCLY	KK 3 MT 3 MI 2 MC 1 QZ 1
	Btk1	56-83	TCLY	MT 3 KK 3 VR 2 MI 2 QZ 1
	Btk2	83-108	TCLY	MT 3 KK 3 MI 2 VR 1 QZ 1
	Btk3	108-142	TCLY	KK 3 MT 3 MI 3 VM 2 HE 1
	Btk4	142-169	TCLY	KK 3 MI 3 MT 2 MM 2 MC 1

## Clay Mineralogy of Selected Soils--Continued

Soil name and sample number	Horizon	Depth (cm)	Fraction	Clay mineralogy (<.002 mm) and its relative peak size by x-ray
Westsum silty clay loam: (S91OK-103-002)	Bt1	16-28	TCLY	MT 3 MI 3 KK 2 MM 1 QZ 1
	Btk1	28-42	TCLY	MT 3 MI 3 KK 3 MM 2
	Btk2	42-86	TCLY	MI 3 KK 3 MT 2 MM 2 QZ 1

## Mineral Legend:

CL = chlorite  
 KK = kaolinite  
 MC = montmorillonite-chlorite  
 MI = mica  
 MM = montmorillonite-mica  
 MT = montmorillonite  
 QZ = quartz  
 VM = vermiculite-mica  
 VR = vermiculite

## Legend for relative peak size:

6 = no peaks  
 5 = very large  
 4 = large  
 3 = medium  
 2 = small  
 1 = very small

Sand-Silt Mineralogy of Selected Soils

(The locations of the sampled pedons are given in the table "Engineering Index Test Data."  
 TR means trace; VFS means very fine sand (0.05-0.10 mm); CSI means coarse silt  
 (0.02-0.05 mm). A legend for the mineral abbreviations is at the end of this table)

Soil name and sample number	Horizon	Depth (cm)	Fraction	Total resistant minerals (pct)	Optical grain count (percent)
Bethany silt loam: (S900K-103-005)	Bt2	46-75	VFS	78	QZ 75 FD 19 QC 2 MS 2 OP 1 HNtr ARtr FPtr PRtr POtr TMtr BTtr GNtr AMtr ZRtr FKtr
Coyle loam: (S900K-103-002)	Bt2	42-59	VFS	98	QZ 93 QC 4 FD 2 OP 1 BTtr HNtr ARtr PRtr MStr AMtr TMtr ZRtr
	Cr	76-96	VFS	99	QZ 96 QC 3 PR 1 FD 1 OPtr TMtr ZRtr MStr CLtr
Grainola silty clay loam: (S900K-103-003)	Btk2	37-63	VFS	73	QZ 69 CB13 CA 7 FD 4 QC 4 AR 2 MStr OPtr FKtr TMtr FPtr ZRtr HNtr POtr PRtr BTtr CLtr
	Cr2	140-180	VFS	98	QZ 89 QC 8 MS 2 FD 1 OP 1 BTtr CAtr ARtr CLtr HNtr TMtr KKtr
Highview gravelly silty clay: (S910K-1003-003)	Bw	10-34	CSI	69	QZ58 CB11 FK10 KK10 OT 4 CA 4 FP 2 OP 1 ZRtr MStr PRtr POtr GStr TMtr BTtr GNtr HNtr
	Cr	34-60	CSI	68	QZ52 KK16 CB13 OT10 FK 7 FP 1 MS 1 CAtr OPtr CLtr BTtr HNtr POtr TMtr
Kirkland silt loam: (S900K-103-006)	Bt2	37-51	VFS	82	QZ76 FD15 QC 5 AR 2 MS 1 OP 1 PRtr BTtr POtr GNtr CLtr TMtr FPtr AMtr
	Btk4b	204-238	VFS	81	QZ77 FD16 QC 4 MS 1 AR 1 OPtr PRtr HNtr BTtr CLtr GNtr POtr ZRtr TMtr
Lela silty clay: (S900K-103-007)	A2	32-58	VFS	67	QZ61 FD18 AR13 QC 6 CLtr MStr HNtr BTtr FKtr FPtr PRtr POtr AMtr OPtr
Lucien very fine sandy loam: (S910K-103-001)	A	0-13	VFS	95	QZ94 FK 4 OT 2 OP 1 POtr ZRtr MStr TMtr AMtr GStr FRtr PRtr
	Bw	21-32	VFS	95	QZ95 FK 3 OT 1 OP 1 ZRtr POtr TMtr
	Cr	32-44	VFS	95	QZ91 FK 4 OP 4 OT 1 TMtr PRtr
Norge silt loam: (S900K-103-008)	Bt1	37-59	VFS	74	QZ 66 FD 24 QC 8 AR 1 OPtr BTtr POtr PRtr HNtr MStr TMtr FPtr AMtr CLtr
Port silt loam: (S900K-103-004)	A2	52-76	VFS	95	QZ 88 QC 5 FD 4 PO 2 MS 1 OPtr PRtr TMtr BTtr GStr KKtr HNtr

## Sand-Silt Mineralogy of Selected Soils--Continued

Soil name and sample number	Horizon	Depth (cm)	Fraction	Total resistant minerals (pct)	Optical grain count (percent)																
Renfrow silt loam: (S900K-103-001)	Btk1	56-83	VFS	95	QZ 90	FD 5	QC 5	ARtr	OPtr	MStr	PRtr	TMtr	POtr	FPtr	BTtr	CLtr	FKtr				
Westsum silty clay loam: (S910K-103-002)	Ap	0-16	CSI	67	QZ63	FK24	FP 3	OP 3	MS 2	PR 2	OT 1	PO 1	HNtr	BTtr	TMtr	GStr	ZRtr	AMtr	CLtr		
	Bt1	16-28	CSI	65	QZ62	FK26	OT 3	OP 2	FP 2	MS 1	PO 1	PR 1	HN 1	TMtr	BTtr	AMtr	ZRtr	GStr	CLtr		
	Btk1	28-42	CSI	69	QZ64	FK20	OT 5	OP 4	CA 2	FP 1	CB 1	PR 1	PO 1	ZRtr	MStr	BTtr	AMtr	CLtr	TMtr	HNtr	
	Btk2	42-86	CSI	70	QZ68	FK15	OT 8	OP 2	CA 1	PR 1	FP 1	CB 1	MS 1	HN 1	ZRtr	TMtr	BTtr	AMtr	GStr	CLtr	POtr

## Mineral Legend:

AM = amphibole  
 AR = weathered aggregates  
 BT = biotite  
 CA = calcite  
 CB = carbonate aggregates  
 CL = chlorite  
 FD = feldspar  
 FK = potassium-feldspar  
 FP = plagioclase-feldspar  
 GE = goethite  
 GN = garnet  
 GS = glass  
 HE = hematite  
 HN = hornblende  
 KK = kaolinite  
 MC = montmorillonite-chlorite  
 MI = mica  
 MM = montmorillonite-mica  
 MS = muscovite  
 MT = montmorillonite  
 OP = opaques  
 PO = plant opal  
 PR = pyroxene  
 QC = clay-coat quartz  
 QZ = quartz  
 TM = tourmaline  
 VM = vermiculite-mica  
 VR = vermiculite  
 ZR = zircon

## Water Features

The table “Water Features” gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

*Hydrologic soil groups* are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 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.

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

*Water table* refers to a saturated zone in the soil. The table “Water Features” indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

*Ponding* is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

*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, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and frequency are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but

possible under unusual weather conditions (the chance of flooding is 1 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); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

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

Water Features

(Depths of layers are in feet. See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Hydro-logic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
AhpA: Ashport-----	B	March	---	---	---	---	None	Brief	Occasional
		April	---	---	---	---	None	Brief	Occasional
		May	---	---	---	---	None	Brief	Occasional
		June	---	---	---	---	None	Brief	Occasional
		July	---	---	---	---	None	Brief	Occasional
		August	---	---	---	---	None	Brief	Occasional
		September	---	---	---	---	None	Brief	Occasional
		October	---	---	---	---	None	Brief	Occasional
APPA: Ashport-----	B	March	---	---	---	---	None	Brief	Frequent
		April	---	---	---	---	None	Brief	Frequent
		May	---	---	---	---	None	Brief	Frequent
		June	---	---	---	---	None	Brief	Frequent
		July	---	---	---	---	None	Brief	Frequent
		August	---	---	---	---	None	Brief	Frequent
		September	---	---	---	---	None	Brief	Frequent
		October	---	---	---	---	None	Brief	Frequent
Port-----	B	March	---	---	---	---	None	Brief	Frequent
		April	---	---	---	---	None	Brief	Frequent
		May	---	---	---	---	None	Brief	Frequent
		June	---	---	---	---	None	Brief	Frequent
		July	---	---	---	---	None	Brief	Frequent
		August	---	---	---	---	None	Brief	Frequent
		September	---	---	---	---	None	Brief	Frequent
		October	---	---	---	---	None	Brief	Frequent
Pulaski-----	B	March	---	---	---	---	None	Very brief	Frequent
		April	---	---	---	---	None	Very brief	Frequent
		May	---	---	---	---	None	Very brief	Frequent
		June	---	---	---	---	None	Very brief	Frequent
		July	---	---	---	---	None	Very brief	Frequent
		August	---	---	---	---	None	Very brief	Frequent
		September	---	---	---	---	None	Very brief	Frequent
		October	---	---	---	---	None	Very brief	Frequent
AspA, AspB: Ashport-----	B	March	---	---	---	---	None	Brief	Occasional
		April	---	---	---	---	None	Brief	Occasional
		May	---	---	---	---	None	Brief	Occasional
		June	---	---	---	---	None	Brief	Occasional
		July	---	---	---	---	None	Brief	Occasional
		August	---	---	---	---	None	Brief	Occasional
		September	---	---	---	---	None	Brief	Occasional
		October	---	---	---	---	None	Brief	Occasional

## Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table			Ponding		Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
BetA, BetB: Bethany-----	C	Jan-Dec	---	---	---	---	None	---	None
BPG: Borrow pits, gravelly----	A	Jan-Dec	---	---	---	---	None	---	None
BPR: Borrow pits, rock-----	---	Jan-Dec	---	---	---	---	None	---	None
BraA: Braman-----	B	April	---	---	---	---	None	Brief	Rare
		May	---	---	---	---	None	Brief	Rare
		June	---	---	---	---	None	Brief	Rare
		July	---	---	---	---	None	Brief	Rare
		August	---	---	---	---	None	Brief	Rare
		September	---	---	---	---	None	Brief	Rare
		October	---	---	---	---	None	Brief	Rare
		November	---	---	---	---	None	Brief	Rare
BrwA: Brewer-----	C	April	---	---	---	---	None	Brief	Rare
		May	---	---	---	---	None	Brief	Rare
		June	---	---	---	---	None	Brief	Rare
		July	---	---	---	---	None	Brief	Rare
		August	---	---	---	---	None	Brief	Rare
		September	---	---	---	---	None	Brief	Rare
		October	---	---	---	---	None	Brief	Rare
		November	---	---	---	---	None	Brief	Rare
CoLC: Coyle-----	B	Jan-Dec	---	---	---	---	None	---	None
Lucien-----	C	Jan-Dec	---	---	---	---	None	---	None
CoyB, CoyC, CoyC2: Coyle-----	B	Jan-Dec	---	---	---	---	None	---	None
CoZC3: Coyle-----	B	Jan-Dec	---	---	---	---	None	---	None
Zaneis-----	B	Jan-Dec	---	---	---	---	None	---	None

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Surface water depth	Ponding		Flooding	
			Upper limit	Lower limit		Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
DalA: Dale-----	B	April	---	---	---	---	None	Brief	Rare
		May	---	---	---	---	None	Brief	Rare
		June	---	---	---	---	None	Brief	Rare
		July	---	---	---	---	None	Brief	Rare
		August	---	---	---	---	None	Brief	Rare
		September	---	---	---	---	None	Brief	Rare
		October	---	---	---	---	None	Brief	Rare
		November	---	---	---	---	None	Brief	Rare
DAM: Dam-----	D	Jan-Dec	---	---	---	---	None	---	None
DaUA: Dale-----	B	April	---	---	---	---	None	Brief	Rare
		May	---	---	---	---	None	Brief	Rare
		June	---	---	---	---	None	Brief	Rare
		July	---	---	---	---	None	Brief	Rare
		August	---	---	---	---	None	Brief	Rare
		September	---	---	---	---	None	Brief	Rare
		October	---	---	---	---	None	Brief	Rare
		November	---	---	---	---	None	Brief	Rare
Urban land---	D	April	---	---	---	---	None	Brief	Rare
		May	---	---	---	---	None	Brief	Rare
		June	---	---	---	---	None	Brief	Rare
		July	---	---	---	---	None	Brief	Rare
		August	---	---	---	---	None	Brief	Rare
		September	---	---	---	---	None	Brief	Rare
		October	---	---	---	---	None	Brief	Rare
		November	---	---	---	---	None	Brief	Rare
DiGE: Dilworth-----	D	Jan-Dec	---	---	---	---	None	---	None
Grainola-----	D	Jan-Dec	---	---	---	---	None	---	None
DooB: Doolin-----	D	Jan-Dec	---	---	---	---	None	---	None
DwhC: Dilworth-----	D	Jan-Dec	---	---	---	---	None	---	None

## Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table			Ponding		Flooding		
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency	
			Ft	Ft	Ft					
EasA: Easpur-----	B	March	---	---	---	---	None	Brief	Occasional	
		April	---	---	---	---	None	Brief	Occasional	
		May	---	---	---	---	None	Brief	Occasional	
		June	---	---	---	---	None	Brief	Occasional	
		July	---	---	---	---	None	Brief	Occasional	
		August	---	---	---	---	None	Brief	Occasional	
		September	---	---	---	---	None	Brief	Occasional	
		October	---	---	---	---	None	Brief	Occasional	
GadA: Gaddy-----	A	March	---	---	---	---	None	Very brief	Occasional	
		April	---	---	---	---	None	Very brief	Occasional	
		May	---	---	---	---	None	Very brief	Occasional	
		June	---	---	---	---	None	Very brief	Occasional	
		July	---	---	---	---	None	Very brief	Occasional	
		August	---	---	---	---	None	Very brief	Occasional	
		September	---	---	---	---	None	Very brief	Occasional	
		October	---	---	---	---	None	Very brief	Occasional	
GayA: Gaddy-----	A	March	---	---	---	---	None	Very brief	Rare	
		April	---	---	---	---	None	Very brief	Rare	
		May	---	---	---	---	None	Very brief	Rare	
		June	---	---	---	---	None	Very brief	Rare	
		July	---	---	---	---	None	Very brief	Rare	
		August	---	---	---	---	None	Very brief	Rare	
		September	---	---	---	---	None	Very brief	Rare	
		October	---	---	---	---	None	Very brief	Rare	
GMLG: Grainola-----	D	Jan-Dec	---	---	---	---	None	---	None	
		Masham-----	D	Jan-Dec	---	---	---	None	---	None
		Lucien-----		C	Jan-Dec	---	---	---	None	---
GohE: Goodnight----	A	Jan-Dec	---	---	---	---	None	---	None	
GraC: Grainola-----	D	Jan-Dec	---	---	---	---	None	---	None	

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Surface water depth	Ponding		Flooding	
			Upper limit	Lower limit		Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
GrAD: Grainola-----	D	Jan-Dec	---	---	---	---	None	---	None
Ashport-----	B	March	---	---	---	---	None	Brief	Frequent
		April	---	---	---	---	None	Brief	Frequent
		May	---	---	---	---	None	Brief	Frequent
		June	---	---	---	---	None	Brief	Frequent
		July	---	---	---	---	None	Brief	Frequent
		August	---	---	---	---	None	Brief	Frequent
		September	---	---	---	---	None	Brief	Frequent
		October	---	---	---	---	None	Brief	Frequent
GrHC: Grant-----	B	Jan-Dec	---	---	---	---	None	---	None
Huska-----	D	Jan-Dec	---	---	---	---	None	---	None
GrLC: Grainola-----	D	Jan-Dec	---	---	---	---	None	---	None
Lucien-----	C	Jan-Dec	---	---	---	---	None	---	None
GrLE: Grainola-----	D	Jan-Dec	---	---	---	---	None	---	None
Lucien-----	C	Jan-Dec	---	---	---	---	None	---	None
GrnC, GrtB: Grant-----	B	Jan-Dec	---	---	---	---	None	---	None
HaPE: Harrah-----	B	Jan-Dec	---	---	---	---	None	---	None
Pulaski-----	B	March	---	---	---	---	None	Very brief	Frequent
		April	---	---	---	---	None	Very brief	Frequent
		May	---	---	---	---	None	Very brief	Frequent
		June	---	---	---	---	None	Very brief	Frequent
		July	---	---	---	---	None	Very brief	Frequent
		August	---	---	---	---	None	Very brief	Frequent
		September	---	---	---	---	None	Very brief	Frequent
		October	---	---	---	---	None	Very brief	Frequent
HiRG: Highview-----	D	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop-	D	Jan-Dec	---	---	---	---	None	---	None

## Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table			Ponding		Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
KekA: Keokuk-----	B	April	---	---	---	---	None	Very brief	Rare
		May	---	---	---	---	None	Very brief	Rare
		June	---	---	---	---	None	Very brief	Rare
		July	---	---	---	---	None	Very brief	Rare
		August	---	---	---	---	None	Very brief	Rare
		September	---	---	---	---	None	Very brief	Rare
		October	---	---	---	---	None	Very brief	Rare
		November	---	---	---	---	None	Very brief	Rare
KeoA: Keokuk-----	B	March	---	---	---	---	None	Very brief	Occasional
		April	---	---	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		June	---	---	---	---	None	Very brief	Occasional
		July	---	---	---	---	None	Very brief	Occasional
		August	---	---	---	---	None	Very brief	Occasional
		September	---	---	---	---	None	Very brief	Occasional
		October	---	---	---	---	None	Very brief	Occasional
KgfB: Kingfisher---	B	Jan-Dec	---	---	---	---	None	---	None
KgLC: Kingfisher---	B	Jan-Dec	---	---	---	---	None	---	None
Lucien-----	C	Jan-Dec	---	---	---	---	None	---	None
KgWC: Kingfisher---	B	Jan-Dec	---	---	---	---	None	---	None
Wakita-----	D	April	2.0-3.0	2.0-3.5	---	---	None	---	None
		May	2.0-3.0	2.0-3.5	---	---	None	---	None
		June	2.0-3.0	2.0-3.5	---	---	None	---	None
KinC2: Kingfisher---	B	Jan-Dec	---	---	---	---	None	---	None
KowB, KowD: Konawa-----	B	Jan-Dec	---	---	---	---	None	---	None
KrdA, KrdB, KrdB2: Kirkland----	D	Jan-Dec	---	---	---	---	None	---	None

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Surface water depth	Ponding		Flooding	
			Upper limit	Lower limit		Duration	Frequency	Duration	Frequency
			<u>Ft</u>	<u>Ft</u>	<u>Ft</u>				
KrPB: Kirkland-----	D	Jan-Dec	---	---	---	---	None	---	None
Pawhuska-----	D	Jan-Dec	---	---	---	---	None	---	None
LAN: Landfill-----	D	Jan-Dec	---	---	---	---	None	---	None
LelA: Lela-----	D	April	---	---	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		June	---	---	---	---	None	Very brief	Occasional
		July	---	---	---	---	None	Very brief	Occasional
		August	---	---	---	---	None	Very brief	Occasional
		September	---	---	---	---	None	Very brief	Occasional
		October	---	---	---	---	None	Very brief	Occasional
LveB: Lovedale-----	B	Jan-Dec	---	---	---	---	None	---	None
M-W. Miscellaneous water									
McaA: McLain-----	C	April	---	---	---	---	None	Brief	Rare
		May	---	---	---	---	None	Brief	Rare
		June	---	---	---	---	None	Brief	Rare
		July	---	---	---	---	None	Brief	Rare
		August	---	---	---	---	None	Brief	Rare
		September	---	---	---	---	None	Brief	Rare
		October	---	---	---	---	None	Brief	Rare
		November	---	---	---	---	None	Brief	Rare
MilB, MilC: Milan-----	B	Jan-Dec	---	---	---	---	None	---	None
MinB, MinC: Minco-----	B	Jan-Dec	---	---	---	---	None	---	None
MirA: Miller-----	D	March	---	---	---	---	None	Brief	Occasional
		April	---	---	---	---	None	Brief	Occasional
		May	---	---	---	---	None	Brief	Occasional
		June	---	---	---	---	None	Brief	Occasional
		July	---	---	---	---	None	Brief	Occasional
		August	---	---	---	---	None	Brief	Occasional
		September	---	---	---	---	None	Brief	Occasional
		October	---	---	---	---	None	Brief	Occasional

## Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table			Ponding		Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
MisA: Miller-----	D	March	---	---	---	---	None	Brief	Occasional
		April	---	---	---	---	None	Brief	Occasional
		May	---	---	---	---	None	Brief	Occasional
MPNC2: Milan-----	B	Jan-Dec	---	---	---	---	None	---	None
Pawhuska-----	D	Jan-Dec	---	---	---	---	None	---	None
Norge-----	B	Jan-Dec	---	---	---	---	None	---	None
MulC, MulD, MulD4: Mulhall-----	B	Jan-Dec	---	---	---	---	None	---	None
NeDG: Newalla-----	D	Jan-Dec	---	---	---	---	None	---	None
Darnell-----	C	Jan-Dec	---	---	---	---	None	---	None
NorA, NorB, NorC, NorC2: Norge-----	B	Jan-Dec	---	---	---	---	None	---	None
NoUC: Norge-----	B	Jan-Dec	---	---	---	---	None	---	None
Urban land---	D	Jan-Dec	---	---	---	---	None	---	None
OWWE: Oil waste land-----	D	Jan-Dec	---	---	---	---	None	---	None
Westsum-----	D	Jan-Dec	---	---	---	---	None	---	None
PoaA: Port-----	B	March	---	---	---	---	None	Very brief	Frequent
		April	---	---	---	---	None	Very brief	Frequent
		May	---	---	---	---	None	Very brief	Frequent
		June	---	---	---	---	None	Very brief	Frequent
		July	---	---	---	---	None	Very brief	Frequent
		August	---	---	---	---	None	Very brief	Frequent
		September	---	---	---	---	None	Very brief	Frequent
		October	---	---	---	---	None	Very brief	Frequent

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table			Ponding		Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
PoOA: Port-----	B	March	---	---	---	---	None	Brief	Occasional
		April	---	---	---	---	None	Brief	Occasional
		May	---	---	---	---	None	Brief	Occasional
		June	---	---	---	---	None	Brief	Occasional
		July	---	---	---	---	None	Brief	Occasional
		August	---	---	---	---	None	Brief	Occasional
		September	---	---	---	---	None	Brief	Occasional
		October	---	---	---	---	None	Brief	Occasional
Oscar-----	D	March	---	---	---	---	None	Very brief	Occasional
		April	---	---	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		June	---	---	---	---	None	Very brief	Occasional
		July	---	---	---	---	None	Very brief	Occasional
		August	---	---	---	---	None	Very brief	Occasional
		September	---	---	---	---	None	Very brief	Occasional
		October	---	---	---	---	None	Very brief	Occasional
PorA, PotA: Port-----	B	March	---	---	---	---	None	Brief	Occasional
		April	---	---	---	---	None	Brief	Occasional
		May	---	---	---	---	None	Brief	Occasional
		June	---	---	---	---	None	Brief	Occasional
		July	---	---	---	---	None	Brief	Occasional
		August	---	---	---	---	None	Brief	Occasional
		September	---	---	---	---	None	Brief	Occasional
		October	---	---	---	---	None	Brief	Occasional
PukA: Pulaski-----	B	March	---	---	---	---	None	Very brief	Frequent
		April	---	---	---	---	None	Very brief	Frequent
		May	---	---	---	---	None	Very brief	Frequent
		June	---	---	---	---	None	Very brief	Frequent
		July	---	---	---	---	None	Very brief	Frequent
		August	---	---	---	---	None	Very brief	Frequent
		September	---	---	---	---	None	Very brief	Frequent
		October	---	---	---	---	None	Very brief	Frequent
PulA: Pulaski-----	B	March	---	---	---	---	None	Very brief	Occasional
		April	---	---	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		June	---	---	---	---	None	Very brief	Occasional
		July	---	---	---	---	None	Very brief	Occasional
		August	---	---	---	---	None	Very brief	Occasional
		September	---	---	---	---	None	Very brief	Occasional
		October	---	---	---	---	None	Very brief	Occasional
RefC2: Renfrow-----	D	Jan-Dec	---	---	---	---	None	---	None

## Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Surface water depth	Ponding		Flooding	
			Upper limit	Lower limit		Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
ReGC2: Renfrow-----	D	Jan-Dec	---	---	---	---	None	---	None
Grainola-----	D	Jan-Dec	---	---	---	---	None	---	None
ReiA: Reinach-----	B	April	---	---	---	---	None	Very brief	Rare
		May	---	---	---	---	None	Very brief	Rare
		June	---	---	---	---	None	Very brief	Rare
		July	---	---	---	---	None	Very brief	Rare
		August	---	---	---	---	None	Very brief	Rare
		September	---	---	---	---	None	Very brief	Rare
		October	---	---	---	---	None	Very brief	Rare
		November	---	---	---	---	None	Very brief	Rare
RenB, RenC, RewC2: Renfrow-----	D	Jan-Dec	---	---	---	---	None	---	None
RGPD3: Renfrow-----	D	Jan-Dec	---	---	---	---	None	---	None
Grainola-----	D	Jan-Dec	---	---	---	---	None	---	None
Pawhuska-----	D	Jan-Dec	---	---	---	---	None	---	None
SlaB, SlaC, SlaG: Slaughter- ville-----	B	Jan-Dec	---	---	---	---	None	---	None
StDD: Stephenville-	B	Jan-Dec	---	---	---	---	None	---	None
Darnell-----	C	Jan-Dec	---	---	---	---	None	---	None
TabA: Tabler-----	D	January	0.5-1.0	0.7-1.2	---	---	None	---	None
		February	0.5-1.0	0.7-1.2	---	---	None	---	None
		March	0.5-1.0	0.7-1.2	---	---	None	---	None
		April	0.5-1.0	0.7-1.2	---	---	None	---	None
		May	0.5-1.0	0.7-1.2	---	---	None	---	None
		June	0.5-1.0	0.7-1.2	---	---	None	---	None
		October	0.5-1.0	0.7-1.2	---	---	None	---	None
		November	0.5-1.0	0.7-1.2	---	---	None	---	None
		December	0.5-1.0	0.7-1.2	---	---	None	---	None

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Surface water depth	Ponding		Flooding	
			Upper limit	Lower limit		Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
TeaA: Tearney-----	D	January	---	---	0.0-0.5	Long	Occasional	---	None
		February	---	---	0.0-0.5	Long	Occasional	---	None
		March	---	---	0.0-0.5	Long	Occasional	Long	Occasional
		April	---	---	0.0-0.5	Long	Occasional	Long	Occasional
		May	---	---	0.0-0.5	Long	Occasional	Long	Occasional
		June	---	---	0.0-0.5	Long	Occasional	Long	Occasional
		July	---	---	---	---	None	Long	Occasional
		August	---	---	---	---	None	Long	Occasional
		September	---	---	---	---	None	Long	Occasional
		October	---	---	---	---	None	Long	Occasional
TelB, TelD, TelD2: Teller-----	B	Jan-Dec	---	---	---	---	None	---	None
VanA: Vanoss-----	B	Jan-Dec	---	---	---	---	None	---	None
W. Water									
WauA: Waurika-----	D	January	0.5-1.5	1.0-2.0	---	---	None	---	None
		February	0.5-1.5	1.0-2.0	---	---	None	---	None
		March	0.5-1.5	1.0-2.0	---	---	None	---	None
		April	0.5-1.5	1.0-2.0	---	---	None	---	None
		May	0.5-1.5	1.0-2.0	---	---	None	---	None
		November	0.5-1.5	1.0-2.0	---	---	None	---	None
		December	0.5-1.5	1.0-2.0	---	---	None	---	None
WesB, WesC: Westsum-----	D	Jan-Dec	---	---	---	---	None	---	None
WiLC: Wisby-----	B	Jan-Dec	---	---	---	---	None	---	None
Lovedale-----	B	Jan-Dec	---	---	---	---	None	---	None
ZaHC: Zaneis-----	B	Jan-Dec	---	---	---	---	None	---	None
Huska-----	D	Jan-Dec	---	---	---	---	None	---	None
ZanB: Zaneis-----	B	Jan-Dec	---	---	---	---	None	---	None

## Soil Features

The table "Soil Features" gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. Depth to top is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

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

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

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

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

Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Restrictive layer		Potential for frost action	Risk of corrosion	
	Kind	Depth to top <u>In</u>		Uncoated steel	Concrete
AhpA: Ashport-----	---	---	None	Moderate	Low
APPA: Ashport-----	---	---	None	Moderate	Low
Port-----	---	---	None	Moderate	Low
Pulaski-----	---	---	None	Low	Moderate
AspA, AspB: Ashport-----	---	---	None	Moderate	Low
BetA, BetB: Bethany-----	---	---	None	High	Low
BPG: Borrow pits, gravelly-----	---	---	None	---	---
BPR: Borrow pits, rock-----	Bedrock (lithic)	0-0	None	---	---
BraA: Braman-----	---	---	None	Moderate	Moderate
BrwA: Brewer-----	---	---	None	High	Moderate
CoLC: Coyle-----	Bedrock (paralithic)	20-40	None	Moderate	Low
Lucien-----	Bedrock (paralithic)	10-20	None	Low	Low
CoyB, CoyC, CoyC2: Coyle-----	Bedrock (paralithic)	20-40	None	Moderate	Low
CoZC3: Coyle-----	Bedrock (paralithic)	20-40	None	Moderate	Low
Zaneis-----	Bedrock (paralithic)	40-60	None	Moderate	Low
DalA: Dale-----	---	---	None	Moderate	Low
DAM: Dam-----	Dense material	0-60	None	---	---

## Soil Features--Continued

Map symbol and soil name	Restrictive layer		Potential for frost action	Risk of corrosion	
	Kind	Depth to top <u>In</u>		Uncoated steel	Concrete
DaUA: Dale-----	---	---	None	Moderate	Low
Urban land.					
DiGE: Dilworth-----	Bedrock (paralithic)	20-40	None	Moderate	Low
Grainola-----	Bedrock (paralithic)	20-40	None	High	Low
DooB: Doolin-----	Bedrock (paralithic)	60-80	None	High	Moderate
DwhC: Dilworth-----	Bedrock (paralithic)	20-40	None	Moderate	Low
EasA: Easpur-----	---	---	None	Moderate	Low
GadA, GayA: Gaddy-----	---	---	None	Low	Low
GMLG: Grainola-----	Bedrock (paralithic)	20-40	None	High	Low
Masham-----	Bedrock (paralithic)	10-20	None	High	Low
Lucien-----	Bedrock (paralithic)	10-20	None	Low	Low
GohE: Goodnight-----	---	---	None	Low	Low
GraC: Grainola-----	Bedrock (paralithic)	20-40	None	High	Low
GrAD: Grainola-----	Bedrock (paralithic)	20-40	None	High	Low
Ashport-----	Bedrock (paralithic)	41-79	None	Moderate	Low
GrHC: Grant-----	Bedrock (paralithic)	40-60	None	Moderate	Low
Huska-----	Bedrock (paralithic)	40-60	None	High	Moderate

## Soil Features--Continued

Map symbol and soil name	Restrictive layer		Potential for frost action	Risk of corrosion	
	Kind	Depth to top In		Uncoated steel	Concrete
GrLC, GrLE: Grainola-----	Bedrock (paralithic)	20-40	None	High	Low
Lucien-----	Bedrock (paralithic)	10-20	None	Low	Low
GrnC, GrtB: Grant-----	Bedrock (paralithic)	40-60	None	Moderate	Low
HaPE: Harrah-----	---	---	None	Moderate	Moderate
Pulaski-----	Bedrock (paralithic)	63-80	None	Low	Moderate
HiRG: Highview-----	Bedrock (paralithic)	10-20	None	High	Low
Rock outcrop.					
KekA, KeoA: Keokuk-----	---	---	None	Low	Low
KgFB: Kingfisher-----	Bedrock (paralithic)	20-40	None	Moderate	Low
KgLC: Kingfisher-----	Bedrock (paralithic)	20-40	None	Moderate	Low
Lucien-----	Bedrock (paralithic)	10-20	None	Low	Low
KgWC: Kingfisher-----	Bedrock (paralithic)	20-40	None	Moderate	Low
Wakita-----	Bedrock (paralithic)	20-40	None	High	High
KinC2: Kingfisher-----	Bedrock (paralithic)	20-40	None	Moderate	Low
KowB, KowD: Konawa-----	---	---	None	Moderate	Moderate
KrdA: Kirkland-----	---	---	None	High	Low
KrdB, KrdB2: Kirkland-----	Bedrock (paralithic)	60-99	None	High	Low

## Soil Features--Continued

Map symbol and soil name	Restrictive layer		Potential for frost action	Risk of corrosion	
	Kind	Depth to top <u>In</u>		Uncoated steel	Concrete
KrPB: Kirkland-----	---	---	None	High	Low
Pawhuska-----	Bedrock (paralithic)	68-80	None	High	High
LAN. Landfill					
Lela: Lela-----	---	---	None	High	Low
LveB: Lovedale-----	---	---	None	Low	Moderate
M-W. Miscellaneous water					
McaA: McLain-----	---	---	None	High	Low
MilB, MilC: Milan-----	---	---	Low	Moderate	Low
MinB, MinC: Minco-----	---	---	None	Low	Low
MirA: Miller-----	---	---	None	High	Low
MisA: Miller-----	---	---	None	High	Moderate
MPNC2: Milan-----	---	---	Low	Moderate	Low
Pawhuska-----	---	---	None	High	High
Norge-----	---	---	None	Moderate	Low
MulC, MulD, MulD4: Mulhall-----	---	---	None	Moderate	Low
NeDG: Newalla-----	Bedrock (paralithic)	40-60	None	High	Moderate
Darnell-----	Bedrock (paralithic)	10-20	None	Low	Moderate
NorA, NorB, NorC, NorC2: Norge-----	---	---	None	Moderate	Low
NoUC: Norge-----	---	---	None	Moderate	Low
Urban land.					

