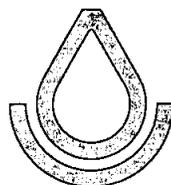


**SOIL SURVEY OF**

# **Fort Hall Area, Idaho**

**Parts of Bannock, Bingham, Caribou, and Power Counties**

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**United States Department of Agriculture  
Soil Conservation Service and  
United States Department of the Interior  
Bureau of Indian Affairs  
In cooperation with  
University of Idaho College of Agriculture  
Idaho Agricultural Experiment Station**

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1963. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Indian Affairs, and the Idaho Agricultural Experiment Station. It is part of the technical assistance furnished to the Central Bingham and Power Soil Conservation Districts and to the Portneuf Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

## HOW TO USE THIS SOIL SURVEY

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

### Locating Soils

All the soils of the Fort Hall Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

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

### Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the Area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the range site in which each soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map

and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units. Woodland is not an important resource in the area. It has been discussed briefly in the section "Woodland."

*Ranchers and others* can find general information about the suitability of the soils for range in the mapping unit descriptions. More specific information can be found in the section "Range."

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

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

*Newcomers in Fort Hall Area* may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the area given at the beginning of the publication.

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# FORT HALL AREA, IDAHO

## PARTS OF BANNOCK, BINGHAM, CARIBOU, AND POWER COUNTIES

BY ROBERT E. McDOLE, UNIVERSITY OF IDAHO<sup>1</sup>

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS, IN COOPERATION WITH THE UNIVERSITY OF IDAHO COLLEGE OF AGRICULTURE, IDAHO AGRICULTURAL EXPERIMENT STATION

**T**HE FORT HALL AREA, IDAHO, PARTS OF BANNOCK, BINGHAM, CARIBOU, AND POWER COUNTIES (hereafter referred to as Fort Hall Area) is in southeastern Idaho (fig. 1).

The Fort Hall Area covers about 523,000 acres, or 817 square miles. About 400,000 acres of the Area is used for grazing. About 385,000 acres of this is open grassland, and 15,000 acres is woodland. Most of the

woodland has little commercial value. Only 100,000 acres is suited to irrigation, and about 40,000 acres is now irrigated. New irrigation projects and well developments are being used to irrigate more of the survey area each year. Dryfarmed grain is grown in some nonirrigated areas.

The Fort Hall Area nearly surrounds the town of Pocatello, the county seat of Bannock County. Pocatello has a population of about 40,000. Blackfoot, which has a population of 4,500, is the county seat of Bingham County. American Falls, 11 miles west of the Area, is the county seat of Power County. It has a population of 2,200.

The Fort Hall Indian Reservation and a small area of Indian-controlled land south of the Reservation along Bannock Creek are in the survey area. The Fort Hall Indian Agency, in the unincorporated community of Fort Hall, is equidistant between Blackfoot and Pocatello. Fort Hall has a population of about 500.

Most of the Fort Hall Indian Reservation is allotted to individual Indians or is controlled by the Shoshone-Bannock Tribes, Incorporated. Most of the reservation is leased to non-Indians for farming and grazing.

The Area can be divided into three major physiographic areas: the nearly level to gently undulating alluvial terraces or valleys at elevations of 4,350 to 5,000 feet; the nearly level to strongly rolling loess-mantled uplands at elevations of 4,700 to 7,000 feet; and the strongly rolling to very steep mountainous areas at elevations of 6,000 to 8,900 feet.

The Area is in the Snake River drainage. The American Falls Reservoir, which is formed by the American Falls dam on the Snake River, floods some of the low river terraces that were originally a part of the reservation.

Major tributaries of the Snake River that pass through the Area are Bannock Creek, Ross Fork Creek, Spring Creek, Lincoln Creek, and Toponce Creek.

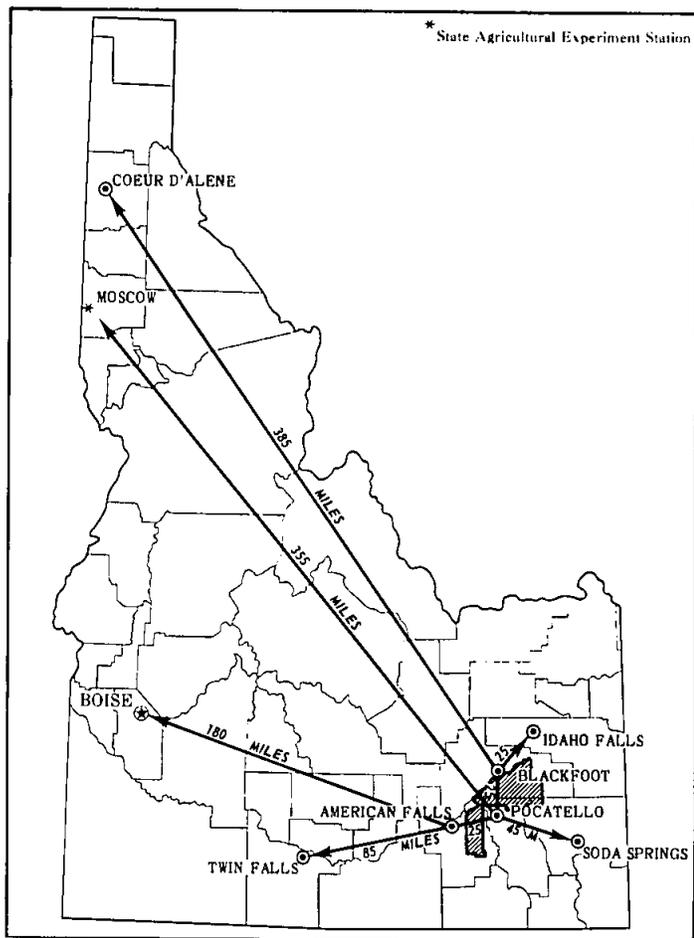


Figure 1.—Location of Fort Hall Area in Idaho.

### How This Survey Was Made

Soil scientists made this survey to learn what kinds

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of soil are in the Fort Hall Area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and velocity of streams, the kinds of native plants or crops, the kinds of rock and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Portneuf and Declo, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of the soil phase indicates a feature that affects management. For example, Declo loam, 0 to 2 percent slopes, is one of several phases within the Declo series.

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

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

Some mapping units are made up of soils of different series or of different phases within one series. Two such mapping units are shown on the soil map of Fort Hall Area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the

name of a soil complex consists of the names of the dominant soils joined by a hyphen. Nagitsy-Nielsen extremely stony loams, hilly, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Moohoo-Dranyon association, steep, is an example.

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

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

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

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their study and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

## General Soil Map

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

A map showing soil associations is useful to people who want a general idea of the soils in an Area, who want to compare different parts of an Area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, an area of range, or a wildlife area, or in planning engineering work, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey area have been grouped into six general kinds of landscape for broad interpretative purposes. Each of the broad groups and their included soil associations are described in the following pages. The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of association 2, "silt loam" refers to the texture of the surface layer. The brief profile description given for each major soil is typical for that soil.

## Nearly Level to Moderately Sloping Soils on Bottom Lands, Low Terraces, and Alluvial Fans

The soils in this group formed in alluvium and are generally very deep. These soils are mainly on bottom lands near the American Falls Reservoir and the lower part of valleys.

Elevation ranges from 4,350 feet near the American Falls Reservoir to 5,200 feet in mountain valleys. The mean annual precipitation ranges from 8 to 14 inches, the mean annual soil temperature ranges from 47° to 52° F, and the frost-free season ranges from 100 to 120 days.

The soils are used for range, meadow hay, wildlife, and recreation. Some areas are used for irrigated and dryfarmed crops.

Three of the associations of the Fort Hall Area are in this group. They make up 9 percent of the survey area.

### 1. Snake-Philbon association

*Nearly level, deep and very deep silt loams and peats on bottom lands*

This association consists of somewhat poorly drained to very poorly drained soils, mainly on bottom lands near the American Falls Reservoir. These soils formed in alluvium and partly decomposed plant remains. Vegetation is mainly sedges, rushes, and other water-tolerant plants. Elevation is about 4,400 feet. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season ranges from 100 to 120 days.

This association makes up about 4 percent of the survey area. It is about 65 percent Snake soils and 15 percent Philbon soils. Minor soils make up the remaining 20 percent.

Snake soils are on low terraces. They have a surface layer of grayish-brown silt loam 8 inches thick. The next layer is light brownish-gray silt loam 5 inches thick. This layer is underlain by pinkish-gray, white, and light-gray silty clay loam to a depth of 58 inches.

Philbon soils are on low terraces and bottom lands. They have a surface layer of very dark gray peat 22 inches thick. This layer is underlain by stratified very dark gray mucky silt loam and light-gray silty clay loam and loam to a depth of 60 inches.

Minor soils in this association are Peteetneet and Parehat soils and Alluvial land and Riverwash.

This association is used for range, wildlife, and recreation.

### 2. Penoyer-Parehat association

*Nearly level and very gently sloping, deep silt loams on bottom lands and low terraces*

This association consists of well-drained to poorly drained soils. These soils are on bottom lands and low terraces along Bannock Creek south of the community of Fort Hall and along the Portneuf River in the southeastern part of the survey area. These soils formed in alluvium. Vegetation is grasses and shrubs. Elevation ranges from 4,400 to 5,200 feet. The mean annual precipitation is 8 to 13 inches, the mean annual soil temperature ranges from 48° to 52° F, and the frost-free season ranges from 100 to 120 days.

This association makes up about 3 percent of the survey area. It is about 50 percent Penoyer soils and 30 percent Parehat soils. Minor soils make up the remaining 20 percent.

Penoyer soils are on bottom lands along streams. They are light brownish-gray silt loam to a depth of 60 inches.

Parehat soils are on low terraces. They have a surface layer of grayish-brown silt loam 9 inches thick. This layer is underlain by stratified, light brownish-gray, gray, and light-gray silt loam and loam to a depth of 60 inches.

Minor soils in this association are Zunhall, Declo, Tickason, and Penoyer soils and Declo variant soils. Minor soils in areas along the Portneuf River in the southeastern part of the survey area are mainly Zunhall soils.

This association generally is used for meadow hay and grazing, and the better drained soils are used for irrigated crops.

### 3. Parehat-McDole association

*Nearly level to moderately sloping, deep silt loams on low terraces and alluvial fans*

This association consists of well-drained to poorly drained soils on low terraces and alluvial fans along the Blackfoot River, Lincoln Creek, and Ross Fork Creek. These soils formed in alluvium derived mainly from loess. Vegetation is grasses and shrubs. Elevation ranges from 4,350 to 5,200 feet. The mean annual precipitation is 10 to 14 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season ranges from 100 to 120 days.

This association makes up about 2 percent of the

survey area. It is about 45 percent Parehat soils and 35 percent McDole soils. Minor soils make up the remaining 20 percent.

Parehat soils are on low terraces. They have a surface layer of grayish-brown silt loam 9 inches thick. This layer is underlain by stratified, light brownish-gray, gray, and light-gray silt loam and loam to a depth of 60 inches.

McDole soils are on alluvial fans. They have a surface layer of grayish-brown silt loam 10 inches thick. This layer is underlain by light brownish-gray silt loam to a depth of 60 inches.

Minor soils in this association are in the Penoyer, Fury, and Knull series.

This association is used for irrigated crops and dry-farmed small grain, hay, and pasture.

### **Nearly Level to Moderately Steep Soils on Alluvial Terraces and Fans**

The soils in this group formed in very deep alluvium and wind-deposited sandy material underlain by gravel or sand. These soils are mainly along the northwestern part of the Area, near the Blackfoot and Snake Rivers and the American Falls Reservoir.

Elevation ranges from 4,350 to 4,700 feet. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 47° to 53° F, and the frost-free season ranges from 100 to 120 days.

Most of the irrigated crops of the survey area are grown on the soils in this group. The soils are also used for pasture and range.

Three of the associations of the Fort Hall Area are in this group. They make up about 14 percent of the survey area.

#### **4. Paniogue-Declo association**

*Nearly level to moderately sloping loams and silt loams on alluvial fans and terraces*

This association consists of well-drained soils on alluvial fans and terraces along the Blackfoot and Snake Rivers. These soils formed in mixed alluvium. Vegetation is mostly bunchgrasses and shrubs. Elevation ranges from 4,400 to 4,700 feet. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 47° to 51° F, and the frost-free season ranges from 100 to 120 days.

This association makes up about 8 percent of the survey area. It is about 45 percent Paniogue soils and 40 percent Declo soils. Minor soils make up the remaining 15 percent.

Paniogue soils are nearly level to moderately sloping. They have a surface layer of grayish-brown and light brownish-gray loam 7 inches thick. The next layer is light brownish-gray silt loam 11 inches thick. The underlying material is stratified and extends to a depth of 60 inches. It is light-gray silt loam, white coarse sandy loam, and light brownish-gray coarse sand and gravelly coarse sand.

Declo soils are nearly level to gently sloping and undulating. They have a surface layer of grayish-brown loam 5 inches thick. The next layer is light brownish-gray silt loam 5 inches thick. The underlying

material is light gray and white silt loam to a depth of 47 inches and light brownish-gray loamy coarse sand and coarse sand to a depth of 60 inches.

Minor soils in this association are in the Tickason, Broncho, and Escalante series.

This association is used for irrigated crops.

#### **5. Paniogue-Broncho association**

*Nearly level to moderately steep loams and gravelly loams on alluvial fans and terraces*

This association consists of well-drained and somewhat excessively drained soils on alluvial fans and terraces near the mouth of the Portneuf River. These soils formed in alluvium underlain by gravel at a depth of 10 to 40 inches. Vegetation is grasses and shrubs. Elevation ranges from 4,350 to 4,700 feet. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season ranges from 100 to 120 days.

This association makes up about 1 percent of the survey area. It is about 50 percent Paniogue soils and 25 percent Broncho soils. Minor soils make up the remaining 25 percent.

Paniogue soils are nearly level to moderately sloping and are on alluvial fans and terraces. They have a surface layer of grayish-brown and light brownish-gray loam 7 inches thick. The next layer is light brownish-gray silt loam 11 inches thick. The underlying material is stratified and extends to a depth of 60 inches. It is light-gray silt loam, white coarse sandy loam, and light brownish-gray coarse sand and gravelly coarse sand.

The nearly level to gently sloping Broncho soils are on ridgetops, and the moderately sloping to moderately steep Broncho soils are on breaks of alluvial fans and terraces. They have a surface layer of light brownish-gray gravelly loam 6 inches thick. The next layer is light brownish-gray gravelly loam 8 inches thick. The underlying material is white very gravelly coarse sandy loam and very gravelly coarse sand to a depth of 60 inches.

Minor soils in this association are in the Declo and Tickason series.

This association is used for irrigated crops and for grazing.

#### **6. Tindahay-Escalante association**

*Nearly level to strongly sloping loamy coarse sands and sandy loams on alluvial fans and terraces*

This association consists of well-drained and somewhat excessively drained soils on alluvial fans and terraces near the mouths of the Bannock Creek and the Portneuf River and in an area north of the Ross Fork Creek. The soils formed in sandy alluvium and eolian sand. Vegetation is bunchgrasses and shrubs. Elevation ranges from 4,400 to 4,700 feet. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 50° to 53° F, and the frost-free season ranges from 100 to 120 days.

This association makes up about 5 percent of the survey area. It is about 55 percent Tindahay soils and 20 percent Escalante soils. Minor soils make up the remaining 25 percent.

Tindahay soils are on sandy terraces of alluvial and eolian deposits. They have a surface layer of grayish-brown loamy coarse sand 2 inches thick. This layer is underlain by pale-brown, brown, light brownish-gray, and light-gray stratified sandy loam or sand to a depth of 60 inches.

Escalante soils are on alluvial terraces. They have a surface layer of grayish-brown sandy loam 2 inches thick. This layer is underlain by stratified light brownish-gray sandy loam and fine sandy loam to a depth of 60 inches.

Minor soils in this association are in the Feltham, Chedehap, Broncho, Declo, and Quincy series.

This association is used for irrigated crops, dry-farmed pasture, and range.

### **Nearly Level to Very Steep Wind-Deposited Soils on Low Plateaus**

The soils in this group formed in very deep eolian sand on low plateaus. These soils are northeast of the community of Fort Hall.

Elevation ranges from 4,400 to 5,000 feet. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 50° to 54° F, and the frost-free season ranges from 100 to 120 days.

The soils are used mainly for grazing.

One of the associations of the Fort Hall Area is in this group. It makes up 8 percent of the survey area.

#### **7. Quincy-Feltham association**

*Nearly level to gently sloping sands and loamy sands on low plateaus*

This association consists of well-drained and excessively drained soils on uplands northeast of the community of Fort Hall. These soils formed in sandy eolian deposits. Vegetation is sparse grasses and shrubs. Elevation ranges from 4,400 to 5,000 feet. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 50° to 54° F, and the frost-free season ranges from 100 to 120 days.

This association makes up about 8 percent of the survey area. It is about 60 percent Quincy soils and 20 percent Feltham soils. Minor soils make up the remaining 20 percent.

Quincy soils are mainly on low plateaus. They have a surface layer of dark grayish-brown sand about 3 inches thick. This layer is underlain by stratified, dark grayish-brown, grayish-brown, and light-gray sand and coarse sand to a depth of 60 inches.

Feltham soils are on wind-worked sandy terraces and uplands. They have a surface layer of brown loamy sand 4 inches thick. This layer is underlain by brown loamy sand and sandy loam to a depth of 32 inches and light-gray and pale-brown loam to a depth of 60 inches.

Minor soils in this association are in the Escalante, Chedehap, Pocatello, and Tindahay series.

This association is used for grazing.

### **Nearly Level to Very Steep Soils on High Fans and Low Dissected Plateaus**

The soils in this group formed in loess on high alluvial fans and low dissected plateaus. Large areas

of these soils are in the vicinity of Bannock Creek and on the lower terraces and foot hills in the eastern part of the Area.

Elevation ranges from 4,300 to 6,500 feet. The mean annual precipitation is 8 to 17 inches, the mean annual soil temperature is 42° to 52° F, and the frost-free season ranges from 75 to 120 days.

The soils are used mainly for grazing, but some dry-farmed small grain and irrigated crops are grown.

Three of the associations of the Fort Hall Area are in this group. They make up about 45 percent of the survey area.

#### **8. Pocatello-Wheeler-Portneuf association**

*Nearly level to very steep silt loams on loess-mantled basalt plains and dissected low plateaus*

This association consists of well-drained silty soils at lower elevations in the major valleys of the survey area. These soils formed in loess and contain carbonates except for a few inches near the surface. Vegetation is mainly bunchgrasses and shrubs. Elevation ranges from 4,500 to 5,400 feet. The mean annual precipitation is 8 to 12 inches, the mean annual soil temperature is 48° to 52° F, and the frost-free season ranges from 100 to 120 days.

This association makes up about 19 percent of the survey area. It is about 40 percent Pocatello soils, 20 percent Wheeler soils, and 15 percent Portneuf soils. Minor soils make up the remaining 25 percent.

Pocatello soils are on high fans and dissected, loess-mantled plateaus. They have a surface layer of light brownish-gray silt loam 4 inches thick. It is underlain by light brownish-gray, pale-brown, and light-gray silt loam to a depth of 60 inches.

Wheeler soils are on south-facing side slopes of dissected plateaus. They have a surface layer of light brownish-gray silt loam 3 inches thick. It is underlain by light brownish-gray and very pale brown silt loam to a depth of 60 inches.

Portneuf soils are on loess-mantled basalt plains and low benches. They have a surface layer of light brownish-gray silt loam 5 inches thick. The next layer is light brownish-gray silt loam 10 inches thick. The underlying material is light-gray and pale-brown silt loam to a depth of 60 inches.

Minor soils in this association are in the Kucera, Penoyer, Neeley, and Waycup series.

This association is used for irrigated crops and for grazing.

#### **9. Neeley-Rexburg association**

*Nearly level to steep silt loams on dissected loess-mantled plateaus*

This association consists of well-drained silty soils on loess-mantled high fans and dissected plateaus along Bannock Creek and east of Blackfoot and Fort Hall. These soils formed in loess and have an accumulation of carbonates between depths of 10 and 35 inches. Vegetation is grasses and shrubs. Elevation ranges from 4,900 to 6,200 feet. The mean annual precipitation is 11 to 15 inches, the mean annual soil temperature is 45° to 50° F, and the frost-free season ranges from 75 to 110 days.

The association makes up 24 percent of the survey area. It is about 45 percent Neeley soils and 30 percent Rexburg soils. Minor soils make up the remaining 25 percent.

Neeley soils are at lower elevations on south-facing side slopes. They have a surface layer of grayish-brown and brown silt loam 7 inches thick. The next layer is pale-brown silt loam 4 inches thick. The underlying material is light brownish-gray, light-gray, and pale-brown silt loam to a depth of 60 inches.

Rexburg soils are on north-facing side slopes at lower elevations and on ridgetops and south-facing side slopes at higher elevations. They have a surface layer of dark grayish-brown silt loam 12 inches thick. The next layer is brown and light brownish-gray silt loam 11 inches thick. The underlying material is light-gray silt loam to a depth of 60 inches.

Minor soils in this association are in the Kucera, Robin, Hondoho, Wahtigup, Highams, and McDole series.

Most of this association is used for grazing, but the Rexburg soils are well suited to dryfarmed winter wheat.

#### 10. *Lanoak association*

*Nearly level to strongly sloping silt loams on loess-mantled mountain foot slopes*

This association consists of well-drained silty soils at higher elevations at the base of mountains. One area is north of Bannock Peak in the southwest corner of the survey area, and the other areas are on uplands in the eastern part of the Area. These soils formed in loess and have carbonates below a depth of 35 to 55 inches. Vegetation is mostly bunchgrasses and shrubs. Elevation ranges from 5,000 to 6,500 feet. The mean annual precipitation is 15 to 17 inches, the mean annual soil temperature is 42° to 47° F, and the frost-free season ranges from 80 to 95 days.

This association makes up about 2 percent of the survey area. It is about 70 percent Lanoak soils. Minor soils make up the remaining 30 percent.

Lanoak soils are at the base of mountains. They have a surface layer of dark grayish-brown silt loam 22 inches thick. The next layer is brown and pale-brown heavy silt loam 35 inches thick. The underlying material is light-gray silt loam to a depth of 60 inches.

Minor soils in this association are in the Robin, Moohoo, Pavohroo, Fury, and McDole series.

This association is used for grazing or for dryfarmed crops.

### **Nearly Level to Steep Soils on Uplands and Mountain Foot Slopes**

The soils in this group formed in shallow to very deep loess and residuum from sedimentary rocks on benches, uplands, and mountain foot slopes. They are on uplands east of Bannock Creek and in the vicinity of Higham Peak, northeast of the community of Fort Hall.

Elevation ranges from 4,900 to 8,500 feet. The mean annual precipitation is 11 to 20 inches, the mean an-

nual soil temperature is 35° to 50° F, and the frost-free season ranges from 30 to 110 days.

The soils are used mainly for grazing, but some areas are dryfarmed.

Two of the associations of the Fort Hall Area are in this group. They make up about 9 percent of the survey area.

#### 11. *Neeley-Hondoho association*

*Nearly level to steep silt loams and very cobbly loams on loess-mantled benches and uplands*

This association consists of well-drained soils on uplands east of Bannock Creek and southeast of the community of Fort Hall. Neeley soils formed in loess, and Hondoho soils formed in loess and residuum from quartzite. Vegetation is bunchgrasses and shrubs. Elevation ranges from 4,900 to 6,500 feet. The mean annual precipitation is 11 to 15 inches, the mean annual soil temperature is 44° to 50° F, and the frost-free season ranges from 80 to 110 days.

This association makes up about 3 percent of the survey area. It is about 40 percent Neeley soils and 30 percent Hondoho soils. Minor soils make up the remaining 30 percent.

Neeley soils are at lower elevations. They have a surface layer of grayish-brown and brown silt loam about 7 inches thick. The next layer is pale-brown silt loam 4 inches thick. The underlying material is light brownish-gray, light-gray, and pale-brown silt loam to a depth of 60 inches.

Hondoho soils are at higher elevations. They have a surface layer of dark grayish-brown and grayish-brown very cobbly loam 12 inches thick. The next layer is pale-brown cobbly loam 4 inches thick. The underlying material is pale-brown and pale-yellow cobbly loam and cobbly sandy clay loam to a depth of 60 inches.

Minor soils in this association are in the Rexburg, Wheeler, Wahtigup, Nagitsy, Penoyer, and McDole series.

Hondoho soils and small areas of Neeley soils are used for grazing. Larger areas of Neeley soils are used for dryfarmed grain.

#### 12. *Nagitsy-Nielsen-Lanoak association*

*Nearly level to steep gravelly, stony, and rocky loams and silt loams on uplands and mountain foot slopes*

This association consists of well-drained soils that are mainly stony, gravelly, and rocky. These soils are in one large area in the vicinity of Higham Peak in the northeastern part of the survey area. The soils formed mainly in residuum and colluvium from quartzite and sandstone and some loess. Vegetation is dominantly bunchgrasses and shrubs. Elevation ranges from 5,000 to 8,500 feet. The mean annual precipitation is 15 to 20 inches, the mean annual soil temperature is 35° to 47° F, and the frost-free season ranges from 30 to 95 days.

This association makes up about 6 percent of the survey area. It is about 30 percent Nagitsy soils, 20 percent Nielsen soils, and 15 percent Lanoak soils. Minor soils make up the remaining 35 percent.

Nagitsy soils formed in residuum and colluvium

from quartzite and sandstone. They have a surface layer of dark grayish-brown gravelly loam 23 inches thick. The next layer is brown very gravelly heavy loam 11 inches thick. Quartzite is at a depth of 34 inches.

Nielsen soils formed in colluvium and residuum from sandstone and quartzite. They have a surface layer of dark grayish-brown extremely stony loam 9 inches thick. This layer is underlain by brown and yellowish-brown channery and very channery loam 10 inches thick. Fractured sandstone is at a depth of 19 inches.

Lanoak soils formed in loess. They have a surface layer of dark grayish-brown silt loam 22 inches thick. The next layer is brown and pale-brown heavy silt loam 35 inches thick. The underlying material is light-gray silt loam to a depth of 60 inches.

Minor soils in this association are in the Tahquats, Pandoah, Highams, Ridgecrest, and Robin series.

This association is used mainly for grazing.

### **Moderately Sloping to Very Steep Soils on Mountains**

The soils in this group formed in shallow to very deep residuum and colluvium from sedimentary rocks and some surficial loess. These soils are in most mountainous areas in the southern, western, and eastern parts of the Area.

Elevations range from 4,800 to 8,500 feet. The mean annual precipitation is 11 to 25 inches, the mean annual soil temperature is 35° to 47° F, and the frost-free season ranges from 30 to 110 days.

The soils are used for grazing, wildlife, recreation, and watershed.

Two of the associations of the Fort Hall Area are in this group. They make up about 15 percent of the survey area.

#### **13. Wahtigup-Highams-Hymas association**

*Moderately sloping to very steep gravelly to extremely stony loams on mountains*

This association consists of well-drained and excessively drained soils in mountainous areas of the southern and eastern part of the survey area. These soils formed mainly in colluvium and residuum from limestone. Vegetation is mainly bunchgrasses and shrubs and small areas of aspen and Douglas-fir on north-facing slopes. Elevation ranges from 4,800 to 8,000 feet. The mean annual precipitation is 11 to 16 inches, the mean annual soil temperature is 42° to 47° F, and the frost-free season ranges from 70 to 110 days.

This association makes up about 9 percent of the survey area. It is about 30 percent Wahtigup soils, 30 percent Highams soils, and 15 percent Hymas soils. Minor soils make up the remaining 25 percent.

Wahtigup soils formed in colluvium and local alluvium weathered from limestone and some loess. They have a surface layer of grayish-brown gravelly loam 8 inches thick. This layer is underlain by grayish-brown, light-gray, and white gravelly loam 33 inches thick. Fractured limestone is at a depth of 41 inches.

Highams soils formed in residuum weathered from limestone. They have a surface layer of light brownish-

gray very gravelly loam 9 inches thick. This layer is underlain by light-gray very gravelly heavy loam 10 inches thick. Limestone is at a depth of 19 inches.

Hymas soils formed in residuum or colluvium from limestone. They have a surface layer of grayish-brown extremely stony loam 9 inches thick. This layer is underlain by light brownish-gray and very pale brown gravelly and very gravelly loam 10 inches thick. Limestone is at a depth of 19 inches.

Minor soils in this association are in the Robin, Rexburg, Nagitsy, Pandoah, and Pavohroo series.

This association is used for grazing and wildlife.

#### **14. Moohoo-Nagitsy-Dranyon association**

*Strongly sloping to steep silt loams, gravelly silt loams, gravelly loams, and stony loams on mountains*

This association consists of well-drained soils in mountainous areas in the vicinity of Mount Putnam and Bannock Peak. These soils formed in residuum weathered from sedimentary rocks and some admixture of loess. Vegetation is bunchgrasses and shrubs on south-facing slopes and Douglas-fir, aspen, lodgepole pine, pinegrass, snowberry, and Idaho fescue on north-facing slopes. Elevation ranges from 6,000 to 8,500 feet. The mean annual precipitation is 15 to 25 inches, the mean annual soil temperature is 35° to 43° F, and the frost-free season ranges from 30 to 75 days.

This association makes up about 6 percent of the survey area. It is about 20 percent Moohoo soils, 20 percent Nagitsy soils, and 15 percent Dranyon soils. Minor soils make up the remaining 45 percent.

Moohoo soils are on north-facing side slopes in mountainous areas in the vicinity of Mt. Putnam. They have a surface layer of dark grayish-brown and brown gravelly silt loam about 11 inches thick. This layer is underlain by brown and pale-brown gravelly and very gravelly silt loam and loam 45 inches thick. Fractured quartzite is at a depth of 56 inches.

Nagitsy soils are on south-facing side slopes. They have a surface layer of dark grayish-brown gravelly loam about 23 inches thick. This layer is underlain by brown very gravelly loam 11 inches thick. Quartzite is at a depth of 34 inches.

Dranyon soils are on north-facing side slopes. They have a surface layer of dark grayish-brown silt loam about 14 inches thick. The next layer is brown silt loam, light clay loam, and gravelly sandy clay loam 34 inches thick. The underlying material is brown very gravelly loam 7 inches thick. Quartzite is at a depth of 55 inches.

Minor soils in this association are in the Nielson, Pavohroo, Robin, Ridgecrest, Tahquats, and Lanoak series. Nielsen and Pavohroo soils each make up about 10 percent of the association.

This association is used for grazing and wildlife. Small acreages of low-quality timber are in patchy, scattered stands, and economical logging is difficult.

### **Descriptions of the Soils**

This section describes the soil series and mapping units in the Fort Hall Area. Each soil series is de-

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

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

As mentioned in the section "How This Survey Was

Made," not all mapping units are in a soil series. Alluvial land, for example does not belong to a soil series, but, nevertheless, is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit can be found by referring to the "Guide to Mapping Units" at the back of this survey. Information about descriptions of range sites and range site symbols is given in the section "Range."

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual.<sup>2</sup>

<sup>2</sup> United States Department of Agriculture. Soil Survey Manual. U.S. Dep. Agric. Handb. No. 18, 503 pp., illus. 1956. [Supplement issued in May 1962]

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

Map symbol	Soil	Acres	Percent	Map symbol	Soil	Acres	Percent
Al	Alluvial land	1,101	0.2	FLF	Feltham loamy sand, undulating	13,850	2.6
BoB	Broncho gravelly loam, 2 to 4 percent slopes	413	.1	Fr	Firth fine sandy loam	544	.1
BoC	Broncho gravelly loam, 4 to 10 percent slopes	337	.1	FU	Fury silt loam	1,377	.3
BoF	Broncho gravelly loam, 20 to 40 percent slopes	362	.1	He	Heiseton fine sandy loam	706	.1
BrD	Broncho very cobbly loam, 2 to 15 percent slopes	498	.1	HGE	Highams very gravelly loam, hilly	1,658	.3
BUE	Buckskin silt loam, rolling	2,356	.5	HGF	Highams very gravelly loam, steep	11,966	2.3
ChA	Chedehap sandy loam, 0 to 2 percent slopes	1,260	.2	HHF	Highams extremely stony loam, steep	5,372	1.0
ChC	Chedehap sandy loam, 2 to 4 percent slopes	536	.1	HHG	Highams extremely stony loam, very steep	378	.1
ChB	Chedehap sandy loam, 4 to 8 percent slopes	219	( <sup>1</sup> )	HOF	Hondoho very cobbly loam, hilly	4,694	.9
ChE	Chedehap sandy loam, 12 to 20 percent slopes	227	( <sup>1</sup> )	HOG	Hondoho very cobbly loam, steep	8,385	1.6
CkA	Chedehap sandy loam, saline-alkali, 0 to 2 percent slopes	371	.1	HYG	Hymas extremely stony loam, steep	2,250	.4
CkB	Chedehap sandy loam, saline-alkali, 2 to 4 percent slopes	210	( <sup>1</sup> )	KN	Knoll silt loam	747	.1
DcA	Declo loam, 0 to 2 percent slopes	6,690	1.3	KUE	Kucera silt loam, 12 to 30 percent slopes	1,132	.2
DcB	Declo loam, 2 to 4 percent slopes	979	.2	LAB	Lanoak silt loam, 0 to 4 percent slopes	252	.1
DcC	Declo loam, 4 to 8 percent slopes	442	.1	LAC	Lanoak silt loam, 4 to 12 percent slopes	2,615	.5
DDD	Declo loam, undulating	1,547	.3	LAE	Lanoak silt loam, 12 to 20 percent slopes	1,304	.3
DeA	Declo loam, saline-alkali, 0 to 2 percent slopes	3,471	.7	LAF	Lanoak silt loam, hilly	13,555	2.6
DeB	Declo loam, saline-alkali, 2 to 4 percent slopes	1,900	.4	MdA	McDole silt loam, 0 to 2 percent slopes	543	.1
DeC	Declo loam, saline-alkali, 4 to 8 percent slopes	569	.1	MEB	McDole silt loam, 0 to 4 percent slopes	2,933	.6
DHB	Declo loam, hardpan variant, 0 to 4 percent slopes	353	.1	MEC	McDole silt loam, 4 to 12 percent slopes	406	.1
DRF	Dranyon silt loam, rolling	3,534	.7	MHF	Moohoo-Dranyon association, hilly	1,464	.3
EnA	Escalante sandy loam, 0 to 2 percent slopes	3,240	.6	MHG	Moohoo-Dranyon association, steep	6,725	1.3
EnB	Escalante sandy loam, 2 to 4 percent slopes	1,130	.2	NAF	Nagitsy gravelly loam, hilly	7,257	1.4
EnC	Escalante sandy loam, 4 to 8 percent slopes	397	.1	NGF	Nagitsy very gravelly loam, 4 to 30 percent slopes	1,141	.2
EOC	Escalante sandy loam, undulating	2,113	.4	NHF	Nagitsy-Nielsen extremely stony loams, hilly	981	.2
EsA	Escalante sandy loam, saline-alkali, 0 to 2 percent slopes	631	.1	NHG	Nagitsy-Nielsen extremely stony loams, steep	6,571	1.3
EsB	Escalante sandy loam, saline-alkali, 2 to 4 percent slopes	335	.1	NLB	Neeley silt loam, 0 to 4 percent slopes	1,249	.2
FeC	Feltham loamy sand, 0 to 4 percent slopes	855	.2	NLC	Neeley silt loam, 4 to 12 percent slopes	4,559	.9
FeB	Feltham loamy sand, 4 to 8 percent slopes	463	.1	NLE	Neeley silt loam, 12 to 20 percent slopes	822	.2
				NLF	Neeley silt loam, rolling	55,760	10.7
				NLG	Neeley silt loam, steep	2,142	.4
				NMG	Nielsen extremely stony loam, very steep	373	.1
				NRF	Nielsen extremely rocky loam, steep	684	.1
				NTF	Nielsen-Nagitsy extremely stony loams, steep	3,200	.6
				PAF	Pandoah channery loam, hilly	457	.1
				PBG	Pandoah very cobbly loam, steep	2,552	.5
				PCG	Pavohroo gravelly loam, steep	2,203	.5
				PeA	Paniogue loam, 0 to 2 percent slopes	9,927	1.9