## Soil Features--Continued

Map symbol and soil name	Restrictive layer		Potential for frost action	Risk of corrosion	
	Kind	Depth to top <u>In</u>		Uncoated steel	Concrete
OWWE: Oil waste land-----	---	---	None	High	High
Westsum-----	---	---	None	High	Low
PoaA: Port-----	---	---	None	Moderate	Low
PoOA: Port-----	---	---	None	Moderate	Low
Oscar-----	---	---	None	High	Moderate
PorA, PotA: Port-----	---	---	None	Moderate	Low
PukA, Pula: Pulaski-----	---	---	None	Low	Moderate
RefC2: Renfrow-----	---	---	None	High	Low
ReGC2: Renfrow-----	Bedrock (paralithic)	61-80	None	High	Low
Grainola-----	Bedrock (paralithic)	20-40	None	High	Low
ReiA: Reinach-----	---	---	None	Low	Low
RenB, RenC: Renfrow-----	---	---	None	High	Low
RewC2: Renfrow-----	Bedrock (paralithic)	61-80	None	High	Low
RGPD3: Renfrow-----	---	---	None	High	Low
Grainola-----	Bedrock (paralithic)	20-40	None	High	Low
Pawhuska-----	---	---	None	High	High
SlaB, SlaC, SlaG: Slaughterville-----	---	---	None	Low	Low
StDD: Stephenville-----	Bedrock (paralithic)	20-40	None	Moderate	Moderate
Darnell-----	Bedrock (paralithic)	10-20	None	Low	Moderate
TabA: Tabler-----	---	---	None	High	Low

## Soil Features--Continued

Map symbol and soil name	Restrictive layer		Potential for frost action	Risk of corrosion	
	Kind	Depth to top <u>In</u>		Uncoated steel	Concrete
TeaA: Tearney-----	---	---	None	High	Low
TelB, TelD, TelD2: Teller-----	---	---	None	Low	Moderate
VanA: Vanoss-----	---	---	None	Moderate	Moderate
W. Water					
WauA: Waurika-----	---	---	None	High	Moderate
WesB, WesC: Westsum-----	---	---	None	High	Low
WiLC: Wisby-----	---	---	None	Low	Low
Lovedale-----	---	---	None	Low	Moderate
ZaHC: Zaneis-----	Bedrock (paralithic)	40-60	None	Moderate	Low
Huska-----	Bedrock (paralithic)	40-60	None	High	Moderate
ZanB: Zaneis-----	Bedrock (paralithic)	40-60	None	Moderate	Low

# Classification of the Soils

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The system of soil classification used by the National Cooperative Soil Survey has six categories (11, 12). 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. The table "Classification of the Soils" lists each soil series in the survey area and gives its classification. The categories are defined in the following paragraphs.

**ORDER.** Twelve 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 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 Argiustolls (*Argi*, meaning argillic horization, 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. An example is Udic Argiustolls.

**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, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, thermic Udic Argiustolls.

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

## Classification of the Soils

Soil name	Family or higher taxonomic class
Ashport-----	Fine-silty, mixed, superactive, thermic Fluventic Haplustolls
Bethany-----	Fine, mixed, superactive, thermic Pachic Paleustolls
Braman-----	Fine-silty, mixed, superactive, thermic Pachic Argiustolls
Brewer-----	Fine, mixed, superactive, thermic Udertic Argiustolls
Coyle-----	Fine-loamy, siliceous, active, thermic Udic Argiustolls
Dale-----	Fine-silty, mixed, superactive, thermic Pachic Haplustolls
Darnell-----	Loamy, siliceous, active, thermic, shallow Udic Haplustepts
Dilworth-----	Fine, mixed, superactive, thermic Udertic Argiustolls
Doolin-----	Fine, smectitic, thermic Typic Natrustolls
Easpur-----	Fine-loamy, mixed, superactive, thermic Fluventic Haplustolls
Gaddy-----	Sandy, mixed, thermic Udic Ustifluvents
Goodnight-----	Mixed, thermic Typic Ustipsamments
Grainola-----	Fine, mixed, active, thermic Udertic Haplustalfts
Grant-----	Fine-silty, mixed, superactive, thermic Udic Argiustolls
Harrah-----	Fine-loamy, siliceous, active, thermic Ultic Paleustalfts
Highview-----	Clayey, mixed, active, thermic, shallow Udic Haplustepts
Huska-----	Fine, mixed, superactive, thermic Mollic Natrustalfts
Keokuk-----	Coarse-silty, mixed, superactive, thermic Fluventic Haplustolls
Kingfisher-----	Fine-silty, mixed, active, thermic Udic Argiustolls
Kirkland-----	Fine, mixed, superactive, thermic Udertic Paleustolls
Konawa-----	Fine-loamy, mixed, active, thermic Ultic Haplustalfts
Lela-----	Fine, mixed, superactive, thermic Udic Haplusterts
Lovedale-----	Fine-loamy, mixed, superactive, thermic Udic Argiustolls
Lucien-----	Loamy, mixed, superactive, thermic, shallow Udic Haplustolls
Masham-----	Clayey, mixed, active, thermic, shallow Udic Haplustepts
McLain-----	Fine, mixed, superactive, thermic Pachic Argiustolls
Milan-----	Fine-loamy, mixed, superactive, thermic Udic Argiustolls
Miller-----	Fine, mixed, superactive, thermic Udertic Haplustolls
Minco-----	Coarse-silty, mixed, superactive, thermic Udic Haplustolls
Mulhall-----	Fine-loamy, siliceous, active, thermic Udic Paleustolls
Newalla-----	Fine-loamy over clayey, siliceous, superactive, thermic Udic Haplustalfts
Norge-----	Fine-silty, mixed, active, thermic Udic Paleustolls
Oscar-----	Fine-silty, mixed, superactive, thermic Typic Natrustalfts
Pawhuska-----	Fine, mixed, superactive, thermic Mollic Natrustalfts
Port-----	Fine-silty, mixed, superactive, thermic Cumulic Haplustolls
Pulaski-----	Coarse-loamy, mixed, superactive, nonacid, thermic Udic Ustifluvents
Reinach-----	Coarse-silty, mixed, superactive, thermic Pachic Haplustolls
Renfrow-----	Fine, mixed, superactive, thermic Udertic Paleustolls
Slaughterville-----	Coarse-loamy, mixed, superactive, thermic Udic Haplustolls
Stephenville-----	Fine-loamy, siliceous, active, thermic Ultic Haplustalfts
Tabler-----	Fine, smectitic, thermic Udertic Argiustolls
Tearney-----	Clayey over sandy or sandy-skeletal, mixed, superactive, thermic Fluventic Hapludolls
Teller-----	Fine-loamy, mixed, active, thermic Udic Argiustolls
Vanoss-----	Fine-silty, mixed, superactive, thermic Udic Argiustolls
Wakita-----	Fine-silty, mixed, active, thermic Leptic Natrustolls
Waurika-----	Fine, smectitic, thermic Vertic Argialbolls
Westsum-----	Fine, mixed, active, thermic Udertic Argiustolls
Wisby-----	Coarse-loamy, mixed, superactive, thermic Udic Argiustolls
Zaneis-----	Fine-loamy, siliceous, active, thermic Udic Argiustolls

## Soil Series and Their Morphology

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each soil series. In addition, the physiographic region, province, and subprovince are specified for most of the series (6). A pedon, a small three-dimensional area of soil, which 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" (15). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (12) and "Keys to Soil Taxonomy" (11). 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."

### **Ashport Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy alluvium of Recent age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Low flood plain

*Slope range:* 0 to 3 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 65 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, superactive, thermic Fluventic Haplustolls

#### **Associated Soils**

- Dale soils which have a mollic epipedon more than 20 inches thick, at the slightly higher elevations or on the higher flood plains that are rarely flooded
- Port soils which have a mollic epipedon more than 20 inches thick, on landscapes that are similar to those of the Ashport soils but are commonly further from the stream channel
- Pulaski soils which have a coarse-loamy control section and do not have a mollic epipedon, on landscapes that are similar to those of the Ashport soils but are generally nearer to the stream channel

#### **Typical Pedon**

Ashport silty clay loam; Payne County, Oklahoma; about 1/2 mile west of Stillwater, Oklahoma, in a cultivated area; 2,440 feet east and 920 feet north of the southwestern corner of sec. 16, T. 19 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 5 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 3/2) moist; weak medium platy structure; hard, firm; many fine roots; slightly acid; abrupt smooth boundary. (0 to 8 inches thick)

A—5 to 16 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR

- 3/2) moist; moderate medium subangular blocky structure; hard, firm; many fine roots; neutral; clear smooth boundary. (0 to 16 inches thick)
- Bw—16 to 36 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 5/4) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; hard, firm; few fine roots; slightly acid; clear smooth boundary. (14 to 54 inches thick)
- Ab—36 to 52 inches; dark reddish gray (5YR 4/2) loam, dark reddish brown (5YR 3/2) moist; weak coarse prismatic structure parting to weak medium granular; slightly hard, friable; slightly acid; gradual smooth boundary. (0 to 20 inches thick)
- Bwb—52 to 66 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; slightly acid; gradual smooth boundary. (0 to 27 inches thick)
- BCb—66 to 80 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable; neutral.

### Range in Characteristics

*Thickness of the mollic epipedon:* Less than 20 inches

*Thickness of the solum:* 26 to more than 60 inches

*Depth to carbonates:* 20 to 60 inches

*Depth to bedrock:* More than 80 inches

*Depth to buried horizon:* 24 to more than 60 inches

#### *A horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—silt loam, loam, clay loam, or silty clay loam

Reaction—moderately acid to moderately alkaline

Roots—many, fine

Clay content—15 to 35 percent

Thickness—10 to 16 inches

#### *Bw horizon:*

Color—hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 3 to 6

Texture—silty clay loam, clay loam, loam, or silt loam

Reaction—slightly acid to moderately alkaline

Roots—few, fine

Clay content—18 to 35 percent

Thickness—14 to 54 inches

#### *C horizon (if it occurs):*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—loam, silt loam, silty clay loam, or clay loam that is stratified with coarser or finer materials

Reaction—slightly acid to moderately alkaline

Clay content—5 to 35 percent

Thickness—0 to 24 inches

#### *Ab horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—slightly acid to moderately alkaline

Clay content—18 to 35 percent

Thickness—0 to 20 inches

#### *Bwb horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3 to 6

Texture—loam, silt loam, or silty clay loam

Reaction—slightly acid to moderately alkaline  
 Clay content—18 to 35 percent  
 Thickness—0 to 27 inches

*BCb horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6  
 Texture—loam, silt loam, or silty clay loam  
 Reaction—slightly acid to moderately alkaline  
 Clay content—18 to 35 percent

### ***Bethany Series***

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Alluvium or loess of Pleistocene age over shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Terrace

*Landform position:* Tread

*Slope range:* 0 to 5 percent

*Slope shape:* Linear-linear

*Elevation range:* 950 to 1,250 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free days:* 190 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Pachic Paleustolls

#### **Associated Soils**

- Pond Creek soils which have less than 35 percent clay in the control section, on landscapes similar to those of the Bethany soils
- Kirkland soils which have an abrupt textural change from the A horizon to the Bt horizon and have COLE value of 0.07 or more, on landscapes similar to those of the Bethany soils
- Renfrow soils which have COLE value of 0.07 or more and have a mollic epipedon less than 20 inches thick, on landscapes similar to those of the Bethany soils
- Norge and Vanoss soils which have a mollic epipedon less than 20 inches thick and have less than 35 percent clay in the control section, on landscapes similar to those of the Bethany soils
- Tabler soils which have COLE value of 0.07 or more, have redoximorphic accumulations and depletions in the Bt horizon, and have smectitic mineralogy; in the slightly lower positions on the landscape

#### **Typical Pedon**

Bethany silt loam; Oklahoma County, Oklahoma; about 1 mile east of Wheatland, in a cultivated area; 1,000 feet north and 200 feet east of the southwestern corner of sec. 28, T. 11 N., R. 4 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary. (0 to 10 inches thick)

- A—6 to 14 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; slightly acid; gradual smooth boundary. (6 to 20 inches thick)
- BA—14 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; many fine roots; neutral; clear smooth boundary. (3 to 10 inches thick)
- Bt1—18 to 36 inches; brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; strong fine and medium blocky structure; very hard, very firm; clay films on faces of peds; common fine roots; slightly alkaline; gradual smooth boundary. (10 to 25 inches thick)
- Bt2—36 to 56 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; moderate medium and coarse blocky structure; very hard, very firm; clay films on faces of peds; few fine roots; common fine iron-manganese concretions; few fine concretions of calcium carbonate; moderately alkaline; gradual smooth boundary. (10 to 30 inches thick)
- Bt3—56 to 72 inches; brown (7.5YR 5/4) silty clay, brown (7.5YR 4/4) moist; moderate medium and coarse blocky structure; very hard, very firm; patchy clay films on faces of peds; few fine roots; common fine and coarse distinct yellowish red (5YR 5/6) and reddish brown (5YR 5/4) redoximorphic accumulations; common fine iron-manganese concretions; few soft accumulations of secondary lime; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary. (10 to 20 inches thick)
- Bt4—72 to 80 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak medium blocky structure; very hard, very firm; patchy clay films on faces of peds; common coarse distinct brown (7.5YR 5/4) and red (2.5YR 5/6) redoximorphic accumulations; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the mollic epipedon:* More than 20 inches

*Thickness of the solum:* More than 60 inches

*Depth to bedrock:* More than 80 inches

*Depth to carbonates:* 28 to 40 inches

#### *A horizon:*

Color—hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 or 3

Texture—silt loam or silty clay loam

Reaction—strongly acid to slightly alkaline

Electrical conductivity of the saturation extract—0 to 1 mmhos/cm

Clay content—14 to 32 percent

Thickness—8 to 20 inches

#### *BA horizon:*

Color—hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 or 3

Texture—silty clay loam or clay loam

Reaction—slightly acid to slightly alkaline

Electrical conductivity of the saturation extract—0 to 1 mmhos/cm

Clay content—27 to 35 percent

Thickness—3 to 10 inches

#### *Bt1 horizon:*

Color—hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 or 3

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—neutral to moderately alkaline

Electrical conductivity of the saturation extract—0 to 1 mmhos/cm

Clay content—35 to 50 percent  
 Thickness—10 to 25 inches

***Bt2 horizon:***

Color—hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6  
 Texture—clay, silty clay, clay loam, or silty clay loam  
 Redoximorphic features—few or common accumulations in shades of brown  
 Reaction—neutral to moderately alkaline  
 Electrical conductivity of the saturation extract—0 to 4 mmhos/cm  
 Sodium adsorption ratio—0 to 8 percent  
 Clay content—35 to 50 percent  
 Thickness—10 to 30 inches

***Bt3 horizon:***

Color—hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6  
 Texture—clay, silty clay, clay loam, or silty clay loam  
 Redoximorphic features—accumulations and depletions in shades of yellow, red, gray, and brown  
 Reaction—slightly alkaline or moderately alkaline  
 Electrical conductivity of the saturation extract—0 to 4 mmhos/cm  
 Clay content—35 to 50 percent  
 Sodium adsorption ratio—0 to 8 percent  
 Thickness—8 to 20 inches

***Bt4 horizon:***

Color—hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6  
 Texture—clay, silty clay, clay loam, or silty clay loam  
 Redoximorphic features—accumulations and depletions in shades of yellow, red, gray, and brown  
 Reaction—neutral to moderately alkaline  
 Clay content—35 to 50 percent

***Braman Series***

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* High flood plain

*Slope range:* 0 to 1 percent

*Slope shape:* Linear-linear

*Elevation range:* 800 to 1,500 feet

*Mean annual precipitation:* 30 to 36 inches

*Mean annual air temperature:* 57 to 61 degrees F

*Frost-free days:* 190 to 230

*Thornthwaite PE index:* 48 to 60

*Taxonomic class:* Fine-silty, mixed, superactive, thermic Pachic Argiustolls

**Associated Soils**

- Brewer, Lela, and McLain soils which have a fine control section, on flood plain levels similar to those of the Braman soils

- Dale soils which do not have an argillic horizon, on flood plain levels similar to those of Braman soils
- Reinach soils which have a coarse-silty control section, on the lower flood plains nearer to the stream than the Braman soils
- Keokuk soils which have a mollic epipedon less than 20 inches thick and have a coarse-silty control section, on the lower flood plains nearer to the stream than the Braman soils
- Port soils which do not have an argillic horizon, on the lower flood plains nearer to the stream than the Braman soils
- Miller soils which have a fine control section and do not have an argillic horizon, on the lower flood plains nearer to the stream than the Braman soils

### Typical Pedon

Braman silt loam, 0 to 1 percent slopes, rarely flooded; Noble County, Oklahoma; about 3 miles west and 2 miles north of Marland, in a cultivated area; 1,700 feet east and 1,000 feet south of the northwestern corner of sec. 4, T. 24 N., R. 1 E. (Colors are for dry soil unless otherwise indicated.)

- Ap—0 to 8 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; hard, friable; common fine roots; common wormcasts; few coarse and common fine tubular pores with low vertical continuity; slightly acid (pH 6.5); clear smooth boundary. (7 to 10 inches thick)
- A—8 to 12 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine and medium granular structure; hard, friable; common fine roots; common wormcasts; common fine tubular pores with low vertical continuity; slightly acid (pH 6.5); clear smooth boundary. (0 to 11 inches thick)
- Bt1—12 to 23 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and very fine subangular blocky structure; hard, firm; few fine roots; common wormcasts; few fine and common very fine tubular pores with low vertical continuity; common distinct clay films on faces of peds; neutral (pH 7.0); gradual smooth boundary. (6 to 12 inches thick)
- Bt2—23 to 36 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate fine prismatic structure parting to moderate very fine subangular blocky; hard, friable; few wormcasts; few fine and common very fine tubular pores with low vertical continuity; few distinct clay films on faces of peds; neutral (pH 7.0); gradual smooth boundary. (6 to 22 inches thick)
- BC—36 to 48 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, very friable; moderately alkaline (pH 8.0); gradual smooth boundary. (0 to 22 inches thick)
- C—48 to 80 inches; stratified reddish brown (5YR 4/4) silty clay and reddish brown (5YR 5/4) loam, reddish brown (5YR 3/4) and reddish brown (5YR 4/4) moist; massive; very hard, very firm and hard, friable; moderately alkaline (pH 8.0).

### Range in Characteristics

*Thickness of the mollic epipedon:* 20 to 31 inches

*Thickness of the solum:* More than 60 inches

*Ap horizon:*

Color—hue of 5YR to 7.5YR, value of 4, and chroma of 2

Texture—silt loam

Reaction—moderately acid to neutral

Roots—many, fine

Clay content—15 to 35 percent

*A horizon:*

Color—hue of 5YR to 7.5YR, value of 4, and chroma of 2  
 Texture—silt loam  
 Reaction—moderately acid to neutral  
 Roots—many, fine  
 Clay content—15 to 35 percent

*Bt horizon:*

Color—hue of 5YR, value of 4 or 5, and chroma of 2 to 4  
 Texture—silt loam, loam, clay loam, or silty clay loam  
 Reaction—moderately acid to moderately alkaline  
 Clay content—18 to 35 percent

*BC horizon:*

Color—hue of 5YR, value of 5, and chroma of 4 to 6  
 Texture—very fine sandy loam or silt loam  
 Reaction—mildly alkaline or moderately alkaline  
 Clay content—15 to 27 percent

*C horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3  
 Texture—very fine sandy loam, silt loam, loam, or silty clay  
 Reaction—moderately acid to moderately alkaline  
 Clay content—15 to 35 percent

**Brewer Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Silty and clayey alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Flood plains

*Slope range:* 0 to 1 percent

*Slope shape:* Linear

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 58 to 63 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Udertic Argiustolls

**Associated Soils**

- Port and Reinach soils which have less than 35 percent clay in the control section, on flood plains
- McLain soils which have upper Bt horizons with hues of 5YR or redder, on flood plains

**Typical Pedon**

Brewer silty clay loam; Pawnee County, Oklahoma; about 1/2 mile north of Pawnee on the east side of Oklahoma Highway 18, in pasture; 200 feet east and 900 feet north of the southwestern corner of sec. 29, T. 22 N., R. 5 E. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; hard, friable; slightly acid; gradual smooth boundary. (8 to 16 inches thick)
- Bt1—12 to 30 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium and fine subangular blocky structure; very hard, firm; clay films on faces of peds; neutral; gradual smooth boundary. (10 to 22 inches thick)
- Bt2—30 to 50 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; very hard, firm; clay films on faces of peds; moderately alkaline; gradual smooth boundary. (12 to 26 inches thick)
- BC—50 to 80 inches; reddish brown (5YR 4/3) silty clay loam; dark reddish brown (5YR 3/3) moist; weak coarse blocky structure; very hard, firm; moderately alkaline; gradual smooth boundary. (15 to 35 inches thick)
- Ck—80 to 90 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; massive; very hard, firm; common fine concretions of calcium carbonate; moderately alkaline.

### Range in Characteristics

*Thickness of the solum:* 50 to 90 inches

*A horizon:*

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 1 or 2

Texture—silty clay loam, clay loam, or silt loam

Reaction—moderately acid to neutral

*Bt1 and Bt2 horizons:*

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 1 or 2

Texture—clay loam, silty clay, loam, or clay

Reaction—slightly acid to moderately alkaline

Redoximorphic features—some pedons have accumulations or depletions in shades of brown or gray below a depth of 30 inches

Sodium—salt or sodium accumulation below a depth of 50 inches in some pedons

Secondary carbonates—below a depth of 28 inches in some pedons

*Btk horizon (if it occurs):*

Color—hue of 7.5YR to 10YR, value of 4 or 5, and chroma of 3 or 4

Texture—silty clay loam, silty clay, or clay

Reaction—slightly acid to moderately alkaline

*BC horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4

Texture—loam, silty clay loam, clay loam, or clay

Reaction—neutral to moderately alkaline

*C horizon (if it occurs):*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4

Texture—loam, silty clay loam, clay loam, or clay

Reaction—neutral to moderately alkaline; horizon may be calcareous or noncalcareous

### Coyle Series

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Parent material and geologic age:* Sandstone of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 1 to 12 percent

*Slope shape:* Convex-convex

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 190 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-loamy, siliceous, active, thermic Udic Argiustolls (fig. 23)

### Associated Soils

- Chickasha and Zaneis soils which have a solum more than 40 inches thick, generally on side slopes below the Coyle soils
- Grainola and Renfrow soils which have a fine control section, typically on convex side slopes below the Coyle soils
- Lucien soils which have a solum less than 20 inches thick over sandstone and do not have Bt horizons, on landscapes similar to those of the Coyle soils

### Typical Pedon

Coyle loam; Payne County, Oklahoma; about 6 miles south and 3 miles west of Stillwater, in rangeland; 70 feet north and 460 feet west of the southeastern corner of sec. 17, T. 18 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

A—0 to 11 inches; dark reddish gray (5YR 4/2) loam, dark reddish brown (5YR 3/2) moist; strong fine granular structure; slightly hard, friable; many fine roots; slightly alkaline; clear smooth boundary. (6 to 14 inches thick)

BA—11 to 14 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; slightly hard, friable; many fine roots; many fine pores; many wormcasts; slightly alkaline; clear smooth boundary. (0 to 8 inches thick)

Bt1—14 to 31 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; common fine roots; thin nearly continuous clay films on faces of peds; neutral; gradual smooth boundary. (7 to 19 inches thick)

Bt2—31 to 39 inches; light red (2.5YR 6/8) sandy clay loam, red (2.5YR 5/8) moist; weak coarse subangular blocky structure; hard, firm; common fine roots; few coarse fragments of sandstone less than 76 mm in diameter; patchy clay films on faces of peds; neutral; abrupt smooth boundary. (0 to 16 inches thick)

Cr—39 to 42 inches; red (2.5YR 5/6) sandstone; material can be augered when moist.

### Range in Characteristics

*Thickness of the mollic epipedon:* 7 to 20 inches

*Thickness of the solum:* 20 to 40 inches

*Depth to bedrock:* 20 to 40 inches

*A or Ap horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—fine sandy loam or loam

Reaction—moderately acid to slightly alkaline

Roots—many, fine

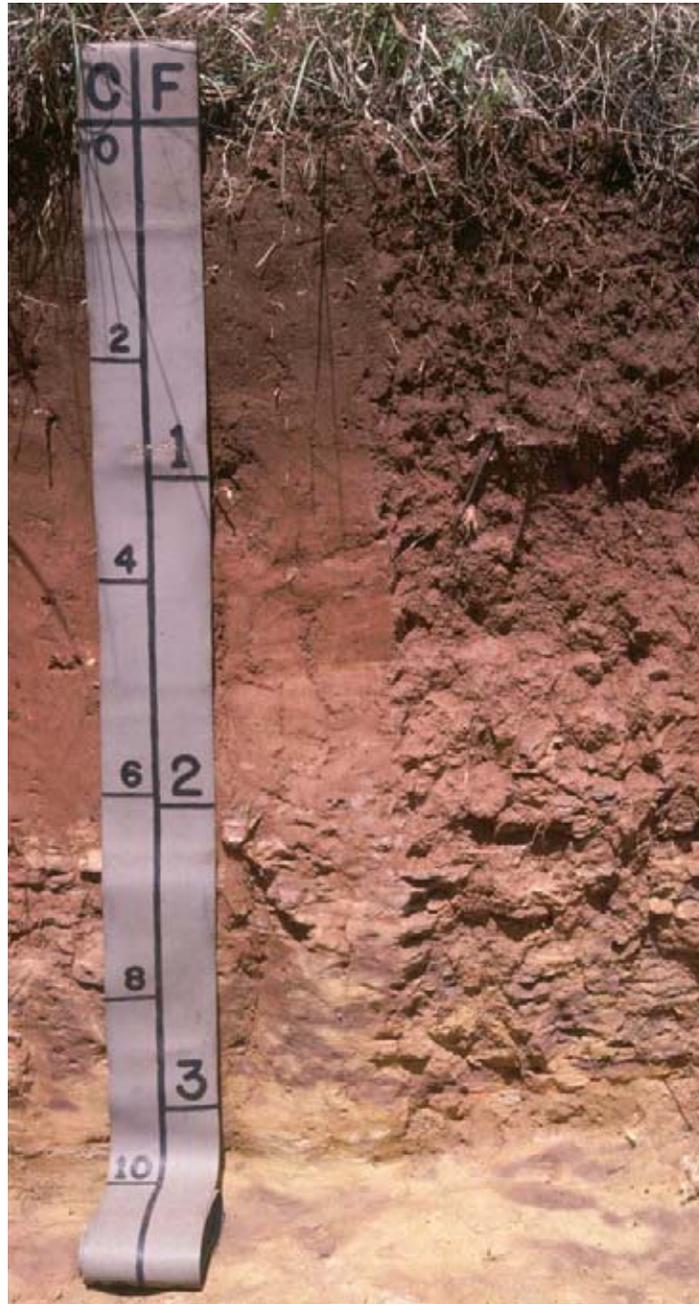


Figure 23.—Profile of Coyle loam.

Clay content—10 to 26 percent  
 Thickness—6 to 14 inches

*BA horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4  
 Texture—loam or fine sandy loam  
 Reaction—moderately acid to slightly alkaline  
 Roots—many, fine  
 Pores—many, fine

Clay content—18 to 26 percent

Thickness—0 to 8 inches

*Bt1 horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—clay loam, loam, or sandy clay loam

Redoximorphic features—red or brown concentrations

Reaction—moderately acid to slightly alkaline

Roots—common, fine

Clay content—20 to 35 percent

Coarse fragments—0 to 10 percent, by volume, fragments less than 76 mm in diameter

Thickness—7 to 19 inches

*Bt2 horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—clay loam, fine sandy loam, loam, or sandy clay loam or their channery, flaggy, or gravelly counterparts

Redoximorphic features—yellow, red, or brown concentrations

Reaction—moderately acid to slightly alkaline

Roots—common, fine

Clay content—18 to 35 percent

Coarse fragments—0 to 35 percent, by volume, sandstone fragments (about 0 to 30 percent are fragments less than 76 mm in diameter and 0 to 30 percent are fragments more than 76 mm in diameter)

Thickness—0 to 16 inches

*Bt3 horizon (if it occurs):*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—clay loam, fine sandy loam, loam, or sandy clay loam or their channery, flaggy, or gravelly counterparts

Redoximorphic features—yellow, red, or brown concentrations

Reaction—moderately acid to slightly alkaline

Roots—common, fine

Clay content—18 to 35 percent

Coarse fragments—0 to 35 percent, by volume, sandstone fragments (about 0 to 30 percent are fragments less than 76 mm in diameter and 0 to 30 percent are fragments more than 76 mm in diameter)

Thickness—0 to 10 inches

*BC horizon (if it occurs):*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—clay loam, loam, fine sandy loam, or very fine sandy loam or their gravelly, channery, or flaggy counterparts

Redoximorphic features—yellow, red, or brown concentrations

Reaction—moderately acid to slightly alkaline

Clay content—18 to 35 percent

Coarse fragments—0 to 35 percent, by volume, sandstone fragments (about 0 to 30 percent are fragments less than 76 mm in diameter and 0 to 30 percent are fragments more than 76 mm in diameter)

Thickness—0 to 16 inches

*Cr horizon:*

Color—hue of 2.5YR to 10YR, value of 5 or 6, and chroma of 4 to 8

Texture—weathered sandstone bedrock

## **Dale Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* High flood plain

*Slope range:* 0 to 8 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free days:* 190 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, superactive, thermic Pachic Haplustolls

### **Associated Soils**

- Port soils which are on the lower landscapes
- Brewer, Lela, and McLain soils which have more than 35 percent clay in the control section, in the slightly lower positions on similar landscapes and farther from the stream than the Dale soils
- Reinach soils which are on the slightly higher landscapes nearer to the stream than the Dale soils
- Canadian and Crisfield soils which have a coarse-loamy control section and have a mollic epipedon less than 20 inches thick, on the slightly higher landscapes nearer to the stream than the Dale soils

### **Typical Pedon**

Dale silt loam; Lincoln County, Oklahoma; about 1 mile east of Harrah, in a cultivated area; 4,000 feet south and 900 feet east of the northwestern corner of sec. 30, T. 12 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

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

A—7 to 21 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; hard, friable; many fine roots; many wormcasts; neutral; abrupt smooth boundary. (10 to 26 inches thick)

Bw—21 to 40 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to moderate medium granular; hard, friable; few fine roots; few wormcasts; slightly alkaline; gradual smooth boundary. (10 to 30 inches thick)

C—40 to 60 inches; brown (7.5YR 5/4) silt loam, brown (7.5YR 4/4) moist; massive; hard, friable; few fine roots; few wormcasts; few films and spots of calcium carbonate; calcareous; moderately alkaline.

### **Range in Characteristics**

*Thickness of the mollic epipedon:* 20 to 50 inches

*Depth to bedrock:* More than 80 inches

*Depth to carbonates:* 20 to 60 inches

*A horizon:*

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3  
 Texture—silt loam, loam, silty clay loam, or clay loam  
 Reaction—slightly acid to moderately alkaline  
 Roots—many, fine  
 Clay content—15 to 35 percent  
 Thickness—10 to 26 inches

*Bw horizon:*

Color—hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 2 to 8  
 Texture—silt loam, loam, silty clay loam, or clay loam  
 Reaction—slightly acid to moderately alkaline  
 Roots—few, fine  
 Clay content—18 to 35 percent  
 Thickness—10 to 30 inches

*C horizon:*

Color—hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 2 to 8  
 Texture—silt loam, loam, silty clay loam, or clay loam; strata of very fine sandy loam, fine sandy loam, or loamy fine sand occur below a depth of 50 inches in some pedons  
 Reaction—slightly acid to moderately alkaline  
 Roots—few, fine  
 Clay content—18 to 35 percent

**Darnell Series**

*Major land resource area:* Northern Cross Timbers (84A)

*Depth class:* Shallow

*Drainage class:* Well drained and somewhat excessively drained

*Parent material and geologic age:* Sandstone of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 1 to 45 percent

*Slope shape:* Convex-convex

*Elevation range:* 750 to 1,300 feet

*Mean annual precipitation:* 28 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Loamy, siliceous, active, thermic, shallow Udic Haplustepts

**Associated Soils**

- Darsil soils which have a textural control section of loamy fine sand or coarser material, intermingled on the same landscape as the Darnell soils
- Harrah soils which have Bt horizons and have a solum more than 60 inches thick, on broad flat summits, shoulders, and backslopes
- Littleaxe soils which have Bt horizons and have a solum that is 40 to 60 inches thick, on broad flat summits, shoulders, and backslopes
- Stephenville soils which have Bt horizons and have a solum that is 20 to 40 inches thick, on broad flat summits, shoulders, and backslopes

- Newalla and Niotaze soils which have a solum more than 20 inches thick, have Bt horizons, and have a fine control section; on broad flats or upper side slopes

### Typical Pedon

Darnell fine sandy loam; Lincoln County, Oklahoma; about 8 miles west of Tryon, in scrub oak forest; 900 feet west and 100 feet north of the southeastern corner of sec. 17, T. 16 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

A—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many roots; moderately acid; gradual smooth boundary. (4 to 10 inches thick)

Bw—5 to 15 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many roots; few fragments of sandstone less than 1 inch in diameter; moderately acid; gradual wavy boundary. (4 to 12 inches thick)

Cr—15 to 30 inches; red (2.5YR 4/6) sandstone, dark red (2.5YR 3/6) moist; material is difficult to auger; moderately acid.