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

Map symbol	Soil	Acres	Per cent	Map symbol	Soil	Acres	Per cent
PeB	Paniogue loam, 2 to 4 percent slopes	1,718	0.3	REF	Ridgecrest-Hymas gravelly loams, hilly	2,063	.4
PeC	Paniogue loam, 4 to 8 percent slopes	465	.1	RGF	Ridgecrest-Hymas very cobbly loams, hilly	1,562	.3
PeD	Paniogue loam, 8 to 12 percent slopes	298	.1	RGG	Ridgecrest-Hymas very cobbly loams, steep	7,944	1.5
PfA	Paniogue loam, saline-alkali, 0 to 2 percent slopes	2,756	.5	RHG	Ridgecrest-Hymas extremely stony loams, very steep	1,591	.3
PfB	Paniogue loam, saline-alkali, 2 to 4 percent slopes	1,804	.3	RKE	Robin silt loam, 4 to 20 percent slopes	1,489	.3
PfC	Paniogue loam, saline-alkali, 4 to 8 percent slopes	520	.1	RKF	Robin silt loam, 20 to 30 percent slopes	1,298	.2
PgA	Paniogue loam, strongly alkali, 0 to 2 percent slopes	346	.1	RKG	Robin silt loam, steep	1,795	.3
PhA	Paniogue gravelly loam, 0 to 2 percent slopes	1,244	.2	RL	Rock land	1,989	.4
PhB	Paniogue gravelly loam, 2 to 4 percent slopes	650	.1	RNC	Rudeen loam, 4 to 12 percent slopes	207	( <sup>1</sup> )
Pk	Parehat silt loam	5,302	1.0	RNE	Rudeen loam, 12 to 20 percent slopes	285	.1
PLB	Penoyer silt loam, 0 to 4 percent slopes	2,617	.5	RNF	Rudeen loam, hilly	1,190	.2
Pm	Parehat silt loam, saline-alkali	1,118	.2	RUE	Rudeen extremely stony loam, hilly	1,603	.3
Pn	Parehat silt loam, high water table	1,356	.3	RUF	Rudeen extremely stony loam, steep	2,134	.4
PoA	Penoyer silt loam, 0 to 2 percent slopes	6,524	1.2	RUG	Rudeen extremely stony loam, very steep	410	.1
PoB	Penoyer silt loam, 2 to 4 percent slopes	1,272	.2	Rw	Riverwash	277	.1
PpA	Penoyer silt loam, saline-alkali, 0 to 2 percent slopes	854	.2	Sn	Snake silt loam	5,350	1.0
Pr	Penoyer silt loam, mottled variant	805	.2	Ss	Snake silt loam, saline-alkali	400	.1
Ps	Peteetneet peat	505	.1	St	Snake silt loam, high water table	3,772	.7
Pt	Peteetneet muck, clayey subsoil variant	1,283	.2	TAC	Tahquats loam, undulating	1,664	.3
Pu	Philbon peat	2,579	.5	TBC	Tahquats very stony loam, rolling	2,320	.4
PvA	Pocatello silt loam, 0 to 2 percent slopes	349	.1	TCD	Tahquats stony loam, heavy variant, rolling	935	.2
PvB	Pocatello silt loam, 2 to 4 percent slopes	2,170	.4	TGA	Tickason loam, 0 to 2 percent slopes	3,843	.7
PvC	Pocatello silt loam, 4 to 8 percent slopes	2,290	.4	TEB	Tickason loam, 0 to 4 percent slopes	2,350	.4
PvD	Pocatello silt loam, 8 to 12 percent slopes	1,087	.2	TGD	Tickason gravelly loam, 4 to 12 percent slopes	447	.1
PvF	Pocatello silt loam, 20 to 30 percent slopes	594	.1	ThA	Tindahay loamy coarse sand, 0 to 2 percent slopes	4,949	.9
PWB	Pocatello silt loam, 0 to 4 percent slopes	636	.1	ThB	Tindahay loamy coarse sand, 2 to 4 percent slopes	15,877	3.0
PWD	Pocatello silt loam, 4 to 12 percent slopes	3,247	.6	ThC	Tindahay loamy coarse sand, 4 to 8 percent slopes	2,025	.4
PWE	Pocatello silt loam, 12 to 20 percent slopes	1,835	.4	THE	Tindahay loamy coarse sand, 12 to 20 percent slopes	324	.1
PWF	Pocatello silt loam, rolling	29,050	5.6	TNF	Tindahay loamy sand, undulating	3,701	.7
PxA	Portneuf silt loam, 0 to 2 percent slopes	2,860	.5	WAF	Wahtigup gravelly loam, hilly	487	.1
PxB	Portneuf silt loam, 2 to 4 percent slopes	2,248	.4	WBF	Wahtigup very cobbly loam, hilly	7,699	1.5
PYB	Portneuf silt loam, 0 to 4 percent slopes	1,300	.2	WBG	Wahtigup very cobbly loam, steep	9,247	1.8
PYC	Portneuf silt loam, undulating	13,915	2.7	Wcd	Waycup gravelly loam, 8 to 12 percent slopes	231	( <sup>1</sup> )
PYD	Portneuf silt loam, 4 to 12 percent slopes	650	.1	WDF	Waycup cobbly loam, hilly	1,393	.3
QnB	Quincy sand, 2 to 4 percent slopes	1,626	.3	WEF	Waycup extremely stony loam, hilly	1,210	.2
QnC	Quincy sand, 4 to 8 percent slopes	1,174	.2	WEG	Waycup extremely stony loam, steep	2,442	.5
QUF	Quincy sand, undulating	19,918	3.8	WhD	Wheeler silt loam, 8 to 12 percent slopes	349	.1
QVD	Quincy very stony sand, moderately shallow, undulating	535	.1	WhF	Wheeler silt loam, 30 to 55 percent slopes	3,765	.7
RBB	Rexburg silt loam, 0 to 4 percent slopes	2,325	.4	WLE	Wheeler silt loam, 12 to 30 percent slopes	23,501	4.5
RBC	Rexburg silt loam, 4 to 12 percent slopes	7,587	1.5	WLF	Wheeler silt loam, steep	1,404	.3
RBE	Rexburg silt loam, 12 to 20 percent slopes	678	.1	WLG	Wheeler silt loam, very steep	246	( <sup>1</sup> )
RBF	Rexburg silt loam, rolling	42,778	8.2	ZN	Zunhall silt loam	2,227	.4
RBG	Rexburg silt loam, steep	247	( <sup>1</sup> )	ZU	Zunhall silt loam, high water table	306	.1
RCF	Ricrest-Ridgecrest gravelly loams, hilly	1,043	.2		Total	523,000	100.0
RDG	Ricrest-Ridgecrest cobbly loams, steep	1,259	.2				

<sup>1</sup> Less than 0.05 percent.

### Alluvial Land

AI—Alluvial land is on low river terraces. It consists of stratified coarse-textured to medium-textured alluvium underlain by sand and gravel. Slopes are generally less than 1 percent. Elevation ranges from 4,350 to 4,400 feet. Dominant vegetation is cottonwood, shrubs, cheatgrass, and annual weeds. The mean annual precipitation is about 10 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season is 100 to 120 days.

Typically, the surface layer is loam to loamy sand 3 to 10 inches thick and is about 5 to 30 percent gravel and cobbles. It is underlain by water-washed sand and gravel.

Permeability is rapid and very rapid. Alluvial land is extremely droughty. Available water capacity is low. The effective rooting depth is more than 60 inches. The seasonal high water table is at a length of 1½ to 3 feet, but the areas are subject to flooding during periods of high runoff in spring.

Alluvial land is used mainly by livestock for shade

and for protection from storms. Capability unit VIIIw-1, nonirrigated; range site NU.<sup>3</sup>

## Broncho Series

The Broncho series consists of somewhat excessively drained soils on alluvial fans and low terraces. These soils formed in mixed alluvium. Slopes are 2 to 40 percent. Elevation ranges from 4,350 to 4,500 feet. Dominant vegetation is big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, and cheatgrass. The mean annual precipitation is 9 to 10 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray gravelly loam about 6 inches thick. The subsoil is light brownish-gray gravelly loam about 8 inches thick. The underlying material is white very gravelly coarse sandy loam to a depth of 17 inches and very gravelly and cobbly coarse sand to a depth of 60 inches. The soil is moderately alkaline to strongly alkaline and is limy below a depth of 6 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is more than 60 inches.

These soils are used mainly for irrigated pasture and range.

Representative profile of Broncho gravelly loam, 2 to 4 percent slopes, at the center of the SE<sup>1</sup>/<sub>4</sub>NW<sup>1</sup>/<sub>4</sub> sec. 2, T. 6 S., R. 33 E.:

- A1—0 to 6 inches, light brownish-gray (10YR 6/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, very thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine vesicular pores below a depth of 1 inch; 20 percent gravel; moderately alkaline; clear, smooth boundary.
- B2—6 to 14 inches, light brownish-gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak, medium, platy structure and weak, coarse, subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; 20 percent gravel; slightly calcareous; pebbles slightly coated with lime on lower side; moderately alkaline; clear, wavy boundary.
- IIC1ca—14 to 17 inches, white (10YR 8/2) very gravelly coarse sandy loam, pale brown (10YR 6/3) moist; massive; hard, firm, nonsticky and nonplastic; very weakly cemented in places; common very fine roots; many very fine tubular pores; 60 percent gravel and cobbles; strongly calcareous; the lower side of gravel has moderately thick coating of lime and the upper side has thin coating; strongly alkaline; abrupt, irregular boundary.
- IIC2ca—17 to 25 inches, variegated very gravelly coarse sand; single grained; loose, nonsticky and nonplastic; weakly cemented in places; few very fine roots; 60 percent gravel and cobbles; moderately calcareous; lower half of pebbles has thick coating of lime but upper half has none; strongly alkaline; gradual, irregular boundary.
- IIC3—25 to 60 inches, variegated very gravelly coarse sand; single grained; loose; few roots; 70 percent gravel and cobbles; slightly calcareous; thin coating of lime on lower side of pebbles; strongly alkaline.

Depth to the very gravelly coarse sand ranges from 10 to 20 inches.

The A1 horizon is generally gravelly loam that contains

a few cobblestones and other stones, but in some areas it is very cobbly. In places the A1 horizon is slightly calcareous.

In some areas cultivation has mixed material from the A1 horizon with that in the B horizon.

**BoB—Broncho gravelly loam, 2 to 4 percent slopes.** This very gently sloping soil is in long narrow strips on ridges. Areas are generally 3 to 10 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that are stony and are indicated on the soil map by the symbol for stoniness. Also included are small areas of soils that have a very gravelly and cobbly surface layer and small areas of soils that have slopes of less than 2 percent. Small areas of Paniogue, Declo, and Tickason loams are included.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, wheat, mixed grain, alfalfa, hay, and pasture. Capability unit IVs-1, irrigated; not assigned to a range site.

**BoC—Broncho gravelly loam, 4 to 10 percent slopes.** This gently sloping to moderately sloping soil is in drainageways.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent and small areas of soils that are stony, very gravelly, or very cobbly. The stony areas are indicated on the map by the symbol for stoniness. Also included are small areas of a Paniogue loam and a Declo loam.

Runoff is slow on nonirrigated areas of this soil and medium on irrigated areas. The hazard of erosion is slight on nonirrigated areas and high on irrigated areas.

This soil is used for irrigated hay and pasture and range. Capability units VIe-2, irrigated, and VIe-1, nonirrigated; range site RY1.

**BoF—Broncho gravelly loam, 20 to 40 percent slopes.** This moderately steep and steep soil is in long, narrow areas that are mainly escarpments of alluvial terraces. It has a profile similar to the one described as representative of the series, but the surface layer is about 4 inches thick.

Included with this soil in mapping are small areas of soils that have a very gravelly surface layer and small areas of soils that have slopes of more than 40 percent. Also included are small areas of a Paniogue loam, a Feltham loamy sand, and a Chedehap sandy loam.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used for range. Capability unit VIIe-0, nonirrigated; range site RY1.

**BrD—Broncho very cobbly loam, 2 to 15 percent slopes.** This very gently sloping to strongly sloping soil is in small, irregularly shaped areas, mainly in cultivated fields. It has a profile similar to the one described as representative of the series, but the surface layer is very cobbly.

Included with this soil in mapping are small areas of soils that have slopes of less than 2 percent and soils that have slopes of more than 15 percent. Also included are small areas of a Paniogue loam and a Chedehap sandy loam.

Runoff is medium on nonirrigated areas of this soil

<sup>3</sup> For explanation of range site symbols, see the publication referred to in footnote, page 59.

and rapid on irrigated areas. The hazard of erosion is moderate on nonirrigated areas and high on irrigated areas. The cobbles make cultivation difficult, but some cultivation is feasible to establish vegetation for irrigated pasture. Where this soil occurs as small patches in cultivated fields, it is generally left uncultivated.

This soil is used for range or irrigated pasture or is left idle. Capability units VIe-2, irrigated, and VIIs-2, nonirrigated; range site RY1.

### Buckskin Series

The Buckskin series consists of well-drained soils on dissected plateaus and mountain foot slopes. These soils formed in eolian silt. Slopes are 4 to 20 percent. Elevation ranges from 5,500 to 7,000 feet. Dominant vegetation is bunchgrasses, shrubs, and aspen. The mean annual precipitation is 17 to 20 inches, the mean annual soil temperature is 38° to 44° F, and the frost-free season is 50 to 75 days.

In a representative profile the surface layer is dark grayish-brown silt loam 12 inches thick. The subsoil is brown light silty clay and silty clay loam to a depth of 61 inches. The underlying material is pale-brown silt loam to a depth of 70 inches. The soil is limy below a depth of 61 inches.

Permeability is slow, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used for range in summer. They are well suited to dryfarmed small grain.

Representative profile of Buckskin silt loam, rolling, 500 feet south of the north quarter corner of sec. 10, T. 6 S., R. 36 E.:

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, thin, platy structure parting to moderate, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine pores; few uncoated silt grains; neutral; clear, smooth boundary.

A12—4 to 12 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) moist; weak, very fine, subangular blocky structure parting to weak, fine, granular; hard, firm, slightly sticky and slightly plastic; many, very fine, fine, and medium roots; common very fine tubular pores; very few insect channels 0.5 inch across; few uncoated silt grains; neutral; clear, smooth boundary.

B21t—12 to 23 inches, brown (10YR 5/3) light silty clay, dark brown (7.5YR 3/3) moist; moderate, medium, prismatic structure parting to strong, fine and medium, subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; few 0.5 inch insect krotovinas; common, moderately thick, nearly continuous clay films on peds and in pores; common uncoated silt grains on peds; neutral; clear, smooth boundary.

B22t—23 to 35 inches, brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, prismatic structure parting to strong, very fine and fine, subangular blocky; very hard, very firm, sticky and plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; common, thin, patchy clay films on peds and in pores; few uncoated silt grains on peds; neutral; clear, wavy boundary.

B23t—35 to 61 inches, brown (7.5YR 5/3) light silty clay

loam, dark brown (7.5YR 3/2) moist; weak, coarse, prismatic structure parting to moderate, very fine and fine, subangular blocky; hard, firm, sticky and plastic; few very fine roots; many very fine and fine tubular pores; a few thin patchy clay films on peds and in pores; neutral; clear, wavy boundary.

C—61 to 70 inches, pale-brown (10YR 6/3) silt loam; massive; slightly hard, friable, slightly sticky and slightly plastic; moderately calcareous; moderately alkaline.

The A horizon is grayish brown or dark grayish brown and ranges from 8 to 16 inches in thickness. The B horizon ranges from 30 to 60 inches in thickness.