### Range in Characteristics

*Thickness of the ochric epipedon:* 4 to 10 inches

*Thickness of the solum:* 10 to 20 inches

*Depth to bedrock:* 10 to 20 inches

#### *A horizon:*

Color—hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 4

Texture—fine sandy loam, sandy loam, loam, stony fine sandy loam, or stony loam

Reaction—strongly acid to neutral

Clay content—10 to 20 percent

Coarse fragments—0 to 20 percent, by volume (0 to 5 percent are fragments less than 3 inches in diameter and 0 to 15 percent are fragments 3 to 10 inches in diameter)

#### *Bw horizon:*

Color—hue of 2.5YR to 10YR, value of 4 to 8, and chroma of 2 to 6

Texture—fine sandy loam, sandy loam, gravelly loam, or gravelly fine sandy loam

Reaction—strongly acid to neutral

Clay content—10 to 25 percent

Content of coarse fragments—0 to 20 percent, by volume (0 to 20 percent are fragments less than 3 inches in diameter and 0 to 5 percent are fragments 3 to 10 inches in diameter)

#### *Cr horizon:*

Color—hue of 10R to 10YR, value of 4 to 7, and chroma of 3 to 8

Texture—weakly to strongly consolidated sandstone

Excavation difficulty—high or very high

Reaction—strongly acid to neutral

Other features—fractures more than 10 cm apart; horizon is root restrictive

### **Dilworth Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Parent material and geologic age:* Gray Permian-age clayey residuum weathered from clayey shale

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Hills

*Landform:* Hillslopes

*Slope range:* 3 to 12 percent

*Slope shape:* Convex

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 36 inches

*Mean annual air temperature:* 57 to 61 degrees F

*Frost-free days:* 200 to 220

*Thornthwaite PE index:* 48 to 60

*Taxonomic class:* Fine, mixed, superactive, thermic Udertic Argiustolls

### Associated Soils

- Grainola soils which have redder shale than the Dilworth soils, in similar positions
- Highview soils which are on adjacent steep backslopes
- Lucien soils which are on summits or shoulder slopes above the Dilworth soils
- Westsum soils which are on very gently sloping or gently sloping lower footslopes and backslopes

### Typical Pedon

Dilworth silty clay loam, 3 to 5 percent slopes; Noble County, Oklahoma; about 7 miles east and 2 miles south of Billings, on a 3 percent slope, in native rangeland; 700 feet south and 1,250 feet east of the northwestern corner of sec. 33, T. 24 N., R. 1 W. (Colors are dry soil unless otherwise indicated.)

- A—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; strong medium granular structure; hard, firm; common fine roots; few pebbles of siltstone; slightly alkaline (pH 7.5); clear smooth boundary. (7 to 10 inches thick)
- Bt—7 to 13 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; moderate very fine subangular blocky structure; very hard, very firm; common fine roots; few distinct clay films on faces of peds; few wormcasts; common very fine rounded carbonate concretions; few very fine rounded masses of calcium carbonate; few pebbles of siltstone; few slightly effervescent spots (HCl, unspecified); moderately alkaline (pH 8.0); clear smooth boundary. (0 to 13 inches thick)
- Btk1—13 to 18 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine subangular blocky structure; very hard, very firm; few fine roots; few very fine discontinuous tubular pores; many distinct clay films on faces of peds; common fine irregular masses of calcium carbonate; few pebbles of siltstone; few strongly effervescent spots (HCl, unspecified); moderately alkaline (pH 8.0); gradual smooth boundary. (4 to 23 inches thick)
- Btk2—18 to 28 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to strong medium and fine subangular blocky; very hard, very firm; few fine roots; few very fine discontinuous tubular pores; common slickensides; many distinct clay films on faces of peds; few very fine rounded carbonate concretions; common medium rounded masses of calcium carbonate; few strongly effervescent spots (HCl, unspecified); moderately alkaline (pH 8.0); clear smooth boundary. (0 to 21 inches thick)
- BCK—28 to 36 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few very fine discontinuous tubular pores; common coarse irregular masses of calcium carbonate; few slightly effervescent spots (HCl, unspecified); moderately alkaline (pH 8.0); clear smooth boundary. (0 to 15 inches thick)

Cr—36 to 43 inches; light brownish gray (2.5Y 6/2) weathered shale, grayish brown (2.5Y 5/2) moist; common films of calcium carbonate in cracks; moderately alkaline (pH 8.0).

### Range in Characteristics

*Thickness of the solum:* 20 to 40 inches

*Depth to shale:* 20 to 40 inches

*Depth to secondary carbonates:* 7 to 17 inches

*Ap or A horizon:*

Color—hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 1 to 3; hue is 5YR in some pedons where the colluvial surface is influenced by red sandstone and shale

Texture—silty clay loam or gravelly silty clay loam

Clay content—27 to 35 percent

Reaction—neutral to moderately alkaline

*Bt horizon:*

Color—hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 to 3

Texture—silty clay loam or silty clay

*Btk1 horizon:*

Color—hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 to 4

Texture—silty clay or gravelly silty clay

Clay content—40 to 60 percent

*Btk2 horizon:*

Color—hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 1 or 2

Texture—silty clay

Clay content—40 to 60 percent

*BCK horizon:*

Color—hue of 2.5Y or 5Y, value of 5 to 7, and chroma of 1 or 2

Texture—silty clay

Clay content—40 to 60 percent

*Cr horizon:*

Color—hue of 2.5Y or 5Y, value of 5 to 7, and chroma of 1 to 4

Paralithic contact—weathered shale; thin strata of red sandstone in some pedons

### **Doolin Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Residuum of old alluvium over sandstone of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 0 to 3 percent

*Slope shape:* Linear-concave and linear-linear

*Elevation range:* 1,000 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, smectitic, thermic Typic Natrustolls

#### **Associated Soils**

- Chickasha, Kirkland, Renfrow, and Zaneis soils which do not have a natric horizon, on side slopes below the Doolin soils
- Kirkland and Pawhuska soils which are on landscapes similar to those of the Doolin soils

#### **Typical Pedon**

Doolin silt loam; Payne County, Oklahoma; about 10 miles east and 3 miles north of Stillwater, on a 0.5 percent slope, in rangeland; 1,100 feet west and 50 feet south of the northeastern corner of sec. 2, T. 19 N., R. 4 E. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary. (10 to 15 inches thick)
- B<sub>tn</sub>1—12 to 20 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; strong coarse columnar structure parting to moderate medium blocky; hard, firm; thick nearly continuous clay films on faces of peds; common fine distinct reddish brown redoximorphic features; few fine dark brown concretions; organic matter staining on faces of peds; exchangeable sodium percentage of 16; neutral; clear smooth boundary. (6 to 14 inches thick)
- B<sub>tn</sub>2—20 to 32 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium blocky structure; hard, firm; thin nearly continuous clay films on faces of peds; few fine distinct strong brown redoximorphic features; organic matter staining between faces of peds; exchangeable sodium percentage of 15; slightly alkaline; gradual smooth boundary. (0 to 21 inches thick)
- 2B<sub>tn</sub>1—32 to 48 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure; hard, firm; thin patchy clay films on faces of peds; many medium prominent strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/4) redoximorphic features; many threads of salts; exchangeable sodium percentage of 18; few medium and fine calcium carbonate concretions; slightly alkaline; gradual smooth boundary. (9 to 30 inches thick)
- 2B<sub>tn</sub>2—48 to 68 inches; reddish yellow (7.5YR 6/8) clay loam, strong brown (7.5YR 5/8) moist; weak coarse prismatic structure; hard, firm; thin patchy clay films on faces of peds; many coarse prominent gray (10YR 5/1), light gray (10YR 7/2), and red (2.5YR 4/8) redoximorphic features; exchangeable sodium percentage of 18; slightly alkaline; abrupt smooth boundary. (0 to 35 inches thick)
- 2Cr—68 to 70 inches; strong brown (7.5YR 5/6) sandstone.

#### **Range in Characteristics**

*Thickness of the mollic epipedon:* 10 to 32 inches

*Thickness of the solum:* More than 60 inches

*Depth to bedrock:* More than 60 inches

*Depth to carbonates:* More than 30 inches

*Ap or A horizon:*

Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2

Texture—silt loam, loam, or very fine sandy loam

Reaction—moderately acid to slightly alkaline

Clay content—10 to 26 percent

Coarse fragments—0 to 5 percent, by volume, rounded dark concretions  
 Thickness—10 to 15 inches  
 Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

*Btn1 horizon:*

Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6  
 Texture—silty clay loam, silty clay, or clay  
 Reaction—slightly acid to moderately alkaline  
 Clay content—35 to 55 percent  
 Coarse fragments—0 to 5 percent, by volume, rounded dark concretions  
 Thickness—6 to 14 inches  
 Exchangeable sodium percentage—15 to 20  
 Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

*Btn2 horizon:*

Color—hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6  
 Texture—silty clay loam, clay, silty clay, or clay loam  
 Redoximorphic features—concentrations in shades of brown  
 Reaction—slightly acid to moderately alkaline  
 Clay content—35 to 55 percent  
 Thickness—0 to 21 inches  
 Exchangeable sodium percentage—15 to 20  
 Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

*2Btn1 and 2Btn2 horizons:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 8  
 Texture—clay loam or sandy clay loam  
 Redoximorphic features—concentrations and depletions in shades of red, brown, and gray  
 Reaction—slightly alkaline or moderately alkaline  
 Clay content—30 to 40 percent  
 Exchangeable sodium percentage—15 to 20  
 Electrical conductivity of the saturation extract—2 to 6 mmhos/cm

*2Cr horizon:*

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 2 to 6  
 Paralithic contact—sandstone

## ***Easpur Series***

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy alluvium of Recent age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Low flood plain

*Slope range:* 0 to 1 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 58 to 63 degrees F

*Frost-free days:* 200 to 230

*Thorntwaite PE index:* 44 to 64

*Taxonomic class:* Fine-loamy, mixed, superactive, thermic Fluventic Haplustolls

### Associated Soils

- Port soils which have a mollic epipedon more than 20 inches thick and have a fine-silty control section, on landscapes similar to those of the Easpur soils
- Dale soils which have a mollic epipedon more than 20 inches thick, have a fine-silty control section, and are rarely flooded; on the slightly higher landscapes
- Pulaski soils which have a coarse-loamy control section and do not have a mollic epipedon, typically closer to the stream channel than the Easpur soils

### Typical Pedon

Easpur loam; Payne County, Oklahoma; about  $\frac{1}{2}$  mile west of Stillwater, in a cultivated area; 2,000 feet east and 1,300 feet north of the southwestern corner of sec. 16, T. 19 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

- Ap—0 to 11 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary. (8 to 14 inches thick)
- Bw1—11 to 19 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; soft, very friable; many fine roots; neutral; clear smooth boundary. (6 to 24 inches thick)
- Bw2—19 to 29 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate fine granular structure; hard, firm; few fine roots; neutral; clear smooth boundary. (0 to 24 inches thick)
- C—29 to 41 inches; stratified reddish brown (5YR 5/4) loam, yellowish red (5YR 5/6) fine sandy loam, and reddish brown (5YR 4/3) clay loam; massive; slightly hard, friable; few fine roots; strata are 1 to 4 inches thick; slightly alkaline; clear smooth boundary. (0 to 33 inches thick)
- 2Ab—41 to 62 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 3/2) moist; moderate fine granular structure; hard, firm; slightly alkaline; clear smooth boundary. (10 to 21 inches thick)
- 2Bwb—62 to 72 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, firm; slightly alkaline.

### Range in Characteristics

*Thickness of the mollic epipedon:* Less than 20 inches

*Thickness of the solum:* 20 to more than 60 inches

*Depth to buried horizons:* 20 to more than 60 inches

*Depth to carbonates (if they occur):* More than 50 inches

*Depth to bedrock:* More than 80 inches

*Ap or A horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3

Texture—loam or silt loam

Reaction—moderately acid to moderately alkaline

Roots—many, fine

Clay content—12 to 26 percent

Thickness—8 to 14 inches

*Bw horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—loam, clay loam, fine sandy loam, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

Roots—few to many, fine

Clay content—18 to 35 percent  
 Thickness—6 to 48 inches

*C horizon:*

Color—hue of 2.5YR to 10YR, value of 4 to 7, and chroma of 3 to 6  
 Texture—stratified fine sandy loam to clay loam  
 Reaction—slightly acid to moderately alkaline  
 Roots—few, fine  
 Clay content—18 to 35 percent  
 Thickness—0 to 33 inches

*2Ab horizon:*

Color—hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3  
 Texture—silt loam, silty clay loam, clay loam, or loam  
 Reaction—slightly acid to moderately alkaline  
 Clay content—18 to 35 percent  
 Thickness—10 to 21 inches

*2Bwb horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4  
 Texture—silt loam, silty clay loam, clay loam, or loam  
 Reaction—slightly acid to moderately alkaline  
 Clay content—18 to 35 percent

## **Gaddy Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Somewhat excessively drained

*Parent material and geologic age:* Recent sandy alluvium

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Low flood plain

*Slope range:* 0 to 3 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,500 feet

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Sandy, mixed, thermic Udic Ustifluvents

### **Associated Soils**

- Gracemore soils which are in the lower areas nearest to the stream channels
- Yahola soils which have textures finer than loamy fine sand in the textural control section, commonly in the higher areas

### **Typical Pedon**

Gaddy loamy fine sand; Pottawatomie County, Oklahoma; about 2 miles east and 1 mile south of Shawnee; about 2,100 feet west and 200 feet south of the northeastern corner of sec. 28, T. 10 N., R. 4 E. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 8 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

C1—8 to 20 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; soft; common thin strata of brown (7.5YR 4/4) fine sandy loam; calcareous; moderately alkaline; gradual smooth boundary.

C2—20 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; common thin strata of brown (10YR 5/3) loamy fine sand and fine sandy loam; calcareous; moderately alkaline.

### Range in Characteristics

*Depth to effervescence:* 0 to 10 inches

#### *A horizon:*

Color—hue of 5YR, 7.5YR, or 10YR, value of 4 to 6 (dry) and 3 to 5 (moist), and chroma of 2 to 6; where the moist value and chroma are less than 3.5, the horizon is less than 10 inches thick or the organic matter content is less than 1 percent

Texture—fine sand to silt loam in the upper 10 inches and loamy fine sand or fine sand below a depth of 10 inches

Reaction—moderately alkaline or slightly alkaline; horizon is calcareous

#### *C horizon:*

Color—hue of 5YR, 7.5YR, or 10YR, value of 6 to 8 (dry) and 5 to 7 (moist), and chroma of 3 to 6

Texture—horizon is loamy fine sand or fine sand and is stratified with thin strata of fine sandy loam to clay loam

Reaction—moderately alkaline; horizon is calcareous

## ***Goodnight Series***

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Excessively drained

*Parent material and geologic age:* Sandy eolian sediments of Recent age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Secondary landscape:* Terrace

*Landform:* Dune field

*Secondary landform:* Dune

*Slope range:* 0 to 45 percent

*Slope shape:* Convex-convex

*Elevation range:* 800 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Mixed, thermic Typic Ustipsamments

### Associated Soils

- Derby soils which are higher in elevation than the Goodnight soils
- Gaddy soils which are on the lower flood plains adjacent to the Goodnight soils
- Amber and Reinach soils which are coarse-silty, on flood plains
- Gracemore soils which have thin strata of finer textures in the control section, on flood plains

- Miller soils which have a fine control section, on flood plains
- Yahola soils which have a coarse-loamy control section, on flood plains

### Typical Pedon

Goodnight loamy fine sand; Payne County, Oklahoma; 5 miles north on Oklahoma Highway 18 and 1 mile east of Cushing, in rangeland; 600 feet south and 200 feet east of the northwestern corner of sec. 11, T. 18 N., R. 5 E. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 5 inches; brown (7.5YR 5/3) loamy fine sand, brown (7.5YR 4/3) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary. (4 to 14 inches thick)
- AC1—5 to 16 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; slightly acid; gradual wavy boundary. (0 to 28 inches thick)
- AC2—16 to 40 inches; reddish yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) moist; single grained; loose; neutral; clear smooth boundary. (0 to 36 inches thick)
- C—40 to 80 inches; reddish yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) moist; single grained; loose; bedding strata and some cross bedding; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the solum:* 10 to 60 inches

*Depth to bedrock:* More than 80 inches

*Depth to carbonates:* 0 to 40 inches

#### *A horizon:*

Color—hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 4

Texture—loamy fine sand or fine sand

Reaction—slightly acid to moderately alkaline

Clay content—2 to 10 percent

#### *AC1 horizon:*

Color—hue of 5YR or 10YR, value of 5 to 7, and chroma of 3 to 6

Texture—loamy fine sand or fine sand

Reaction—slightly acid to moderately alkaline

Clay content—2 to 12 percent

#### *AC2 horizon:*

Color—hue of 5YR or 7.5YR, value of 5 to 8, and chroma of 4 to 8

Texture—loamy fine sand or fine sand

Reaction—neutral to moderately alkaline

Clay content—2 to 12 percent

#### *C horizon:*

Color—hue of 5YR or 7.5YR, value of 5 to 8, and chroma of 4 to 8

Texture—loamy fine sand or fine sand

Reaction—neutral to moderately alkaline

Clay content—2 to 12 percent

### **Grainola Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Parent material and geologic age:* Shale of Recent age

*Physiographic region:* Interior Lowlands



Figure 24.—Profile of Grainola clay loam.

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Shoulder and backslope

*Slope range:* 1 to 25 percent

*Slope shape:* Linear-convex

*Elevation range:* 800 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, active, thermic Udertic Haplustalfs (fig. 24)

### Associated Soils

- Aydelotte soils which have a solum more than 60 inches thick, commonly on broad ridges that are slightly higher on the landscape than the Grainola soils
- Foraker soils which have smectitic mineralogy, commonly on broad ridges that are slightly higher on the landscape than the Grainola soils
- Apperson, Corbin, and Renfrow soils which have a mollic epipedon, commonly on broad ridges that are slightly higher on the landscape than the Grainola soils
- Kiti, Lucien, and Shidler soils which are less than 20 inches thick, do not have an argillic horizon, and have a mollic epipedon; on ridgetops
- Masham soils which are less than 20 inches thick, typically in areas slightly lower on the landscape than the Grainola soils
- Tamford soils which do not have an argillic horizon, on footslopes
- Piedmont and Renthin soils which have a mollic epipedon, typically in the slightly higher, smoother areas

### Typical Pedon

Grainola very gravelly silty clay loam; Osage County, Oklahoma; about 4 miles west and 3 miles north of Shidler, in rangeland; 1,060 feet east and 280 feet south of the north-western corner of sec. 14, T. 27 N., R. 5 E. (Colors are for dry soil unless otherwise indicated.)

- Ak—0 to 6 inches; reddish brown (5YR 4/3) very gravelly silty clay loam, dark reddish brown (5YR 3/3) moist; strong medium granular structure; hard, friable; about 25 percent, by volume, flat limestone fragments 2 to 76 mm in diameter and about 10 percent flat limestone fragments more than 76 mm in diameter; about 5 percent calcium carbonate concretions 2 to 76 mm in diameter; calcareous; moderately alkaline; clear smooth boundary. (4 to 10 inches thick)
- BAk—6 to 13 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; moderate medium granular structure; hard, firm; about 7 percent, by volume, flat limestone fragments 2 to 76 mm in diameter; about 5 percent calcium carbonate concretions 2 to 76 mm in diameter; calcareous; moderately alkaline; gradual smooth boundary. (0 to 10 inches thick)
- Btk1—13 to 28 inches; reddish brown (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) moist; common fine light olive gray spots of weathered shale; weak medium blocky structure; very hard, very firm; nearly continuous clay films or pressure faces on faces of peds; about 5 percent, by volume, sandstone fragments 2 to 76 mm in diameter; few calcium carbonate concretions; few masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary. (8 to 16 inches thick)
- Btk2—28 to 36 inches; reddish brown (2.5YR 4/4) very gravelly silty clay, dark reddish brown (2.5YR 3/4) moist; weak medium blocky structure; very hard, very firm; patchy clay films on faces of peds; about 40 percent, by volume, dark reddish brown and olive gray shale fragments 2 to 76 mm in diameter; few calcium carbonate concretions; common masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary. (0 to 16 inches thick)
- Cr—36 to 42 inches; weak red (2.5YR 5/2) shale bedrock; laminated; calcium carbonate films on faces of some fragments; calcareous.

### Range in Characteristics

*Thickness of the ochric epipedon:* 4 to 10 inches

*Thickness of the solum:* 20 to 40 inches

*Depth to bedrock:* 20 to 40 inches

*A horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 or 4

Texture—silt loam, loam, silty clay loam, or clay loam or their gravelly, cobbly, bouldery, or stony counterparts

Reaction—neutral to moderately alkaline

Clay content—15 to 35 percent

Coarse fragments—0 to 55 percent, by volume (0 to 35 percent are fragments of hard limestone or sandstone less than 76 mm in diameter, 0 to 20 percent are fragments 76 to 250 mm in diameter, and 0 to 20 percent are fragments 250 to 375 mm in diameter)

*BA horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—silty clay loam, clay loam, clay, or silty clay or their gravelly, cobbly, stony, or bouldery counterparts

Reaction—moderately alkaline; horizon is calcareous

Clay content—35 to 60 percent

Coarse fragments—0 to 55 percent, by volume (0 to 35 percent are fragments of hard limestone or sandstone less than 76 mm in diameter, 0 to 20 percent are fragments 76 to 250 mm in diameter, and 0 to 20 percent are fragments 250 to 375 mm in diameter)

*Btk1 horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 8

Texture—silty clay loam, clay loam, clay, or silty clay

Reaction—moderately alkaline; horizon is calcareous

Clay content—35 to 60 percent

Coarse fragments—0 to 15 percent, by volume, soft shale fragments less than 76 mm in diameter; fragments slake in water within 15 hours

*Btk2 horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 8

Texture—clay loam, silty clay loam, clay, or silty clay or their gravelly or very gravelly counterparts

Reaction—moderately alkaline; horizon is calcareous

Clay content—35 to 60 percent

Coarse fragments—5 to 45 percent, by volume, soft shale fragments less than 76 mm in diameter; fragments slake in water within 15 hours

Carbonates—0 to 10 percent, by volume, masses of calcium carbonate

*BC horizon (if it occurs):*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 2 to 8

Texture—clay loam, silty clay loam, clay, or silty clay or their gravelly, very gravelly, or extremely gravelly counterparts

Reaction—moderately alkaline; horizon is calcareous

Clay content—35 to 60 percent

Coarse fragments—5 to 70 percent, by volume, soft shale fragments less than 76 mm in diameter; fragments slake in water within 15 hours

Carbonates—0 to 10 percent, by volume, masses of calcium carbonate

*Cr horizon:*

Color—hue of 10R to 5YR, value of 3 to 5, and chroma of 2 to 6; horizon is streaked or spotted in shades of gray, brown, yellow, or olive in some pedons

Paralithic contact—weathered shale and thin strata of sandstone and limestone

Excavation difficulty—high or very high

## **Grant Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Deep

*Drainage class:* Well drained

*Parent material and geologic age:* Silty sandstone or silty shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Dissected terrace

*Landform position:* Summit, shoulder, and backslope

*Slope range:* 0 to 20 percent

*Slope shape:* Linear-linear/convex

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free days:* 190 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, superactive, thermic Udic Argiustolls

### **Associated Soils**

- Bethany soils which have more than 35 percent clay in the textural control section
- Lucien, Nash, and Nashville soils which do not have an argillic horizon and have bedrock within a depth of 40 inches, on side slopes
- Norge soils which are in the lower positions on side slopes
- Pond Creek soils which are in the lower positions on broad flats

### **Typical Pedon**

Grant silt loam; Garfield County, Oklahoma; about 2 miles north and 6 1/2 miles west of Hillsdale; 500 feet south and 100 feet east of the northwestern corner of sec. 6, T. 24 S., R. 8 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 7 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A—7 to 12 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; slightly acid; gradual smooth boundary.

AB—12 to 16 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; slightly hard, very friable; many fine roots; neutral; gradual smooth boundary.

Bt—16 to 32 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; clay films on faces of peds; neutral; gradual smooth boundary.

BC—32 to 47 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; hard, friable; few fine roots; slightly alkaline; gradual smooth boundary.

C—47 to 59 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; massive; hard, friable; few fine roots; common medium fragments of sandstone; calcareous; moderately alkaline; clear smooth boundary.

Cr—59 to 72 inches; red (2.5YR 5/6) weakly consolidated sandstone, red (2.5YR 4/6) moist; calcareous in seams.

### Range in Characteristics

*Thickness of the solum:* 40 to 60 inches

*Depth to bedrock:* 40 to 60 inches

*Depth to carbonates:* 30 to 60 inches

*A horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5 (dry) and 3 (moist), and chroma of 2 or 3

Texture—silt loam, very fine sandy loam, or loam

Reaction—slightly acid to slightly alkaline

*AB or BA horizon (if it occurs):*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5 (dry) and 3 or 4 (moist), and chroma of 2 to 4

Texture—silt loam, very fine sandy loam, or loam

Reaction—slightly acid to slightly alkaline

*Bt horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5 (dry) and 3 or 4 (moist), and chroma of 2 to 8

Texture—silt loam, loam, very fine sandy loam, silty clay loam, or clay loam

Reaction—slightly acid to moderately alkaline; lower part of horizon is calcareous in some pedons

Clay content—18 to 35 percent

*BC horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6 (dry) and 3 to 5 (moist), and chroma of 4 to 8

Texture—silt loam, loam, very fine sandy loam, silty clay loam, or clay loam

Reaction—neutral to moderately alkaline; horizon is calcareous in some pedons

*C horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 7 (dry) and 3 to 6 (moist), and chroma of 4 to 8

Texture—silt loam, loam, or very fine sandy loam

Reaction—slightly alkaline or moderately alkaline; horizon is noncalcareous in some pedons

Coarse fragments—0 to 20 percent, by volume, sandstone fragments 5 mm to 1 inch in diameter

*Cr horizon:*

Texture—soft reddish silty sandstone or silty shale bedrock

Reaction—slightly alkaline or moderately alkaline; horizon may or may not be calcareous

Hardness—dominantly nonparalithic with an excavation difficulty of low or moderate; paralithic with a high excavation difficulty in some pedons

Moist bulk density—1.85 to more than 2.0 gm/cm<sup>3</sup>

### **Harrah Series**

*Major land resource area:* Northern Cross Timbers (84A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Sandy and loamy colluvial material weathered from sandstone of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Footslope

*Slope range:* 3 to 45 percent

*Slope shape:* Concave-linear

*Elevation range:* 1,000 to 1,300 feet

*Mean annual precipitation:* 30 to 38 inches

*Mean annual air temperature:* 58 to 62 degrees F

*Frost-free days:* 190 to 220

*Thornthwaite PE index:* 48 to 64

*Taxonomic class:* Fine-loamy, siliceous, active, thermic Ultic Paleustalfs

### Associated Soils

- Darnell and Darsil soils which do not have an argillic horizon and are less than 20 inches thick over sandstone, mainly on ridge crests
- Pulaski soils which do not have an argillic horizon, have an irregular decrease in organic carbon content with increasing depth, and have a coarse-loamy control section; on flood plains
- Tribbey soils which do not have an argillic horizon, have an irregular decrease in organic carbon content with increasing depth, have a coarse-loamy control section, and have a water table within a depth of 40 inches most of the time; on flood plains
- Stephenville soils which have a solum less than 40 inches thick, in the slightly higher areas

### Typical Pedon

Harrah fine sandy loam; Cleveland County, Oklahoma; about 10 miles east and 2.6 miles north of the intersection of U.S. Highway 77 and Robinson Street in Norman, on a 6 percent, convex east-facing slope, in a severely eroded field that was reseeded to native grasses; about 2,350 feet south and 900 feet east of the northwestern corner of sec. 12, T. 9 N., R. 1 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 9 inches; brown (7.5YR 5/2) fine sandy loam, brown (7.5YR 4/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary. (2 to 10 inches thick)

E—9 to 19 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary. (0 to 20 inches thick)

Bt1—19 to 34 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak fine blocky structure; hard, firm; thin nearly continuous clay films on faces of peds; slightly acid; gradual wavy boundary. (10 to 25 inches thick)

Bt2—34 to 52 inches; red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm; thin nearly continuous clay films on faces of peds; about 5 percent, by volume, uncoated sand grains on vertical faces of peds and in pores; moderately acid; gradual wavy boundary. (12 to 45 inches thick)

Btb1—52 to 76 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm; thin continuous clay films on faces of peds; about 20 percent, by volume, uncoated sand grains on vertical faces of peds and in pores; moderately acid; gradual wavy boundary. (0 to 28 inches thick)

Btb2—76 to 86 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate medium blocky structure; hard, firm; thin continuous clay films on faces of

pedes; few fine dark concretions; about 10 percent, by volume, uncoated sand grains on vertical faces of pedes and in pores; slightly acid.

### Range in Characteristics

*Thickness of the solum:* More than 60 inches

*Ap or A horizon:*

Color—hue of 5YR or 10YR, value of 4 to 6, and chroma of 2 to 4

Texture—fine sandy loam or loamy fine sand

Reaction—very strongly acid to neutral

Clay content—5 to 18 percent

*E horizon:*

Color—hue of 2.5YR to 7.5YR, value of 5 to 7, and chroma of 4 to 6

Texture—fine sandy loam or loamy fine sand

Reaction—very strongly acid to neutral

Clay content—5 to 18 percent

*Bt horizon:*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—sandy clay loam or fine sandy loam

Reaction—very strongly acid to neutral

Clay content—18 to 35 percent

*Btb horizon:*

Color—hue of 10R or 2.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—fine sandy loam or sandy clay loam

Reaction—very strongly acid to neutral

Clay content—18 to 35 percent

### Highview Series

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Shallow

*Drainage class:* Well drained

*Parent material and geologic age:* Colluvial material weathered from gray Permian shale

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Hills

*Landform:* Hillslope

*Slope range:* 5 to 45 percent

*Slope shape:* Concave

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 30 to 36 inches

*Mean annual air temperature:* 57 to 61 degrees F

*Frost-free days:* 200 to 220

*Thornthwaite PE index:* 48 to 60

*Taxonomic class:* Clayey, mixed, active, thermic, shallow Udic Haplustepts

### Associated Soils

- Masham soils which have redder shale than the Highview soils, on similar landscapes
- Steedman soils which are on gently sloping or sloping backslopes and footslopes
- Lucien soils which are underlain by red sandstone at a depth of less than 20 inches, on summits above the Highview soils

- Westsum soils which are on very gently sloping or gently sloping backslopes and footslopes

### Typical Pedon

Highview channery silty clay in an area of Highview-Rock outcrop complex, 15 to 45 percent slopes; Noble County, Oklahoma; about 2 miles east and 5 miles south of Billings, on a 40 percent slope, in native rangeland; 500 feet east and 2,100 feet south of the northwestern corner of sec. 22, T. 23 N., R. 2 W. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 6 inches; grayish brown (10YR 5/2) channery silty clay, dark grayish brown (10YR 4/2) moist; weak fine angular blocky structure; very hard, very firm; many fine roots; about 20 percent coarse fragments; 70 percent of surface covered by coarse fragments of siltstone and dolomite; moderately alkaline; clear smooth boundary. (3 to 6 inches thick)
- Bw—6 to 17 inches; grayish brown (2.5Y 5/2) channery silty clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine angular blocky structure; extremely hard, very firm; common fine roots; about 20 percent coarse fragments; moderately alkaline; clear smooth boundary. (4 to 15 inches thick)
- Cr—17 to 25 inches; grayish brown (2.5Y 5/2) weathered shale, dark grayish brown (2.5Y 4/2) moist; moderately alkaline.

### Range in Characteristics

*Thickness of the solum and shale:* 8 to 20 inches

#### *A horizon:*

Color—hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 or 3; hue is 5YR in some pedons where the colluvial surface is influenced by red sandstone and shale

Texture—silty clay, silty clay loam, channery silty clay, channery silty clay loam, very channery silty clay loam, very channery silty clay, or very channery clay loam

Reaction—slightly alkaline or moderately alkaline

#### *Bw horizon:*

Color—hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2

Texture—silty clay, silty clay loam, channery silty clay, very channery silty clay, or very channery silty clay loam

Reaction—moderately alkaline; horizon is calcareous in some pedons

#### *Cr horizon:*

Color—hue of 2.5YR, value of 5, and chroma of 2

Paralithic contact—weathered shale

## **Huska Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Interbedded shale and sandstone of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 1 to 5 percent

*Slope shape:* Linear-convex and convex-linear

*Elevation range:* 900 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Mollic Natrustalfs

#### **Associated Soils**

- Chickasha and Zaneis soils which have a fine-loamy control section and do not have a natric horizon, on landscapes similar to those of the Huska soils
- Grainola and Renfrow soils which do not have a natric horizon, commonly on landscapes below the Huska soils
- Lucien soils which do not have a natric horizon and have a solum less than 20 inches thick, on landscapes similar to those of the Huska soils

#### **Typical Pedon**

Huska silt loam; Payne County, Oklahoma; on the Oklahoma State University Golf Driving Range in Stillwater, on a 1 percent slope, in rangeland; 2,200 feet west and 500 feet south of the northeastern corner of sec. 10, T. 19 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

A—0 to 9 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; massive; hard, friable; slightly acid; abrupt smooth boundary. (4 to 9 inches thick)

B<sub>tn</sub>—9 to 18 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; moderate coarse columnar structure; extremely hard, very firm; thick nearly continuous clay films on faces of peds; ped faces are dark reddish brown (5YR 3/2); few fine black concretions; exchangeable sodium percentage of 22; neutral; clear smooth boundary. (7 to 11 inches thick)

B<sub>tnz1</sub>—18 to 25 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; extremely hard, very firm; thin nearly continuous clay films on faces of peds; few fine faint strong brown redoximorphic concentrations; exchangeable sodium of 39 percent; few fine calcium carbonate concretions; common fine visible threads of salts; moderately alkaline; clear smooth boundary. (8 to 18 inches thick)

B<sub>tnz2</sub>—25 to 34 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; weak medium blocky structure; extremely hard, very firm; thin nearly continuous clay films on faces of peds; many fine irregular threads of salts; few medium crystals of gypsum; exchangeable sodium of 53 percent; moderately alkaline; clear smooth boundary. (9 to 23 inches thick)

B<sub>tn</sub>—34 to 50 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; weak fine subangular blocky structure; extremely hard, firm; thin patchy clay films on faces of peds; exchangeable sodium of 52 percent; moderately alkaline; abrupt smooth boundary. (10 to 33 inches thick)

Cr—50 to 55 inches; slightly gray (5YR 7/1) sandstone; rippable.