**BUE—Buckskin silt loam, rolling.** This soil is on dissected plateaus and foot slopes of mountains. Slopes range from 4 to 20 percent.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent and soils that have slopes of more than 20 percent. Also included are areas of Robin, Lanoak, and Rexburg silt loams.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for range, but it is suited to dryfarmed small grain. Capability unit IIIe-9, nonirrigated; range site CY4.

### Chedehap Series

The Chedehap series consists of well-drained soils on long, narrow ridges on alluvial terraces. These soils formed in eolian sandy material. Slopes are 0 to 20 percent. Elevation ranges from 4,400 to 4,500 feet. Dominant vegetation is bunchgrasses and shrubs. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 47° to 51° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray sandy loam about 5 inches thick. The subsoil is light brownish-gray sandy loam to a depth of 17 inches. The underlying material is light-gray sandy loam, coarse sandy loam, and loamy coarse sand to a depth of 35 inches, and below this it is light brownish-gray coarse sand to a depth of 54 inches. The soil is limy below a depth of 14 inches.

Permeability is moderately rapid, and available water capacity is moderate. The effective rooting depth is more than 60 inches.

These soils are used for irrigated crops, dryfarmed pasture, and range.

Representative profile of Chedehap sandy loam, 0 to 2 percent slopes, in the SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 35, T. 6 S., R. 33 E.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, thin, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; a few fine pebbles; mildly alkaline; clear, smooth boundary.

B2—5 to 14 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine tubular pores; a few fine pebbles; mildly alkaline; gradual, wavy boundary.

B3—14 to 17 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak,

coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine tubular pores; a few fine pebbles; common hard nodules that are weakly cemented with silica-lime; slightly calcareous; moderately alkaline; clear, smooth boundary.

C1ca—17 to 22 inches, light-gray (10YR 7/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many decaying roots; common very fine tubular pores; a few fine pebbles; common hard nodules that are weakly cemented with silica-lime; moderately calcareous; moderately alkaline; clear, wavy boundary.

C2ca—22 to 29 inches, light-gray (10YR 7/2) coarse sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many brown (7.5YR 4/4) decaying roots; common very fine tubular pores; 5 percent fine gravel; moderately calcareous; strongly alkaline; clear, wavy boundary.

C3ca—29 to 35 inches, light-gray (10YR 7/2) loamy coarse sand, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine tubular pores; 10 percent gravel; moderately calcareous; strongly alkaline; clear, wavy boundary.

IIC4—35 to 54 inches, light brownish-gray (10YR 6/2) coarse sand, dark grayish brown (10YR 4/2) moist; single grained; loose; many very fine interstitial pores; 5 percent fine gravel; moderately calcareous; very strongly alkaline.

The A1 horizon is 3 to 6 inches thick and is calcareous in places. The B horizon ranges from 7 to 20 inches in thickness. A layer of loose loamy sand, sand, or gravelly sand is at a depth of 20 to 40 inches.

**ChA—Chedehap sandy loam, 0 to 2 percent slopes.** This nearly level soil is on tops of alluvial terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 2 percent, small areas of soils that are saline-alkali, and small areas of Paniogue, Feltham, Escalante, Quincy, and Broncho soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, alfalfa hay, and pasture. Capability unit IIs-1, irrigated; not assigned to a range site.

**ChB—Chedehap sandy loam, 2 to 4 percent slopes.** This very gently sloping soil is on tops of alluvial terraces.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent, small areas of soils that are saline-alkali, and small areas of Feltham, Escalante, and Paniogue soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for irrigated potatoes, sugar beets, small grain, alfalfa hay, and pasture. Capability unit IIIe-13, irrigated; not assigned to a range site.

**ChC—Chedehap sandy loam, 4 to 8 percent slopes.** This gently sloping soil is on side slopes of alluvial terraces.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent, areas of soils that are saline-alkali, and small areas of Paniogue, Feltham, Escalante, and Tindahay soils.

Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIIe-13, irrigated; not assigned to a range site.

**ChE—Chedehap sandy loam, 12 to 20 percent slopes.** This strongly sloping soil is in ravines and on escarpments of alluvial terraces.

Included with this soil in mapping are small areas of soils that have slopes of less than 12 percent and small areas of Paniogue, Feltham, and Tindahay soils. Also included are areas of soils that have a surface layer of gravelly loam, and are indicated on the soil map by the symbol for gravel.

Runoff is medium, and the hazard of erosion is high.

This soil is used for range. Capability unit VIe-1, nonirrigated; range site S11.

**CkA—Chedehap sandy loam, saline-alkali, 0 to 2 percent slopes.** This very gently sloping soil is on terraces. It has a profile similar to the one described as representative of the series, but some small areas are slightly affected by salt and alkali.

Included with this soil in mapping are areas of soils that are moderately affected by salt and alkali, have very slow infiltration, and have stunted vegetation. These areas are 6 to 20 feet in diameter and make up 20 percent of mapped areas. Also included are areas of Paniogue and Feltham soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IVs-8, irrigated; not assigned to a range site.

**CkB—Chedehap sandy loam, saline-alkali, 2 to 4 percent slopes.** This very gently sloping soil is on terraces. It has a profile similar to the one described as representative of the series, but it is affected by salt and alkali.

Included with this soil in mapping are areas of soils that are moderately affected by salt and alkali and have slow infiltration. These areas are 6 to 20 feet in diameter and make up 15 to 25 percent of mapped areas. Also included are small areas of soils that have slopes of more than 4 percent and areas of Paniogue and Feltham soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, alfalfa hay, and pasture. Capability unit IVs-8, irrigated; not assigned to a range site.

## Declo Series

The Declo series consists of well-drained soils on alluvial terraces. These soils formed in mixed alluvium. Slopes are 0 to 15 percent. Elevation ranges from 4,400 to 4,500 feet. Dominant vegetation is bunchgrasses and shrubs. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 47° to 51° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish-brown loam about 5 inches thick. The subsoil is light brownish-gray silt loam about 5 inches thick. The underlying material is light-gray and white silt loam to a depth of 47 inches, light brownish-gray loamy coarse sand between the depths of 47 and 52 inches, and light brownish-gray coarse sand below this, to a

depth of 60 inches. The profile is mildly alkaline to moderately alkaline. It is limy except for upper 2 inches of the surface layer.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for irrigated potatoes, sugar beets, small grain, and hay. Some areas are used for range.

Representative profile of Declo loam, 0 to 2 percent slopes, in SE $\frac{1}{4}$ SW $\frac{1}{4}$ , sec. 2, T. 6 S., R. 32 E.:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, thin, platy structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial and few fine tubular pores; mildly alkaline; clear, smooth boundary.
- A12—2 to 5 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, thin and medium, platy structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores and common very fine tubular pores; slightly calcareous; mildly alkaline; clear, smooth boundary.
- B2—5 to 8 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, thick, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and few fine tubular pores; slightly calcareous; mildly alkaline; clear, smooth boundary.
- B3—8 to 10 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium and coarse, subangular blocky structure parting to weak, very fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and few fine tubular pores; moderately calcareous, a few limy spots; mildly alkaline; clear, wavy boundary.
- C1ca—10 to 14 inches, light-gray (10YR 7/2) silt loam, grayish brown (2.5Y 5/2) moist; moderate, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; common very fine tubular pores; strongly calcareous, many fine spots of lime; mildly alkaline; abrupt, smooth boundary.
- C2ca—14 to 20 inches, white (10YR 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; very strongly calcareous, few spots of lime; mildly alkaline; gradual, wavy boundary.
- C3ca—20 to 34 inches, white (10YR 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; 15 percent very hard nodules that are weakly cemented with silica-lime; strongly calcareous, few fine spots of lime; moderately alkaline; gradual, wavy boundary.
- C4—34 to 47 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; few, fine, faint, very pale brown (10YR 7/4) root stainings, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine tubular pores; 5 percent hard nodules that are weakly cemented with silica-lime; moderately calcareous, few fine spots and veins of lime; moderately alkaline; clear, wavy boundary.
- IIC5—47 to 52 inches, light brownish-gray (2.5Y 6/2) loamy coarse sand, dark grayish brown (10YR 4/2)

moist; single grained; loose dry and moist; slightly calcareous; moderately alkaline; abrupt, smooth boundary.

IIC6—52 to 60 inches, light brownish-gray (10YR 6/2) coarse sand, grayish brown (10YR 5/2) moist; single grained; loose; 5 percent fine gravel; 25 percent dark sand; very slightly calcareous; moderately alkaline.

The A1 or Ap horizon is 4 to 9 inches thick. The B horizon is light brownish gray to pale brown and is absent in some cultivated areas. The Cca horizon is at a depth of 8 to 16 inches. The stratified underlying material is below a depth of 40 inches and ranges from silt loam to coarse sand and gravel.

**DcA—Declo loam, 0 to 2 percent slopes.** This nearly level soil is on alluvial terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 2 percent, small areas of soils that are moderately saline-alkali, and small areas of Paniogue, Tickason, Broncho, and Penoyer soils.

Runoff is slow, and the hazard of erosion is none or slight.

This soil is used for irrigated potatoes, sugar beets, small grain, alfalfa, and pasture. Capability unit IIC-2, irrigated; not assigned to a range site.

**DcB—Declo loam, 2 to 4 percent slopes.** This very gently sloping soil is on alluvial terraces.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and small areas of soils that are severely saline-alkali. Also included are small areas of Paniogue, Tickason, Broncho, and Escalante soils.

Runoff is medium, and the hazard of erosion is moderate. Row crops under surface irrigation require more careful management on this soil than on Declo loam, 0 to 2 percent slopes.

This soil is used for irrigated potatoes, sugar beets, small grain, alfalfa, and pasture. Capability unit IIC-1, irrigated; not assigned to a range site.

**DcC—Declo loam, 4 to 8 percent slopes.** This gently sloping soil is on alluvial terraces.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent and areas of soils that have slopes of more than 8 percent. Also included are small areas of Paniogue and Escalante soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for irrigated potatoes, sugar beets, small grain, alfalfa, and pasture. Capability unit IIC-1, irrigated; not assigned to a range site.

**DDD—Declo loam, undulating.** This soil is on alluvial terraces. Slopes are 0 to 15 percent.

Included with this soil in mapping are small areas of soils that have slopes of more than 15 percent and areas of Escalante, Paniogue, and Penoyer soils.

Runoff is slow, and the hazard of erosion is slight to moderate.

This soil is used only for range. Capability unit VIe-1, nonirrigated; range site SII.

**DeA—Declo loam, saline-alkali, 0 to 2 percent slopes.** This nearly level soil is on alluvial terraces. It has a profile similar to the one described as representative of the series, but it is slightly affected by salt and alkali.

Included with this soil in mapping and making up 15 to 25 percent of mapped areas are areas of saline-alkali soils. These areas have a moderately alkaline to strongly alkaline surface layer and have a sparse vegetative cover. Response of cultivated crops in these areas is generally affected by the saline-alkali condition. Also included are small areas of soils that have slopes of more than 2 percent, small areas of soils that have clay below a depth of 40 inches, and areas of Tickason and Escalante soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIc-2, irrigated; not assigned to a range site.

**DeB—Declo loam, saline-alkali, 2 to 4 percent slopes.** This very gently sloping soil is on alluvial terraces. It has a profile similar to the one described as representative of the series, but it is slightly affected by salt and alkali.

Included with this soil in mapping and making up 15 to 25 percent of mapped areas are areas of saline-alkali soils. These areas have a moderately alkaline to strongly alkaline surface layer and have sparse, stunted native vegetation. Crop response in these areas generally is affected by the saline-alkali condition. Also included are small areas of soils that have slopes of more than 4 percent and areas of Tickason, Paniogue, and Escalante soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIe-1, irrigated; not assigned to a range site.

**DeC—Declo loam, saline-alkali, 4 to 8 percent slopes.** This gently sloping soil is on alluvial terraces. The profile of this soil is similar to the one described as representative of the series, but it is slightly affected by salt and alkali.

Included with this soil in mapping and making up 15 to 25 percent of mapped areas are areas of saline-alkali soils. These areas have a moderately alkaline to very strongly alkaline surface layer and have sparse, stunted native vegetation. Crop response in these areas generally is affected by the saline-alkali condition. Also included are small areas of soils that have slopes of more than 8 percent, small areas of soils that are gravelly, and areas of Tickason, Paniogue, and Broncho soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for irrigated small grain, hay, and pasture. Capability unit IIIe-1, irrigated; not assigned to a range site.

## Declo Variant

The Declo variant soils are moderately well drained. These soils are along stream bottoms. They formed in alluvium derived from loess. Slopes are 0 to 4 percent. Elevation ranges from 4,500 to 5,500 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 11 to 15 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray loam about 9 inches thick. The subsoil is pinkish-gray silt loam about 6 inches thick. The underlying material is light brownish-gray loam and light-gray silt loam to a depth of 60 inches. The soil is moderately alkaline to very strongly alkaline and is limy throughout.

Permeability is slow, and available water capacity is high. Roots penetrate to a depth of 60 inches but are restricted by a weakly cemented layer at a depth of 15 to 30 inches.

These soils are used mainly for range. Small areas are used for irrigated crops.

Representative profile of Declo loam, hardpan variant, 0 to 4 percent slopes, in SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 21, T. 8 S., R. 33 E.:

- A11—0 to 3 inches, light brownish-gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; weak, very thin, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many very fine and few fine tubular pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.
- A12—3 to 9 inches, light brownish-gray (10YR 6/2) loam, dark brown (10YR 3/3) moist; strong, very thin, platy structure in upper part, strong, thin, and medium and weak, thick, platy structure in lower part; hard, friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; moderately calcareous; very strongly alkaline; clear, smooth boundary.
- B2—9 to 15 inches, pinkish-gray (7.5YR 6/2) silt loam, brown (7.5YR 4/4) moist; weak, medium, prismatic structure parting to weak, very fine, subangular blocky; slightly hard, friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many very fine and few fine tubular pores; moderately calcareous; very strongly alkaline; clear, wavy boundary.
- C1sica—15 to 31 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; pinkish-gray (7.5YR 7/2) coatings and few, fine, distinct, reddish-brown (5YR 5/3) stains; weak, thick, platy structure parting to weak, fine, subangular blocky; very hard, very firm, nonsticky and nonplastic; weakly silica-lime cemented; many very fine, fine, and medium roots; many very fine and common fine tubular pores; strongly calcareous, plates coated with lime; strongly alkaline; clear, wavy boundary.
- C2sica—31 to 39 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; matrix not cemented; common very fine and fine roots; many very fine and few fine tubular pores; few very hard nodules that are weakly cemented with silica-lime; strongly calcareous, common fine coating of lime; strongly alkaline; clear, wavy boundary.
- C3sica—39 to 45 inches, light-gray (10YR 7/1) silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and few fine tubular pores; about 15 percent nodules that are weakly cemented with silica-lime; strongly calcareous, much segregated lime; moderately alkaline; gradual, wavy boundary.
- C4ca—45 to 60 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and common fine tubular pores; strongly calcareous, common splotches and few veins of lime; moderately alkaline.

The A horizon and B horizon are moderately alkaline, strongly alkaline, or very strongly alkaline. The B horizon is pinkish gray or pale brown.

**DHB—Declo loam, hardpan variant, 0 to 4 percent slopes.** This nearly level and gently sloping soil is on valley stream bottoms along Bannock Creek.

Included with this soil in mapping are small areas of soils that have a cemented pan at a depth of less than 15 inches and areas of soils that have a strongly saline surface layer. Also included are small areas of somewhat poorly drained and poorly drained soils and areas of Tickason, Penoyer, and Parehat soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for range. Small areas are used for irrigated hay and pasture. Capability units IIs-1, irrigated, and IVw-9, nonirrigated; range site SL8.

## Dranyon Series

The Dranyon series consists of well-drained soils on north-facing side slopes. These soils formed in weathered sedimentary or metamorphic rock and an overlay of loess. Slopes are 4 to 55 percent. Elevation ranges from 6,000 to 7,000 feet. Dominant vegetation is quaking aspen and pinegrass. The mean annual precipitation is 17 to 20 inches, the mean annual soil temperature is 37° to 42° F, and the frost-free season is 60 to 75 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 14 inches thick. The subsoil is brown throughout. It is heavy silt loam to a depth of 26 inches, light clay loam between depths of 26 and 34 inches, and gravelly sandy clay loam from 34 inches to a depth of 48 inches. The underlying material is brown very gravelly loam to a depth of 55 inches and is underlain by quartzite bedrock. The soil is medium acid in the upper part and slightly acid in the lower part. It is leached of lime.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is 40 to 60 inches.

These soils are used for range late in spring and in summer.

Representative profile of Dranyon silt loam, rolling, in SE $\frac{1}{4}$  sec. 19, T. 5 S., R. 38 E.:

O1—1 inch to 0, partly decomposed aspen leaves, twigs, and grass; neutral; abrupt, wavy boundary.

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, medium and thick, platy structure parting to moderate, fine and very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium and few coarse roots; many very fine interstitial pores; 5 percent gravel; medium acid; abrupt, smooth boundary.

A12—3 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure parting to weak, medium and fine, granular; hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse and very coarse roots; many very fine and few fine tubular pores; 5 percent gravel; medium acid; clear, smooth boundary.

A13—9 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 2/2) moist; weak, medium, prismatic structure parting to weak,

fine and medium, subangular blocky and granular; hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse and very coarse roots; many very fine and fine tubular pores; 10 percent gravel; medium acid; clear, smooth boundary.