#### **Range in Characteristics**

*Thickness of the solum:* 40 to 60 inches

*Depth to carbonates:* More than 30 inches

*Exchangeable sodium:* 15 to 55 percent in the B<sub>tn</sub> horizon

*A horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—fine sandy loam, very fine sandy loam, loam, or silt loam

Reaction—moderately acid to slightly alkaline  
 Clay content—8 to 26 percent  
 Electrical conductivity of the saturation extract—0 to 8 mmhos/cm  
 Other features—the Ap horizon, or materials between the soil surface and a depth of 18 cm after mixing, have moist value of 3 or less and dry value of 5 or less (crushed and smoothed sample); the A horizon is typically hard when dry

*Btn horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6  
 Texture—silty clay loam, clay loam, silty clay, or clay  
 Reaction—neutral to moderately alkaline  
 Clay content—35 to 45 percent  
 Redoximorphic features—red concentrations  
 Electrical conductivity of the saturation extract—2 to 16 mmhos/cm  
 Other features—ped faces have a lower value and chroma than the matrix in most pedons

*Btnz1 horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3 to 6  
 Texture—silty clay loam, clay loam, silty clay, or clay  
 Redoximorphic features—red and brown concentrations  
 Reaction—moderately alkaline  
 Clay content—35 to 60 percent  
 Other features—calcium carbonate concretions and visible threads of salts occur in most pedons

*Btnz2 horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8  
 Texture—silty clay loam, clay loam, clay, or silty clay  
 Redoximorphic features—red and brown concentrations  
 Reaction—moderately alkaline  
 Clay content—35 to 60 percent  
 Other features—soft bodies of calcium carbonate, threads of salts, and dark concretions occur in most pedons

*B'tn horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8  
 Texture—silty clay loam, clay loam, clay, or silty clay  
 Reaction—slightly alkaline or moderately alkaline  
 Clay content—35 to 60 percent  
 Other features—threads and soft bodies of salts occur in some pedons

*Cr horizon:*

Color and texture—interbedded reddish or grayish sandstone and sandy shale and red shale  
 Hardness—nonparalithic with a low or moderate excavation difficulty  
 Other features—fractures more than 10 cm apart; horizon is dense enough to be root restrictive; most of the material slakes in water within 15 hours

***Keokuk Series***

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy and sandy alluvium of Recent age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Low flood plain

*Slope range:* 0 to 1 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Coarse-silty, mixed, superactive, thermic Fluventic Haplustolls

### Associated Soils

- Amber soils which do not have a mollic epipedon, in slightly concave areas on side slopes
- Dale soils which have a mollic epipedon more than 20 inches thick and have a fine-silty control section, in slightly concave areas
- Gaddy soils which have a sandy control section, typically on the lower flood plains that are closer to the stream channel than the Keokuk soils
- Lela and McLain soils which have a fine control section, in the slightly concave areas
- Port soils which have a mollic epipedon more than 20 inches thick and have a fine-silty control section, typically on the lower flood plains that are closer to the stream channel than the Keokuk soils
- Yahola soils which have a coarse-loamy control section, typically on the lower flood plains that are closer to the stream channel than the Keokuk soils

### Typical Pedon

Keokuk silt loam; Pottawatomie County, Oklahoma; about 6 miles east and 6 miles north of Shawnee, in a cultivated area; 1,850 feet east and 200 feet south of the northwestern corner of sec. 29, T. 11 N., R. 5 E. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, very friable; slightly acid; gradual smooth boundary. (7 to 18 inches thick)

Bw—12 to 24 inches; brown (7.5YR 5/2) silt loam, brown (7.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; slightly alkaline; gradual smooth boundary. (8 to 26 inches thick)

C—24 to 65 inches; light brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; material stratified with a few layers of silt loam, loam, and loamy very fine sand that are 1/4 inch to 3 inches thick; few films of secondary carbonates at a depth of 29 inches; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the solum:* 18 to 44 inches

*Depth to carbonates:* 10 to 35 inches

*Ap or A horizon:*

Color—hue of 5YR or 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—silt loam, loam, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—10 to 18 percent

*Bw horizon:*

Color—hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 2 to 8

Texture—silt loam, loam, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—10 to 18 percent

*C horizon:*

Color—hue of 2.5YR to 10YR, value of 4 to 7, and chroma of 2 to 8

Texture—stratified silt loam, loam, very fine sandy loam, and loamy very fine sand

Reaction—slightly alkaline or moderately alkaline

Clay content—5 to 18 percent

### **Kingfisher Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy material weathered from silty red beds of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 0 to 8 percent

*Slope shape:* Linear-convex

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 58 to 63 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, active, thermic Udic Argiustolls

#### **Associated Soils**

- Bethany and Grant soils which are on nearby landscapes
- Norge and Pond Creek soils which are on the lower landscapes of high stream terraces
- Grainola soils which do not have a mollic epipedon and have more than 35 percent clay in the textural control section, on landscapes similar to those of the Kingfisher soils
- Lucien and Ironmound soils which do not have a Bt horizon and are less than 20 inches thick over sandstone, typically in the more sloping areas on adjacent landscapes
- Ironmound soils which do not have a mollic epipedon
- Nash soils which do not have a Bt2 horizon and contain less than 18 percent clay in the control section, on nearby landscapes
- Piedmont and Renthin soils which have more than 35 percent clay in the textural control section, typically in the more sloping areas on adjacent landscapes

#### **Typical Pedon**

Kingfisher silt loam; Kingfisher County, Oklahoma; about 1 mile west and 5 miles south of Kingfisher, in a cultivated area; 1,800 feet west and 50 feet south of the northeastern corner of sec. 16, T. 15 N., R. 7 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 14 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; slightly hard, friable; many fine roots; upper 6 inches mixed by cultivation; many fine pores; slightly acid; gradual smooth boundary. (8 to 16 inches thick)

- BA—14 to 21 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate coarse granular structure; hard, friable; many fine roots; neutral; gradual smooth boundary. (3 to 10 inches thick)
- Bt1—21 to 32 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm; common fine roots throughout peds; distinct continuous clay films on faces of peds; slightly alkaline; gradual smooth boundary. (6 to 16 inches thick)
- Bt2—32 to 38 inches; reddish brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm; few fine pores; few fine roots; distinct continuous clay films on faces of peds; moderately alkaline; gradual smooth boundary. (2 to 10 inches thick)
- Cr—38 to 46 inches; red (2.5YR 5/8) weathered silty shale red beds, red (2.5YR 4/8) moist; weakly effervescent.

### Range in Characteristics

*Thickness of the mollic epipedon:* 8 to 16 inches

*Thickness of the solum:* 20 to 40 inches

*Depth to bedrock:* 20 to 40 inches

#### *Ap horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—loam or silt loam

Reaction—slightly acid to slightly alkaline

Clay content—15 to 27 percent

#### *BA horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—silt loam, silty clay loam, or clay loam

Reaction—slightly acid to slightly alkaline

Clay content—25 to 35 percent

#### *Bt1 horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silty clay loam or clay loam

Reaction—slightly acid to moderately alkaline

Clay content—27 to 35 percent

#### *Bt2 horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silty clay loam or clay loam

Reaction—slightly acid to moderately alkaline

Clay content—27 to 42 percent

#### *BC horizon (if it occurs):*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silty clay loam or clay loam

Reaction—neutral to moderately alkaline

Clay content—27 to 40 percent

#### *Cr horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8

Texture—weathered interbedded siltstone, shale, and sandstone

Hardness—paralithic with a high excavation difficulty

Reaction—slightly alkaline or moderately alkaline

### **Kirkland Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Predominantly clayey mantles over shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Terrace

*Landform position:* Tread

*Slope range:* 0 to 3 percent

*Slope shape:* Linear-linear/concave

*Elevation range:* 800 to 1,300 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 190 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Udertic Paleustolls

#### **Associated Soils**

- Renfrow soils which are in the lower areas on side slopes
- Aydelotte and Grainola soils which do not have a mollic epipedon
- Bethany soils which are in the slightly higher areas on side slopes
- Pawhuska and Doolin soils which have a natric horizon, on nearby landscapes
- Pond Creek soils which are fine silty, on high terraces
- Tabler soils which are in the slightly lower positions
- Waurika soils which are on nearby landscapes in slightly concave areas
- Renthin and Piedmont soils which have a solum less than 60 inches thick, in the lower areas on side slopes

#### **Typical Pedon**

Kirkland silt loam; Logan County, Oklahoma; about 4 miles south and 8 miles west of Guthrie, in a cultivated area; 1,000 feet north and 150 feet west of the southeastern corner of sec. 36, T. 16 N., R. 4 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 8 inches; dark grayish brown (10YR 4/2, exterior) and grayish brown (10YR 5/2, crushed) silt loam, very dark brown (10YR 2/2, exterior) and very dark grayish brown (10YR 3/2, crushed) moist; moderate medium subangular blocky structure parting to moderate fine granular; soft, very friable; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; electrical conductivity of the saturation extract is less than 1 mmho/cm; sodium adsorption ratio of less than 1; strongly acid; abrupt wavy boundary. (6 to 14 inches thick)

Bt1—8 to 19 inches; dark grayish brown (10YR 4/2) silty clay, black (10YR 2/1) moist; weak medium prismatic structure parting to strong medium subangular blocky; very hard, very firm; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; few fine rounded iron-manganese concretions; 65 percent of volume has distinct discontinuous clay films in root channels and pores; electrical conductivity of the saturation extract is less than 1 mmho/cm; sodium adsorption ratio of 2; neutral; gradual smooth boundary. (11 to 15 inches thick)

Bt2—19 to 28 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; weak medium and coarse prismatic structure parting to strong medium subangular blocky; extremely hard, extremely firm; common very fine and fine roots throughout;

- common very fine and fine vesicular and tubular pores; about 2 percent of volume is prominent continuous intersecting slickensides on faces of peds; electrical conductivity of the saturation extract is less than 1 mmho/cm; sodium adsorption ratio of 4; slightly alkaline; clear smooth boundary. (6 to 20 inches thick)
- Btk—28 to 42 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; weak medium and coarse prismatic structure parting to strong medium angular blocky; extremely hard, extremely firm; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; few fine and medium irregular carbonate threads; few medium rounded carbonate concretions; few medium rounded iron-manganese concretions; common distinct discontinuous clay films on faces of peds; common prominent continuous intersecting slickensides; strongly effervescent; electrical conductivity of the saturation extract is 1 mmho/cm; sodium adsorption ratio of 6; moderately alkaline; gradual wavy boundary. (10 to 20 inches thick)
- 2Bt1—42 to 51 inches; brown (7.5YR 4/4) silty clay, dark brown (7.5YR 3/4) moist; strong medium prismatic structure parting to strong medium angular blocky; extremely hard, extremely firm; few very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; few fine and medium rounded iron-manganese concretions; common faint continuous clay films on faces of peds; common distinct continuous intersecting slickensides; strongly effervescent; electrical conductivity of the saturation extract is 1.5 mmhos/cm; sodium adsorption ratio of 7; moderately alkaline; gradual wavy boundary. (0 to 16 inches thick)
- 2Btk—51 to 60 inches; reddish brown (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) moist; moderate medium and coarse prismatic structure parting to strong medium angular blocky; very hard, very firm; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; many fine and common medium distinct dark red (2.5YR 3/6) redoximorphic accumulations associated with root channels; few fine and medium and few coarse rounded iron-manganese concretions; few medium and coarse carbonate concretions; cracks between peds are filled with dark brown (7.5YR 3/3) silty clay loam; strongly effervescent; 1 percent quartzite pebbles; electrical conductivity of the saturation extract is 1.76 mmhos/cm; sodium adsorption ratio of 8; moderately alkaline; gradual wavy boundary. (0 to 18 inches thick)
- 2Bt2—60 to 75 inches; red (2.5YR 4/6) silty clay, dark reddish brown (2.5YR 3/6) moist; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, very firm; few very fine and fine roots throughout; common fine and common very fine vesicular and tubular pores; common fine and medium prominent gray (10YR 6/1) and very dark gray (10YR 3/1) redoximorphic depletions associated with root channels; cracks between peds filled with dark brown (7.5YR 3/3) silty clay loam from above; strongly effervescent; electrical conductivity of the saturation extract is 2.16 mmhos/cm; sodium adsorption ratio of 8; slightly alkaline; diffuse wavy boundary. (0 to 15 inches thick)
- 2Bt3—75 to 82 inches; red (2.5YR 4/6) silty clay, dark red (2.5YR 3/6) moist; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, very firm; common very fine roots throughout; common fine and very fine vesicular and tubular pores; few medium prominent brown (7.5YR 5/3), common fine distinct reddish gray (5YR 5/2), and common fine prominent very dark grayish brown (10YR 3/2) redoximorphic accumulations and depletions associated with root channels; few fine irregular threads of calcium carbonate; strongly effervescent; electrical conductivity of the saturation extract is 2.12 mmhos/cm; sodium adsorption ratio of 7; slightly alkaline; abrupt wavy boundary. (0 to 11 inches thick)
- 2Cr—82 to 98 inches; red (2.5YR 5/8) weakly cemented sandy siltstone, red (2.5YR 4/8)

moist; very hard, very firm; very few very fine roots in cracks; very slightly effervescent; slightly alkaline.

### Range in Characteristics

*Thickness of the mollic epipedon:* 20 to 43 inches

*Thickness of the solum:* More than 60 inches

*Depth to carbonates:* 25 to 50 inches

*Depth to bedrock:* More than 60 inches

*Other features:* Cracks within a depth of 125 cm that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years; slickensides in a layer 15 cm or more thick that has its upper boundary within a depth of 125 cm; a linear extensibility of 6.0 cm or more between the mineral soil surface and a depth of 100 cm

#### *A horizon:*

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—silt loam, clay loam, or silty clay loam

Reaction—moderately acid to neutral

Clay content—13 to 35 percent

Electrical conductivity of the saturation extract—0 to 1 mmho/cm

Sodium adsorption ratio—1 to 4

#### *Bt1 horizon:*

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—clay or silty clay

Reaction—neutral or slightly alkaline

Clay content—40 to 60 percent

Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

Sodium adsorption ratio—2 to 12

#### *Bt2 horizon:*

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 to 4

Texture—clay or silty clay

Reaction—neutral to moderately alkaline

Clay content—40 to 60 percent

Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

Sodium adsorption ratio—2 to 12

#### *Btk horizon:*

Color—hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 3 to 6

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—slightly alkaline or moderately alkaline; horizon is calcareous

Clay content—35 to 60 percent

Electrical conductivity of the saturation extract—2 to 4 mmhos/cm

Sodium adsorption ratio—3 to 16

#### *2Bt and 2Btk horizons:*

Color—hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 2 to 8

Texture—clay, silty clay, clay loam, or silty clay loam

Redoximorphic features—common redoximorphic accumulations and depletions in shades of red, brown, and gray

Reaction—slightly alkaline or moderately alkaline; horizon is calcareous

Clay content—35 to 60 percent

Electrical conductivity of the saturation extract—2 to 4 mmhos/cm

Sodium adsorption ratio—3 to 16

*2Cr horizon:*

- Color—hue of 2.5YR to 7.5YR, value of 4 to 8, and chroma of 2 to 8
- Texture—weakly consolidated shale, clay, or siltstone
- Excavation difficulty—low or moderate
- Reaction—moderately alkaline; horizon is calcareous

**Konawa Series**

*Major land resource area:* Northern Cross Timbers (84A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Sandy and loamy stream terrace sediments of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Terrace

*Landform position:* Tread and riser

*Slope range:* 0 to 20 percent

*Slope shape:* Linear/convex-convex

*Elevation range:* 500 to 1,500 feet

*Mean annual precipitation:* 30 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 48 to 64

*Taxonomic class:* Fine-loamy, mixed, active, thermic Ultic Haplustalfs

**Associated Soils**

- Dougherty and Stidham soils which are in similar areas on the landscape or in areas slightly higher than the Konawa soils
- Bastrop soils which have a thicker argillic horizon that does not decrease in clay content as depth increases, on broad flat landscapes that are slightly higher and farther from the stream channel than the Konawa soils
- Eufaula soils which have an A horizon more than 20 inches thick and have a sandy control section, on the slightly higher landscapes
- Teller soils which have a mollic epipedon, typically on similar landscapes farther from the stream channel than the Konawa soils

**Typical Pedon**

Konawa fine sandy loam; Payne County, Oklahoma; about 8 miles west and 1 mile south of Perkins, in bermudagrass pasture; 2,000 feet north and 200 feet west of the southeastern corner of sec. 10, T. 17 N., R. 1 E. (Colors are for dry soil unless otherwise indicated.)

A—0 to 9 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary. (4 to 10 inches thick)

E—9 to 17 inches; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary. (0 to 17 inches thick)

Bt—17 to 53 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; very hard, friable; thin discontinuous

clay films on peds; moderately acid; gradual smooth boundary. (10 to 36 inches thick)

BC—53 to 72 inches; red (2.5YR 5/6) fine sandy loam, red (5YR 4/6) moist; weak coarse subangular blocky structure; very hard, friable; neutral.

### Range in Characteristics

*Thickness of the solum:* 40 to 60 inches

*Depth to carbonates:* 10 to 30 inches

*A horizon:*

Color—hue of 5YR to 10YR, value of 4 to 7, and chroma of 2 to 6

Texture—fine sandy loam, loamy fine sand, or fine sand

Reaction—strongly acid to slightly acid

Clay content—2 to 18 percent

*E horizon:*

Color—hue of 5YR to 10YR, value of 5 to 8, and chroma of 2 to 6

Texture—fine sandy loam, loamy fine sand, or fine sand

Reaction—strongly acid to slightly acid

Clay content—2 to 18 percent

*Bt horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8

Texture—fine sandy loam or sandy clay loam

Reaction—strongly acid to neutral

Clay content—18 to 30 percent

Coarse fragments—0 to 5 percent, by volume, rounded gravel 2 to 10 mm in diameter

*BC horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8

Texture—fine sandy loam, sandy clay loam, or loamy fine sand

Reaction—strongly acid to neutral

Clay content—7 to 30 percent

*C horizon (if it occurs):*

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8

Texture—fine sandy loam, loamy fine sand, or fine sand

Reaction—strongly acid to slightly alkaline

Clay content—2 to 30 percent

## **Lela Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Somewhat poorly drained

*Parent material and geologic age:* Calcareous clayey alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Flood plain and backslope

*Slope range:* 0 to 1 percent

*Slope shape:* Nearly level to slightly concave

*Elevation range:* 800 to 1,200 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Udic Haplusterts

#### **Associated Soils**

- Asher soils which have a fine-silty control section, on flood plains similar to those of the Lela soils
- Braman soils which have an argillic horizon and a fine-silty control section, on flood plains similar to those of the Lela soils
- Brewer and McLain soils which have an argillic horizon, on flood plains similar to those of the Lela soils
- Dale soils which have a fine-silty control section, on flood plains similar to those of the Lela soils
- Port soils which have a fine-silty control section, on the lower flood plains closer to the stream channel than the Lela soils
- Gaddy soils which have a sandy control section, on the lower flood plains closer to the stream channel than the Lela soils
- Keokuk and Reinach soils which have a coarse-silty control section, on flood plains similar to those of the Lela soils
- Miller soils which do not have wedge-shaped structural aggregates or intersecting slickensides at some depth between 10 and 40 inches and do not have gilgai relief, on the lower flood plains closer to the stream channel than the Lela soils
- Yahola soils which have a coarse-loamy control section, on the lower flood plains closer to the stream channel than the Lela soils

#### **Typical Pedon**

Lela silty clay, 0 to 1 percent slopes, occasionally flooded; Noble County, Oklahoma; about 2 miles north and 6 miles west of Marland, on a 0.5 percent slope, in cropland; 2,500 feet south and 50 feet west of the northeastern corner of sec. 1, T. 24 N., R. 1 W. (Colors are for dry soil unless otherwise indicated.)

- Ap—0 to 6 inches; dark reddish brown (5YR 3/2, crushed) silty clay, dark reddish brown (5YR 2/2, crushed) moist; moderate fine angular blocky structure parting to strong fine granular; very hard, firm; common fine roots; moderately acid (pH 6.0); abrupt smooth boundary. (0 to 10 inches thick)
- A—6 to 13 inches; dark reddish brown (5YR 3/2, crushed) silty clay, dark reddish brown (5YR 2/2, crushed) moist; strong very fine and fine angular blocky structure; very hard, very firm; few fine roots; few very fine and fine constricted tubular pores; neutral (pH 7.0); clear wavy boundary. (4 to 12 inches thick)
- Bss1—13 to 34 inches; dark reddish brown (5YR 3/2, crushed) silty clay, dark reddish brown (5YR 2/2, crushed) moist; moderate medium angular blocky structure parting to strong very fine and fine angular blocky; very hard, very firm; few very fine roots; common very fine and fine constricted tubular pores; common intersecting slickensides tilted at an angle of 20 to 40 degrees; pressure faces on faces of peds; slightly alkaline (pH 7.5); gradual wavy boundary. (10 to 30 inches thick)
- Bss2—34 to 42 inches; 80 percent dark reddish brown (5YR 3/2, crushed) and 20 percent dark reddish gray (5YR 4/2) silty clay, 80 percent dark reddish brown (5YR 2/2, crushed) and 20 percent dark reddish brown (5YR 3/2) moist; moderate coarse angular blocky structure parting to strong very fine and fine angular blocky; very hard, very firm; few very fine and fine roots; few very fine and fine constricted tubular pores; cracks 1 to 2 cm wide filled with dark reddish brown (5YR 3/2) surface material; common pressure faces on faces of peds; common intersecting slickensides tilted at an angle of about 45 degrees; moderately alkaline (pH 8.0); gradual wavy boundary. (0 to 15 inches thick)

- Bss3**—42 to 53 inches; dark reddish gray (5YR 4/2, crushed) silty clay, dark reddish brown (5YR 3/2, crushed) moist; moderate coarse angular blocky structure parting to strong very fine and fine angular blocky; very hard, very firm; few fine roots; few very fine and fine constricted tubular pores; cracks 0.5 to 3 cm wide filled with dark reddish brown (5YR 3/2) surface material; common pressure faces on faces of peds; common dark reddish brown (5YR 3/2) intersecting slickensides tilted at an angle of about 45 degrees; moderately alkaline (pH 8.0); clear wavy boundary. (8 to 25 inches thick)
- Bkss1**—53 to 61 inches; reddish gray (5YR 5/2) silty clay, dark reddish gray (5YR 4/2) moist; moderate coarse angular blocky structure parting to strong very fine and fine angular blocky; very hard, very firm; few fine roots between peds; few very fine constricted tubular pores; cracks 0.5 to 2 cm wide filled with dark reddish brown (5YR 3/2) surface material; common pressure faces on faces of peds; dark reddish brown (5YR 3/2) intersecting slickensides tilted at an angle of about 30 degrees; few fine rounded calcium carbonate concretions; strongly effervescent (HCl, unspecified) continuous; moderately alkaline (pH 8.0); gradual wavy boundary. (5 to 30 inches thick)
- Bkss2**—61 to 72 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; moderate coarse angular blocky structure parting to strong very fine and fine angular blocky; very hard, very firm; few fine roots between peds; cracks 1 to 3 cm wide filled with dark reddish brown (5YR 3/2) surface material; common pressure faces on faces of peds; reddish brown (5YR 5/3) intersecting slickensides tilted at an angle of about 30 degrees; few black stains on horizontal faces of peds; common fine and common medium rounded calcium carbonate concretions; strongly effervescent (HCl, unspecified) continuous; moderately alkaline (pH 8.0); gradual wavy boundary. (0 to 5 inches thick)
- BCss**—72 to 87 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; strong coarse angular blocky structure parting to moderate very fine angular blocky; very hard, very firm; few very fine roots between peds; cracks 1 to 3 cm wide filled with dark reddish brown (5YR 3/2) surface material; some cracks tilted at an angle of about 30 degrees; common pressure faces on faces of peds; dark reddish brown (5YR 3/2) intersecting slickensides tilted at an angle of about 45 degrees; few fine and common medium calcium carbonate concretions; moderately alkaline (pH 8.0).

### Range in Characteristics

*Thickness of the solum:* 20 to 80 inches

*Microrelief:* Gilgai in undisturbed areas; the cycles of microlows and microhighs are repeated at linear intervals of 6 to 12 feet

*Slickensides:* Intersecting slickensides occur between depths of 10 and 40 inches

*A horizon:*

Color—hue of 5YR to 10YR, value of 2 to 4, and chroma of 1 to 3; where the horizon is less than 12 inches thick, the moist value is less than 3.5 to a depth of more than 12 inches; where chroma of 1 occurs between depths of 15 and 20 inches, the 1-chroma material makes up less than half of the pedon

Texture—silty clay loam, silty clay, or clay

Reaction—slightly acid to slightly alkaline

*Bss horizon:*

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 to 4

Texture—silty clay or clay

Redoximorphic features—distinct or prominent depletions and concentrations in shades of gray, red, and brown in some pedons

Reaction—slightly alkaline or moderately alkaline; horizon is calcareous in some pedons

Calcium carbonate concretions—1 to 15 percent, by volume

Structure—few to many intersecting slickensides

*Bkss horizon:*

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 to 4

Texture—silty clay or clay

Reaction—slightly alkaline or moderately alkaline

Calcium carbonate concretions—few to many masses and films

Structure—few to many intersecting slickensides

*BCss and C horizons (if they occur):*

Color—similar to the Bkss horizon

Texture—similar to the Bkss horizon

Reaction—similar to the Bkss horizon

### **Lovedale Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy sediments of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Terrace

*Landform position:* Tread and riser

*Slope range:* 0 to 12 percent

*Slope shape:* Linear-linear/convex

*Elevation range:* 1,000 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 62 degrees F

*Frost-free days:* 190 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-loamy, mixed, superactive, thermic Udic Argiustolls

#### **Associated Soils**

- Waynoka and Wisby soils which are in the slightly lower positions
- Devol and Eda soils which have less clay in the subsoil than the Lovedale soils, on the steeper slopes
- Milan soils which have more clay in the argillic horizon than the Lovedale soils, on the less sloping landscapes

#### **Typical Pedon**

Lovedale fine sandy loam; Woods County, Oklahoma; about 0.75 mile north of Dacoma; 180 feet north and 360 feet east of the southwestern corner of sec. 1, T. 25 N., R. 13 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 9 inches; brown (7.5YR 4/3) fine sandy loam, dark brown (7.5YR 3/3) moist; weak fine granular structure; hard, friable; common fine roots; moderately acid; clear smooth boundary.

BA—9 to 16 inches; brown (7.5YR 4/3) sandy clay loam, dark brown (7.5YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots;

few faint clay films on faces of peds; noneffervescent; slightly acid; gradual smooth boundary.

Bt1—16 to 26 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; many distinct clay films on faces of peds; noneffervescent; neutral; clear smooth boundary.

Bt2—26 to 40 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to weak coarse subangular blocky; very hard, firm; few fine roots; common distinct clay films on faces of peds; common fine rounded iron-manganese concretions; noneffervescent; moderately alkaline; clear smooth boundary.

BC—40 to 55 inches; reddish yellow (5YR 6/6) sandy loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure; hard, friable; noneffervescent; 1 percent gravel; moderately alkaline; abrupt smooth boundary.

C—55 to 80 inches; reddish yellow (5YR 7/6) fine sand, reddish yellow (5YR 6/6) moist; massive; loose; very slightly effervescent; 1 percent gravel; moderately alkaline.

### Range in Characteristics

*Thickness of the mollic epipedon:* 10 to 20 inches

*Thickness of the solum:* 30 to more than 60 inches

*Depth to bedrock:* More than 60 inches

*Depth to carbonates:* More than 34 inches

*Ap or A horizon:*

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—sandy loam, fine sandy loam, loamy sand, or loamy fine sand

Reaction—moderately acid to neutral

Coarse fragments—0 to 2 percent, by volume, fragments less than 76 mm in diameter

*BA or AB horizon:*

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—sandy loam, fine sandy loam, loam, or sandy clay loam

Reaction—moderately acid to neutral

*Bt horizon:*

Color—hue of 2.5YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—sandy clay loam, loam, or sandy loam

Redoximorphic features—yellow or brown concentrations, below a depth of 40 inches

Reaction—slightly acid to moderately alkaline

Clay content—18 to 27 percent; more than 20 percent sand coarser than fine

Coarse fragments—0 to 10 percent, by volume, fragments less than 76 mm in diameter

*BC horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—sandy clay loam, sandy loam, or fine sandy loam

Reaction—neutral to moderately alkaline

Clay content—8 to 27 percent

Coarse fragments: 0 to 10 percent, by volume, fragments less than 76 mm in diameter

*C horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8

Texture—coarse sandy loam, sandy loam, fine sandy loam, loamy sand, or sand

Reaction—slightly acid to moderately alkaline

Coarse fragments—0 to 20 percent, by volume, fragments 2 to 76 mm in diameter

### **Lucien Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Shallow

*Drainage class:* Well drained

*Parent material and geologic age:* Material weathered from sandstone, interbedded with clay, siltstone, or sandy shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 1 to 30 percent

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Loamy, mixed, superactive, thermic, shallow Udic Haplustolls (fig. 25)

#### **Associated Soils**

- Kingfisher soils which have Bt horizons and have a solum more than 20 inches thick, on adjacent side slopes
- Nash soils which have a solum more than 20 inches thick, on adjacent side slopes
- Coyle soils which have Bt horizons and have a solum more than 20 inches thick, on adjacent side slopes
- Stoneburg and Zaneis soils which have Bt horizons, on adjacent side slopes
- Grainola and Steedman soils which have Bt horizons, a solum more than 20 inches thick, and a fine control section; on adjacent side slopes
- Shidler soils which are on ridges

#### **Typical Pedon**

Lucien very fine sandy loam in an area of Kingfisher-Lucien complex, 1 to 5 percent slopes; Noble County, Oklahoma; about 6 miles east and 8 miles north of Perry, in rangeland; 3,000 feet east and 2,450 feet south of the northwestern corner of sec. 2, T. 22 N., R. 1 E. (Colors are for dry soil unless otherwise indicated.)

A—0 to 4 inches; brown (7.5YR 4/2) very fine sandy loam, dark brown (7.5YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable; many very fine and fine roots throughout; common irregular wormcasts; few very fine and common fine and medium constricted tubular pores; slightly acid; clear smooth boundary. (4 to 10 inches thick)

BA—4 to 8 inches; brown (7.5YR 4/2) very fine sandy loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots throughout; common irregular wormcasts; many very fine and few fine constricted tubular pores; neutral; clear smooth boundary. (3 to 8 inches thick)

Bw—8 to 14 inches; brown (7.5YR 4/4) very fine sandy loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots throughout; common irregular wormcasts;



Figure 25.—Profile of Lucien loam.

common very fine constricted tubular pores; 10 percent pebbles of sandstone; noncalcareous having a yellowish red (5YR 5/6) weathering rind  $\frac{1}{4}$  to  $\frac{1}{2}$  inch thick with a strong brown (7.5YR 5/6) interior; neutral; abrupt wavy boundary. (3 to 13 inches thick)

Cr—14 to 20 inches; 75 percent strong brown (7.5YR 5/6) and 25 percent yellowish red (5YR 5/6) weathered bedrock, 75 percent strong brown (7.5YR 4/6) and 25 percent yellowish red (5YR 4/6) moist; few very fine and fine roots in cracks; neutral.