B21t—14 to 26 inches, brown (7.5YR 5/3) heavy silt loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse and very coarse roots; many very fine and fine tubular pores; 10 percent gravel; many thin patchy clay films on peds and moderately thick nearly continuous clay films in some channels and pores; common uncoated silt grains on ped surfaces; slightly acid; gradual, wavy boundary.

B22t—26 to 34 inches, brown (7.5YR 5/3) light clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores; 10 percent gravel; common thin patchy clay films on peds and moderately thick nearly continuous clay films in some channels and pores; common partly uncoated silt grains on peds and some in splotches; a few darker krotovinas; slightly acid; clear, wavy boundary.

B3t—34 to 48 inches, brown (7.5YR 5/4) gravelly sandy clay loam, dark brown (7.5YR 4/3) moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; 45 percent gravel, mainly pinkish-white (7.5YR 8/2) sandstone or quartzite and 2- to 3-millimeters thick reddish-brown (5YR 5/5) weathering rinds; common fine black stains; common thin patchy clay films on peds and in some pores, and moderately thick nearly continuous clay films in some channels; slightly acid; clear, wavy boundary.

C—48 to 55 inches, brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; 70 percent sandstone or quartzite gravel as in B3t horizon and a few light brownish-gray (2.5Y 6/2) gravel; slightly acid; clear, wavy boundary.

IIR—55 to 60 inches, quartzite.

The A horizon ranges to as much as 10 percent gravel and is dark gray or dark grayish brown. The B2 horizon is 5 to 20 percent coarse fragments. The content of coarse fragments increases as depth increases. Bedrock is at a depth of 40 to 60 inches.

**DRF—Dranyon silt loam, rolling.** This soil is on foot slopes or on north-facing side slopes of mountains. Slopes are relatively long and narrow, and they range from 4 to 20 percent.

Included with this soil in mapping are small areas of soils that have slopes of more than 20 percent and areas of Tahquats, Nagitsy, Moohoo, Robin, and Lanoak soils.

Runoff is medium, and the hazard of erosion is moderate to high.

This soil is used for range late in spring and in summer. Capability unit IIIe-9, nonirrigated; range site MP4.

## Escalante Series

The Escalante series consists of well-drained soils on alluvial fans and terraces. These soils formed in sandy

alluvium. Slopes are 0 to 8 percent. Elevation ranges from 4,400 to 4,600 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 50° to 52° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish-brown sandy loam about 2 inches thick. The underlying material is stratified, light brownish-gray sandy loam and fine sandy loam to a depth of 60 inches. The soil is mildly alkaline and limy throughout.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used for irrigated potatoes, sugar beets, small grain, hay, and pasture and for range.

Representative profile of Escalante sandy loam, 0 to 2 percent slopes, 1,100 feet east and 300 feet south of the center of sec. 21, T. 3 S., R. 35 E.:

- A1—0 to 2 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thin, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many interstitial pores; moderately calcareous; mildly alkaline; abrupt, smooth boundary.
- C1—2 to 9 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, medium, subangular blocky structure parting to weak, very fine, granular; soft, very friable, nonsticky and slightly plastic; common very fine, fine, and medium roots; many interstitial pores and few tubular pores; moderately calcareous; mildly alkaline; clear, smooth boundary.
- C2ca—9 to 17 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, subangular blocky structure parting to weak, fine, granular; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; many tubular pores; strongly calcareous; mildly alkaline; gradual, smooth boundary.
- C3ca—17 to 27 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few, very fine and fine roots; many tubular pores; strongly calcareous; mildly alkaline; clear, wavy boundary.
- C4ca—27 to 41 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; few very fine tubular pores; strongly calcareous; mildly alkaline; clear, smooth boundary.
- C5ca—41 to 60 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; common very fine tubular pores; strongly calcareous; mildly alkaline.

The A horizon is grayish brown or light brownish gray, and in places, it is noncalcareous. It is mixed with the upper part of the C horizon in cultivated areas. The strongly calcareous Cca horizon is at a depth of 9 to 20 inches. The soil is underlain by sand and some gravel in places.

**EnA—Escalante sandy loam, 0 to 2 percent slopes.** This nearly level soil is on ridgetops of terraces and alluvial fans. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately saline-alkali soils and small areas of Chedehap, Feltham, Paniogue, and Tindahay soils.

Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used for irrigated potatoes, small grain, alfalfa, and pasture. Sugar beets can be grown, but response is slightly reduced because of the sandy loam texture. Capability unit IIe-4, irrigated; not assigned to a range site.

**EnB—Escalante sandy loam, 2 to 4 percent slopes.** This very gently sloping soil is on alluvial fans and tops or sides of terraces.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and small areas of moderately saline-alkali soils. Also included are small areas of Feltham, Chedehap, Paniogue, and Declo soils.

Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used for irrigated potatoes, small grain, sugar beets, hay, and pasture. Capability unit IIe-1, irrigated; not assigned to a range site.

**EnC—Escalante sandy loam, 4 to 8 percent slopes.** This gently sloping soil is on side slopes of terraces.

Included with this soil in mapping are small areas of soils that have slopes of more than 8 percent, areas of soils that are moderately saline-alkali, and small areas of Feltham, Chedehap, Paniogue, and Declo soils.

Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This soil is used for irrigated potatoes, small grain, sugar beets, hay, and pasture. Capability unit IIIe-13, irrigated; not assigned to a range site.

**EOC—Escalante sandy loam, undulating.** This soil is on terraces. Slopes range from 2 to 8 percent.

Included with this soil in mapping are small areas of soils that have slopes of as much as 12 percent and areas of Paniogue, Feltham, Tindahay, Penoyer, and Pocatello soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used only for range. Capability unit VIe-1, nonirrigated; range site SI1.

**EsA—Escalante sandy loam, saline-alkali, 0 to 2 percent slopes.** This soil is on alluvial terraces.

Included with this soil in mapping are small areas of soils that are moderately affected by salt and alkali. These areas range from 6 to 20 feet in diameter and make up 15 to 25 percent of mapped areas. Also included are areas of Paniogue, Chedehap, and Feltham soils.

Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used for irrigated potatoes, sugar beets, small grain, alfalfa, and pasture. Crop response is less than that of soils not affected by salt and alkali. Capability unit IVs-8, irrigated; not assigned to a range site.

**EsB—Escalante sandy loam, saline-alkali, 2 to 4 percent slopes.** This soil is on tops and sides of terraces.

Included with this soil in mapping are small areas of soils that are moderately affected by salt and alkali. These areas range from 6 to 20 feet in diameter and make up 15 to 25 percent of mapped areas. Also in-

cluded are small areas of Paniogue, Chedehap, and Feltham soils.

Runoff is slow, the hazard of water erosion is slight, and the hazard of soil blowing is moderate.

This soil is used for irrigated potatoes, small grain, sugar beets, alfalfa, and pasture. Crop response is less than that of soils not affected by salt and alkali. Capability unit IVs-8, irrigated; not assigned to a range site.

### Feltham Series

The Feltham series consists of well-drained soils. These soils formed in wind-worked alluvium. Slopes are 0 to 12 percent. Elevation ranges from 4,400 to 5,000 feet. Vegetation is sparse grasses and shrubs. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 50° to 53° F, and the frost-free season is 100 to 120 days.

In a representative profile, the surface layer is brown loamy sand about 4 inches thick. The underlying material is brown loamy sand to a depth of 22 inches, brown sandy loam between the depths of 22 and 32 inches, light-gray loam between the depths of 32 and 46 inches, and pale-brown loam from 46 inches to a depth of 60 inches. The soil is limy below a depth of 22 inches.

Permeability is moderately rapid, and available water capacity is moderate. The effective rooting depth is more than 60 inches.

These soils are used mainly for range. Small areas are being developed under sprinkler irrigation to produce potatoes and small grain.

Representative profile of Feltham loamy sand, undulating, in NE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 23, T. 3 S., R. 35 E.:

- A1—0 to 4 inches, brown (10YR 5/3) loamy sand, very dark grayish brown (10YR 3/2) moist; 20 to 25 percent dark-colored mineral grains; single grained; loose when dry and moist; common very fine and fine roots; many fine interstitial pores; mildly alkaline; clear, smooth boundary.
- C1—4 to 11 inches, brown (10YR 5/3) loamy sand, very dark brown (10YR 3/3) moist; 20 percent dark-colored mineral grains; single grained; loose dry and moist; common very fine and fine roots; many fine interstitial pores; mildly alkaline; gradual, wavy boundary.
- C2—11 to 22 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) moist; single grained; loose dry and moist; common very fine and fine roots; many fine interstitial pores; moderately alkaline; clear, wavy boundary.
- IIC3ca—22 to 32 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; single grained; loose dry and moist; common very fine and fine roots; many fine interstitial pores; moderately calcareous; moderately alkaline; clear, wavy boundary.
- IIC4ca—32 to 46 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many fine tubular pores; few firm nodules; moderately calcareous, many lime splotches and veins; strongly alkaline; gradual, wavy boundary.
- IIC5ca—46 to 60 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many fine tubular pores; moderately calcareous, many lime splotches and veins; strongly alkaline.

The A horizon is grayish brown to brown. Depth to the sandy loam or loam layer ranges from 22 to 35 inches. The soil is noncalcareous to a depth of 20 to 35 inches.

**FeB—Feltham loamy sand, 0 to 4 percent slopes.** This nearly level and very gently sloping soil is on alluvial terraces.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and areas of Tindahay, Escalante, Quincy, and Chedehap soils.

Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This soil is used for irrigated potatoes, small grain, alfalfa, and pasture. It is also used for range. Capability units IVE-5, irrigated, and VIIe-0, nonirrigated; range site SA1.

**FeC—Feltham loamy sand, 4 to 8 percent slopes.** This gently sloping soil is on benches or alluvial terraces.

Included with this soil in mapping are small areas of active sand dunes and areas of Tindahay, Quincy, Escalante, and Chedehap soils.

Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used for irrigated potatoes, small grain, alfalfa, and pasture. Capability units IVE-5, irrigated, and VIIe-0, nonirrigated; range site SA1.

**FLF—Feltham loamy sand, undulating.** This soil is on wind-worked alluvial terraces. Slopes range from 2 to 12 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of active sand dunes and areas of Escalante, Tindahay, Quincy, and Chedehap soils.

Runoff is slow, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is high.

This soil is used only for range. Capability unit VIIe-0, nonirrigated; range site SA1.

### Firth Series

The Firth series consists of somewhat poorly drained soils on terraces and in stream bottoms. These soils formed in alluvium. Slopes are 0 to 2 percent. Elevation ranges from 4,700 to 5,350 feet. Dominant vegetation is dense grasses. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 44° to 47° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark-gray and gray fine sandy loam about 17 inches thick. The underlying material is light gray. It is fine sandy loam to a depth of 35 inches, sandy loam between depths of 35 and 45 inches, and very gravelly coarse sandy loam below this to a depth of 60 inches. The profile is moderately alkaline and limy throughout.

Permeability is moderate, and available water capacity is moderate. The effective rooting depth is more than 60 inches but is restricted by the seasonal high water table, which is at a depth of 24 to 40 inches.

These soils are used mainly for range. Small areas are used for irrigated pasture, small grain, and hay.

Representative profile of Firth fine sandy loam, is SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 33, T. 4 S., R. 33 E.:

- A11—0 to 3 inches, dark-gray (2.5Y 4/1) fine sandy loam, black (10YR 2/1) moist; weak, medium, platy structure parting to weak, very fine, granular; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; slightly calcareous; mildly alkaline; abrupt, smooth boundary.
- A12—3 to 9 inches, gray (2.5Y 5/1) fine sandy loam, very dark gray (2.5Y 3/1) moist; few, fine, faint, brown (10YR 5/3) mottles, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; clear, smooth boundary.
- A13—9 to 17 inches, gray (2.5Y 5/1) fine sandy loam, very dark gray (2.5Y 3/1) moist; few, fine, faint, pale-brown (10YR 6/3) mottles, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.
- C1—17 to 35 inches, light-gray (2.5Y 6/1) fine sandy loam, dark gray (2.5Y 4/1) moist; few, fine, faint, pale-brown (10YR 6/3) mottles, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; common very fine, fine, and medium roots; many very fine tubular pores; moderately calcareous; moderately alkaline; gradual, wavy boundary.
- IIC2—35 to 45 inches, light-gray (2.5Y 6/1) sandy loam, dark gray (2.5Y 4/1) moist; few, fine, faint, brown (10YR 5/3) mottles, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine tubular pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.
- IIC3—45 to 60 inches, light-gray (2.5Y 6/1) very gravelly coarse sandy loam, dark gray (2.5Y 4/1) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; 60 percent gravel; moderately calcareous, thin lime coatings on gravel; moderately alkaline.

The A horizon is dark gray or dark grayish brown and ranges from 12 to 17 inches in thickness. The very gravelly coarse sandy loam layer is below a depth of 40 inches.

**Fr—Firth fine sandy loam.** This nearly level soil is on alluvial terraces and bottoms of stream valleys.

Included with this soil in mapping are small areas of soils that have a seasonal high water table at the surface and small areas of soils that are strongly affected by salt and alkali. Also included are small areas of Heiseton, Parehat, Snake, and Peteetneet soils.

Runoff is very slow, and the hazard of erosion is slight or none.

This soil is used mainly for range. Small areas are used for irrigated small grain, hay, and pasture. Capability units IIw-2, irrigated, and IVw-9, nonirrigated; range site SB8.

## Fury Series

The Fury series consists of poorly drained soils along stream bottoms. These soils formed in alluvium. Slopes range from 0 to 4 percent but are mainly less than 1 percent. Elevation ranges from 5,000 to 6,500 feet. Dominant vegetation is dense grasses. The mean annual precipitation is 11 to 15 inches, the mean annual soil temperature is 45° to 47° F, and the frost-free season is 80 to 100 days.

In a representative profile the upper part of the surface layer is dark-gray silt loam about 3 inches thick. The lower part is very dark gray and dark-gray silty clay loam to a depth of 25 inches, and below this it is gray silty clay loam to a depth of 60 inches. The profile is leached of lime and is mottled throughout.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is more than 60 inches but is restricted somewhat by the seasonal high water table, which is at a depth of 24 to 40 inches.

These soils are used for range.

Representative profile of Fury silt loam, in SW $\frac{1}{4}$  NE $\frac{1}{4}$  NE $\frac{1}{4}$  sec. 28, T. 5 S., R. 36 E.:

- A11—0 to 3 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) moist; common, fine, distinct, brown (10YR 5/3) stains around root channels; weak, thin, platy structure parting to strong, fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; neutral; clear, smooth boundary.
- A12—3 to 10 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; common, fine, distinct, brown (10YR 5/3) and pale-brown (10YR 6/3) mottles, dark brown (10YR 4/3) moist, mainly as stains around root channels; weak, thin, platy structure parting to moderate, fine, granular; hard, friable, sticky and plastic; common very fine and fine roots; many very fine tubular pores; neutral; gradual, wavy boundary.
- A13g—10 to 15 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; few, fine, distinct, brown (7.5YR 5/4) and pale-yellow (2.5Y 7/4) mottles, dark brown (7.5YR 4/4) and yellowish brown (10YR 5/4) moist; weak, medium, prismatic structure parting to moderate, very fine, subangular blocky and medium granular; hard, friable, sticky and plastic; few roots; many very fine and fine tubular pores; neutral; gradual, wavy boundary.
- A14g—15 to 25 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; common, fine, distinct, brown (10YR 4/3) and dark grayish-brown (10YR 4/2) mottles, very dark brown (10YR 2/2) moist; few, fine, distinct, light yellowish-brown (10YR 6/4) mottles, brown (10YR 4/3) moist; weak, medium, prismatic structure parting to moderate, very fine and fine, subangular blocky; hard; friable, sticky and plastic; few roots; many very fine and fine and few medium tubular pores; few uncoated silt grains on vertical surfaces of prisms; neutral; gradual, wavy boundary.
- A15g—25 to 43 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; many, fine, distinct, brown (7.5YR 5/4 and 7.5YR 4/2) and dark grayish-brown (10YR 4/2) mottles, dark brown (7.5YR 3/2) and very dark brown (7.5YR 2/2 and 10YR 2/2) moist; weak, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; very hard, friable, sticky and plastic; few roots; many very fine and fine tubular pores; common uncoated silt grains on vertical surfaces of prisms; neutral; gradual, wavy boundary.
- A16g—43 to 60 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; common, fine, distinct, brown (7.5YR 4/3) and dark grayish-brown (10YR 4/2) mottles, very dark brown (7.5YR 2/2 and 10YR 2/2) moist; weak, medium, prismatic structure parting to weak, medium and coarse, subangular blocky; very hard, firm, sticky and plastic; few roots; many very fine and fine tubular pores; common uncoated silt grains on vertical surfaces of prisms; neutral.

The A11 horizon is dark gray or very dark gray. Some areas have sand and gravel below a depth of 40 inches.

**FU—Fury silt loam.** This nearly level and gently sloping soil is on stream bottoms and in drainageways.

Included with this soil in mapping are small areas of soils that have a gravelly or cobbly surface layer and areas of Zunhall, Tahquats, and Parehat soils.

Runoff is slow or ponded, and the hazard of erosion is slight.

This soil is used for range. Capability unit IVw-9, nonirrigated; range site SB8.

## Heiseton Series

The Heiseton series consists of moderately well drained soils on bottom lands along the Snake River. These soils formed in alluvium. Slopes are 0 to 2 percent. Elevation ranges from 4,350 to 4,400 feet. Dominant vegetation is grasses. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 45° to 47° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish-brown and light brownish-gray fine sandy loam about 4 inches thick. The underlying material is stratified, light brownish-gray and light-gray fine sandy loam, loam, sandy loam, and silty clay loam to a depth of 60 inches. The soil is moderately alkaline and limy throughout.

Permeability is moderately rapid, and available water capacity is high. The effective rooting depth is more than 60 inches. These soils are flooded in spring during periods of runoff.

These soils are used mainly for range. Small areas are used for irrigated potatoes, sugar beets, small grain, hay, and pasture.

Representative profile of Heiseton fine sandy loam, 1,000 feet north, 2,350 feet west of southeast corner of sec. 27, T. 4 S., R. 33 E.:

A11—0 to 2 inches, grayish-brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak, thin, platy structure parting to moderate, very fine and fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

A12—2 to 4 inches, light brownish-gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thin, platy structure parting to weak, fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

C1—4 to 7 inches, light brownish-gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium and coarse, subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

C2—7 to 14 inches, light brownish-gray (10YR 6/2) light loam, dark grayish brown (10YR 4/2) moist; weak, medium and fine, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

C3—14 to 25 inches, light brownish-gray (10YR 6/2) light sandy loam, dark grayish brown (10YR 4/2) moist;

few, fine, faint, brown (10YR 5/3) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

C4—25 to 35 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline; abrupt, wavy boundary.

C5—35 to 46 inches, light-gray (10YR 6/1) light silty clay loam, dark gray (2.5Y 4/1) moist; weak, fine, subangular blocky structure; hard, firm, sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; moderately calcareous, few fine veins and spots of lime; moderately alkaline; abrupt, wavy boundary.

C6—46 to 60 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; few, fine, distinct, brown (10YR 5/3) mottles, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline.

The A horizon is slightly calcareous or moderately calcareous. The C horizon is predominantly fine sandy loam or sandy loam to a depth of 40 inches. Sand and gravel are at a depth of as little as 40 inches in some areas.

**He—Heiseton fine sandy loam.** This nearly level soil is on low terraces, mainly along the Snake River.

Included with this soil in mapping are small areas of soils that have a loam or silt loam surface layer or loam underlying material. Also included are small areas of soils that have sand and gravel at a depth of 20 to 40 inches and areas of Firth, Snake, and Parehat soils and Alluvial land and Riverwash.

Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly for range, but some areas are used for irrigated potatoes, small grain, and hay. Capability units IIw-2, irrigated, and VIw-1, nonirrigated; range site SII.

## Highams Series

The Highams series consists of excessively drained soils, mainly on mountains. These soils formed in residuum weathered from limestone. Slopes are 12 to 70 percent. Elevation ranges from 4,800 to 8,000 feet. Dominant vegetation is sparse grasses and shrubs. The mean annual precipitation is 11 to 15 inches, the mean annual soil temperature is 44° to 47° F, and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is light brownish-gray very gravelly loam about 9 inches thick. The underlying material is light-gray very gravelly heavy loam about 10 inches thick. It is underlain by dark-gray limestone at a depth of 19 inches. The profile is moderately alkaline and limy throughout.

Permeability is moderate, and available water capacity is very low. The effective rooting depth is 10 to 20 inches.

These soils are used mainly for range, but many areas cannot be grazed because the soils are too steep and have numerous coarse fragments. Such areas are used only for wildlife habitat, recreation, and watershed.

Representative profile of Highams very gravelly loam, steep, in SW  $\frac{1}{4}$  NW  $\frac{1}{4}$  sec. 26, T. 4 S., R. 36 E.:

A11—0 to 4 inches, light brownish-gray (2.5Y 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine vesicular pores; 50 percent dark-gray angular limestone gravel and some angular cobbles, limestone stained weak red (2.5Y 5/2) and yellowish brown (10YR 5/4); moderately calcareous; moderately alkaline; abrupt, smooth boundary.

A12—4 to 9 inches, light brownish-gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak, very fine and fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium and few coarse roots; many very fine interstitial and very fine tubular pores; 50 percent angular limestone gravel and some angular cobbles, stained weak red (2.5Y 5/2) and yellowish brown (10YR 5/4), 1-millimeter lime crusts on lower sides; few sandstone fragments; strongly calcareous; moderately alkaline; clear, wavy boundary.

C1—9 to 12 inches, light-gray (10YR 7/2) very gravelly heavy loam, brown (10YR 5/3) moist; weak, very fine, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium and few coarse roots; many very fine and fine tubular pores; 50 percent angular limestone gravel and some angular cobbles, weathered pale-yellow (2.5Y 7/3) outer edges and coated with 1 to 2 millimeters of lime on lower sides; strongly calcareous; moderately alkaline; clear, wavy boundary.

C2—12 to 16 inches, light-gray (10YR 7/2) very gravelly heavy loam, brown (10YR 5/3) moist; weak, very fine and fine, subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium and few coarse roots; many very fine and fine tubular pores; 50 percent angular gravel and cobbles, common lime coatings on lower half of fragments; very strongly calcareous; moderately alkaline; clear, wavy boundary.

C3—16 to 19 inches, light-gray (10YR 7/2) very gravelly heavy loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; about 55 percent dark-gray (N 4/0) angular limestone gravel and some angular cobbles, pale-yellow (2.5Y 7/3), light reddish-brown (5Y 6/4), and light yellowish-brown (10YR 6/4) weathered rinds, coated on lower half with a 1- to 3-millimeter lime crust; few fine black stains; very strongly calcareous; moderately alkaline; abrupt, wavy boundary.

R—19 to 30 inches, dark-gray (N 4/0) hard limestone, stained and weathered reddish brown (5YR 5/4) and reddish yellow (7.5YR 6/5); upper surface coated with 1 millimeter of lime; moderately alkaline.

The A1 horizon is slightly calcareous to strongly calcareous. The depth to limestone bedrock ranges from 10 to 20 inches.

**HGE—Highams very gravelly loam, hilly.** This soil is on south-facing exposures of mountains. Slopes range from 12 to 20 percent.

Included with this soil in mapping are small areas of soils that have slopes of less than 12 percent, areas of soils that have slopes of more than 20 percent, and small areas of rock outcrop. Also included are areas of Wahtigup, Hymas, Ridgecrest, and Neeley soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used only for range. Capability unit VIIe-0, nonirrigated; range site SW2.

**HGF—Highams very gravelly loam, steep.** This soil is on south-facing exposures of mountainous uplands. Slopes range from 20 to 55 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of less than 20 percent or areas of soils that have slopes of slightly more than 55 percent. Also included are areas of rock outcrop and areas of Wheeler, Wahtigup, Ridgecrest, and Hymas soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used for range. Capability unit VIIe-0, nonirrigated; range site ST2.

**HHF—Highams extremely stony loam, steep.** This soil is mainly on south-facing slopes in mountainous areas. Slopes range from 20 to 55 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is 3 to 15 percent stone-size fragments of limestone.

Included with this soil in mapping are small areas of rock outcrop and areas of soils that have slopes of more than 55 percent. Also included are small areas of Hymas, Ridgecrest, and Wahtigup soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is suited to wildlife habitat, recreation, and watershed. Capability unit VIIIs-1, nonirrigated; range site NU.

**HHG—Highams extremely stony loam, very steep.** This soil is in steep, mountainous areas. Slopes range from 55 to 70 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is 3 to 15 percent stones.

Included with this soil in mapping are small areas of soils that have slopes of more than 70 percent and areas of soils that have slopes of less than 55 percent. Also included are small areas of Wahtigup, Hymas, and Ridgecrest soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is suited to wildlife habitat, recreation, and watershed. Capability unit VIIIs-1, nonirrigated; range site NU.

## Hondoho Series

The Hondoho series consists of well-drained soils in mountainous areas. These soils formed in mixed loess and quartzite residuum. Slopes are 8 to 55 percent. Elevation ranges from 5,000 to 6,500 feet. Dominant vegetation is bunchgrasses. The mean annual precipitation is 13 to 15 inches, the mean annual soil temperature is 44° to 47° F, and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is dark grayish-brown very cobbly loam 8 inches thick over 4 inches of grayish-brown cobbly loam. The subsoil is pale-brown cobbly heavy loam about 4 inches thick. The underlying material is pale-brown cobbly heavy loam to a depth of 24 inches, pale-brown cobbly sandy clay loam between the depths of 24 and 36 inches, and

pale-yellow very cobbly sandy clay loam below this, to a depth of 60 inches. The profile is neutral to moderately alkaline. It is limy below a depth of 12 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is more than 60 inches.

These soils are used mainly for range. They are generally too cobbly or steep to be cultivated. Some areas are used for wildlife habitat, recreation, and watershed.

Representative profile of Hondoho very cobbly loam, hilly, in SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 24, T. 7 S., R. 33 E.:

- A11—0 to 8 inches, dark grayish-brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; weak, thin, platy structure in upper 2 inches and weak, medium, platy in lower part, parting to moderate, very fine and fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; few medium and coarse roots; many very fine interstitial pores; 60 percent white (7.5YR 8/1) and pale-brown (10YR 6/3) angular quartzite cobbles and gravel; neutral; clear, smooth boundary.
- A12—8 to 12 inches, grayish-brown (10YR 5/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to moderate, fine and very fine, subangular blocky and weak, fine and medium, granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine roots and few fine and medium tubular pores; 25 percent angular cobbles and gravel; mildly alkaline; clear, wavy boundary.
- B2—12 to 16 inches, pale-brown (10YR 6/3) cobbly heavy loam, brown (10YR 4/3) moist; many grayish-brown (10YR 5/2) krotovinas, pockets, and streaks, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to moderate, fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium and coarse roots; many very fine and few fine and medium tubular pores; few nodules that are weakly cemented with silicalime; 30 percent angular cobbles and gravel, mainly reddish-gray (5YR 5/2) quartzite coated on lower half with 1 millimeter to 2 millimeters of lime; moderately alkaline; gradual, wavy boundary.
- C1ca—16 to 24 inches, pale-brown (10YR 6/3) cobbly heavy loam, brown (10YR 5/3) moist; weak, medium, prismatic structure parting to moderate, fine and very fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; 35 percent cobbles and gravel coated with lime on lower sides; strongly calcareous, common large lime splotches, spots, and veins; moderately alkaline; gradual, wavy boundary.
- C2ca—24 to 36 inches, pale-brown (10YR 6/3) cobbly sandy clay loam, yellowish brown (10YR 5/4) moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles; massive; hard, friable, sticky and plastic; few very fine and fine roots; common very fine tubular pores; 40 percent slightly weathered angular quartzite cobbles and gravel coated with lime on lower sides; strongly calcareous, many lime splotches, spots, and veins; moderately alkaline; gradual, wavy boundary.
- C3ca—36 to 60 inches, pale-yellow (5Y 7/3) very cobbly sandy clay loam, pale olive (5Y 6/3) moist; few, fine, faint, light yellowish-brown (2.5Y 6/4) mottles; massive; hard, friable, sticky and plastic; no roots; common very fine tubular pores; 70 percent reddish-gray (5YR 5/2), white (5YR 8/1), and pale-red (10YR 6/2) angular quartzite cobbles, gravel, and stones; strongly calcareous, many large

lime splotches, spots, and veins; moderately alkaline.

Depth to bedrock ranges from 40 inches to more than 60 inches. The A11 horizon is grayish brown or dark grayish brown. The B horizon ranges from heavy loam to light clay loam and from pale brown to brown. Depth to the Cca horizon ranges from 14 to 30 inches. Coarse fragments make up as much as 70 to 90 percent of the material below a depth of 40 inches.

**HOF—Hondoho very cobbly loam, hilly.** This soil is on foot slopes in mountainous areas. Slopes range from 8 to 30 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of rock outcrop, areas of soils that have slopes of less than 8 percent, and areas of soils that have slopes of more than 30 percent. Also included are areas of Nagitsy, Neeley, and Wahtigup soils and small areas of soils that are less than 40 inches deep over bedrock.

Runoff is medium, and the hazard of erosion is high.

This soil is used for grazing. Capability unit VIIs-2, nonirrigated; range site SI2.

**HOG—Hondoho very cobbly loam, steep.** This soil is in mountainous areas. Slopes range from 30 to 55 percent.

Included with this soil in mapping are small areas of soils that have slopes of less than 30 percent and areas of soils that have fewer cobbles and gravel in the surface layer than this Hondoho soil. Also included are areas of Nagitsy and Wahtigup soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used for wildlife habitat, recreation, and watershed. Capability unit VIIIs-1, nonirrigated; range site NU.

## Hymas Series

The Hymas series consists of well-drained soils on mountainous uplands. These soils formed in residuum or colluvium weathered from limestone. Slopes are 4 to 70 percent. Elevation ranges from 5,000 to 6,500 feet. Dominant vegetation is shrubs and grasses. The mean annual precipitation is 12 to 16 inches, the mean annual soil temperature is 42° to 45° F, and the frost-free season is 70 to 90 days.

In a representative profile the surface layer is grayish-brown extremely stony loam about 9 inches thick. The underlying material is light brownish-gray gravelly loam to a depth of 16 inches and very pale brown very gravelly loam between the depths of 16 and 19 inches. It is underlain by gray limestone. The profile is moderately alkaline and limy throughout.

Permeability is moderate, and available water capacity is very low. The effective rooting depth is 10 to 20 inches.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed.

Representative profile of Hymas extremely stony loam, steep, in SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 6, T. 4 S., R. 38 E.:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; weak, thin, platy structure parting to strong, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; 20 percent

angular gravel and 15 percent angular stones and cobbles of limestone; moderately calcareous; moderately alkaline; clear, smooth boundary.

- A12—2 to 9 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine interstitial and very fine tubular pores; 20 percent angular gravel and 15 percent angular limestone cobbles and stones; moderately calcareous, bottoms of rock fragments coated with lime; moderately alkaline; clear, wavy boundary.
- C1—9 to 16 inches, light brownish-gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure parting to moderate, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; 30 percent angular gravel and some angular limestone cobbles; very strongly calcareous, lower sides of rock fragments coated with 3 or 4 millimeters of lime; moderately alkaline; clear, wavy boundary.
- C2—16 to 19 inches, very pale brown (10YR 8/3) very gravelly loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine tubular pores; 60 percent angular gravel and some angular cobbles of gray (7.5YR 5/1) limestone; fragments coated with lime; very strongly calcareous; moderately alkaline.
- R—19 to 25 inches, gray, fractured limestone.

The A horizon is grayish brown or dark grayish brown and ranges from 4 to 16 inches in thickness. The soil is moderately alkaline to strongly alkaline. Depth to bedrock ranges from 10 to 20 inches.

**HYG—Hymas extremely stony loam, steep.** This soil is on uplands in mountainous areas. Slopes range from 20 to 55 percent.

Included with this soil in mapping are small areas of soils that are more than 20 inches deep over bedrock and areas of outcrop. Also included are small areas of Highams, Wahtigup, Ridgecrest, and Nielsen soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used to a limited extent for range. It is also used for recreation, wildlife habitat, and watershed. Capability unit VII<sub>s</sub>—2, nonirrigated; range site SS3.

## Knull Series

The Knull series consists of well-drained soils on plains and terraces. These soils formed in loess or alluvium derived from loess. Slopes are 0 to 4 percent. Elevation ranges from 4,300 to 5,000 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 11 to 13 inches, the mean annual soil temperature is 48° to 50° F, and the frost-free season is 100 to 110 days.

In a representative profile the surface layer is grayish-brown silt loam about 7 inches thick. The subsoil is brown and very pale brown heavy silt loam to a depth of 16 inches. The underlying material is light-gray silt loam to a depth of 60 inches. The profile is mildly alkaline to a depth of 11 inches and moderately alkaline below that depth. It is limy below a depth of

7 inches. It has an accumulation of salt between depths of 11 and 40 inches.

Permeability is slow, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for range.

Representative profile of Knull silt loam, in NW $\frac{1}{4}$ , NW $\frac{1}{4}$ , sec. 5, T. 5 S., R. 36 E.:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; soft, very friable, non-sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; mildly alkaline; clear, smooth boundary.
- A12—2 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, very thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; few uncoated silt grains; mildly alkaline; clear, smooth boundary.
- A13—4 to 7 inches, grayish-brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; weak, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and few fine and medium tubular pores; few uncoated silt grains; mildly alkaline; abrupt, smooth boundary.
- B2t—7 to 11 inches, brown (10YR 5/3) heavy silt loam, dark brown (10YR 3/3) moist; common slightly darker coatings on peds; moderate, fine and very fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; a few krotovinas; thin patchy clay films on peds and moderately thick patchy clay films in pores; slightly calcareous; mildly alkaline; gradual, wavy boundary.
- B3tsa—11 to 16 inches, very pale brown (10YR 7/3) heavy silt loam, brown (10YR 4/3) moist; moderate, very fine and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; many firm and very firm nodules that are weakly cemented with silica-lime; few thin clay films on peds and thin patchy clay films in some pores; few fine white salt veins and spots; strongly calcareous; moderately alkaline; gradual, wavy boundary.
- C1casa—16 to 23 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; weak, medium and thick, platy structure parting to weak, fine, angular blocky; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; many hard, firm or very firm nodules that are weakly cemented with silica-lime and that slake in a solution of hydrochloric acid; strongly calcareous, few fine veins and spots of lime; moderately alkaline; gradual, wavy boundary.
- C2casa—23 to 40 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; common hard or very hard nodules that are weakly cemented with silica-lime; strongly calcareous, few lime veins; moderately alkaline; gradual, wavy boundary.
- C3—40 to 57 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few very fine tubular pores; strongly calcareous, few lime veins; moderately alkaline; gradual, wavy boundary.
- C4—57 to 60 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly

hard, very friable, nonsticky and nonplastic; few fine roots; few very fine tubular pores; moderately calcareous, few lime veins; strongly alkaline.