#### Range in Characteristics

*Thickness of the mollic epipedon:* 7 inches or more

*Thickness of the solum:* 10 to 20 inches

*Depth to bedrock:* 10 to 20 inches

*Content of coarse fragments:* 0 to 30 percent, by volume, throughout the profile (0 to 10 percent are fragments less than 76 mm in diameter and 0 to 20 percent are fragments more than 76 mm in diameter)

*A and BA horizons:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 or 3  
 Texture—loam, silt loam, very fine sandy loam, or fine sandy loam or their stony counterparts  
 Reaction—moderately acid to slightly alkaline  
 Clay content—10 to 25 percent

*Bw horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 6  
 Texture—loam, silt loam, very fine sandy loam, or fine sandy loam or their stony counterparts  
 Reaction—moderately acid to slightly alkaline  
 Clay content—10 to 25 percent

*Cr horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8  
 Texture—rippable sandstone interbedded with clay, siltstone, or sandy shale  
 Reaction—moderately acid to moderately alkaline

***Masham Series***

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Shallow

*Drainage class:* Well drained

*Parent material and geologic age:* Material weathered from shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Shoulder and backslope

*Slope range:* 1 to 45 percent

*Slope shape:* Convex-linear, linear-concave, and linear-convex

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Clayey, mixed, active, thermic, shallow Udic Haplustepts

**Associated Soils**

- Coyle, Grainola, and Renfrow soils which have an argillic horizon and have a solum more than 20 inches thick, typically on slopes above the Masham soils
- Ironmound and Lucien soils which are underlain by sandstone at a depth of less than 20 inches and have less than 35 percent clay in the control section, typically on ridgetops above the Masham soils
- Highview soils which occur over gray Permian shale, in positions similar to those of the Masham soils
- Piedmont and Renthin soils which have a mollic epipedon, typically on shoulder slopes

**Typical Pedon**

Masham silty clay loam; Payne County, Oklahoma; about 6 miles north and 4 miles east of Stillwater, in rangeland; 500 feet west and 150 feet south of the northeastern corner of sec. 21, T. 20 N., R. 3 E. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 5 inches; reddish brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; strong very fine subangular blocky structure; hard, firm; many fine roots; calcareous; moderately alkaline; gradual smooth boundary. (3 to 9 inches thick)
- Bkw—5 to 16 inches; reddish brown (2.5YR 5/4) silty clay, reddish brown (2.5YR 4/4) moist; moderate medium and fine subangular blocky structure; hard, firm; few round calcium carbonate concretions 10 to 50 mm in diameter; many pressure faces; calcareous; moderately alkaline; diffuse wavy boundary. (5 to 17 inches thick)
- Cr—16 to 40 inches; reddish brown (2.5YR 5/4) weathered silty shale, reddish brown (2.5YR 4/4) moist; massive; extremely hard, firm; few fine roots between shale fragments; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the solum:* 10 to 20 inches

*Depth to bedrock:* 10 to 20 inches

*Depth to carbonates:* Profile is moderately alkaline throughout; the A horizon is noncalcareous in some pedons

*Coarse fragments on the surface:* Rounded limestone, sandstone, hematite, and hard pitted calcium carbonate concretions that are 2 to 76 mm in diameter cover 0 to 75 percent of the surface

*A or AB horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5 (dry) and 3 or 4 (moist), and chroma of 4 to 6

Texture—silty clay loam, clay loam, silty clay, or clay

Clay content—35 to 60 percent

Coarse fragments—0 to 15 percent, by volume, rounded fragments of sandstone, ironstone, and calcium carbonate 2 to 76 mm in diameter

*Bw or Bkw horizon:*

Color—hue of 10R to 5YR, value of 4 or 5 (dry) and 3 or 4 (moist), and chroma of 3 to 6 (dry or moist)

Texture—silty clay loam, silty clay, or clay

Clay content—35 to 60 percent

Coarse fragments—1 to 5 percent, by volume, rounded calcium carbonate concretions less than 76 mm in diameter

*Cr horizon:*

Color—hue of 10R or 2.5YR, value of 3 to 5 (dry) and 3 or 4 (moist), and chroma of 2 to 6 (dry or moist)

Texture—weathered shale that can be dug with a spade when moist

Hardness—nonparalithic with a low or moderate excavation difficulty

Other features—fractures more than 10 cm apart; horizon is dense enough to be root restrictive; most of the material slakes in water within 15 hours

### McLain Series

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Clayey and loamy alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* High flood plain

*Slope range:* 0 to 1 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Pachic Argiustolls

#### **Associated Soils**

- Lela soils which do not have Bt horizons, on the same flood plains as the McLain soils
- Brewer soils which do not have upper Bt horizons with hues of 5YR or redder, on the same flood plains as the McLain soils
- Canadian, Dale, and Reinach soils which have less than 35 percent clay in the control section and do not have Bt horizons, on the same flood plains as the McLain soils
- Port soils which have less than 35 percent clay in the control section and do not have Bt horizons, on the adjacent lower flood plains
- Miller soils which do not have Bt horizons, on the adjacent lower flood plains

#### **Typical Pedon**

McLain silty clay loam; Caddo County, Oklahoma; about 1 mile west of Verden, in a cultivated area; 1,000 feet south and 50 feet east of the northwestern corner of sec. 13, T. 7 N., R. 9 W. (Colors are for dry soil unless otherwise indicated.)

A1—0 to 7 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; hard, friable; neutral; clear smooth boundary. (0 to 10 inches thick)

A2—7 to 14 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; moderate medium granular structure; very hard, firm; neutral; gradual smooth boundary. (6 to 22 inches thick)

Bt1—14 to 28 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; weak fine blocky structure; very hard, very firm; nearly continuous clay films on faces of pedis; slightly alkaline; gradual smooth boundary. (10 to 30 inches thick)

Bt2—28 to 36 inches; reddish brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; weak medium subangular blocky structure; very hard, firm; patchy clay films on faces of pedis; slightly alkaline; gradual smooth boundary. (0 to 20 inches thick)

C—36 to 60 inches; reddish brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; massive; hard, friable; few soft powdery accumulations and few fine concretions of calcium carbonate; calcareous; moderately alkaline.

#### **Range in Characteristics**

*Thickness of the mollic epipedon:* More than 20 inches

*Thickness of the solum:* 30 to more than 60 inches

*Depth to carbonates:* 30 inches or more

*A horizon:*

Color—hue of 5YR or 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—silty clay loam, silt loam, loam, or clay loam

Reaction—moderately acid to moderately alkaline

Clay content—18 to 35 percent

*BA horizon (if it occurs):*

Color—hue of 5YR or 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—silty clay loam, silt loam, loam, or clay loam

Reaction—moderately acid to moderately alkaline

Clay content—18 to 35 percent

*Bt1 horizon:*

Color—hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 2 to 8

Texture—silty clay loam, clay loam, silty clay, or clay

Reaction—slightly acid to moderately alkaline

Clay content—35 to 50 percent

*Bt2 horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silty clay loam, clay loam, silty clay, or clay

Reaction—slightly acid to moderately alkaline

Clay content—35 to 50 percent

*BC horizon (if it occurs):*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silty clay loam, clay loam, silty clay, or clay

Reaction—slightly acid to moderately alkaline

Clay content—20 to 45 percent

*C horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 3 to 8

Texture—silt loam, loam, silty clay loam, clay loam, silty clay, or clay

Reaction—neutral to moderately alkaline

Clay content—20 to 45 percent

## **Milan Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Deep

*Drainage class:* Well drained

*Parent material and geologic age:* Pleistocene sandy and gravelly alluvium

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Hills

*Landform:* Hillslope

*Slope range:* 0 to 6 percent

*Slope shape:* Convex-linear

*Elevation range:* 1,000 to 1,500 feet

*Mean annual precipitation:* 26 to 34 inches

*Mean annual air temperature:* 57 to 61 degrees F

*Frost-free days:* 185 to 220

*Thornthwaite PE index:* 44 to 54

*Taxonomic class:* Fine-loamy, mixed, superactive, thermic Udic Argiustolls

### **Associated Soils**

- Rosehill soils which are fine textured and have bedrock at depths of 20 to 40 inches
- Bethany and Pond Creek soils which have a mollic epipedon more than 20 inches thick
- Waynoka soils which have a lithologic discontinuity between depths of 30 and 60 inches

### **Typical Pedon**

Milan loam; Sumner County, Kansas; about 4 miles east of Milan, in a cultivated area;

2,000 feet north and 300 feet west of the southeastern corner of sec. 14, T. 32 S., R. 3 W. (Colors are for dry soil unless otherwise indicated.)

- Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many roots; few pebbles as much as  $\frac{3}{4}$  inch in diameter; moderately acid; clear smooth boundary. (7 to 14 inches thick)
- BA—10 to 14 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse granular structure; hard, firm; many roots; few pebbles; slightly acid; gradual smooth boundary. (0 to 6 inches thick)
- Bt—14 to 34 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate and strong medium and coarse blocky structure; extremely hard, very firm; continuous clay films of darker color on exterior of peds; few fine roots; few pebbles; neutral; gradual smooth boundary. (15 to 30 inches thick)
- BC—34 to 48 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium blocky structure; hard, firm; few fine roots; few pebbles; neutral; gradual smooth boundary. (6 to 20 inches thick)
- C—48 to 70 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; massive; hard, friable; few fine roots; many pebbles; neutral.

#### Range in Characteristics

*Thickness of the solum:* Typically 40 to 50 inches; ranging from 30 to 70 inches

*Coarse fraction:* 0 to 10 percent, by volume, coarse sand and gravel as much as 1 inch in diameter

*Carbonate accumulations:* Small calcium carbonate concretions in the C horizon in some pedons

#### *A and BA horizons:*

Color—hue of 5YR, 7.5YR, or 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—typically loam; less commonly, sandy loam, clay loam, or fine sandy loam

Reaction—strongly acid to neutral

#### *Bt horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6 (dry) and 3 to 5 (moist), and chroma of 3 to 7

Texture—clay loam or sandy clay loam

Clay content—28 to 35 percent

Sand content—more than 20 percent sand coarser than fine

Reaction—moderately acid to neutral

#### *BC horizon:*

Color—similar to the Bt horizon

Texture—sandy clay loam, loam, clay loam, or sandy loam

Reaction—similar to the Bt horizon

#### *C horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 7 (dry) and 3 to 6 (moist), and chroma of 4 to 8

Texture—sandy loam, sandy clay loam, clay loam, or loamy sand

Reaction—moderately acid to moderately alkaline

### **Miller Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Clayey alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Low flood plain

*Slope range:* 0 to 1 percent

*Slope shape:* Linear-linear and linear-concave

*Elevation range:* 800 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Udertic Haplustolls

### Associated Soils

- Gaddy, Pulaski, and Yahola soils which do not have a mollic epipedon and have less than 18 percent clay in the textural control section
- Ashport and Port soils which have less than 35 percent clay in the textural control section

### Typical Pedon

Miller clay; Cotton County, Oklahoma; about 4 miles west of Cookietown, in a cultivated area; 400 feet north and 500 feet east of the southwestern corner of sec. 24, T. 3 S., R. 13 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 7 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; weak medium granular structure; slightly hard, friable; many fine roots; few fine and medium pores; calcareous; moderately alkaline; clear smooth boundary. (0 to 9 inches thick)

A—7 to 14 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine blocky structure; hard, firm; common fine roots; few fine and medium pores; calcareous; moderately alkaline; clear smooth boundary. (5 to 22 inches thick)

Bw—14 to 35 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; shiny pressure faces on faces of peds; few medium slickensides that do not intersect; common vertical cracks filled with material from above; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary. (10 to 40 inches thick)

Ab—35 to 60 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; shiny faces on some peds; few fine slickensides that do not intersect; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the solum:* 30 to more than 60 inches

*Depth to carbonates:* The 10- to 40-inch control section is calcareous throughout; soft powdery lime is within a depth of 30 inches

*Other features:* Cracks more than 1 cm wide extend from the surface to a depth of about 30 inches during some season in most years

*A horizon:*

Color—hue of 5YR or 7.5YR, value of 2 to 5, and chroma of 2 or 3

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—slightly alkaline or moderately alkaline  
Clay content—35 to 50 percent

*Bw horizon:*

Color—hue of 2.5 to 7.5YR, value of 3 to 5, and chroma of 2 to 6  
Texture—clay, silty clay, clay loam, or silty clay loam  
Reaction—slightly alkaline or moderately alkaline  
Clay content—35 to 60 percent

*Ab horizon:*

Color—hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 2 to 6  
Texture—silt loam to clay  
Reaction—slightly alkaline or moderately alkaline  
Clay content—25 to 50 percent

*C horizon (if it occurs):*

Color—hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 2 to 6  
Texture—clay, silty clay, clay loam, silty clay loam, or silt loam  
Reaction—slightly alkaline or moderately alkaline  
Clay content—15 to 60 percent

## **Minco Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy eolian deposits of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Primary landscape:* Valley

*Secondary landscape:* Terrace

*Landform:* Stream terrace

*Landform position:* Tread and riser

*Slope range:* 0 to 30 percent

*Slope shape:* Linear-convex, convex-linear, and linear-linear

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 190 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Coarse-silty, mixed, superactive, thermic Udic Haplustolls

### **Associated Soils**

- Grant, Norge, and Teller soils which have an argillic horizon with a clay content of more than 18 percent, in the higher positions
- Pond Creek soils which have a mollic epipedon more than 20 inches thick and an argillic horizon with a clay content of more than 18 percent, in the higher positions
- Dougherty and Konawa soils which have an argillic horizon but do not have a mollic epipedon, in similar or slightly higher positions
- Reinach soils which have a mollic epipedon more than 20 inches thick, on low terraces of flood plains

### **Typical Pedon**

Minco silt loam; Grady County, Oklahoma; about 1 <sup>3</sup>/<sub>4</sub> miles north of Tuttle, in a

cultivated area; 1,035 feet south and 300 feet east of the northwestern corner of sec. 26, T. 10 N., R. 6 W. (Colors are for dry soil unless otherwise indicated.)

- Ap—0 to 7 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; slightly hard, very friable; many fine roots; moderately acid; abrupt smooth boundary. (0 to 10 inches thick)
- A—7 to 15 inches; brown (7.5YR 4/3) silt loam, dark brown (7.5YR 3/3) moist; moderate medium granular structure; slightly hard, very friable; many fine roots; slightly acid; gradual smooth boundary. (6 to 12 inches thick)
- Bw1—15 to 24 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; moderate medium prismatic structure; slightly hard, friable; common fine roots; slightly alkaline; gradual smooth boundary. (8 to 14 inches thick)
- Bw2—24 to 38 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 5/4) moist; moderate medium prismatic structure; slightly hard, friable; common fine roots; slightly alkaline; gradual smooth boundary. (10 to 20 inches thick)
- Bw3—38 to 55 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; weak coarse prismatic structure; slightly hard, friable; few fine roots; moderately alkaline; gradual smooth boundary. (0 to 20 inches thick)
- C—55 to 72 inches; red (2.5YR 5/8) silt loam, red (2.5YR 4/8) moist; massive; slightly hard, friable; few fine roots; few films of secondary carbonates; calcareous; moderately alkaline.

#### **Range in Characteristics**

*Thickness of the solum:* 25 to more than 60 inches

*Depth to bedrock:* More than 72 inches

*Other features:* Clay content is 8 to 18 percent throughout the profile

#### *A and Ap horizons:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—loam, silt loam, or very fine sandy loam

Reaction—moderately acid to neutral

#### *Bw horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—loam, silt loam, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

#### *BC horizon (if it occurs):*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 8

Texture—loam, silt loam, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

#### *C horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—loam, silt loam, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

### **Mulhall Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Colluvium underlain with silty shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Footslope

*Slope range:* 3 to 8 percent

*Slope shape:* Concave-linear

*Elevation range:* 1,000 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-loamy, siliceous, active, thermic Udic Paleustolls

#### **Associated Soils**

- Chickasha and Zaneis soils which are on landscapes similar to those of the Mulhall soils
- Grainola soils which have a solum less than 40 inches thick, do not have a mollic epipedon, and have a fine control section; on landscapes that are slightly higher than those of the Mulhall soils
- Lucien soils which have a solum less than 20 inches thick, do not have an argillic horizon, and have mixed mineralogy; typically on ridgetops
- Renfrow soils which have a fine control section, on landscapes that are slightly higher than those of the Mulhall soils

#### **Typical Pedon**

Mulhall loam; Payne County, Oklahoma; about 6 miles south and 3 miles west of Stillwater, in rangeland; 200 feet north and 1,600 feet west of the southeastern corner of sec. 17, T. 18 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 13 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary. (6 to 14 inches thick)
- BA—13 to 17 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; weak medium granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary. (4 to 14 inches thick)
- Bt1—17 to 31 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; thin nearly continuous clay films on faces of peds; common fine roots; few rounded sandstone fragments less than 3 inches in diameter; slightly acid; gradual smooth boundary. (7 to 22 inches thick)
- Bt2—31 to 41 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; common fine distinct strong brown and reddish brown mottles; moderate medium prismatic structure; hard, firm; thin nearly continuous clay films on faces of peds; common fine roots; slightly acid; gradual wavy boundary. (10 to 26 inches thick)
- Bt3—41 to 70 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; weak coarse prismatic structure; hard, firm; thin patchy clay films on faces of peds; few fine roots; many coarse prominent pinkish gray (5YR 6/2) and light reddish brown (5YR 6/3) redoximorphic depletions and concentrations; about 10 percent of the vertical ped faces are coated with clean sand grains; neutral; clear wavy boundary. (8 to 32 inches thick)
- 2Cr—70 to 80 inches; red (10R 5/6) weakly laminated silty shale, red (10R 4/6) moist; calcareous; moderately alkaline.

#### **Range in Characteristics**

*Thickness of the solum:* More than 60 inches

*A horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3  
Texture—loam or fine sandy loam  
Reaction—moderately acid to slightly alkaline  
Clay content—12 to 26 percent

*BA horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4  
Texture—loam, sandy clay loam, or clay loam  
Reaction—slightly acid or neutral  
Clay content—20 to 35 percent

*Bt1 horizon:*

Color—hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 8  
Texture—clay loam or sandy clay loam  
Reaction—slightly acid to slightly alkaline  
Clay content—18 to 35 percent  
Coarse fragments—0 to 10 percent, by volume, rounded sandstone fragments less than 76 mm in diameter

*Bt2 horizon:*

Color—hue of 2.5YR to 7.5YR, value of 5 or 6, and chroma of 4 to 8  
Texture—clay loam or sandy clay loam  
Reaction—slightly acid to moderately alkaline  
Clay content—20 to 35 percent  
Coarse fragments—0 to 10 percent, by volume, rounded sandstone fragments less than 76 mm in diameter

*Bt3 horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8  
Texture—clay loam, sandy clay loam, gravelly clay loam, or gravelly sandy clay loam  
Redoximorphic features—red, brown, or gray concentrations and depletions  
Reaction—neutral to moderately alkaline  
Clay content—20 to 35 percent  
Coarse fragments—0 to 20 percent, by volume, dark concretions less than 76 mm in diameter

*Bt4 horizon (if it occurs):*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8  
Texture—clay loam, sandy clay loam, gravelly clay loam, or gravelly sandy clay loam  
Redoximorphic features—red, brown, or gray concentrations and depletions  
Reaction—neutral to moderately alkaline  
Clay content—20 to 35 percent  
Coarse fragments—0 to 20 percent, by volume, dark concretions less than 76 mm in diameter

*BC horizon (if it occurs):*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8  
Texture—loam or clay loam  
Redoximorphic features—red, brown, or gray concentrations and depletions  
Reaction—neutral to moderately alkaline  
Clay content—20 to 35 percent

*2Cr horizon:*

Color—red  
Texture—weakly consolidated silty shale

Hardness—nonparalithic with a low or moderate excavation difficulty  
 Other features—fractures more than 10 cm apart; material is dense enough to be root restrictive; material slakes in water within 15 hours

### ***Newalla Series***

*Major land resource area:* Northern Cross Timbers (84A)

*Depth class:* Deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Backslope

*Slope range:* 1 to 25 percent

*Slope shape:* Convex-convex and linear-convex

*Elevation range:* 800 to 1,200 feet

*Mean annual precipitation:* 30 to 40 inches

*Mean annual air temperature:* 58 to 62 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-loamy over clayey, siliceous, superactive, thermic Udic Haplustalfs

### **Associated Soils**

- Darnell and Darsil soils which do not have an argillic horizon and are less than 20 inches thick over sandstone, mainly on ridge crests
- Grainola soils which are on side slopes of prairie uplands
- Harrah soils which have a fine-loamy control section and have a solum more than 72 inches thick, on the lower footslopes and side slopes
- Stephenville soils which have a solum that is 20 to 40 inches thick over sandstone and have a fine-loamy control section, on landscapes similar to those of the Newalla soils
- Littleaxe soils which have a fine-loamy control section, on ridge crests
- Renfrow soils which have a solum that is more than 60 inches thick, on the higher prairie uplands

### **Typical Pedon**

Newalla fine sandy loam; Cleveland County, Oklahoma; about 1 mile south and 7.4 miles east of Slaughterville, on a 7 percent, slightly convex southeast-facing upland side slope, in a savannah of post oak and blackjack oak; 1,900 feet east and 150 feet south of the northwestern corner of sec. 21, T. 7 N., R. 1 E. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 3 inches; brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; many very fine and fine and common medium roots; strongly acid; clear smooth boundary. (2 to 9 inches thick)
- E—3 to 6 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak medium granular structure; slightly hard, very friable; many very fine and fine and common medium roots; very strongly acid; abrupt wavy boundary. (0 to 7 inches thick)

- Bt—6 to 10 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm; common very fine, fine, and medium and few coarse roots; patchy clay films on faces of peds; many faces of peds coated with light brown (7.5YR 6/4) fine sandy loam; very strongly acid; clear wavy boundary. (3 to 15 inches thick)
- 2Bt—10 to 16 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate fine and medium blocky structure; very hard, very firm; common very fine and fine and few medium and coarse roots; nearly continuous clay films on faces of peds; very strongly acid; gradual wavy boundary. (4 to 23 inches thick)
- 2Btss—16 to 30 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak medium subangular blocky structure; extremely hard, extremely firm; common very fine and fine and few medium and coarse roots; few nonintersecting slickensides; nearly continuous clay films on faces of peds; few fine dark concretions; moderately acid; gradual wavy boundary. (0 to 26 inches thick)
- 2Btkss—30 to 42 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak medium subangular blocky and angular blocky structure; extremely hard, extremely firm; few very fine, fine, medium, and coarse roots; few nonintersecting slickensides; nearly continuous clay films on faces of peds; few fine dark concretions; common fine and medium soft masses of calcium carbonate; slight effervescence; slightly alkaline; gradual wavy boundary. (0 to 28 inches thick)
- 2B'tss—42 to 51 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak medium and coarse blocky structure; extremely hard, extremely firm; few very fine and fine roots; common nonintersecting slickensides; nearly continuous clay films on faces of peds; few fine dark concretions; slight effervescence; moderately alkaline; gradual wavy boundary.
- 2BC—51 to 58 inches; red (2.5YR 4/6) gravelly silty clay, dark red (2.5YR 3/6) moist; weak medium subangular blocky structure; very hard, very firm; few very fine roots; patchy clay films on faces of peds; common fine distinct yellowish red (5YR 4/6) redoximorphic accumulations; 25 percent, by volume, shale fragments 2 to 76 mm in diameter; slight effervescence; slightly alkaline; clear wavy boundary. (0 to 18 inches thick)
- 2Cr—58 to 80 inches; red (2.5YR 4/6) weakly laminated, soft shale; slightly alkaline.

### Range in Characteristics

*Thickness of the solum:* 40 to 60 inches

*Depth to bedrock:* 40 to 60 inches

*A or Ap horizon:*

Color—hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 6

Texture—typically fine sandy loam; loam or sandy clay loam in some eroded areas

Reaction—very strongly acid to neutral

Clay content—7 to 25 percent

*E horizon:*

Color—hue of 5YR to 10YR, value of 4 to 7, and chroma of 3 to 6

Texture—fine sandy loam

Reaction—very strongly acid to neutral

Clay content—7 to 17 percent

*Bt horizon:*

Color—hue of 2.5YR to 7.5YR, value of 5 or 6, and chroma of 3 to 8

Texture—sandy clay loam or clay loam

Reaction—very strongly acid to neutral

Clay content—20 to 35 percent

*2Bt and 2B'tss horizons:*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—silty clay or clay

Redoximorphic features—red, yellow, or brown concentrations in some pedons

Reaction—very strongly acid to moderately alkaline

Clay content—40 to 60 percent

*2Btkss horizon:*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—clay or silty clay

Redoximorphic features—red, yellow, or brown concentrations in some pedons

Reaction—neutral to moderately alkaline

Clay content—40 to 60 percent

*2BC or 2BCk horizon:*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—sandy clay, silty clay, gravelly silty clay, or very gravelly silty clay

Redoximorphic features—red, yellow, or brown concentrations in some pedons

Reaction—slightly alkaline or moderately alkaline

Clay content—40 to 60 percent

Carbonates—0 to 10 percent, by volume, soft accumulations of calcium carbonate

*2Cr horizon:*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 2 to 6

Reaction—slightly alkaline or moderately alkaline

**Norge Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Terrace

*Landform position:* Tread and riser

*Slope range:* 0 to 8 percent

*Slope shape:* Linear-linear/convex

*Elevation range:* 900 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, active, thermic Udic Paleustolls (fig. 26)

**Associated Soils**

- Bethany soils which have a fine control section, on the same or higher landscapes
- Grant soils which have a solum less than 60 inches thick and have a decrease in clay content of more than 20 percent within a depth of 60 inches, on side slopes of nearby landscapes
- Navina soils which have a decrease in clay content of more than 20 percent within a depth of 60 inches, on the lower terraces or on the same terrace but nearer to the stream than the Norge soils

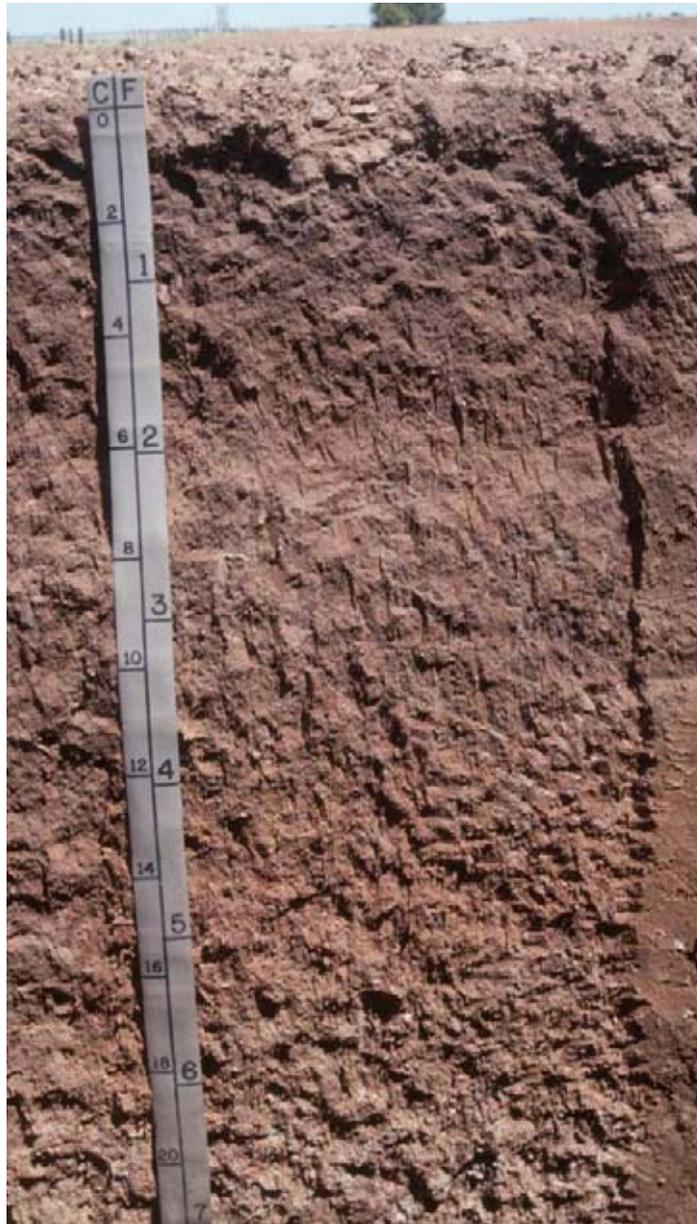


Figure 26.—Profile of Norge silt loam.

- Teller and Vanoss soils which have a decrease in clay content of more than 20 percent within a depth of 60 inches, on the lower terraces or on the same terrace but nearer to the stream than the Norge soils
- Pond Creek soils which have a mollic epipedon that is more than 20 inches thick and have a decrease in clay content within a depth of 60 inches, on the lower terraces or on the same terrace but nearer to the stream than the Norge soils

#### Typical Pedon

Norge silt loam; Pawnee County, Oklahoma; about 8 miles northeast of Pawnee, in a cultivated area; 725 feet east and 150 feet south of the northwestern corner of sec. 9, T. 22 N., R. 6 E. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 12 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; moderately acid; gradual smooth boundary. (6 to 16 inches thick)
- BA—12 to 18 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; hard, friable; many fine roots; moderately acid; gradual smooth boundary. (0 to 10 inches thick)
- Bt1—18 to 36 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; common fine roots; nearly continuous clay films on faces of peds; moderately acid; gradual smooth boundary. (9 to 25 inches thick)
- Bt2—36 to 48 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots; continuous clay films on faces of peds; slightly acid; gradual smooth boundary. (9 to 37 inches thick)
- Bt3—48 to 66 inches; red (2.5YR 5/8) silty clay loam, red (2.5YR 4/8) moist; weak coarse subangular blocky structure; hard, firm; few fine roots; discontinuous clay films on faces of peds; slightly acid.

#### Range in Characteristics

*Thickness of the mollic epipedon:* 10 to 20 inches

*Thickness of the solum:* More than 60 inches

*Depth to carbonates:* More than 40 inches

#### *A horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—silt loam, loam, silty clay loam, or clay loam

Reaction—moderately acid to neutral

Clay content—15 to 35 percent

#### *BA horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4

Texture—silt loam, loam, silty clay loam, or clay loam

Reaction—moderately acid to neutral

Clay content—18 to 35 percent

#### *Bt1 and Bt2 horizons:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6

Texture—silty clay loam or clay loam

Reaction—moderately acid to slightly alkaline

Clay content—27 to 35 percent

#### *Bt3 horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8

Texture—silty clay loam, clay loam, or silty clay

Reaction—slightly acid to moderately alkaline

Clay content—27 to 50 percent

#### *Bt4 horizon (if it occurs):*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—silty clay loam, silty clay, or clay loam

Redoximorphic features—concentrations and depletions in shades of gray, yellow, and brown in some pedons

Reaction—slightly acid to slightly alkaline

Clay content—27 to 50 percent

#### *BC horizon (if it occurs):*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—silty clay loam, silty clay, or clay loam

Reaction—neutral to moderately alkaline

### **Oscar Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Loamy alluvium of Recent age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Flood plain

*Slope range:* 0 to 2 percent

*Slope shape:* Linear to concave

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, superactive, thermic Typic Natrustalfs

#### **Associated Soils**

- McLain soils which have an argillic horizon with a clay content of 35 percent or more and do not have a natric horizon
- Port soils which have a mollic epipedon more than 20 inches thick and do not have a natric horizon

#### **Typical Pedon**

Oscar silt loam; Jefferson County, Oklahoma; about 5 miles east and 1 mile north of Waurika, in rangeland; 50 feet north and 2,500 feet east of the southwestern corner of sec. 26, T. 4. S., R. 7 W. (Colors are for dry soil unless otherwise indicated.)

A—0 to 5 inches; light brown (7.5YR 6/3) silt loam, brown (7.5YR 4/3) moist; weak fine platy structure in the upper part, massive in the lower part; hard, friable; many pores; slightly acid; abrupt smooth boundary. (2 to 14 inches thick)

B<sub>tn</sub>—5 to 12 inches; reddish brown (5YR 4/3) silt clay loam, dark reddish brown (5YR 3/3) moist; moderate coarse prismatic structure parting to weak coarse blocky; hard, firm; clay films on faces of peds; patchy dark reddish brown (5YR 3/2) coatings on upper part and sides of peds; moderately alkaline; gradual smooth boundary. (6 to 30 inches thick)

BC<sub>n</sub>—12 to 24 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak fine blocky structure; very hard, firm; few soft accumulations of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary. (4 to 20 inches thick)

C—24 to 60 inches; reddish brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; massive; hard, friable; strata of coarser textured material separated by bedding planes in the lower part of horizon; many soft accumulations and concretions of calcium carbonate; calcareous; moderately alkaline.

#### **Range in Characteristics**

*Soil depth:* 60 inches or more

*Thickness of the solum:* 20 to more than 60 inches

*Secondary lime:* Soft and powdery material is within a depth of 60 inches

*A horizon:*

Color—hue of 5YR to 10YR, value of 4 to 7, and chroma of 2 to 4  
 Texture—silt loam, loam, or very fine sandy loam  
 Structure—massive to weak fine platy or weak fine granular  
 Exchangeable sodium—0 to 75 percent  
 Electrical conductivity—0 to 16 mmhos/cm  
 Reaction—moderately acid to moderately alkaline

*Btn horizon:*

Color—hue of 2.5YR to 2.5Y, value of 4 to 7, and chroma of 2 to 6  
 Texture—silt loam, silty clay loam, or clay loam  
 Clay content—24 to 35 percent  
 Structure—columnar, prismatic, or blocky  
 Exchangeable sodium—15 to about 80 percent  
 Electrical conductivity—4 to about 16 mmhos/cm  
 Reaction—neutral to strongly alkaline

*BCn or C horizon:*

Color—hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 2 to 6  
 Texture—silt loam, loam, silty clay loam, or clay loam  
 Clay content—24 to 35 percent  
 Exchangeable sodium and electrical conductivity—about the same as the Btn horizon  
 Reaction—slightly alkaline to very strongly alkaline

*Buried A or Bw horizons (if they occur):*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4  
 Texture—silt loam, silty clay loam, or loam  
 Reaction—neutral to moderately alkaline  
 Other features—horizons occur below a depth of 30 inches; horizons are not diagnostic

**Pawhuska Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Interbedded sandstones and shales of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and shoulder

*Slope range:* 0 to 5 percent

*Slope shape:* Linear-linear/convex

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Mollic Natrustalfs

**Associated Soils**

- Corbin, Kirkland, Norge, and Renfrow soils which do not have a natric horizon, on the same landscape as the Pawhuska soils

### Typical Pedon

Pawhuska silt loam; Osage County, Oklahoma; about 2 miles south and 6 miles west of Burbank, in rangeland; 500 feet south and 380 feet west of the northeastern corner of sec. 11, T. 25 N., R. 4 E. (Colors are for dry soil unless otherwise indicated.)