The A horizon is grayish brown to light brownish gray if not disturbed, but it is light brownish gray to a depth of 7 inches when crushed and mixed by cultivation. Depth to lime ranges from 5 to 15 inches. The profile is strongly calcareous at a depth of 8 to 20 inches.

**KN—Knull silt loam.** This nearly level and very gently sloping soil is on broad alluvial fans and upland plains.

Included with this soil in mapping are small slickspots that have no vegetation. Also included are small areas of Tickason, Penoyer, Paniogue, Neeley, and Pocatello soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for range. Capability unit VIIs-2, nonirrigated; range site SI2.

## Kucera Series

The Kucera series consists of well-drained soils on north- to northeast-facing side slopes. These soils formed in loess. Slopes are 12 to 30 percent. Elevation ranges from 4,500 to 5,200 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 13 to 15 inches, the mean annual soil temperature is 45° to 47° F, and the frost-free season is 100 to 115 days.

In a representative profile the surface layer is grayish-brown silt loam about 34 inches thick. The subsoil is pale-brown silt loam and extends to a depth of 59 inches. The underlying material is pale-brown silt loam to a depth of 65 inches. The profile is mildly alkaline to a depth of 7 inches and moderately alkaline below that depth. It is free of lime to a depth of 34 inches, slightly limy between depths of 34 and 59 inches, and moderately limy below a depth of 59 inches.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for range.

Representative profile of Kucera silt loam, 12 to 30 percent slopes, in NE $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 20, T. 2 S., R. 37 E.:

A11—0 to 7 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, very thin, platy structure in upper 2 inches, weak, thick, platy structure in lower 5 inches parting to weak, very fine, granular; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; mildly alkaline; clear, smooth boundary.

A12—7 to 16 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, very fine, granular; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; moderately alkaline; gradual, wavy boundary.

A13—16 to 34 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, very fine, granular; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; moderately alkaline; gradual, wavy boundary.

B21—34 to 48 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to weak, medium and

coarse, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; few very hard nodules that are weakly cemented with silica-lime; slightly calcareous, common fine spots and veins of lime; moderately alkaline; gradual, wavy boundary.

B22—48 to 59 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to weak, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and few fine tubular pores; few very hard nodules that are weakly cemented with silica-lime; slightly calcareous, a few fine spots and veins of lime; moderately alkaline; clear, wavy boundary.

Cca—59 to 65 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; moderately calcareous, many fine veins and some blotches and coatings of lime; moderately alkaline.

The A horizon is 17 to 36 inches thick. The soil is noncalcareous to a depth of 25 to 43 inches.

**KUE—Kucera silt loam, 12 to 30 percent slopes.** This strongly sloping and moderately steep soil is in long, relatively narrow areas on loess-mantled, dissected plateaus.

Included with this soil in mapping are small areas of soils that have slopes of less than 12 percent or areas of soils that have slopes of more than 30 percent. Also included are areas of Pocatello, Wheeler, Neeley, and Robin soils.

Runoff is medium, and the hazard of erosion is high.

This soil is used mainly for range. Capability unit VIe-1, nonirrigated; range site SI2.

## Lanoak Series

The Lanoak series consists of well-drained soils on high alluvial fans and dissected plateaus. These soils formed in loess. Slopes are 0 to 30 percent. Elevation ranges from 5,000 to 6,500 feet. Dominant vegetation is bunchgrasses, shrubs, and scattered aspen. The mean annual precipitation is 15 to 17 inches, the mean annual soil temperature is 42° to 47° F, and the frost-free season is 80 to 95 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 22 inches thick. The subsoil is brown and pale-brown heavy silt loam and extends to a depth of 57 inches. The underlying material is light-gray silt loam to a depth of 60 inches. The profile ranges from slightly acid in the surface layer to mildly alkaline in the underlying material. It is limy below a depth of 48 inches.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used for dryfarmed small grain and for range.

Representative profile of Lanoak silt loam, 4 to 12 percent slopes, in SW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 4, T. 6 S., R. 36 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate, very fine and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots;

many very fine interstitial pores and few very fine and fine tubular pores; slightly acid; abrupt, smooth boundary.

- A12—7 to 16 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; a few half-inch spots of grayish brown (10YR 5/2); weak, coarse, prismatic structure parting to weak, fine, subangular blocky and moderate, fine and medium, granular; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular pores; a few uncoated silt grains; slightly acid; gradual, wavy boundary.
- A13—16 to 22 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, medium, prismatic structure parting to moderate, medium and fine, subangular blocky and weak, medium and fine, granular; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; a few uncoated silt grains; neutral; gradual, wavy boundary.
- B21t—22 to 29 inches, brown (10YR 5/3) heavy silt loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to moderate, fine, subangular blocky and weak, medium, granular; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine tubular pores; many uncoated silt grains on vertical surfaces of peds; common, thin, patchy clay films on peds and nearly continuous clay films in some pores; neutral; gradual, smooth boundary.
- B22t—29 to 38 inches, brown (10YR 5/3) heavy silt loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure parting to moderate, fine, subangular blocky and weak, medium, granular; very hard, friable, slightly sticky and plastic; few very fine and fine roots; many very fine and few fine tubular pores; many uncoated silt grains, mainly on vertical surfaces of peds; common, thin, patchy clay films on peds and in pores; neutral; clear, smooth boundary.
- B23t—38 to 48 inches, brown (10YR 5/3) heavy silt loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to moderate, fine and medium, subangular blocky; very hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and few fine tubular pores; few uncoated silt grains on vertical ped surfaces; common thin clay films on peds and in pores; one thin, wavy, yellowish-brown (10YR 5/4), clayey lamella; neutral; clear, smooth boundary.
- B3—48 to 57 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak, fine and medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and few fine tubular pores; a few thin clay films on peds and in channels; some pockets of moderately calcareous material, common lime veins and spots; mildly alkaline; gradual, wavy boundary.
- Cca—57 to 60 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; very few very fine roots; many very fine tubular pores; a few firm nodules 2 millimeters in diameter; strongly calcareous, common very fine spots and few blotches of lime; mildly alkaline.

The A horizon is 10 to 32 inches thick, and the B horizon is 20 to 40 inches thick. The C horizon is below a depth of 40 inches. It is moderately calcareous to strongly calcareous.

**LAB—Lanoak silt loam, 0 to 4 percent slopes.** This nearly level and very gently sloping soil is on tops of ridges on alluvial fans and plateaus.

Included with this soil in mapping are small areas

of soils that have slopes of more than 4 percent and small areas of Rexburg and Neeley soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for dryfarmed small grain and for range. Capability unit IIIc-4, nonirrigated; range site SI3.

**LAC—Lanoak silt loam, 4 to 12 percent slopes.**

This gently sloping and moderately sloping soil is on high fans or plateaus or both. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of very gently sloping soils and areas of Rexburg and Neeley soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for dryfarmed small grain. Some areas are used for range. Capability unit IIIe-4, nonirrigated; range site SI3.

**LAE—Lanoak silt loam, 12 to 20 percent slopes.**

This strongly sloping soil is on hilly uplands or on mountain foot slopes.

Included with this soil in mapping are small areas of Rexburg, Robin, and Buckskin soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for dryfarmed small grain and for range. Capability unit IIIe-4, nonirrigated; range site SI3.

**LAF—Lanoak silt loam, hilly.** This soil is in foot hills of mountains. Slopes range from 8 to 30 percent, but they are generally 20 to 30 percent in cultivated areas.

Included with this soil in mapping are small areas of Robin, Rexburg, and Neeley soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is mostly used for range. It is also suited to dryfarmed small grain. Capability unit IIIe-4, nonirrigated; range site SI3.

## McDole Series

The McDole series consists of well-drained soils on alluvial fans. These soils formed in alluvium derived from loess. Slopes are 0 to 12 percent. Elevation ranges from 4,700 to 5,200 feet. Dominant vegetation is bunchgrasses and shrubs. The mean annual precipitation is 11 to 14 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season is 100 to 115 days.

In a representative profile the surface layer is grayish-brown silt loam about 10 inches thick. The underlying material is light brownish-gray silt loam to a depth of 60 inches. The soil is moderately alkaline to a depth of 41 inches and strongly alkaline below that depth. It is limy throughout.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. They are also used for dryfarmed grain and for range.

Representative profile of McDole silt loam, 0 to 2 percent slopes, in NW $\frac{1}{4}$ , NE $\frac{1}{4}$  sec. 17, T. 2 S., R. 37 E.:

Ap—0 to 5 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium and thin, platy structure parting to weak,

very fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine interstitial pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

A12—5 to 10 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline; clear, smooth boundary.

C1—10 to 17 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine and few fine tubular pores; moderately alkaline; clear, smooth boundary.

C2—17 to 41 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; a few hard nodules that are weakly cemented with silica-lime; moderately calcareous, few fine veins and spots of lime in the lower 5 inches; moderately alkaline; clear, smooth boundary.

C3—41 to 60 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; very few roots; many very fine tubular pores; moderately calcareous, few lime veins; strongly alkaline.

The A horizon is grayish brown or dark brownish-gray and is slightly calcareous or moderately calcareous. The C horizon ranges from light brownish gray to white.

**MDa—McDole silt loam, 0 to 2 percent slopes.** This nearly level soil is on alluvial fans adjacent to loess-mantled uplands. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 2 percent and small areas of Tickason, Penoyer, Wheeler, and Pocatello soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIC-2, irrigated; not assigned to a range site.

**MEB—McDole silt loam, 0 to 4 percent slopes.** This nearly level and very gently sloping soil is on alluvial fans or in stream valleys adjacent to loess-mantled uplands.

Included with this soil in mapping are small areas of soils that have a gravelly surface layer and small areas of Penoyer, Tickason, Wheeler, and Pocatello soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for dryfarmed small grain, but production is low. The soil is also used for range. Capability unit IVc-45, nonirrigated; range site SI2.

**MEC—McDole silt loam, 4 to 12 percent slopes.** This gently sloping and moderately sloping soil is on alluvial fans adjacent to loess-mantled uplands.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent and small areas of Wheeler, Pocatello, and Penoyer soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryfarmed small grain and for

range. Capability unit IVE-45, nonirrigated; range site SI2.

## Mooahoo Series

The Mooahoo series consists of well-drained soils on north-facing side slopes of mountains. These soils formed mainly in residuum derived from sedimentary rock, but they have some loess in the upper part of the profile. Slopes are 8 to 55 percent. Elevation ranges from 6,500 to 8,500 feet. Dominant vegetation is Douglas-fir and associated vegetation. The mean annual precipitation is 17 to 25 inches, the mean annual soil temperature is 35° to 42° F, and the frost-free season is 30 to 50 days.

In a representative profile 21½ inches of organic matter is on the surface. The surface layer is dark grayish-brown and brown gravelly silt loam about 11 inches thick. The underlying material is brown gravelly silt loam to a depth of 20 inches, and below this it is pale-brown gravelly loam and very gravelly loam to a depth of 56 inches. It is underlain by quartzite bedrock. The profile is leached of lime and is strongly acid throughout.

Permeability is moderate, and available water capacity is moderate. The effective rooting depth is 40 to 60 inches.

These soils are used for range, wildlife habitat, recreation, and watershed.

Representative profile of Mooahoo gravelly silt loam in an area of Mooahoo-Dranyon association, steep, in NE¼,NW¼ sec. 29, T. 5 S., R. 37 E.:

O11—2.5 inches to 1.5 inch, slightly decomposed needles, roots, leaves, and stems; medium acid; abrupt, wavy boundary.

O12—1.5 inch to 0, dark-gray (10YR 4/1) moderately decomposed needles, roots, leaves, and stems, very dark brown (10YR 1/2) moist; fibrous; slightly matted; medium acid; abrupt, wavy boundary.

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) moist; weak, very fine, crumb structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse and very coarse roots; many very fine interstitial pores; 15 percent angular quartzite gravel and cobbles; strongly acid; abrupt, smooth boundary.

A12—2 to 6 inches, brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) moist; weak, very fine and fine, crumb structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse and very coarse roots; many very fine and fine tubular pores; 15 percent angular gravel and 5 percent cobbles; strongly acid; clear, wavy boundary.

A13—6 to 11 inches, brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) moist; weak, very fine, crumb structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse and very coarse roots; many fine and very fine tubular pores; 20 percent angular quartzite gravel and 5 percent cobbles; strongly acid; clear, wavy boundary.

C1—11 to 20 inches, brown (10YR 5/3) gravelly silt loam, dark brown (10YR 4/3) moist; weak, very fine, crumb structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium, coarse, and very coarse roots; many fine and very fine tubular pores; 20 percent angular quartzite gravel and 5 percent cobbles; strongly acid; clear, wavy boundary.

C2—20 to 28 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium, coarse, and very coarse roots; many fine and very fine tubular pores; 40 percent angular gravel, cobbles, and stones of quartzite; strongly acid; gradual, wavy boundary.

C3—28 to 56 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine, medium, and coarse roots; common very fine tubular pores; 50 percent angular quartzite gravel and some cobbles and stones; strongly acid; abrupt, irregular boundary.

R—56 to 70 inches, fractured quartzite.

The content of coarse fragments generally increases as depth to bedrock increases. Bedrock is at a depth of 40 to 60 inches. The A horizon ranges from 7 to 22 inches in thickness. The A11 horizon is dark grayish brown to brown.

**MHF—Moohoo-Dranyon association, hilly.** This association has slopes of 8 to 30 percent. It is about 40 percent Moohoo gravelly silt loam and 30 percent Dranyon silt loam.

The moderately steep Moohoo soil is on north-facing side slopes. Vegetation is dominantly Douglas-fir and associated plants. The moderately sloping and strongly sloping Dranyon soil is generally on north-facing side slopes, but a few moderately sloping areas are on south-facing side slopes. Vegetation is dominantly quaking aspen.

Included with this association in mapping, and making up about 30 percent of mapped areas, are areas of rock outcrop, areas of soils that are very stony, areas of soils that are less than 40 inches deep over bedrock, and small areas of Fury soils in open meadows. Also included are small areas of Nagitsy, Nielsen, and Pavahroo soils.

Runoff is rapid on the soils of this association. The hazard of erosion is high to very high.

This association is used chiefly for range. It is also used for production of wood crops, wildlife habitat, recreation, and watershed. Moohoo soil in capability unit VIe-1, nonirrigated; Dranyon soil in capability unit IIIe-9, nonirrigated; both soils in range site MP4.

**MHG—Moohoo-Dranyon association, steep.** This association has slopes of 30 to 55 percent. It is about 50 percent Moohoo gravelly silt loam and 20 percent Dranyon silt loam.

The Moohoo soil is on north-facing side slopes. A Moohoo soil in this association has the profile described as representative of the series. The Dranyon soil is less sloping than the Moohoo soil and is on south-facing side slopes.

Included with this association in mapping are areas of rock outcrop, areas of soils that are very stony, and areas of soils that are less than 40 inches deep over bedrock. Also included are small areas of Nagitsy, Nielsen, and Pavohroo soils.

Runoff is rapid on the soils of this association. The hazard of erosion is very high.

This association is used chiefly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIIe-0, nonirrigated; range site NE4.

## Nagitsy Series

The Nagitsy series consists of well-drained soils on hilly and mountainous uplands. These soils formed in residuum and colluvium derived from quartzite. Slopes are 4 to 55 percent. Elevation ranges from 6,000 to 8,500 feet. Dominant vegetation is shrubs and bunchgrasses. The mean annual precipitation is 15 to 20 inches, the mean annual soil temperature is 38° to 43° F, and the frost-free season averages 30 to 50 days.

In a representative profile the surface layer is dark grayish-brown and brown gravelly loam about 23 inches thick. The subsoil is brown very gravelly loam about 11 inches thick. It is underlain by quartzite bedrock at a depth of about 34 inches. The profile is slightly acid and is leached of lime.

Permeability is moderate, and available water capacity is low. The effective rooting depth is 20 to 40 inches.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed.

Representative profile of Nagitsy gravelly loam, hilly, in NW¼, NW¼, sec. 33, T. 5 S., R. 37 E.:

A11—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak, thin, platy structure in upper 3 inches, strong, very fine and fine, granular structure below; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; 25 percent angular quartzite gravel that is white (10YR 8/1 and 5YR 8/1) with exterior surfaces stained light reddish brown (5YR 6/4); slightly acid; clear, smooth boundary.

A12—7 to 13 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to strong, fine, medium, and very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial and common very fine tubular pores; 35 percent angular quartzite gravel; slightly acid; clear, wavy boundary.

A3—13 to 23 inches, dark grayish-brown (10YR 4/2) and brown (7.5YR 5/3) gravelly loam, very dark brown (10YR 2/2) and dark brown (7.5YR 3/2) moist; weak, medium, prismatic structure parting to weak, very fine and fine, subangular blocky and moderate, medium, fine, and very fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine tubular pores; 25 percent angular quartzite gravel; slightly acid; clear, wavy boundary.