- A—0 to 3 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable; many fine roots; neutral; abrupt wavy boundary. (2 to 11 inches thick)
- Btn1—3 to 10 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium columnar structure parting to strong fine blocky; very hard, firm; common fine roots; nearly continuous clay films on faces of peds; grayish coatings on tops of columns; slightly alkaline; clear smooth boundary. (6 to 17 inches thick)
- Btn2—10 to 18 inches; reddish gray (5YR 5/2) silty clay, dark reddish gray (5YR 4/2) moist; moderate medium blocky structure; extremely hard, firm; few fine roots; nearly continuous clay films on faces of peds; many fine concretions of calcium carbonate; moderately alkaline; clear wavy boundary. (8 to 17 inches thick)
- Btn3—18 to 30 inches; reddish brown (5YR 5/3) silty clay, reddish brown (5YR 4/3) moist; moderate medium blocky structure; extremely hard, firm; few fine roots; nearly continuous clay films on faces of peds; few fine black concretions; many fine concretions of calcium carbonate; few fine soft accumulations of calcium carbonate; moderately alkaline; gradual smooth boundary. (0 to 20 inches thick)
- Btn4—30 to 50 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; weak medium blocky structure; extremely hard, firm; few fine roots; patchy clay films on faces of peds; common fine black concretions; common fine concretions of calcium carbonate; few fine soft accumulations of calcium carbonate; slight effervescence; moderately alkaline; gradual smooth boundary. (0 to 20 inches thick)
- BC—50 to 80 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; weak medium and coarse blocky structure; extremely hard, firm; patchy clay films on faces of peds; common fine black concretions; few fine concretions of calcium carbonate; few fine soft accumulations of calcium carbonate; slight effervescence; moderately alkaline.

### Range in Characteristics

*Thickness of the umbric epipedon:* 2 to 11 inches

*Thickness of the solum:* More than 60 inches

*Depth to carbonates:* 10 to 35 inches

*Depth to bedrock:* More than 60 inches

*A or Ap horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 1 to 4

Texture—silt loam or silty clay loam

Reaction—moderately acid to neutral

Clay content—18 to 35 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—5 to 20

*E horizon (if it occurs):*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 to 6

Texture—silt loam or silty clay loam

Reaction—moderately acid to neutral

Clay content—18 to 35 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—5 to 20

*Btn1 horizon:*

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 1 to 4  
 Texture—silty clay loam or silty clay  
 Reaction—slightly acid to moderately alkaline  
 Clay content—35 to 50 percent  
 Electrical conductivity of the saturation extract—2 to 16 mmhos/cm  
 Sodium adsorption ratio—15 to 26

*Btn2 horizon:*

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 2 to 8  
 Texture—silty clay loam or silty clay  
 Reaction—neutral to moderately alkaline  
 Clay content—35 to 50 percent  
 Electrical conductivity of the saturation extract—2 to 16 mmhos/cm  
 Sodium adsorption ratio—16 to 25

*Btn3 horizon:*

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 2 to 8  
 Texture—silty clay loam or silty clay  
 Reaction—neutral to moderately alkaline  
 Clay content—35 to 50 percent  
 Electrical conductivity of the saturation extract—2 to 16 mmhos/cm  
 Sodium adsorption ratio—16 to 25

*Btn4 horizon:*

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 2 to 8  
 Texture—silty clay loam or silty clay  
 Reaction—neutral to moderately alkaline  
 Clay content—35 to 50 percent  
 Electrical conductivity of the saturation extract—2 to 16 mmhos/cm  
 Sodium adsorption ratio—16 to 25

*BC horizon:*

Color—hue of 2.5YR to 5YR, value of 4 or 5, and chroma of 3 to 6  
 Texture—silty clay loam or silty clay  
 Reaction—slightly alkaline or moderately alkaline  
 Clay content—35 to 50 percent  
 Electrical conductivity of the saturation extract—2 to 16 mmhos/cm  
 Sodium adsorption ratio—16 to 25

*Cr horizon (if it occurs):*

Color and texture—soft reddish sandstone interbedded with calcareous reddish, yellowish, brownish, or grayish shale  
 Excavation difficulty—low or moderate

**Port Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Calcareous loamy alluvium of Recent age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Low flood plain

*Slope range:* 0 to 3 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,300 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free days:* 185 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, superactive, thermic Cumulic Haplustolls (fig. 27)

#### **Associated Soils**

- Ashport and Easpor soils which have a mollic epipedon less than 20 inches thick, on the slightly lower flood plains and closer to the stream than the Port soils
- Brewer soils which have a fine control section and an argillic horizon, on the slightly higher flood plains
- Dale and Reinach soils, on the slightly higher flood plains
- McLain soils which have a fine control section and an argillic horizon, on the slightly higher flood plains
- Lawrie soils which have an argillic horizon, on the slightly higher flood plains
- Canadian soils which have a mollic epipedon less than 20 inches thick and have a coarse-loamy control section, on the slightly higher flood plains
- Gaddy soils which have a sandy control section and do not have a mollic epipedon, typically on the slightly lower flood plains and closer to the stream channel than the Port soils
- Miller soils which have a fine control section, on landforms similar to those of the Port soils
- Pulaski and Yahola soils which have a coarse-loamy control section and do not have a mollic epipedon, on landforms similar to those of the Port soils

#### **Typical Pedon**

Port silt loam; Grady County, Oklahoma; about 7 miles east of Chickasha, Oklahoma, in a cultivated area; 2,300 feet north and 100 feet east of the southwestern corner of sec. 24, T. 7 N., R. 6 W. (Colors are for dry soil unless otherwise indicated.)

- Ap—0 to 9 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; soft, very friable; neutral; clear smooth boundary. (0 to 11 inches thick)
- A—9 to 27 inches; dark reddish brown (5YR 3/3) silt loam, dark reddish brown (5YR 2/2) moist; moderate coarse granular structure; slightly hard, friable; neutral; gradual smooth boundary. (10 to 30 inches thick)
- Bk—27 to 42 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, firm; few thin strata of darker material; common soft masses and films of secondary lime; calcareous; moderately alkaline; diffuse smooth boundary. (0 to 25 inches thick)
- C—42 to 72 inches; reddish brown (2.5YR 5/4) silt loam, reddish brown (2.5YR 4/4) moist; massive; hard, firm; few thin strata of dark reddish brown silty clay loam; common soft masses and films of secondary lime; calcareous; moderately alkaline.

#### **Range in Characteristics**

*Thickness of the mollic epipedon:* 20 to 40 inches

*Depth to carbonates:* 20 to 60 inches

*Ap or A horizon:*

Color—hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 1 to 3

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—moderately acid to slightly alkaline

Clay content—10 to 35 percent



Figure 27.—Profile of Port silt loam.

*Bk horizon:*

Color—hue of 2.5YR to 7.5YR, value of 3 to 6, and chroma of 1 to 6  
 Texture—loam, silt loam, clay loam, or silty clay loam  
 Reaction—slightly acid to moderately alkaline  
 Clay content—20 to 35 percent

*C horizon:*

Color—hue of 2.5YR to 7.5YR, value of 3 to 6, and chroma of 1 to 6  
 Texture—loam, silt loam, clay loam, or silty clay loam  
 Reaction—moderately alkaline; horizon is calcareous  
 Clay content—20 to 35 percent

## ***Pulaski Series***

*Major land resource area:* Northern Cross Timbers (84A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy alluvial sediments of Recent age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* Low flood plain

*Slope range:* 0 to 3 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,300 feet

*Mean annual precipitation:* 30 to 40 inches

*Mean annual air temperature:* 58 to 63 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Coarse-loamy, mixed, superactive, nonacid, thermic Udic Ustifluvents

### **Associated Soils**

- Tribbey and Yahola soils which are on landscapes similar to those of the Pulaski soils
- Cyril soils which have a mollic epipedon, on landscapes similar to those of the Pulaski soils
- Gaddy soils which are on flood plains of larger streams and nearer to the stream channel than the Pulaski soils
- Gracemont soils which have an apparent water table within a depth of 20 to 40 inches and are calcareous throughout, typically on flood plains of the larger streams and nearer to the stream channel than the Pulaski soils
- Gracemore soils which have a sandy control section, have an apparent water table within a depth of 20 to 40 inches, and are calcareous throughout; typically on flood plains of the larger streams and nearer to the stream channel than the Pulaski soils
- Ashport and Port soils which have a mollic epipedon and a fine-silty textural control section, at the slightly higher elevations
- Easpur soils which have a mollic epipedon and a fine-loamy textural control section, at the slightly higher elevations

### **Typical Pedon**

Pulaski fine sandy loam; Lincoln County, Oklahoma; about 6 miles north and 1 mile east of Chandler, in a cultivated area; 1,135 feet north and 200 feet east of the southwestern corner of sec. 2, T. 15 N., R. 4 E. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 7 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and very fine granular structure; soft, very friable; moderately acid; clear smooth boundary. (6 to 12 inches thick)

A—7 to 19 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and very fine granular structure; slightly hard, very friable; moderately acid; gradual smooth boundary. (4 to 20 inches thick)

C1—19 to 40 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few thin strata of darker colored fine sandy loam in the lower part of horizon; slightly acid; gradual smooth boundary. (16 to 36 inches thick)

C2—40 to 64 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable; common thin strata of loamy fine sand; slightly acid.

### Range in Characteristics

*Depth to bedrock:* More than 72 inches

*Depth to carbonates:* More than 40 inches

*Depth to buried horizons:* More than 30 inches

*A horizon:*

Color—hue of 2.5YR to 10YR, value of 4 to 7, and chroma of 2 to 6

Texture—fine sandy loam, loam, or loamy fine sand

Reaction—moderately acid to slightly alkaline

Clay content—5 to 18 percent

*C horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 3 to 8

Texture—fine sandy loam, very fine sandy loam, or loam

Reaction—moderately acid to slightly alkaline

Clay content—5 to 18 percent

### Reinach Series

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Valley

*Landform:* High flood plain

*Slope range:* 0 to 1 percent

*Slope shape:* Linear-linear

*Elevation range:* 700 to 1,300 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 64 degrees F

*Frost-free days:* 185 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Coarse-silty, mixed, superactive, thermic Pachic Haplustolls

### Associated Soils

- Amber soils which do not have a mollic epipedon, in the slightly lower areas
- Canadian and Crisfield soils, on the same landscape as the Reinach soils but closer to the streams
- Dale soils which are on the same landscape as the Reinach soils but further from the stream
- Hawley soils which have a coarse-loamy textural control section, on the same landscape as the Reinach soils but closer to the streams
- McLain soils which have an argillic horizon that has more than 35 percent clay in the control section, on the lower landscapes of high flood plains and farther from the stream than the Reinach soils
- Port soils which have more than 18 percent clay in the textural control section, on the lower flood plains
- Yahola soils which do not have a mollic epipedon and have a coarse-loamy textural control section, on the lower flood plains

### Typical Pedon

Reinach silt loam; Grady County, Oklahoma; about 1 mile north and 1.6 miles east of Verden; 2,060 feet west and 50 feet north of the southwestern corner of sec. 6, T. 7 N., R. 8 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 9 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; many fine roots; neutral; clear smooth boundary.

A1—9 to 14 inches; reddish brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; many fine pores; many wormcasts; neutral; gradual smooth boundary.

A2—14 to 30 inches; reddish brown (2.5YR 5/3) silt loam, dark reddish brown (2.5YR 3/3) moist; weak fine and medium granular structure; slightly hard, very friable; many fine pores; many wormcasts; few dark krotovina; mildly alkaline; gradual smooth boundary.

Bw—30 to 50 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; weak fine and medium granular structure; slightly hard, very friable; many fine pores; many wormcasts; few dark krotovina; few soft bodies and threads of secondary lime beginning at a depth of 35 inches; calcareous; moderately alkaline; gradual smooth boundary.

C—50 to 84 inches; red (2.5YR 5/6) very fine sandy loam, red (2.5YR 4/6) moist; massive; slightly hard, very friable; many fine roots and pores; few wormcasts; few soft bodies and films of secondary lime; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the mollic epipedon:* More than 20 inches

*Depth to carbonates:* 20 to 60 inches

*Buried horizons:* Buried A horizon at a depth of 40 inches in some pedons

#### *A horizon:*

Color—hue of 2.5YR to 10YR, value of 4 or 5 (dry) and 3 (moist), and chroma of 2 or 3

Texture—loam, very fine sandy loam, or silt loam

Reaction—slightly acid to moderately alkaline

#### *Bw horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6 (dry) and 3 to 5 (moist), and chroma of 2 to 6

Texture—loam, very fine sandy loam, or silt loam

Reaction—neutral to moderately alkaline; horizon commonly is calcareous

#### *C horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6 (dry) and 3 to 5 (moist), and chroma of 3 to 6

Texture—very fine sandy loam, loam, or silt loam; horizon is stratified with thin strata of coarser or finer textured materials below a depth of 50 inches in some pedons

Reaction—moderately alkaline; horizon is calcareous

### **Renfrow Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Clayey shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 0 to 5 percent

*Slope shape:* Linear-linear and convex

*Elevation range:* 900 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 190 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, superactive, thermic Udertic Paleustolls

### **Associated Soils**

- Bethany and Kirkland soils which are in the higher landscape positions
- Tabler soils which have a mollic epipedon more than 20 inches thick, in the higher areas
- Piedmont and Renthin soils which have a solum less than 60 inches thick, typically on shoulder slopes
- Grainola and Masham soils which do not have a mollic epipedon and have a solum less than 60 inches thick, typically on backslopes
- Kingfisher soils which have a fine-silty control section, on the same landscape as the Renfrow soils
- Stoneburg and Zaneis soils which have a fine-loamy control section, on the same landscape as the Renfrow soils

### **Typical Pedon**

Renfrow silt loam; Kay County, Oklahoma; about 4 miles south and 3 miles west of Tonkawa, in native range; 2,200 feet south and 50 feet east of the northwestern corner of sec. 25, T. 25 N., R. 2 W. (Colors are for dry soil unless otherwise indicated.)

A—0 to 9 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; hard, friable; many fine roots; slightly acid; gradual smooth boundary. (5 to 12 inches thick)

BA—9 to 13 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; hard, friable; many fine roots; slightly acid; clear smooth boundary. (3 to 10 inches thick)

Btss1—13 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; nearly continuous clay films on faces of peds; few slickensides; common fine roots; neutral; gradual smooth boundary. (8 to 20 inches thick)

Btss2—25 to 40 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate coarse blocky structure; extremely hard, very firm; nearly continuous clay films on faces of peds; common slickensides; few fine roots; calcareous at a depth of 30 inches; slightly alkaline; gradual smooth boundary. (8 to 25 inches thick)

Btss3—40 to 65 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak coarse blocky structure; extremely hard, very firm; patchy clay films on faces of peds; few slickensides; few fine roots; few fine and medium concretions of calcium carbonate; few fine soft rounded bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary. (0 to 33 inches thick)

C—65 to 75 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; massive; extremely hard, very firm; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the mollic epipedon:* 10 to 20 inches

*Thickness of the solum:* More than 60 inches

*Depth to carbonates:* 20 to 50 inches

*Other features:* There are cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years; slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; a linear extensibility of 6.0 cm or more between the mineral soil surface and a depth of 100 cm

#### *A horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—silt loam, silty clay loam, clay loam, or loam

Reaction—moderately acid to slightly alkaline

Clay content—18 to 35 percent

#### *BA horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—silty clay loam, clay loam, or silt loam

Reaction—slightly acid to slightly alkaline

Clay content—22 to 40 percent

#### *Bt1 horizon:*

Color—hue of 2.5YR to 5YR, value of 4 to 6, and chroma of 3 to 6

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—slightly acid to moderately alkaline

Clay content—35 to 55 percent

#### *Bt2 horizon:*

Color—hue of 2.5YR to 5YR, value of 4 to 6, and chroma of 3 to 6

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—slightly acid to moderately alkaline

Clay content—35 to 55 percent

#### *Bt3 horizon:*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 3 to 8

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—neutral to moderately alkaline

Clay content—35 to 55 percent

#### *BC horizon (if it occurs):*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 3 to 8

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—moderately alkaline; horizon is calcareous

Clay content—35 to 55 percent

Coarse fragments—0 to 15 percent, by volume, shale gravel 2 to 25 mm in diameter

#### *C horizon (if it occurs):*

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 6 to 8

Texture—clay, silty clay, silty clay loam, or clay loam

Redoximorphic features—redoximorphic accumulations and depletions in shades of brown, red, and gray in some pedons

Reaction—moderately alkaline; horizon is calcareous

Clay content—35 to 55 percent

Coarse fragments—0 to 15 percent, by volume, shale gravel 2 to 25 mm in diameter

*Cr horizon (if it occurs):*

Texture—consolidated shale

Depth—more than 60 inches

***Slaughterville Series****Major land resource area:* Central Rolling Red Prairies (80A)*Depth class:* Very deep*Drainage class:* Well drained*Parent material and geologic age:* Loamy and sandy eolian deposits of Pleistocene age*Physiographic region:* Interior Lowlands*Physiographic province:* Central Lowland*Physiographic sub-province:* Osage Plain*Primary landscape:* Valley*Secondary landscape:* Terrace*Landform:* Dune*Landform position:* Interdune*Slope range:* 1 to 45 percent*Slope shape:* Linear-convex and convex-convex*Elevation range:* 800 to 1,200 feet*Mean annual precipitation:* 26 to 40 inches*Mean annual air temperature:* 58 to 64 degrees F*Frost-free days:* 200 to 230*Thornthwaite PE index:* 44 to 64*Taxonomic class:* Coarse-loamy, mixed, superactive, thermic Udic Haplustolls**Associated Soils**

- Canadian soils which are subject to rare flooding, on nearly level or very gently sloping flood plains
- Derby soils which have a sandy control section with lamellae, on landscapes similar to those of the Slaughterville soils
- Konawa soils which have lighter colored A horizons than the Slaughterville soils and have a fine-loamy control section, on the higher landscapes that are farther from the stream
- Dougherty soils which have lighter colored A horizons than the Slaughterville soils, have a fine-loamy control section, and have A horizons more than 20 inches thick; on the higher landscapes that are farther from the stream
- Minco soils which are typically in the slightly higher and flatter adjacent areas
- Norge, Teller, and Vanoss soils which have an argillic horizon, on similar landscapes that are farther from the stream than the Slaughterville soils

**Typical Pedon**

Slaughterville fine sandy loam; Cleveland County, Oklahoma; about 6 miles west and 6 miles north of Norman, in pasture; about 2,040 feet east and 580 feet north of the southwestern corner of sec. 29, T. 10 N., R. 3 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 9 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many very fine and few medium roots; slightly acid; clear smooth boundary. (7 to 11 inches thick)

A—9 to 18 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, very friable; many very fine roots; slightly acid; gradual smooth boundary. (3 to 10 inches thick)

Bw—18 to 30 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak

- fine subangular blocky structure; slightly hard, very friable; many very fine roots; neutral; gradual smooth boundary. (10 to 56 inches thick)
- C1—30 to 58 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; soft, very friable; common very fine roots; slightly alkaline; gradual smooth boundary. (8 to 48 inches thick)
- C2—58 to 76 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 5/6) moist; massive; soft, very friable; few very fine roots; moderately alkaline.

### Range in Characteristics

*Thickness of the solum:* 20 to more than 50 inches

*A and Ap horizons:*

Color—hue of 7.5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—fine sandy loam

Reaction—moderately acid to neutral

*Bw horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 6

Texture—fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—10 to 18 percent

*C horizon:*

Color—hue of 5YR or 7.5YR, value of 5 to 7, and chroma of 4 to 6

Texture—dominantly fine sandy loam; loamy fine sand or fine sand below a depth of 45 inches in some pedons

Reaction—neutral to moderately alkaline

## Stephenville Series

*Major land resource area:* Northern Cross Timbers (84A)

*Depth class:* Moderately deep

*Drainage class:* Well drained

*Parent material and geologic age:* Sandstone of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 1 to 25 percent

*Slope shape:* Linear-convex

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 30 to 38 inches

*Mean annual air temperature:* 58 to 63 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 48 to 64

*Taxonomic class:* Fine-loamy, siliceous, active, thermic Ultic Haplustalfs

### Associated Soils

- Littleaxe, Dougherty, Galey, Harrah, Konawa, and Stidham soils which are on landscapes similar to those of the Stephenville soils
- Darnell and Darsil soils which have a solum less than 20 inches thick and do not have Bt horizons, on ridgetops

- Niotaze soils which have a fine control section, on side slopes typically at the lower elevations

### Typical Pedon

Stephenville loamy fine sand; Oklahoma County, Oklahoma; about 2 1/2 miles east and 1 mile north of Spencer, on a south-facing slope on a ridge crest, in rangeland; about 750 feet south and 450 feet east of the northwestern corner of sec. 8, T. 12 N., R. 1 W.

(Colors are for dry soil unless otherwise indicated.)

- A—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; many very fine and fine and few medium and coarse roots; moderately acid; clear smooth boundary. (3 to 8 inches thick)
- E—5 to 15 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; weak fine granular structure; soft, very friable; common very fine and fine and few medium roots; strongly acid; abrupt wavy boundary. (0 to 13 inches thick)
- Bt1—15 to 25 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; common very fine and fine and few medium roots; common distinct continuous clay films on faces of pedis; clean sand grains along root channels; strongly acid; gradual wavy boundary. (5 to 25 inches thick)
- Bt2—25 to 33 inches; light red (2.5YR 6/6) sandy clay loam, red (2.5YR 5/6) moist; weak coarse subangular blocky structure; hard, firm; few very fine and medium, common fine, and very few coarse roots; common distinct patchy clay films on faces of pedis; clean sand grains along root channels; strongly acid; clear wavy boundary. (0 to 12 inches thick)
- Cr1—33 to 40 inches; red (2.5YR 5/6) weakly cemented fine-grained sandstone, red (2.5YR 4/6) moist; hard; common fine and few medium roots in fractures; strongly acid.
- Cr2—40 to 51 inches; light red (2.5YR 6/8) weakly cemented fine-grained sandstone, red (2.5YR 5/8) moist; hard; common fine and few medium roots in fractures; strongly acid.

### Range in Characteristics

*Thickness of the solum:* 20 to 40 inches

*Depth to bedrock:* 20 to 40 inches

#### *A horizon:*

Color—hue of 5YR to 10YR, value of 3 to 7, and chroma of 2 to 6

Texture—fine sandy loam or loamy fine sand

Reaction—strongly acid to slightly acid

Clay content—5 to 20 percent

#### *E horizon:*

Color—hue of 5YR to 10YR, value of 5 to 7, and chroma of 2 to 6

Texture—fine sandy loam or loamy fine sand

Reaction—strongly acid to slightly acid

Clay content—5 to 20 percent

#### *Bt horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 3 to 8

Texture—sandy clay loam or fine sandy loam

Reaction—very strongly acid to slightly acid

Clay content—18 to 35 percent

#### *BC horizon (if it occurs):*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—fine sandy loam or sandy clay loam  
 Reaction—very strongly acid to slightly acid  
 Clay content—10 to 35 percent

*Cr horizon:*

Color and texture—reddish sandstone  
 Excavation difficulty—high or very high

**Tabler Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Loess over Pleistocene silty and clayey alluvium

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Plains

*Landform:* Upland terrace

*Landform position:* Tread

*Slope range:* Dominantly less than 1 percent but as much as 3 percent

*Slope shape:* Concave

*Elevation range:* 750 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 190 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, smectitic, thermic Udertic Argiustolls

**Associated Soils**

- Bethany, Kirkland, and Renfrow soils which have mixed mineralogy, on adjacent convex slopes
- Pond Creek soils which have fine-silty control sections, on adjacent convex slopes
- Norge and Vanoss soils which have a mollic epipedon less than 20 inches thick and a fine-silty control section, on adjacent convex slopes
- Wetbeth soils which have an apparent water table within a depth of 60 inches

**Typical Pedon**

Tabler silt loam; Grant County, Oklahoma; about 3 miles west and 1 mile north of Deer Creek, in a cultivated area; 315 feet north and 195 feet east of the southwestern corner of sec. 7, T. 27 N., R. 3 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 10 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, friable; slightly acid; clear smooth boundary. (6 to 14 inches thick)

Btss—10 to 30 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; weak medium blocky structure; extremely hard, very firm; prominent nearly continuous clay films on faces of pedis; few slickensides tilted at an angle of 45 to 60 degrees; neutral; gradual smooth boundary. (14 to 70 inches thick)

BC—30 to 44 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak medium blocky structure; extremely hard, very firm; common fine faint gray redoximorphic depletions and yellowish brown redoximorphic accumulations; few fine calcium carbonate concretions; calcareous; slightly alkaline; diffuse smooth boundary. (0 to 21 inches thick)

C—44 to 60 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2)

moist; massive; extremely hard, very firm; few fine faint gray redoximorphic depletions and few fine distinct reddish brown redoximorphic accumulations; few medium soft calcium carbonate masses; few fine calcium carbonate concretions; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the solum:* 40 to more than 60 inches

*Thickness of mollic epipedon:* More than 20 inches

*Carbonate accumulations:* Concretions and soft masses at a depth of 10 to 60 inches

*Depth to redoximorphic features:* 30 to 40 inches

*A or Ap horizon:*

Color—hue of 10YR, value of 3 to 5, and chroma of 1 to 3

Texture—silt loam, loam, clay loam, or silty clay loam

Reaction—moderately acid to moderately alkaline

*Bt horizon:*

Color—hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2

Texture—silty clay or clay

Redoximorphic features—iron depletions and accumulations in shades of brown, gray, and red

Reaction—slightly acid to moderately alkaline

Structure—slickensides occur in most pedons

*BC horizon:*

Color—hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3

Texture—silty clay, clay, or silty clay loam

Redoximorphic features—iron depletions and accumulations in shades of brown, gray, and red

Reaction—slightly alkaline or moderately alkaline; horizon may be calcareous or noncalcareous

*C horizon:*

Color—hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3

Texture—clay, silty clay, clay loam, or silty clay loam

Redoximorphic features—iron depletions and accumulations in shades of brown, gray, and red

Reaction—slightly alkaline or moderately alkaline; horizon may be calcareous or noncalcareous

### **Tearney Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Clayey alluvium over sandy alluvium of Recent age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Flood plains

*Landform:* Interdunal depressions

*Slope range:* 0 to 1 percent

*Slope shape:* Concave

*Elevation range:* 600 to 1,000 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Clayey over sandy or sandy-skeletal, mixed, superactive, thermic  
Fluventic Hapludolls

#### Associated Soils

- Gaddy soils which are typically closer to the drain than the Tearney soils
- Goodnight soils which are on dunes
- Keokuk and Yahola soils which are in the slightly higher positions

#### Typical Pedon

Tearney silty clay, 0 to 1 percent slopes, ponded; Noble County, Oklahoma; about 8 miles south and 2.5 miles west of Ponca City, in rangeland; 3,800 feet west and 2,300 feet south of the northeastern corner of sec. 5, T. 24 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

A—0 to 10 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; strong moderate and fine angular blocky structure; extremely hard, extremely firm; common fine roots; very few very fine iron-manganese concretions; slightly alkaline; clear smooth boundary.

Bw—10 to 26 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; strong medium subangular blocky structure; very hard, very firm; common fine roots; few fine iron-manganese concretions; many pressure faces; slightly alkaline; abrupt smooth boundary.

2C1—26 to 30 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.

2C2—30 to 80 inches; reddish yellow (7.5YR 7/6) sand, reddish yellow (7.5YR 6/6) moist; single grained; loose; slightly effervescent; slightly alkaline.

#### Range in Characteristics

*Thickness of the mollic epipedon:* 10 to 12 inches

*Ap or A horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3

Texture—silty clay or silty clay loam

Reaction—slightly alkaline or moderately alkaline

*Bw horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—dominantly clay, silty clay loam, or silty clay; lower part of horizon is loam or silt loam in a few pedons

Reaction—slightly alkaline or moderately alkaline

*2C1 horizon:*

Color—hue of 5YR or 7.5YR, value of 6 or 7, and chroma of 4 to 6

Texture—typically loamy fine sand or fine sand; horizon is stratified with layers of very fine sandy loam in some pedons

Reaction—slightly alkaline or moderately alkaline

*2C2 horizon:*

Color—hue of 5YR to 10YR, value of 6 to 8, and chroma of 4 to 6

Texture—typically fine sand or sand; horizon is stratified with silt loam, very fine sandy loam, or loam in some pedons

Reaction—slightly alkaline or moderately alkaline

## **Teller Series**

*Major land resource area:* Central Rolling Red Prairies (80A)  
*Depth class:* Very deep  
*Drainage class:* Well drained  
*Parent material and geologic age:* Loamy sediments of Pleistocene age  
*Physiographic region:* Interior Lowlands  
*Physiographic province:* Central Lowland  
*Physiographic sub-province:* Osage Plain  
*Landscape:* Upland  
*Landform:* Terrace  
*Landform position:* Tread or summit  
*Slope range:* 0 to 8 percent  
*Slope shape:* Linear-convex, linear-linear, and convex-linear  
*Elevation range:* 950 to 1,300 feet  
*Mean annual precipitation:* 26 to 38 inches  
*Mean annual air temperature:* 58 to 63 degrees F  
*Frost-free days:* 200 to 230  
*Thornthwaite PE index:* 44 to 64  
*Taxonomic class:* Fine-loamy, mixed, active, thermic Udic Argiustolls

### **Associated Soils**

- Dougherty and Konawa soils which do not have a mollic epipedon, in the slightly higher positions
- Minco soils which do not have an argillic horizon, in the higher positions or in areas between terraces
- Norge, Pond Creek, and Vanoss soils which have a fine-silty control section, in the slightly lower positions
- Navina soils which are on landscapes similar to those of the Teller soils
- Slaughterville soils which do not have an argillic horizon, in the slightly lower positions nearer to the major streams than the Teller soils

### **Typical Pedon**

Teller fine sandy loam; Payne County, Oklahoma; about 1 mile west and 1 mile north of Perkins, in a cultivated area; 2,100 feet north and 80 feet east of the southwestern corner of sec. 36, T. 18 N., R. 2 E. (Colors are for dry soil unless otherwise indicated.)

- Ap—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; slightly hard, very friable; moderately acid; clear smooth boundary. (0 to 11 inches thick)
- A—6 to 15 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate medium and fine granular structure; slightly hard, friable; moderately acid; gradual smooth boundary. (6 to 15 inches thick)
- BA—15 to 20 inches; brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure parting to moderate medium granular; hard, friable; moderately acid; gradual smooth boundary. (0 to 8 inches thick)
- Bt1—20 to 32 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; thin nearly continuous clay films on faces of peds; moderately acid; gradual smooth boundary. (6 to 20 inches thick)
- Bt2—32 to 42 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; patchy clay films on faces of peds; moderately acid; gradual smooth boundary. (6 to 20 inches thick)
- Bt3—42 to 60 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6)

moist; weak coarse prismatic structure; hard, friable; patchy clay films on faces of peds; moderately acid; diffuse smooth boundary. (10 to 30 inches thick)  
 C—60 to 70 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure; hard, friable; patchy clay films on faces of peds; moderately acid.

### Range in Characteristics

*Thickness of the mollic epipedon:* Less than 20 inches

*Thickness of the solum:* More than 50 inches

*Depth to bedrock:* More than 60 inches

*Ap or A horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4

Texture—fine sandy loam, loam, silt loam, or very fine sandy loam

Reaction—dominantly moderately acid or slightly acid; neutral in limed areas

Clay content—10 to 20 percent

*BA horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—fine sandy loam, loam, silt loam, or very fine sandy loam

Reaction—dominantly moderately acid or slightly acid; neutral in limed areas

Clay content—10 to 25 percent

*Bt1 and Bt2 horizons:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—sandy clay loam or clay loam

Reaction—moderately acid to neutral

Clay content—20 to 30 percent

*Bt3 horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—fine sandy loam, loam, clay loam, or very fine sandy loam

Reaction—moderately acid to neutral

Clay content—10 to 30 percent

*BC horizon (if it occurs):*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—loam, fine sandy loam, or very fine sandy loam

Reaction—slightly acid to slightly alkaline

Clay content—10 to 20 percent

*C horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—loam, fine sandy loam, or very fine sandy loam

Reaction—moderately acid to moderately alkaline

Clay content—10 to 20 percent

### **Vanoss Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Loamy alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Terrace

*Landform position:* Tread or summit

*Slope range:* 0 to 8 percent

*Slope shape:* Linear-linear

*Elevation range:* 900 to 1,300 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, superactive, thermic Udic Argiustolls

#### **Associated Soils**

- Norge soils which are on similar slopes and on adjacent side slopes
- Teller soils which are typically on the slightly higher convex ridges
- Bethany soils which have a fine control section, on the slightly concave broad flats
- Minco soils which have a coarse-silty control section and do not have Bt horizons, typically on adjacent side slopes and closer to the river channel than the Vanoss soils

#### **Typical Pedon**

Vanoss loam; Pottawatomie County, Oklahoma; about 1/2 mile west of Shawnee, in a cultivated area; 1,400 feet south and 2,200 feet east of the northwestern corner of sec. 24, T. 10 N., R. 3 E. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; strongly acid; abrupt smooth boundary. (6 to 13 inches thick)

A—7 to 11 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, friable; strongly acid; clear smooth boundary. (4 to 10 inches thick)

BA—11 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable; moderately acid; clear smooth boundary. (0 to 8 inches thick)

Bt1—15 to 27 inches; dark yellowish brown (10YR 4/4) clay loam, dark yellowish brown (10YR 3/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; continuous clay films on faces of peds; moderately acid; clear smooth boundary. (8 to 36 inches thick)

Bt2—27 to 37 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; very hard, friable; continuous clay films on faces of peds; moderately acid; clear smooth boundary. (0 to 12 inches thick)

Bt3—37 to 50 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; hard, friable; patchy clay films on faces of peds; moderately acid; gradual smooth boundary. (8 to 22 inches thick)

C—50 to 95 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; hard, friable; many medium faint grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/6) redoximorphic features; moderately acid.

#### **Range in Characteristics**

*Thickness of the mollic epipedon:* Less than 20 inches

*Thickness of the solum:* 40 to more than 60 inches

*Ap or A horizon:*

Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 1 to 3

Texture—loam or silt loam

Reaction—strongly acid to neutral

Clay content—15 to 26 percent

*BA horizon:*

Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4

Texture—loam, silt loam, silty clay loam, or clay loam

Reaction—strongly acid to neutral

Clay content—18 to 30 percent

*Bt1 and Bt2 horizons:*

Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6

Texture—clay loam or silty clay loam

Redoximorphic features—red or brown concentrations in some pedons

Reaction—strongly acid to neutral

Clay content—27 to 35 percent

*Bt3 horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 to 8

Texture—loam, silt loam, clay loam, or silty clay loam

Redoximorphic features—red or brown concentrations in some pedons

Reaction—moderately acid to slightly alkaline

Clay content—18 to 35 percent

*BC and C horizons:*

Color—hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 8

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—moderately acid to slightly alkaline

Clay content—10 to 35 percent

Other features—some pedons have buried horizons that are fine sandy loam or sandy clay loam

## **Wakita Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Moderately deep

*Drainage class:* Moderately well drained

*Parent material and geologic age:* Interbedded sandstone and shale of Permian age or thin loamy deposits over interbedded sandstone and shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Primary landscape:* Hills

*Secondary landscape:* Hillslopes

*Landform:* Backslopes

*Slope range:* 1 to 5 percent

*Slope shape:* Convex-convex

*Elevation range:* 800 to 1,500 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-silty, mixed, active, thermic Leptic Natrustolls

### **Associated Soils**

- Grant, Kingfisher, Norge, Pond Creek, and Zaneis soils which do not have a natric horizon, on the same landscape as the Wakita soils

### Typical Pedon

Wakita silt loam; Grant County, Oklahoma; about 3 miles east of Nash, in a cultivated area; 1,800 feet south and 400 feet east of the northwestern corner of sec. 12, T. 25 N., R. 7 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 5 inches; light reddish brown (5YR 6/4) silt loam, dark reddish brown (5YR 3/4) moist; moderate medium platy structure; massive; hard, friable; many fine pores; moderately acid; abrupt smooth boundary. (4 to 10 inches thick)

Btn—5 to 14 inches; reddish gray (5YR 5/2) silt loam, dark reddish brown (5YR 3/2) moist; moderate coarse columnar structure parting to subangular blocky; hard, friable; many fine pores; clay films on faces of peds; slightly alkaline; gradual smooth boundary. (6 to 20 inches thick)

Bt<sub>ny</sub>1—14 to 22 inches; reddish brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm; eluvial material with uncoated sand and silt grains on faces of structure; common fine pores; clay films on faces of peds; few fine threads of gypsum; slightly alkaline; gradual smooth boundary. (8 to 30 inches thick)

Bt<sub>ny</sub>2—22 to 32 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure breaking to subangular blocky; hard, firm; few fine pores; clay films on faces of peds; few fine threads of gypsum; moderately alkaline; clear smooth boundary. (6 to 30 inches thick)

Cr—32 to 37 inches; light reddish brown (5YR 6/4) weathered interbedded sandstone and silty shale, reddish brown (5YR 4/4) moist; calcareous; moderately alkaline.

### Range in Characteristics

*Thickness of the solum:* 20 to 40 inches

*Depth to bedrock:* 20 to 40 inches

*Thickness of the mollic epipedon:* 7 to 15 inches

*Base saturation:* 50 percent or more in all horizons between the upper boundary of the natric horizon and a depth of 60 inches

*Salts:* Visible crystals of gypsum or more soluble salts, or both, are within a depth of 16 inches of the mineral soil surface

#### *Ap and A horizons:*

Color of A horizon—hue of 5YR to 7.5YR, value of 5 or 6, and chroma of 2 to 4; moist value of 2 to 4

Color of Ap horizon—hue of 5YR to 7.5YR, value of 5 or less (dry, crushed and smoothed sample) and 3 or less (moist), and chroma of 3 or less

Texture—loam or silt loam

Coarse fragments—0 to 2 percent, by volume, fragments of sandstone and shale 2 to 76 mm in diameter

Structure—massive, platy, granular, or blocky

Reaction—moderately acid to strongly alkaline

Sodium adsorption ratio—10 to 30

Electrical conductivity of the saturation extract—0 to 15 mmhos/cm

#### *Btn horizon:*

Color—hue of 5YR or 7.5YR, value of 4 to 6, chroma of 2 to 6

Texture—silt loam, clay loam, or silty clay loam

Clay content—25 to 35 percent

Coarse fragments—0 to 10 percent, by volume, sandstone and shale fragments 2 to 76 mm in diameter

Structure—columnar or prismatic, or blocky with tongues of eluvial material that has some uncoated silt or sand grains

Reaction—slightly alkaline to strongly alkaline

*Bt<sub>ny</sub>1 and Bt<sub>ny</sub>2 horizons:*

- Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 3 to 6
- Texture—silt loam, clay loam, or silty clay loam
- Redoximorphic features—red, yellow, or brown concentrations in some pedons
- Coarse fragments—0 to 15 percent, by volume, sandstone and shale fragments 2 to 76 mm in diameter
- Reaction—slightly alkaline to strongly alkaline
- Sodium adsorption ratio—13 to 100
- Electrical conductivity of the saturation extract—0 to 12 mmhos/cm
- Other features—seams of soluble salts or gypsum crystals occur in most pedons at some time during the year

*Cr or C horizon:*

- Color—dominantly hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8; hue of 5Y or 5GY, value of 5 to 7, and chroma of 1 or 2 in a few pedons
- Texture—interbedded sandstone and shale that can be cut with a spade
- Hardness—nonparalithic with a low or moderate excavation difficulty
- Other features—fractures more than 10 cm apart; material is dense enough to be root restrictive; material slakes in water within 15 hours

**Waurika Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Somewhat poorly drained

*Parent material and geologic age:* Clayey and loamy old alluvium or residuum weathered from shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Terrace

*Landform position:* Tread or summit

*Slope range:* 0 to 1 percent

*Slope shape:* Linear-linear

*Elevation range:* 900 to 1,300 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 58 to 63 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, smectitic, thermic Vertic Argialbolls

**Associated Soils**

- Bethany, Kirkland, and Tabler soils which do not have an albic horizon, on landscapes similar to those of the Waurika soils
- Renfrow soils which do not have an albic horizon, in the more sloping convex areas
- Aydelotte soils which do not have a mollic epipedon and do not have an albic horizon, in the more sloping convex areas
- Chickasha soils which have a fine-loamy control section and do not have an albic horizon, in the more sloping convex areas
- Foard soils which have a natric horizon and do not have an albic horizon, on landscapes similar to those of the Waurika soils
- Seminole soils which have a natric horizon and do not have an albic horizon, in the more sloping convex areas

- Grainola soils which have a solum that is less than 40 inches thick over shale bedrock and do not have an albic horizon, in the more sloping convex areas
- Lucien soils which have a have solum that is less than 20 inches thick over sandstone bedrock and do not have an albic horizon, in the more sloping convex areas

### Typical Pedon

Waurika silt loam; Cotton County, Oklahoma; about 1 mile south and 3 miles east of Temple, in a cultivated area; 190 feet south and 100 feet west of the northeastern corner of sec. 31, T. 3 S., R. 9 W. (Colors are for dry soil unless otherwise indicated.)

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; moderately acid; clear smooth boundary. (0 to 8 inches thick)

A—6 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; few fine roots; few wormcasts; neutral; gradual smooth boundary. (0 to 10 inches thick)

E—10 to 12 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; porous; slightly hard, friable; neutral; abrupt wavy boundary. (1 to 5 inches thick)

Btss—12 to 32 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; very hard, very firm; nearly continuous clay films on faces of pedis; many slickensides; few lime concretions; neutral; gradual smooth boundary. (12 to 25 inches thick)

Btk—32 to 57 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium blocky structure; very hard, firm; few black concretions; common lime concretions; few films and masses of calcium carbonate; calcareous; slightly alkaline; gradual smooth boundary. (20 to 30 inches thick)

C—57 to 72 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; massive; many coarse reddish yellow (5YR 6/6) redoximorphic concentrations; few concretions of calcium carbonate; calcareous; slightly alkaline.

### Range in Characteristics

*Thickness of the solum:* 40 to more than 60 inches

*Depth to bedrock:* More than 60 inches

*Depth to carbonates:* 24 to 48 inches

#### *A horizon:*

Color—hue of 7.5YR, value of 3 to 5, and chroma of 2; hue of 10YR, value of 3 to 5, and chroma of 1 or 2; or hue of 2.5Y, value of 3 to 5, and chroma of 2

Texture—silt loam or loam

Reaction—moderately acid to neutral

Clay content—15 to 25 percent

Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

Sodium adsorption ratio—0 to 4

#### *E horizon:*

Color—hue of 7.5YR, value of 4 to 6, and chroma of 2; hue of 10YR, value of 4 to 6, and chroma of 1 or 2; or hue of 2.5Y, value of 4 to 6, and chroma of 2

Texture—loam or silt loam

Reaction—moderately acid to neutral

Clay content—15 to 25 percent

Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

Sodium adsorption ratio—0 to 4

*Btss horizon:*

Color—hue of 7.5YR, value of 3 to 5, and chroma of 2; hue of 10YR, value of 3 to 5, and chroma of 1 to 3; or hue of 2.5Y, value of 3 to 5, and chroma of 2

Texture—clay, silty clay, or silty clay loam

Redoximorphic features—brown or gray concentrations or depletions in some pedons

Reaction—slightly acid to moderately alkaline

Clay content—35 to 60 percent

Electrical conductivity of the saturation extract—0 to 4 mmhos/cm

Sodium adsorption ratio—4 to 10

*Btk horizon:*

Color—hue of 7.5YR, value of 4 or 5, and chroma of 2; hue of 10YR, value of 4 or 5, and chroma of 1 to 3; or hue of 2.5Y, value of 4 or 5, and chroma of 2

Texture—clay loam, silty clay loam, silty clay, or clay

Redoximorphic features—brown or gray concentrations or depletions in some pedons

Reaction—slightly alkaline or moderately alkaline

Clay content—30 to 50 percent

Electrical conductivity of the saturation extract—0 to 8 mmhos/cm

Sodium adsorption ratio—8 to 20

*BC horizon (if it occurs):*

Color—hue of 7.5YR, value of 4 or 5, and chroma of 2; hue of 10YR, value of 4 or 5, and chroma of 1 to 3; or hue of 2.5Y, value of 4 or 5, and chroma of 2

Texture—clay loam, silty clay loam, silty clay, or clay

Redoximorphic features—brown or gray concentrations or depletions in some pedons

Reaction—slightly alkaline or moderately alkaline

Clay content—30 to 50 percent

*C horizon:*

Color—hue of 7.5YR, value of 4 or 5, and chroma of 2 to 4; hue of 10YR, value of 4 to 7, and chroma of 1 to 4; or hue of 2.5Y, value of 4 to 7, and chroma of 2

Texture—clay loam or silty clay loam

Redoximorphic features—brown, yellow, gray, or red concentrations or depletions in some pedons

Reaction—slightly alkaline or moderately alkaline

Electrical conductivity of the saturation extract—0 to 8 mmhos/cm

Sodium adsorption ratio—8 to 20

**Westsum Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Well drained

*Parent material and geologic age:* Residual material weathered from gray clayey Permian shale

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Hills

*Landform:* Hillslope

*Slope range:* 1 to 5 percent

*Slope shape:* Concave

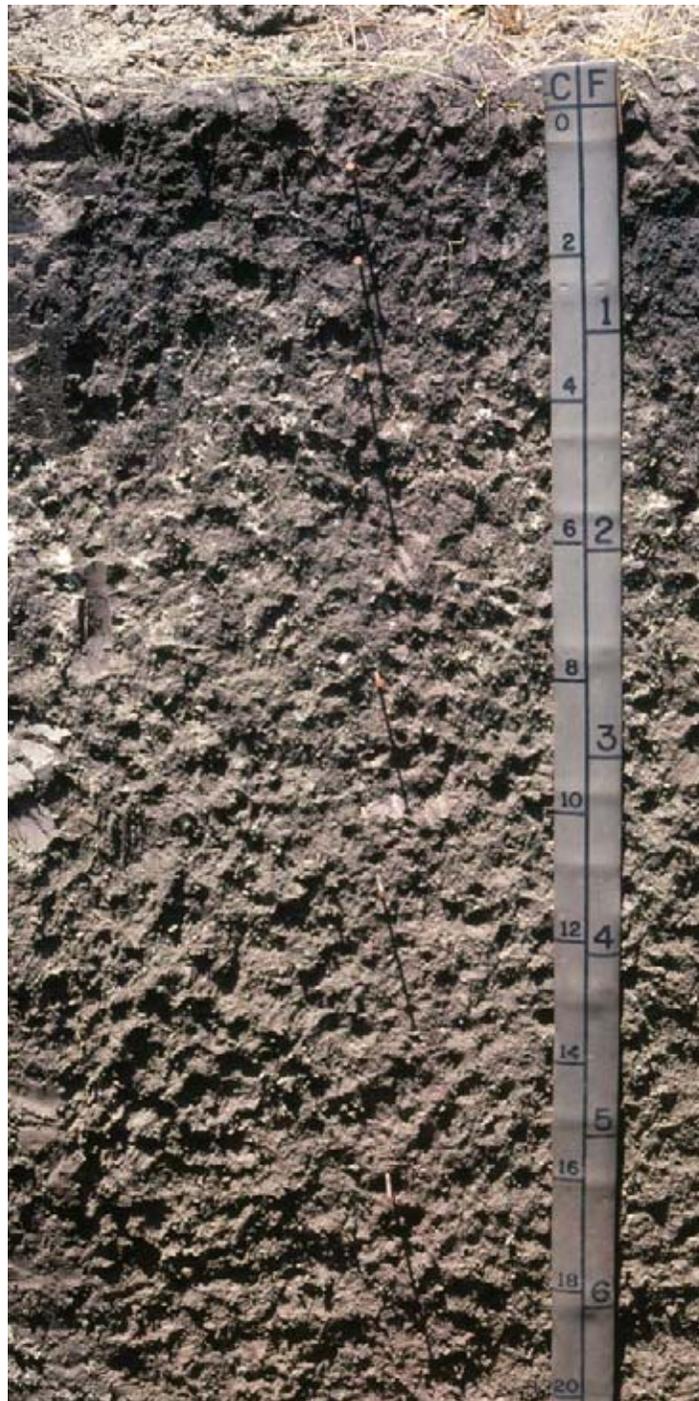


Figure 28.—Profile of Westsum silty clay loam.

*Elevation range:* 700 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 63 degrees F

*Frost-free days:* 200 to 220

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine, mixed, active, thermic Udertic Argiustolls (fig. 28)

### Associated Soils

- Dilworth, Grainola, and Highview soils which are on the more sloping backslopes of hillsides above the Westsum soils
- Kirkland and Renfrow soils which are on the higher parts of the landscape

### Typical Pedon

Westsum silty clay loam, 1 to 3 percent slopes; Noble County, Oklahoma; about 7 miles east and 4 miles south of Billings, on a 2 percent slope, in cropland; 650 feet north and 150 feet west of the southeastern corner of sec. 8, T. 23 N., R. 1 W. (Colors are for dry soil unless otherwise indicated.)

- Ap—0 to 10 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to weak fine granular; hard, friable; common fine roots throughout; few slightly effervescent spots (HCl, unspecified); moderately alkaline (pH 7.8); abrupt smooth boundary. (5 to 10 inches thick)
- Bt1—10 to 16 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure parting to strong very fine blocky; very hard, firm; few fine roots; few fine and common very fine tubular pores with low vertical continuity; few fine fragments of siltstone; many distinct clay films on faces of peds; few wormcasts; few very slightly effervescent spots (HCl, unspecified); moderately alkaline (pH 8.0); clear smooth boundary. (6 to 13 inches thick)
- Btk1—16 to 30 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate very fine and fine blocky structure; very hard, very firm; few very fine tubular pores with low vertical continuity; few fine faint yellowish brown (10YR 5/4) redoximorphic concentrations; few fine fragments of siltstone; few distinct dark gray (10YR 4/1) streaks of surface material in cracks; common distinct clay films on faces of peds; many fine irregular soft masses of calcium carbonate; few medium and few fine rounded calcium carbonate concretions; strongly effervescent (HCl, unspecified); moderately alkaline (pH 8.0); gradual smooth boundary. (10 to 19 inches thick)
- Btk2—30 to 36 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate very fine and fine blocky structure; very hard, very firm; few very fine tubular pores with low vertical continuity; few fine fragments of siltstone; common distinct clay films on faces of peds; few distinct dark gray (10YR 4/1) streaks of surface material in cracks; common fine irregular soft masses of calcium carbonate; few medium rounded calcium carbonate concretions; strongly effervescent (HCl, unspecified); moderately alkaline (pH 8.0); gradual smooth boundary. (0 to 8 inches thick)
- Bt2—36 to 52 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; moderate fine blocky structure; very hard, very firm; few very fine tubular pores with low vertical continuity; few fine faint light yellowish brown (10YR 6/4) redoximorphic concentrations; few fine fragments of siltstone; common distinct clay films on faces of peds; few distinct dark gray (10YR 4/1) streaks of surface material in cracks; slightly effervescent (HCl, unspecified); moderately alkaline (pH 8.0); gradual smooth boundary. (9 to 28 inches thick)
- Bt3—52 to 65 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate fine blocky structure; very hard, very firm; few fine and very fine fragments of siltstone; common distinct clay films on faces of peds; few fine rounded dark concretions; moderately alkaline (pH 8.0); gradual smooth boundary. (0 to 13 inches thick)
- BC—65 to 80 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak fine subangular blocky structure; very hard, very firm; common very fine shale fragments; few faint clay films on faces of peds; common very fine

rounded dark concretions; few medium and common fine rounded calcium carbonate concretions; very slightly effervescent (HCl, unspecified); moderately alkaline (pH 8.0). (0 to 21 inches thick)

### Range in Characteristics

*Thickness of the solum:* More than 55 inches

*Depth to shale:* More than 60 inches

*Thickness of the mollic epipedon:* 12 to 18 inches

*Depth to secondary carbonates:* 10 to 23 inches

*A horizon:*

Color—hue of 10YR, value of 3 or 4, and chroma of 1 or 2

Texture—silty clay loam or silt loam

Reaction—slightly alkaline or moderately alkaline

*BA horizon (if it occurs):*

Color—hue of 10YR, value of 4, and chroma of 2

Texture—silty clay loam or silt loam

Reaction—slightly alkaline or moderately alkaline

*Bt1 horizon:*

Color—hue of 10YR, value of 3 to 5, and chroma of 1 to 3

Texture—silty clay or silty clay loam

*Btk1 horizon:*

Color—hue of 10YR to 2.5Y, value of 4 to 6, and chroma of 2 or 3

Texture—silty clay or silty clay loam

Redoximorphic features—few brownish yellow or yellowish brown concentrations in a few pedons

Structure—slickensides in a few pedons

*Btk2 horizon (if it occurs):*

Color—hue of 10YR to 5Y, value of 5 or 6, and chroma of 2

Texture—silty clay

Redoximorphic features—few brownish yellow, light yellowish brown, yellowish red, or yellowish brown concentrations in a few pedons

Structure—slickensides in a few pedons

*Bt2 horizon:*

Color—hue of 10YR to 5Y, value of 5 or 6, and chroma of 2 to 4

Texture—silty clay

Redoximorphic features—few brownish yellow, light yellowish brown, yellowish red, or pink concentrations in a few pedons

Structure—slickensides in a few pedons

*Bt3 horizon:*

Color—hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 2 to 4

Texture—silty clay

Redoximorphic features—few brownish yellow concentrations in a few pedons

Structure—slickensides in a few pedons

*BC horizon:*

Color—hue of 7.5YR to 5Y, value of 5 or 6, and chroma of 1 to 4

Texture—silty clay or clay loam

Structure—slickensides in a few pedons

*C horizon (if it occurs):*

Color—hue of 10YR to 5Y, value of 5 or 6, and chroma of 2 to 4

Texture—weathered bedrock or shaly clay

*Cr horizon (if it occurs):*

Color—hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 4  
Paralithic contact—shale bedrock

**Wisby Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Very deep

*Drainage class:* Somewhat excessively drained

*Parent material and geologic age:* Loamy sediments over old sandy alluvium of Pleistocene age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Dissected terrace

*Landform position:* Tread

*Slope range:* 0 to 20 percent

*Slope shape:* Convex-convex

*Elevation range:* 800 to 1,500 feet

*Mean annual precipitation:* 26 to 38 inches

*Mean annual air temperature:* 57 to 62 degrees F

*Frost-free days:* 185 to 210

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Coarse-loamy, mixed, superactive, thermic Udic Argiustolls

**Associated Soils**

- Milan and Lovedale soils which are fine-loamy and do not have a gravelly substratum, generally in the slightly higher landscape positions

**Typical Pedon**

Wisby sandy loam; Alfalfa County, Oklahoma; about 2,300 feet west and 300 feet south of the northwestern corner of sec. 1, T. 24 N., R. 10 W. (Colors are for dry soil unless otherwise indicated.)

A—0 to 12 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate medium granular structure; hard, friable; noneffervescent; neutral; gradual smooth boundary. (8 to 18 inches thick)

Bt—12 to 24 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 3/4) moist; weak coarse prismatic structure parting to weak medium granular; slightly hard, friable; few faint patchy clay films on faces of peds; common clay bridging between sand grains; noneffervescent; neutral; gradual smooth boundary. (12 to 20 inches thick)

2C—24 to 80 inches; strong brown (7.5YR 5/6) gravelly sand, strong brown (7.5YR 4/6) moist; single grained; noneffervescent; neutral.

**Range in Characteristics**

*Thickness of the mollic epipedon:* 8 to 20 inches

*Thickness of the solum:* 20 to 40 inches

*Depth to carbonates:* More than 36 inches

*A horizon:*

Color—hue of 7.5YR or 10YR, value of 4 or 5 (dry) and 2 or 3 (moist), and chroma of 2 or 3

Texture—sandy loam or fine sandy loam

Reaction—neutral to moderately acid

Coarse fragments—0 to 15 percent, by volume, rounded gravel less than 3 inches in diameter

*Bt horizon:*

Color—hue of 10YR to 2.5YR, value of 4 to 6 (dry) and 3 to 5 (moist), and chroma of 2 to 6

Texture—sandy loam or loam with 10 to 18 percent clay and 45 to 75 percent medium and coarse sand

Reaction—slightly acid to slightly alkaline

Coarse fragments—0 to 15 percent, by volume, rounded gravel less than 3 inches in diameter

*BC horizon (if it occurs):*

Color—hue of 10YR to 2.5YR, value of 4 to 6 (dry) and 3 to 5 (moist), and chroma of 2 to 6

Texture—coarse sandy loam, sandy loam, or loamy sand

Reaction—neutral to moderately alkaline

*2C horizon:*

Color—hue of 7.5YR or 5YR, value of 4 to 6 (dry) and 4 or 5 (moist), and chroma of 4 to 8

Texture—sand, gravelly sand, or loamy sand

Reaction—slightly acid to moderately alkaline

Coarse fragments—0 to 40 percent, by volume, rounded gravel less than 3 inches in diameter

## **Zaneis Series**

*Major land resource area:* Central Rolling Red Prairies (80A)

*Depth class:* Deep

*Drainage class:* Well drained

*Parent material and geologic age:* Material weathered from interbedded sandstone and shale of Permian age

*Physiographic region:* Interior Lowlands

*Physiographic province:* Central Lowland

*Physiographic sub-province:* Osage Plain

*Landscape:* Upland

*Landform:* Hills

*Landform position:* Summit and backslope

*Slope range:* 0 to 8 percent

*Slope shape:* Linear-convex and convex-convex

*Elevation range:* 900 to 1,200 feet

*Mean annual precipitation:* 26 to 40 inches

*Mean annual air temperature:* 58 to 64 degrees F

*Frost-free days:* 200 to 230

*Thornthwaite PE index:* 44 to 64

*Taxonomic class:* Fine-loamy, siliceous, active, thermic Udic Argiustolls

### **Associated Soils**

- Bethany soils which have a fine control section, on the slightly higher broad flats
- Chickasha and Coyle soils which are on landscapes similar to those of the Zaneis soils
- Grainola soils which do not have a mollic epipedon, have a fine control section, and have a solum less than 40 inches thick; on side slopes

- Loco and Lucien soils which have a solum less than 20 inches thick and do not have Bt horizons, typically on ridge crests and upper side slopes
- Mulhall soils which are on the slightly lower side slopes and footslopes
- Nash soils which have a coarse-silty control section and do not have Bt horizons, typically on landscapes similar to those of the Zaneis soils
- Renfrow soils which have a fine control section, on the slightly higher convex ridge crests
- Stephenville soils which do not have a mollic epipedon and have a solum less than 40 inches thick, in areas that have savannah vegetation on landscapes similar to those of the Zaneis soils
- Teller soils which are typically in the slightly lower areas that are closer to the stream channel than the Zaneis soils

### Typical Pedon

Zaneis loam; Oklahoma County, Oklahoma; about 1 mile east and 5 miles north of Edmond, in a cultivated area; 100 feet south and 1,000 feet east of the northwestern corner of sec. 6, T. 14 N., R. 2 W. (Colors are for dry soil unless otherwise indicated.)

A1—0 to 6 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak medium platy structure parting to weak fine granular; slightly hard, very friable; many very fine and few fine roots; many very fine and fine continuous tubular pores; moderately acid; abrupt smooth boundary. (0 to 10 inches thick)

A2—6 to 12 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, very friable; many very fine and few fine roots; many very fine and fine continuous tubular pores; moderately acid; clear smooth boundary. (4 to 14 inches thick)

BA—12 to 19 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) moist; weak fine prismatic structure parting to weak fine subangular blocky; hard, firm; many very fine and few fine and medium roots; common very fine and fine continuous tubular pores; moderately acid; gradual smooth boundary. (0 to 7 inches thick)

Bt1—19 to 31 inches; brown (7.5YR 5/3) clay loam, brown (7.5YR 4/3) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, very firm; many very fine and few fine roots; common very fine and fine continuous tubular pores; common distinct continuous clay films on vertical and horizontal faces; slightly acid; gradual wavy boundary. (4 to 18 inches thick)

Bt2—31 to 39 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to moderate medium blocky; very hard, very firm; common very fine roots; common very fine and fine continuous tubular pores; common distinct continuous clay films on vertical and horizontal faces; common medium distinct red (2.5YR 4/6) redoximorphic concentrations; few fine iron-manganese concretions; moderately acid; gradual wavy boundary. (6 to 23 inches thick)

Bt3—39 to 48 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; common very fine roots; many very fine and common fine continuous tubular pores; common distinct discontinuous clay films on vertical and horizontal faces; common coarse prominent olive yellow (5Y 6/6), reddish brown (2.5YR 5/4), and brown (7.5YR 5/3) redoximorphic concentrations; common fine iron-manganese concretions; brown (7.5YR 4/3) material in root channels; slightly acid; gradual wavy boundary. (0 to 24 inches thick)

Bt4—48 to 55 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, firm; few very fine roots; few very fine, many fine, and common medium continuous tubular pores; common faint discontinuous clay films on vertical faces; common medium distinct dark red (2.5YR 3/6) redoximorphic concentrations; few fine iron-manganese

concretions; brown (7.5YR 4/3) material along root channels; slightly acid; clear wavy boundary. (0 to 15 inches thick)

BC—55 to 59 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak coarse subangular blocky structure; hard, friable; few very fine roots; common very fine and many fine continuous tubular pores; few medium distinct dark red (10R 3/6) redoximorphic concentrations; brown (7.5YR 4/3) material along root channels; 10 percent, by volume, weathered sandstone fragments; slightly acid; abrupt wavy boundary. (0 to 10 inches thick)

Cr—59 to 65 inches; red (2.5YR 4/6) soft laminated sandstone, dark red (2.5YR 3/6) moist; slightly acid.

### Range in Characteristics

*Thickness of the mollic epipedon:* Less than 20 inches

*Thickness of the solum:* 40 to 60 inches

*Depth to bedrock:* 40 to 60 inches

*A or Ap horizon:*

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—loam or fine sandy loam

Reaction—moderately acid to neutral

Clay content—10 to 26 percent

*BA horizon:*

Color—hue of 5YR or 7.5YR, value of 4, and chroma of 2 to 4

Texture—loam or clay loam

Reaction—moderately acid to neutral

Clay content—18 to 30 percent

*Bt1 horizon:*

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4

Texture—loam, clay loam, or sandy clay loam

Reaction—moderately acid to slightly alkaline

Clay content—18 to 30 percent

*Bt2 horizon:*

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6

Texture—clay loam or sandy clay loam

Redoximorphic features—red concentrations

Reaction—moderately acid to slightly alkaline

Clay content—20 to 38 percent

*Bt3 horizon:*

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8

Texture—clay loam or sandy clay loam

Redoximorphic features—red, brown, or yellow concentrations

Reaction—slightly acid to moderately alkaline

Clay content—20 to 38 percent

*Bt4 horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—fine sandy loam, clay loam, or sandy clay loam

Redoximorphic features—red concentrations

Reaction—moderately acid to slightly alkaline

Clay content—18 to 30 percent

*BC horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—fine sandy loam, clay loam, or sandy clay loam

Clay content—18 to 30 percent  
Reaction—moderately acid to slightly alkaline

*Cr horizon:*

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8  
Texture—weathered sandstone  
Reaction—moderately acid to slightly alkaline

# Formation of the Soils

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This section discusses the factors of soil formation and how they relate to the soils in Noble County. It also discusses the geology of the survey area.

## Factors of Soil Formation

The following paragraphs describe the five factors of soil formation—climate, living organisms, topography, parent material, and time. The combined influence of these factors determines the characteristics and properties of a soil.

### Climate

Noble County has a moist, subhumid climate. Because the climate is fairly uniform throughout the county, differences among soils cannot be attributed to differences in climate based on the present climatic regime. Moisture and warm temperatures have been sufficient for the formation of distinct layers in many of the soils. Soil leaching is moderate. The physical abrasion and redistribution of materials by wind action contributes to soil formation. Cold temperatures occur often enough and long enough in the survey area to alter materials through the processes of freezing and thawing.

### Living Organisms

Plants, burrowing animals, insects, and soil micro-organisms have a direct influence on the formation of soils. The native grasses and trees in the county have had different effects on the losses and gains of organic matter and plant nutrients in the soil and on soil structure and porosity. Soils that formed under prairie vegetation, such as Kirkland and Norge, have a dark grayish brown surface layer and a moderately high content of organic matter. Soils that formed under trees, such as Harrah and Stephenville, have a brown surface layer and a low content of organic matter.

### Topography

Relief influences the formation of the soils mainly through its effect on water movement, erosion, soil temperature, and the kind of plant cover. In Noble County, relief is determined largely by the resistance of underlying formations to weathering and geological erosion. The topography of the southern third of Noble County is rolling to hilly uplands with long, narrow, very gently sloping to moderately sloping summits. The drainage deeply dissects the uplands, thus forming broad, gently sloping to steep side slopes with narrow flood plains. The native vegetation is a prairie savannah of post oak and blackjack oak with an understory of tall and mid grasses. The northern two thirds of Noble County consists of nearly level to rolling uplands with broad, nearly level and very gently sloping summits. The native vegetation is mid and tall prairie grasses.

## Parent Material

Soils form in unconsolidated material, which influences the rate of formation; the chemical, physical, and mineral composition of the soil; and the color of the soil. Soils on the uplands in Noble County formed in material weathered from alluvium, sandstone, and shale. Examples of soils that formed in shale are Masham and Grainola. Soils that formed in sandstone are Darnell, Lucien, Stephenville, Coyle, and Zaneis.

Alluvial sediment is extensive along streams and rivers in the county. The kind of sediment deposited and the kinds of soil that formed in it largely depend on the source of the sediment and the velocity of the streams. Soils that formed in ancient fluvial sediments include Norge, Bethany, Teller, and Kirkland. Soils that formed in recent fluvial sediments are Ashport, Port, Pulaski, and Gaddy.

## Time

As a factor of soil formation, time is difficult to measure in years. The length of time needed for the development of genetic horizons depends on the intensity and the interaction of the other soil-forming factors in promoting the loss, gain, transfer, or transformation of the constituents that make up soil horizons. Soils that have no definite genetic horizons are young or immature. Mature or older soils are in equilibrium with their environment and tend to have well defined horizons.

The soils in Noble County range from young to old. Bethany and Renfrow soils are examples of old soils. Coyle and Teller soils are younger, but they have well expressed horizons. Darnell and Masham soils are considered young soils. Although these soils have had sufficient time to develop well expressed horizons, geological erosion has taken away soil material almost as fast as it forms because the soils are in sloping areas. Ashport and Pulaski soils are young soils that formed in recent sediments on flood plains. These soils show little horizon development.

## Geology

Kenneth S. Johnson, Oklahoma Geological Survey, the University of Oklahoma, Norman, Oklahoma, helped prepare this section.

The surface geology of Noble County is fairly simple. It is shown on the Surface Geology Map of the county included with the soil maps. The outcropping rocks in this county consist of reddish brown shales and sandstones of Permian age. These sediments were deposited near the shores of shallow seas that once covered much of western Oklahoma (4). In many parts of the county, these sedimentary rocks are mantled by unconsolidated alluvium of Quaternary age that was laid down by ancient or modern rivers and streams. Permian sandstones and Quaternary alluvium are local sources of small or moderate amounts of fairly fresh ground water. The outcropping Permian strata overlie older sedimentary rocks that are important petroleum reservoirs in many parts of Oklahoma.

Subsurface rock units of sedimentary origin are about 5,500 feet thick in the eastern part of the county and about 8,000 feet thick in the western part. These strata rest upon a "basement" of granite and other igneous or metamorphic rocks that extends 20 to 25 miles down into the earth's crust. These subsurface sedimentary rocks were deposited in great, shallow seas that bordered the deep sedimentary basins of western Oklahoma, including the Anadarko Basin to the southwest and the Arkoma Basin to the southeast. These seas inundated the survey area intermittently from the Cambrian Period of geologic time (about 525 million years ago) through the later part of Permian time (about 250 million years ago). Noble County is considered part of the stable platform of north-central Oklahoma, and the various rock formations that underlie the county dip gently to the west. The Nemaha Uplift, a series of buried, fault-bounded uplift blocks, formed

during Pennsylvanian time. It extends in a north-south direction in the subsurface material, just west of Noble County.

The outcropping rocks in Noble County were deposited during the late Permian Period (about 250 to 270 million years ago). Sands, silts, and clays were eroded from marginal land areas that existed during this time in eastern Oklahoma and adjacent parts of Arkansas. These materials were transported generally to the west and northwest by streams and rivers that flowed, at the time, toward the large inland sea (Anadarko Basin) that covered most of western Oklahoma. Noble County was close to the shoreline of this ancient sea, and, therefore, was the site for deposition of interbedded shales, siltstones, sandstones, and a few thin limestones (to the east) in alternating riverine, deltaic, tidal-flat, and shallow marine environments.

Permian rock outcrops are typically red or reddish brown with local light gray or greenish gray variations. The red color in these sedimentary rocks primarily results from the presence of iron oxide minerals (e.g., hematite), which are commonly distributed uniformly throughout the rocks. Iron oxides generally do not occur in sedimentary rocks having grayish, greenish, or whitish colors. Soils that developed from Permian reddish-colored rocks tend to retain the hematite stain of the parent material. This tendency explains the red color of most of the soils in Noble County.

The oldest rocks exposed in the survey area crop out along the eastern county boundary and are overlain by successively younger Permian strata to the west. These outcropping strata dip gently to the west at an angle of less than 1 degree, as shown in the east-west cross section included with the Surface Geology Map.

The parent materials of soils are generally the product of weathering and disaggregation of outcropping rock units. As such, there is a close relationship between the physical and chemical properties of these rock formations and the soils that develop upon them. Therefore, a description of the rock units that crop out in the county can help to explain the character and distribution of soils.

The oldest rock unit exposed in Noble County is the Oscar Group. Oscar sediments in Noble County have a total thickness of about 600 feet, although only the uppermost 300 feet is exposed along the eastern side of the county. This unit consists mainly of red shale with minor interbeds of sandstone and several thin beds of limestone. The Oscar Group is the parent material for several general soil map units, the most common of which is the Renfrow-Grainola-Coyle general soil map unit. The loamy soils in this map unit are gently sloping and well drained and formed in material weathered (primarily) from shale or sandstone. In several general soil map units that are mapped on the Oscar Group outcrop, the soils actually formed in a thin veneer of loamy alluvium covering the bedrock.

The Oscar Group is conformably overlain by the Wellington Formation. The Wellington Formation is approximately 850 feet thick. Its outcrops are extensive and cover about 70 percent of Noble County. The Wellington strata consist mainly of red shale with minor sandstone beds and a thin layer of limestone nodules. The Wellington Formation is the parent material for several general soil map units. The Norge-Bethany-Kirkland and Renfrow-Grainola-Kingfisher-Grant general soil map units are most commonly mapped on Wellington sediments in Noble County. The Renfrow-Grainola-Coyle and Grainola-Lucien-Masham general soil map units are mapped to a lesser extent. The loamy soils of these map units formed in alluvium weathered from shale, siltstone, or sandstone or in a thin veneer of loamy alluvium that mantles the bedrock. Soils that developed on Wellington sediments typically are shallow to very deep and well drained or moderately well drained and occur on nearly level to steep slopes.

The Garber Sandstone overlies the Wellington Formation, but it is restricted to small areas in the western part of the county. Although the Garber Sandstone has a total thickness of about 600 feet farther west in Garfield County, the upper part of the formation has been eroded from all parts of Noble County and only the lower 50 to 150 feet remains in the west. The Garber Sandstone deposits consist mainly of orange-

brown to red-brown sandstone beds that are irregularly interlayered with red-brown shale and siltstone. The Renfrow-Grainola-Kingfisher-Grant general soil map unit is most commonly mapped on the Garber Sandstone outcrops in Noble County. The Teller-Konawa and Bethany-Kirkland-Norge-Tabler general soil map units are mapped to a lesser extent. The loamy soils in these map units typically occur on uplands and formed in alluvium weathered from shale, siltstone, or sandstone or in a thin veneer of loamy alluvium that mantles the bedrock. Soils developed on the Garber Sandstone outcrops are shallow to very deep and well drained or moderately well drained and occur on nearly level to steep slopes.

Alluvial and terrace deposits of Quaternary age in Noble County are generally 10 to 60 feet thick and consist mainly of sand, silt, and clay and some gravel. These sediments were eroded from Permian strata within and to the west of Noble County and also from other rock units that occur west and northwest of the county and are within the Arkansas and Cimarron River drainage basins. Quaternary sediments (deposited approximately within the past million years) were laid down mainly as flood plain or alluvial deposits along major rivers and streams that flowed predominantly to the east across the county. In addition, some of the sands and silts are windblown deposits.

Terrace deposits, which consist of older alluvium left behind after a river shifts position or cuts more deeply into underlying material, occur either as broad and level, or hummocky and undulating, expanses that are topographically higher than, and generally adjacent to, the present-day flood plains. They occur mainly to the northeast along the Arkansas River but also may be present in small areas near Black Bear Creek and Red Rock Creek. Arkansas River terrace deposits are the parent sediments for soils in the Vanoss-Slaughterville-Teller general soil map unit. The loamy soils of this map unit are very deep and well drained and occur on nearly level to sloping topography.

Alluvial deposits are the unconsolidated sediments in stream channels or flood plains of present-day rivers and streams, such as the main stream tributaries of the Arkansas River and of Red Rock, Black Bear, and Stillwater Creeks. Alluvial deposits associated with the Arkansas River and the Salt Fork of the Arkansas River are the parent materials for soils in the Keokuk-Goodnight-Ashport and McLain-Braman-Lela general soil map units. These soils are very deep and somewhat poorly drained to somewhat excessively drained and locally are clayey, loamy, or sandy. Alluvium associated with Red Rock, Black Bear, and Stillwater Creeks makes up the parent sediments for soils in the Port-Ashport-Pulaski general soil map unit. These loamy soils are very deep and well drained and occur on nearly level or very gently sloping topography.

## **Landscape Evolution and Quaternary Geology**

Surface features in Oklahoma were significantly affected by landscape evolution processes during Quaternary (Pleistocene and Holocene) time (see the Quaternary Geology Map). River systems flowing across Oklahoma deposited an alluvial cover over a large part of the State. These deposits are of prime importance to agriculture in Oklahoma, as most prime farmland is associated with soils that developed in alluvium and wind-reworked alluvium (eolian sediments) deposited during the past two million years. Alluvium in Noble County ranges from a few feet to more than 50 feet thick. Many smaller areas are not identified on standard geologic maps, primarily because the delineations are too small to be identified at the map scale. This section discusses the nature and depositional history of Quaternary deposits and the surface (geomorphic) features associated with these deposits in the survey area.

### **Depositional History**

*Terrace development.*—Alluvial and eolian sediments associated with Pleistocene terraces were deposited by rivers (or blown from beds of rivers) originating in the Rocky Mountains and flowing across the High Plains and Osage Plains. The Ogallala Formation

of Miocene-Pliocene age and geologic formations of Permian age were dissected by these eastward-flowing rivers, and Pleistocene alluvium, loess, and eolian sands were deposited on this unconformity surface. Pleistocene alluvial deposits are laterally discontinuous, and it is not always clear which stream deposited these sediments. Five major Pleistocene terraces are recognized in Noble County. Terrace level Qt5 is the highest terrace in Noble County and lies on the divide between the Cimarron and Arkansas Rivers.

The north-facing escarpment (E5), which is continuous west to southeast of the town of Perry, represents the southern boundary of an ancient Arkansas River valley. This ancestral Arkansas River was probably a braided stream carrying sediments from the Rocky Mountains across the High Plains and Osage Plains. According to Fay (5), Quaternary sediments in Noble County belong to an ancient Arkansas River that flowed southeast from the Dodge City, Kansas area and along the present course of the Medicine Lodge River and the Salt Fork of the Arkansas River. This ancestral Arkansas River cut escarpment E5 and formed the Qt4 terrace, which typically contains large strips of bed-load material. Remnants of the Qt4 terrace also occur north of Red Rock Creek, where gravel deposits are isolated on topographic highs.

Rejuvenation caused the river system to erode its valley, cut escarpment E4, and deposit terrace Qt3. Volcanic ash in the Qt3 terrace has been dated at about 750,000 years B.P. (16). Sediments on the Qt3 terrace are dominantly silts and clays. The mineralogy and color of these sediments are not indicative of Permian red beds but strongly suggest alluvial plain sediments from the Rocky Mountains. Areas of the Qt3 terrace occur in northern and central parts of Noble County and in valleys that breach the Qt4 terrace. The Qt3 terrace deposits are further discussed in the following paragraphs with the development of Black Bear Creek and Red Rock Creek.

The Qt2 terrace in the northeastern corner of Noble County is confined to a meander bend of the Arkansas River and is slightly lower than the Qt3 terrace. The sediment texture and the position of the Qt2 terrace relative to the river suggest a major eolian influence. Recent eolian soils and depositional areas on the Qt2 terrace suggest that the prevailing wind direction and channel form facilitated the accumulation of eolian sands and silts since (at least) late Pleistocene time. The presence of this material is also evidence that the river generally flowed within the existing channel in this area for many years. The river cut escarpment E2 while providing eolian material for the Qt2 terrace.

The Qt1 terrace in the northeastern part of the county is the lowest Pleistocene terrace. It lies below escarpment E2 and is a terrace of the modern Arkansas River. Escarpment E1 is the lowest escarpment. It is below the Qt1 terrace and immediately above the Holocene flood plain of the Arkansas River.

*Stream piracy.*—Stream piracy played an important role in the development of the modern drainage network. The pattern of sediments on the Qt3 terrace bisects the modern drainage system and also bisects the Qt4 terrace in two valleys north of Perry. Following deposition of the Qt4 terrace, north-south drainage developed. Two possible scenarios could have produced this feature during the development of the Qt3 terrace. In one scenario, the main river could have breached the Qt4 terrace and flowed to the south into what is now the Cimarron River drainage. Terrace sediments in a wind gap in sections 7 and 18, T. 20 N., R. 3 E. in Payne County are analogous to these sediments. They are at the same elevation, have the same soil series, and are in line with the southeast trend of the sediments. In a second scenario, tributaries of the main river flowing north could have bisected the Qt4 terrace. The sediment, however, is the same type as the main body of the Qt3 terrace. Stream piracy eventually diverted the drainage into the modern course of Black Bear Creek and Red Rock Creek.

Additional evidence of streams flowing north or south are wind gaps in the major divides, in line from north to south. These wind gaps are higher valleys in saddles of the major divides that have alluvium on the valley floor but through which active streams no longer flow. Stream piracy has diverted flow into Black Bear Creek and Red Rock Creek.

The area of Antelope Valley (north half of section T. 22 N., R. 2 W.) is an example of an area isolated by stream piracy. Active stream piracy is still taking place in section 7, T. 24 N., R. 1 W. This area is in the saddle of a wind gap in the divide between the Salt Fork of the Arkansas River and Red Rock Creek. Escarpment E3 helps define wind gaps near the northern boundary of Noble County.

*Development of Red Rock Creek and Black Bear Creek.*—After the deposition of the Qt4 and Qt3 terraces, streams forming in backwater positions of the terraces continued to capture drainage. These creeks became deferred tributaries to the main river, flowing from west to east. Red Rock Creek drains the Qt3 terrace, and Black Bear Creek drains the Qt4 terrace. Both streams are younger than the terraces that they dissect. One factor that complicates an understanding of the Qt3 terrace is the common movement of streams down the strike of the Permian formations across Oklahoma. As Red Rock Creek drifts southward, the terrace sediments are reworked and the elevation range of these sediments grades into the lower terraces. South of the town of Billings and east of the town of Red Rock, several small treads and risers in the Qt3 terrace show episodic downcutting. The south bank of Red Rock Creek and its tributaries are cutting into Permian formations.

*Holocene flood plains.*—Flood plains of Holocene age along Black Bear, Red Rock, and Stillwater Creeks are similar in form and history. The paleosol known as the Copan Soil is found on all Holocene flood plains and, in some places, is the land-surface soil. This soil developed during a wet environment lasting from 2,000 to 1,000 years B.P. and is characterized by an over-thickened, organic-rich surface (7). In many places, this paleosol is covered by 3 to 8 feet of silty and loamy alluvium that is less than 1,000 years old. Holocene alluvium in stream valleys is derived from local Permian rocks and Pleistocene terraces. Thickness of the alluvium ranges from 25 to 45 feet along Red Rock Creek and from 25 to 55 feet along Black Bear Creek.

*Arkansas River System.*—The Salt Fork of the Arkansas River is an underfit stream flowing in the ancestral Arkansas River valley, which was discussed above. The Salt Fork of the Arkansas River has a Holocene meander belt much narrower than the Pleistocene flood plain. The Pleistocene flood plain is still rarely flooded by the Salt Fork of the Arkansas River but is relict as far as active aggradation is concerned. The flood plain of the Salt Fork of the Arkansas River is about 5 miles wide at Tonkawa, Oklahoma, and the Arkansas River flood plain is only about 1 mile wide where the two rivers join about 20 miles east. The Arkansas River is now deeply entrenched into Permian and Pennsylvanian formations, and its broad flood plain narrows as the river cuts resistant rock layers to the east.

### **Exposed Permian and Pennsylvanian Materials**

Areas in the figure (shown by "P") have soils that developed in residuum from outcropping Permian and Pennsylvanian shale and sandstone. Surface exposures of Permian and Pennsylvanian sediments occur at all elevations within Noble County, and some soils are mapped regardless of elevation (e.g., Grainola and Lucien soils). Although these surfaces have different ages, ranging from middle to late Pleistocene, mapped soils show the same degree of pedogenesis whether high or low in elevation. One possible explanation for this discrepancy is that the soil-forming processes on these landscapes are offset somewhat by geologic erosion, thus youthful characteristics are maintained in the soil profiles.

Faulting in bedrock at depth is common. Most faulting occurred during Pennsylvanian time. Subsequent movement produced gentle folds at the surface, although associated faults do not normally reach the surface.

*Characteristics of terrace deposits and escarpments.*—The other important geomorphic features in Noble County are the many escarpments throughout the survey area and the relict, high, isolated river valleys (wind gaps). The escarpments are dissected and of (primarily) Pleistocene age, and some have slopes as low as 5

percent. High valleys have alluvium on the valley floor and walls and correlate with valleys on other divides in this area. The terrace deposits mapped in the county are delineated based on elevation, soil series, texture, drainage density, and associated escarpments.

*Terrace Level 5.*—The highest and oldest terrace (Qt5) caps the divide between the Cimarron and Arkansas Rivers. This is a fining-upward terrace with thick sand deposits overlain by clayey and silty surfaces. The soils mapped on this level are mostly Paleustolls, typically Kirkland soils. This terrace is well dissected, and only small remnants remain in Noble County.

*Terrace Level 4.*—The Qt4 terrace lies at the base of escarpment E5, at an elevation of 1,050 to 1,125 feet. This terrace occurs mostly in the south-central part of the county, although outliers also occur on topographic highs, capping Permian rocks north of Red Rock Creek. Although the Qt4 terrace is also a fining-upward terrace, finer surface sediment overlies thick deposits of bed-load sands and gravel. These deposits provide large amounts of gravel and sand for construction. Laboratory data shows that the surface layer of the Qt4 terrace has a loessial influence, but the loess layer is thin and mixed with underlying alluvium. The soils mapped on this level are Argiustolls and Paleustolls. Wisby, Milan, and Lovedale soils are associated with sandy and gravelly bed-load deposits. Bethany and Norge soils are associated with silty surface layers. The Qt4 terrace is well dissected, and erosion has isolated several areas on interfluves in the eastern part of Noble County.

*Terrace Level 3.*—The Qt3 terrace lies below escarpment E4 at an elevation of 950 to 1,050 feet. This terrace is composed dominantly of silty and clayey sediments with sand and gravel as minor components. Laboratory data shows that the surface layer of the Qt3 terrace also has a loessial influence, but these layers are also thin and mixed with underlying alluvium. The soils mapped on this level are Paleustolls and Argiustolls, including Kirkland, Bethany, Tabler, and Norge soils. Norge soils are commonly mapped near Red Rock Creek where either basal sediments are exposed or sediments have been reworked by the migrating stream. The Qt3 terrace is the most susceptible surface to formation of saline seeps in Noble County. Depth to Permian bedrock on this terrace is less than 20 feet, and percolating water dissolves Permian salts and creates saline seeps on slopes where a contact between the terrace material and bedrock is exposed. The presence of Kirkland, Bethany, Norge, and Tabler soils on several terrace levels makes delineation of these terrace levels more difficult. However, it is possible that the fine textured soils (Kirkland, Bethany, and Tabler) have reached a steady state with the present climate, or the differences are not discernable with present knowledge. Similar alluvial sediments on each level also tend to produce similar soils. The drainage density on this level is low or medium, and large areas of nearly level, well drained Kirkland soils and moderately well drained Tabler soils are present.

*Terrace Level 2.*—The Qt2 terrace is confined to a large, entrenched meander of the Arkansas River in the northeastern corner of the county. The elevation of this terrace is 950 to 1,000 feet. The Qt2 terrace sediments are mostly very fine sand, presumably eolian. These sands cap the Permian Herington Limestone and in places are blown up against escarpment E2 below the Herington Limestone on south-facing slopes. Soils mapped on this level have argillic horizons, but they are not as well developed or as thick as argillic horizons in Qt3 terrace soils. Teller soils (Udic Argiustolls) are the dominant soils, but the soils are slightly more silty than typical for the Teller series. Drainage density is medium.

*Terrace Level 1.*—The youngest terrace (Qt1) is below the Qt2 terrace level and is directly related to the modern Arkansas River. The elevation of this terrace is 900 to 925 feet. The drainage density is very low, and the mapped soils are unique to this terrace. Haplustolls (Minco and Slaughterville soils) formed in eolian sediments and wind-reworked alluvium along the first escarpment above the Arkansas River. Argiustolls (Vanoss soils) formed on the terrace tread and in backwater positions farther from the

river. Several additional late Pleistocene terraces along Red Rock Creek and Black Bear Creek are included in the Qt1 terrace level. Teller soils also occur on this level along Black Bear Creek and Red Rock Creek.

### **Summary**

Most prime farmland soils in Noble County formed in Quaternary alluvium. Soils and associated water resources are the most valuable natural resources affecting the future of agriculture in the survey area. An understanding of the extent, source, depositional framework, and soil-geomorphic relationships of these terraces is helpful when managing soil and water resources.

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# Glossary

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**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 gravel, sand, silt, or clay, deposited on land by streams.

**Alpha,alpha-dipyridyl.** A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

**Animal unit month (AUM).** The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

**Aquic conditions.** Current soil wetness characterized by saturation, reduction, and redoximorphic features.

**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.

**Argillic horizon.** A subsoil horizon characterized by an accumulation of illuvial clay.

**Aspect.** The direction in which a slope faces.

**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

**Backslope.** The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Backslopes in profile are commonly steep, are linear, and may or may not include cliff segments.

**Badland.** Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

**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 strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.
- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Bench terrace.** A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.
- Blowout.** A shallow depression from which all or most of the soil material has been removed by 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.
- Bottom land.** The normal flood plain of a stream, subject to flooding.
- Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.
- Breaks.** The steep and very steep broken land at the border of an upland summit that is dissected by ravines.
- Brush management.** Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.
- Butte.** An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.
- 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 directly beneath the solum, or it is exposed at the surface by erosion.
- Canyon.** A long, deep, narrow, very steep-sided valley with high, precipitous walls in an area of high local relief.
- 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.
- Catena.** A sequence of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.
- Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.
- Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.
- Cemented.** Material in an air-dry test specimen that does not slake after being immersed in water for 1 hour. Cemented soil material has a brittle, hard consistence caused by some cementing agent other than clay. Calcium carbonate, silica, or oxides or salts of iron and aluminum are common cementing materials.
- Channeled.** Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.
- Channery soil material.** Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

- Chemical treatment.** Control of unwanted vegetation through the use of chemicals.
- 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 depletions.** Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.
- Clayey soil.** Silty clay, sandy clay, or clay.
- 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 plant community.** 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.
- Closed depression.** A low area completely surrounded by higher ground and having no natural outlet.
- Coarse fragments.** Mineral or rock particles larger than 2 millimeters in diameter.
- Coarse textured soil.** Sand or loamy sand.
- Cobble (or cobblestone).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.
- Cobby soil material.** Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobby soil material has 35 to 60 percent of these rock fragments, and extremely cobby soil material has more than 60 percent.
- COLE (coefficient of linear extensibility).** See Linear extensibility.
- Colluvium.** Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Complex slope.** Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.
- Complex, soil.** A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.
- Compressible** (in tables). Excessive decrease in volume of soft soil under load.
- Concretions.** Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.
- Conglomerate.** A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.
- Conservation cropping system.** Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

- 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.** Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."
- Consolidated sandstone.** Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.
- Consolidated shale.** Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.
- Consolidated siltstone.** Siltstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.
- 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.
- Coppice dune.** A small dune of fine-grained soil material stabilized around shrubs or small trees.
- Corrosion.** Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.
- 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.
- Cropping system.** Growing crops according to a planned system of rotation and management practices.
- Crop residue management.** Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.
- Cuesta.** A hill or ridge that has a gentle slope on one side and a steep slope on the other; specifically, an asymmetric, homoclinal ridge capped by resistant rock layers of slight or moderate dip.
- 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.
- Deep soil.** A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.
- Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.
- Dense layer** (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.
- Depth, soil.** Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep soils, 20 to 40 inches; shallow soils, 10 to 20 inches; and very shallow soils, less than 10 inches.
- Depth to rock** (in tables). Bedrock is too near the surface for the specified use.
- Dip slope.** A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

- Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.
- Drainage class (natural).** Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained*. These classes are defined in the “Soil Survey Manual.”
- Drainage, surface.** Runoff, or surface flow of water, from an area.
- Drainageway.** An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.
- Draw.** A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.
- Dune.** A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.
- Eluviation.** The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.
- Endosaturation.** A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.
- 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.
- Ephemeral stream.** A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.
- Episaturation.** A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of 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, such as a fire, that exposes the surface.
- Escarpment.** A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.
- Excess fines** (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.
- Excess lime** (in tables). Excess carbonates in the soil that restrict the growth of some plants.
- Excess salts** (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.
- Excess sodium** (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of 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 grain

is 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 oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

**Fine textured soil.** Sandy clay, silty clay, or clay.

**First bottom.** The normal flood plain of a stream, subject to frequent or occasional flooding.

**Flaggy soil material.** Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

**Flagstone.** A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

**Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

**Fluvial.** Of or pertaining to rivers; produced by river action, as a fluvial plain.

**Footslope.** The inclined surface at the base of a hill.

**Forb.** Any herbaceous plant not a grass or a sedge.

**Fragile** (in tables). A soil that is easily damaged by use or disturbance.

**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.

**Gilgai.** Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

**Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

**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 as much as 3 inches (7.6 centimeters) in diameter. An individual piece is a pebble.

**Gravelly soil material.** Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter. Very gravelly soil material has 35 to 60 percent of these rock fragments, and extremely gravelly soil material has more than 60 percent.

**Green manure crop (agronomy).** A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

**Ground water.** 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.

**Gypsum.** A mineral consisting of hydrous calcium sulfate.

**Hard bedrock.** Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

**Hardpan.** A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

**Heavy metal.** Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

**Hemic soil material (mucky peat).** Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

**High-residue crops.** Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

**Hill.** A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

*O horizon.*—An organic layer of fresh and decaying plant residue.

*A horizon.*—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

*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 A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

*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 soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

*Cr horizon.*—Soft, consolidated bedrock beneath the soil.

*R layer.*—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

**Humus.** The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly

permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

**Igneous rock.** Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

**Illuviation.** The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

**Impervious soil.** A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

**Increasers.** Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**Infiltration 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

**Intermittent stream.** A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

**Invaders.** On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

**Iron depletions.** Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are:

*Basin.*—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

*Corrugation.*—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

*Drip (or trickle).*—Water is applied slowly and under low pressure to the surface of

the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

*Furrow.*—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

*Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

*Subirrigation.*—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

*Wild flooding.*—Water, released at high points, is allowed to flow onto an area without controlled distribution.

**Knoll.** A small, low, rounded hill rising above adjacent landforms.

**Lacustrine deposit.** Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

**Large stones** (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Linear extensibility.** Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at  $1/3$ - or  $1/10$ -bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

**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.

**Loamy soil.** Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

**Low-residue crops.** Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

**Low strength.** The soil is not strong enough to support loads.

**Masses.** Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

**Mechanical treatment.** Use of mechanical equipment for seeding, brush management, and other management practices.

**Medium textured soil.** Very fine sandy loam, loam, silt loam, or silt.

**Mesa.** A broad, nearly flat-topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.

**Metamorphic rock.** Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

**Microhigh.** An area that is 2 to 12 inches higher than the adjacent microlow.

**Microlow.** An area that is 2 to 12 inches lower than the adjacent microhigh.

**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 deep soil.** A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.
- Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.
- Mollic epipedon.** A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.
- 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. 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).
- Mudstone.** Sedimentary rock formed by induration of silt and clay in approximately equal amounts.
- 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.
- Natric horizon.** A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.
- Neutral soil.** A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)
- Nodules.** Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.
- 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. The content of organic matter in the surface layer is described as follows:
- |                      |                       |
|----------------------|-----------------------|
| Very low .....       | less than 0.5 percent |
| Low .....            | 0.5 to 1.0 percent    |
| Moderately low ..... | 1.0 to 2.0 percent    |
| Moderate .....       | 2.0 to 4.0 percent    |
| High .....           | 4.0 to 8.0 percent    |
| Very high .....      | more than 8.0 percent |
- Oxbow.** The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.
- Pan.** A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.
- Parent material.** The unconsolidated organic and mineral material in which soil forms.
- Pebble.** See Gravel.
- Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedimentation.** A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher-lying areas of the erosion surface.

**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.

**Percolates slowly** (in tables). The slow movement of water through the soil adversely affects the specified use.

**Permeability.** The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as “saturated hydraulic conductivity,” which is defined in the “Soil Survey Manual.” In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as “permeability.” Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow .....	0.00 to 0.01 inch
Very slow .....	0.01 to 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 flooding.

**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.

**Plateau.** An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

**Playa.** The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas. Temporary flooding occurs primarily in response to precipitation and runoff.

**Plowpan.** A compacted layer formed in the soil directly below the plowed layer.

**Ponding.** Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

**Poor filter** (in tables). Because of rapid or very 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.

**Poor outlets** (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

**Potential native plant community.** See Climax plant community.

**Potential rooting depth (effective rooting depth).** Depth to which roots could

penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

**Prescribed burning.** Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

**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.

**Proper grazing use.** Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

**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, savannahs, 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:

Ultra acid .....	less than 3.5
Extremely acid .....	3.5 to 4.4
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

**Red beds.** Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

**Redoximorphic concentrations.** Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

**Redoximorphic depletions.** Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

**Redoximorphic features.** Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features

indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

- Reduced matrix.** A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.
- Regolith.** The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.
- Relict stream terrace.** One of a series of platforms in or adjacent to a stream valley that formed prior to the current stream system.
- 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.
- Ridge.** A long, narrow elevation of the land surface. It generally is sharp crested and forms an extended upland between valleys.
- 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.
- Riser.** The relatively short, steeply sloping area below a terrace tread that grades to a lower terrace tread or base level.
- Riverwash.** Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.
- Road cut.** A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.
- Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.
- Rock outcrop.** Exposures of bare bedrock other than lava flows and rock-lined pits.
- 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.
- Rubble land.** Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.
- 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 the growth of plants. A saline soil does not contain excess exchangeable sodium.
- Salinity.** The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:
- |                            |              |
|----------------------------|--------------|
| Nonsaline .....            | 0 to 2       |
| Very slightly saline ..... | 2 to 4       |
| Slightly saline .....      | 4 to 8       |
| Moderately saline .....    | 8 to 16      |
| Strongly saline .....      | more than 16 |
- Sand.** As a soil separate, individual rock or mineral fragments ranging 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.

**Sandy soil.** Sand or loamy sand.

**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.

**Saturation.** Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

**Scarification.** The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

**Second bottom.** The first terrace above the normal flood plain (or first bottom) of a river.

**Sediment.** Solid, clastic material, both mineral and organic, that is in suspension, is being transported or has been moved from its site of origin by water, wind, ice, or mass wasting, and has come to rest on the earth's surface either above or below sea level.

**Sedimentary plain.** An extensive nearly level to gently rolling or moderately sloping area that is underlain by sedimentary bedrock and that has a slope of 0 to 8 percent.

**Sedimentary rock.** Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

**Sedimentary uplands.** Land areas of bedrock formed from water- or wind-deposited sediments. They are higher on the landscape than the flood plain.

**Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

**Semiconsolidated sedimentary beds.** Soft geologic sediments that disperse when fragments are placed in water. The fragments are hard or very hard when dry. Determining the texture by the usual field method is difficult.

**Sequum.** A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

**Series, soil.** A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

**Shale.** Sedimentary rock formed by the hardening of a clay deposit.

**Shallow soil.** A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

**Sheet erosion.** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**Shoulder slope.** The uppermost inclined surface at the top of a hillside. It is the transition zone from the backslope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

**Silica.** A combination of silicon and oxygen. The mineral form is called quartz.

**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.

**Sinkhole.** A depression in the landscape where limestone has been dissolved.

**Slickensides.** Polished and grooved surfaces produced by one mass sliding past

another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

**Slick spot.** A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

**Slippage** (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

**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. In this survey the following slope classes are recognized:

Nearly level .....	0 to 1 percent
Very gently sloping .....	1 to 3 percent
Gently sloping .....	3 to 5 percent
Moderately sloping .....	5 to 8 percent
Strongly sloping .....	8 to 12 percent
Moderately steep .....	12 to 20 percent
Steep .....	20 to 45 percent
Very steep .....	45 percent and higher

Classes for complex slopes are as follows:

Nearly level .....	0 to 3 percent
Gently undulating .....	1 to 5 percent
Undulating .....	1 to 8 percent
Gently rolling .....	5 to 12 percent
Rolling .....	5 to 15 percent
Hilly .....	8 to 30 percent
Steep .....	20 to 45 percent
Very steep .....	45 percent and higher

**Slope** (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

**Slow intake** (in tables). The slow movement of water into the soil.

**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.

**Sodic (alkali) 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.

**Sodicity.** The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of  $Na^+$  to  $Ca^{++} + Mg^{++}$ . The degrees of sodicity and their respective ratios are:

Slight .....	less than 13:1
Moderate .....	13 to 30:1
Strong .....	more than 30:1

**Soft bedrock.** Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

**Soil.** A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates.** Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand .....	2.0 to 1.0
Coarse sand .....	1.0 to 0.5
Medium sand .....	0.5 to 0.25
Fine sand .....	0.25 to 0.10
Very fine sand .....	0.10 to 0.05
Silt .....	0.05 to 0.002
Clay .....	less than 0.002

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

**Species.** A single, distinct kind of plant or animal having certain distinguishing characteristics.

**Stone line.** A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

**Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

**Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.

**Stratified.** Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

**Strath terrace.** A surface cut formed by the erosion of hard or semiconsolidated bedrock and thinly mantled with stream deposits.

**Stream channel.** The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

**Stream terrace.** One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands that 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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Stubble mulch.** Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Subsoiling.** Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

- Substratum.** The part of the soil below the solum.
- Subsurface layer.** Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface 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.
- Summit.** A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.
- Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."
- Surface soil.** The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.
- Tailwater.** The water directly downstream of a structure.
- 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. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.
- Terrace (geologic).** An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.
- 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). Otherwise suitable soil material too thin for the specified use.
- Thornthwaite PE index.** The annual PE index is the sum of the 12 monthly precipitation effectiveness indices.
- Tilth, soil.** The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.
- Toeslope.** The outermost inclined surface at the base of a hill; part of a footslope.
- 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.
- Toxicity** (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.
- Trace elements.** Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.
- Trafficability.** The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.
- Tread.** The relatively flat terrace surface that was cut or built by stream or wave action.
- Unstable fill** (in tables). Risk of caving or sloughing on banks of fill material.
- Upland (geology).** Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.
- Valley.** An elongated depressional area primarily developed by stream action.
- Valley fill.** Alluvium deposited by heavily loaded streams.
- Variation.** Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.
- Very deep soil.** A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

**Very shallow soil.** A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

**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 oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

# **NRCS Accessibility Statement**

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