B2—23 to 34 inches, brown (7.5YR 5/3) very gravelly heavy loam, dark brown (7.5YR 3/3) moist; weak, fine, subangular blocky structure parting to moderate, fine, medium, and very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine tubular pores; 50 percent gravel; slightly acid; abrupt, irregular boundary.

R—34 to 40 inches, white (5YR 8/1) slightly weathered, fractured quartzite, stained inward 1 millimeter and in cracks with light reddish brown (5YR 6/4) and some reddish yellow (5YR 6/6); slightly acid.

Depth to bedrock ranges from 20 to 40 inches. The A horizon is grayish brown or dark grayish brown and ranges from 16 to 25 inches in thickness.

**NAF—Nagitsy gravelly loam, hilly.** This soil is on mountain foot slopes and mountainous uplands. Slopes

range from 8 to 30 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 30 percent, small areas of soils that have a stony surface layer, and areas of rock outcrop. Also included are areas of Nielsen, Pandoah, Tahquats, and Moohoo soils.

Runoff is medium, and the hazard of erosion is high.

This soil is used mainly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIe-1, nonirrigated; range site SI3.

**NGF—Nagitsy very gravelly loam, 4 to 30 percent slopes.** This moderately sloping to moderately steep soil is on mountainous uplands. It has a profile similar to the one described as representative of the series, but the surface layer is very gravelly.

Included with this soil in mapping are small areas of soils that have slopes of more than 30 percent and small areas of soils that are stony. Also included are areas of Nielsen, Tahquats, and Lanoak soils.

Runoff is medium, and the hazard of erosion is high.

This soil is used mainly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIe-1, nonirrigated; range site RY3.

**NHF—Nagitsy-Nielsen extremely stony loams, hilly.** This complex is in mountainous areas, mainly in the vicinity of Mt. Putnam. Slopes range from 8 to 30 percent. The complex is about 50 percent Nagitsy extremely stony loam and 30 percent Nielsen extremely stony loam. The Nagitsy soil has a profile similar to the one described as representative of the series, but the surface layer is extremely stony. These soils are in such intricate patterns that it is not practical to map them separately.

Included with this complex in mapping are small areas of rock outcrop and areas of soils that have slopes of more than 30 percent. Also included are areas of Moohoo, Tahquats, and Dranyon soils.

Runoff is medium to rapid, and the hazard of erosion is moderate to very high.

These soils are used for range, wildlife habitat, recreation, and watershed. Capability unit VIIs-2, nonirrigated; range site RY3.

**NHG—Nagitsy-Nielsen extremely stony loams, steep.** This complex is in mountainous areas, mainly in the vicinity of Mt. Putnam. Slopes range from 30 to 55 percent. The complex is about 50 percent Nagitsy extremely stony loam and 30 percent Nielsen extremely stony loam. The Nagitsy soil has a profile similar to the one described as representative of the series, but the surface layer is extremely stony. These soils are in such intricate patterns that it is not practical to map them separately.

Included with this complex in mapping are small areas of soils that have a surface layer that is gravelly or stony, areas of rock outcrop, and areas of soils that have slopes of more than 55 percent. Also included are areas of Moohoo, Tahquats, and Dranyon soils.

Runoff is medium to very rapid, and the hazard of erosion is very high.

These soils are used for range, wildlife habitat, recreation, and watershed. Capability unit VIIs-2, nonirrigated; range site ST3.

## Neeley Series

The Neeley series consists of well-drained soils on uplands. These soils formed in calcareous loess. Slopes are 0 to 55 percent. Elevation ranges from 4,900 to 5,400 feet. Dominant vegetation is shrubs and bunchgrasses. The mean annual precipitation is 11 to 13 inches, the mean annual soil temperature is 48° to 50° F, and the frost-free season is 100 to 110 days.

In a representative profile the surface layer is grayish-brown and brown silt loam about 7 inches thick. The subsoil is pale-brown silt loam about 4 inches thick. The underlying material is light brownish-gray, light-gray, and pale-brown silt loam to a depth of 60 inches. The profile ranges from mildly alkaline in the surface layer to very strongly alkaline in the lower part. It is limy below a depth of 4 inches.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for range. Some areas are used for dryfarmed small grain and for wildlife habitat, recreation, and watershed.

Representative profile of Neely silt loam, rolling, 150 feet southwest of the center of sec. 3, T. 5 S., R. 37 E.:

A11—0 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, thin and medium, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; mildly alkaline; gradual, smooth boundary.

A12—4 to 7 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many very fine tubular pores; slightly calcareous in spots; moderately alkaline; gradual, smooth boundary.

B2—7 to 11 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3 and 10YR 4/2) moist; moderate, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline; clear, smooth boundary.

C1ca—11 to 17 inches, light brownish-gray (10YR 6/2) silt loam, brown (10YR 4/3) moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; common very hard firm nodules that are weakly cemented with silica-lime; strongly calcareous, common lime veins and spots and thin lime coating on nodules; moderately alkaline; clear, smooth boundary.

C2ca—17 to 33 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine tubular pores; many very hard firm nodules that are weakly cemented with silica-lime; strongly calcareous, common lime veins and splotches and thin lime coating around nodules; moderately alkaline; gradual, smooth boundary.

C3—33 to 44 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky, nonplastic; few fine roots; common very fine tubular pores; strongly calcareous; strongly alkaline; clear, wavy boundary.

C4—44 to 60 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very fri-

able, nonsticky and slightly plastic; few fine roots; many very fine tubular pores; moderately calcareous; very strongly alkaline.

The A horizon is 4 to 13 inches thick. The B horizon is pale brown or brown and is slightly calcareous or moderately calcareous. The Cca horizon is light brownish gray to white and is 10 to 38 inches thick.

**NLB—Neeley silt loam, 0 to 4 percent slopes.** This nearly level to gently sloping soil is on tops of benches or ridges; on undulating, loess-mantled high fans; or on dissected, low plateaus.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and small areas that are strongly affected by salt and alkali. Also included are small areas of Portneuf, Rexburg, and Lanoak soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for dryfarmed small grain and for range. Capability unit IVC-45, nonirrigated; range site SI2.

**NLC—Neeley silt loam, 4 to 12 percent slopes.** This gently sloping to moderately sloping soil is on loess-mantled fans and dissected plateaus.

Included with this soil in mapping are small areas of soils that have slopes of more than 12 percent, small areas of soils that are gravelly or stony, and small areas of soils that are strongly affected by salt and alkali. Also included are areas of Rexburg, Portneuf, Wheeler, and Hondoho soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryfarmed small grain and for range. Capability unit IVE-45, nonirrigated; range site SI2.

**NLE—Neeley silt loam, 12 to 20 percent slopes.** This strongly sloping soil is on south-facing exposures of loess-mantled plateaus.

Included with this soil in mapping are small areas of soils that have slopes of more than 20 percent and areas of soils that are strongly affected by salt and alkali. Also included are areas of Rexburg and Wheeler soils.

Runoff is rapid, and the hazard of erosion is very high.

The soil is used for dryfarmed small grain and for range. Capability unit VIe-1, nonirrigated; range site SI2.

**NLF—Neeley silt loam, rolling.** This soil is on loess-mantled fans and plateaus. Slopes range from 4 to 20 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 20 percent and areas of Portneuf, Rexburg, and Robin soils.

Runoff is medium on nonirrigated areas and rapid on irrigated areas. The hazard of erosion is moderate on nonirrigated areas and high on irrigated areas.

This soil is used mainly for range. Production of dryfarmed small grain is marginal because precipitation is low. Capability unit VIe-1, nonirrigated; range site SI2.

**NLG—Neeley silt loam, steep.** This soil is on south-facing side slopes on loess-mantled plateaus and alluvial fans. Slopes range from 30 to 55 percent.

Included with this soil in mapping are areas of Robin, Rexburg, and Wheeler soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used mainly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIIe-0, nonirrigated; range site ST2.

## Nielsen Series

The Nielsen series consists of well-drained soils on dissected plateaus and mountains. These soils formed in thin colluvium or residuum derived from sandstone or quartzite. Slopes are 8 to 70 percent. Elevation ranges from 5,500 to 8,500 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 15 to 17 inches, the mean annual soil temperature is 35° to 45° F, and the frost-free season is 30 to 50 days.

In a representative profile the surface layer is dark grayish-brown extremely stony loam and channery loam about 9 inches thick. The subsoil is brown and yellowish-brown channery loam and very channery loam about 10 inches thick. It is underlain by fractured sandstone at a depth of about 19 inches. The profile is leached of lime and is neutral.

Permeability is moderately slow, and available water capacity is very low. The effective rooting depth is 10 to 20 inches.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed. They are generally too steep or stony to be cultivated.

Representative profile of Nielsen extremely stony loam in an area of Nielsen extremely rocky loam, steep, in N½NE¼ sec. 29, T. 3 S., R. 38 E.:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) extremely stony loam, very dark brown (10YR 2/2) moist; weak, very thin, platy structure parting to moderate, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many, very fine, fine, and medium roots; many very fine interstitial pores; 25 percent angular gravel and stones; neutral; abrupt, smooth boundary.

A12—2 to 6 inches, dark grayish-brown (10YR 4/2) extremely stony loam, very dark brown (10YR 2/2) moist; weak, thin and medium, platy structure parting to moderate, very fine and fine, granular; slightly hard, friable, slightly sticky and slightly plastic; common, very fine, fine, and medium roots; many very fine and common fine tubular pores; 15 percent angular gravel and flagstones; neutral; abrupt, smooth boundary.

A3—6 to 9 inches, dark grayish-brown (10YR 4/2) channery loam, very dark brown (10YR 2/2) moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and few fine tubular pores; 20 percent angular sandstone fragments; thin patchy clay films in some pores; neutral; clear, wavy boundary.

B21t—9 to 13 inches, brown (10YR 5/3) channery loam, dark brown (10YR 3/3) moist; moderate, very fine and fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine and few fine tubular pores; thin patchy clay films on peds and in pores; 40 percent angular sandstone fragments; neutral; abrupt, wavy boundary.

B22t—13 to 19 inches, yellowish-brown (10YR 5/4) very

channery loam, dark yellowish brown (10YR 4/4) moist; moderate, fine and very fine, subangular blocky structure; hard, friable, sticky and plastic; few very fine, fine, and medium roots; many very fine and few fine and medium tubular pores; thin patchy clay films on peds and in pores; 75 percent angular sandstone fragments; neutral; abrupt, irregular boundary.

IIR—19 inches, very pale brown (10YR 7/4), partly weathered and fractured sandstone, yellowish brown (10YR 5/5) moist; mildly alkaline.

The A horizon is grayish brown or dark grayish brown. The B horizon is dark grayish-brown, brown, or yellowish-brown loam or light clay loam. Fractured quartzite or sandstone is at a depth of less than 20 inches.

**NMG—Nielsen extremely stony loam, very steep.** This soil is on mountains. Stones cover about 3 to 10 percent of the soil surface. Slopes range from 55 to 70 percent.

Included with this soil in mapping are small areas of rock outcrop and small areas of soils that are 20 to 40 inches deep over bedrock. Also included are small areas of Moohoo and Pandoah soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is better suited to use for wildlife habitat, recreation, and watershed than to most other uses. Capability unit VIIIs-1, nonirrigated; range site NU.

**NRF—Nielsen extremely rocky loam, steep.** This mapping unit is on mountainous uplands. Slopes range from 20 to 55 percent. It is about 65 percent Nielsen extremely stony loam and 25 percent rock outcrop. A Nielsen extremely stony loam in an area of this soil has the profile described as representative of the series.

Included with this unit in mapping are areas of soils that have a gravelly or very gravelly surface layer and areas of Nagitsy, Ridgecrest, Pandoah, Moohoo, and Robin soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used mainly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIIs-2, nonirrigated; range site SS3.

**NTF—Nielsen-Nagitsy extremely stony loams, steep.** This complex is in mountainous areas. Slopes are 20 to 55 percent. It is about 50 percent Nielsen extremely stony loam and 30 percent Nagitsy extremely stony loam. The moderately deep Nagitsy soil has a profile similar to the one described as representative of the series, but the surface layer is extremely stony. These soils are in such intricate patterns that it is not practical to map them separately.

Runoff is rapid, and the hazard of erosion is very high.

These soils are used mainly for wildlife habitat, recreation, and range. Capability unit VIIs-2, nonirrigated; range site SS3.

## Pandoah Series

The Pandoah series consists of well-drained soils on foothills and mountains. These soils formed in colluvium or residuum derived from sandstone. Slopes are 10 to 55 percent. Elevation ranges from 4,800 to 6,800 feet. Dominant vegetation is grasses, shrubs, and scattered juniper. The mean annual precipitation

is 11 to 12 inches, the mean annual soil temperature is 45° to 47° F, and the frost-free season is 100 to 110 days.

In a representative profile the surface layer is 3 inches of reddish-gray very cobbly loam over reddish-gray and reddish-brown channery loam to a depth of 16 inches. The underlying material is reddish-brown channery loam to a depth of 22 inches and reddish-brown very channery loam between the depths of 22 and 26 inches. It is underlain by sandstone bedrock. The profile is moderately alkaline and limy throughout.

Permeability is moderate, and available water capacity is low. The effective rooting depth is 20 to 40 inches.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed.

Representative profile of Pandoah very cobbly loam, steep, in NE¼ sec. 21, T. 3 S., R. 37 E., in Cold Creek Valley:

A11—0 to 3 inches, reddish-gray (5YR 5/2), very cobbly loam, dark reddish brown (5YR 3/2) moist; strong, fine and very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; 55 percent coarse fragments of reddish-brown (2.5YR 5/4) sandstone, ranging from angular gravel to stones in size; moderately calcareous; moderately alkaline; clear, wavy boundary.

A12—3 to 10 inches, reddish-gray (5YR 5/2) channery light loam, dark reddish brown (5YR 3/3) moist; moderate, fine and very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine tubular pores; 40 percent reddish-brown (2.5YR 5/4) coarse sandstone fragments; including channers and flagstones; moderately calcareous; rock fragments thinly coated with lime on the lower sides; moderately alkaline; clear, smooth boundary.

A13—10 to 16 inches, reddish-brown (5YR 5/3) channery light loam, dark reddish brown (5YR 3/3) moist; weak, medium, subangular blocky structure parting to weak, fine and medium, granular; slightly hard, very friable, slightly sticky and nonplastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; 35 percent coarse fragments, including channers and flagstones; moderately calcareous, few fine veins and spots of lime; rock fragments weakly coated with lime on the lower sides; moderately alkaline; clear, wavy boundary.

C1ca—16 to 22 inches, reddish-brown (5YR 5/3) channery light loam, dark reddish brown (5YR 3/3) moist; very weak, medium, subangular blocky structure parting to weak, very fine and fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; 45 percent reddish-brown (2.5YR 5/4), slightly calcareous, coarse sandstone fragments, which are moderately coated with lime on the lower sides; moderately calcareous, few fine lime veins and spots; moderately alkaline; clear, wavy boundary.

C2—22 to 26 inches, reddish-brown (5YR 5/3) very channery light loam, dark reddish brown (5YR 3/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few roots; many very fine tubular pores; 80 percent weak-red (10YR 4/3) coarse sandstone fragments, including channers, flagstones, and stones; moderately calcareous; lime coatings on lower sides of rock fragments; moderately alkaline; abrupt, broken boundary.

R—26 to 40 inches, weak-red (10R 4/3) sandstone, dusky red (10YR 3/3) moist; thin lime coatings on rock surfaces.

The A horizon ranges from 7 to 19 inches in thickness. The A11 horizon has moderate to strong granular structure. Bedrock is at a depth of 20 to 40 inches.

**PAF—Pandoah channery loam, hilly.** This soil is on south-facing side slopes of foot hills and mountains. Slopes range from 10 to 30 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is channery.

Included with this soil in mapping are small areas of soils that have slopes of more than 30 percent, areas of soils that have a gravelly surface layer, and areas of soils that are stony. Also included are areas of Nagitsy, Nielsen, and Rexburg soils.

Runoff is medium, and the hazard of erosion is high.

This soil is used mainly for range. Capability unit VIe-1, nonirrigated; range site SI2.

**PBG—Pandoah very cobbly loam, steep.** This soil is on mountainous uplands. Slopes range from 20 to 55 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have a gravelly surface layer, areas of rock outcrop, and areas of soils that have slopes of 55 to 70 percent. Also included are areas of Nielsen, Nagitsy, Highams, and Rexburg soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIIs-2, nonirrigated; range site SS3.

## Paniogue Series

The Paniogue series consists of well-drained soils on alluvial fans and terraces. These soils formed in calcareous alluvium. Slopes are 0 to 12 percent. Elevation ranges from 4,400 to 4,700 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 48° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish-brown and light brownish-gray loam about 7 inches thick. The subsoil is light brownish-gray silt loam about 11 inches thick. The underlying material is light-gray silt loam to a depth of 28 inches, white coarse sandy loam between the depths of 28 and 31 inches, light brownish-gray coarse sand between the depths of 31 and 47 inches, and variegated gravelly very coarse sand below this, to a depth of 60 inches. The profile is mildly alkaline to strongly alkaline. It is limy below a depth of 14 inches.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Some areas are used only for range.

Representative profile of Paniogue loam, 0 to 2 percent slopes, in sec. 14, T. 6 S., R. 32 E.:

A1—0 to 3 inches, grayish-brown (2.5Y 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, very

thin, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; mildly alkaline; abrupt, smooth boundary.

A3—3 to 7 inches, light brownish-gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; weak, very thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; few very fine tubular pores; mildly alkaline; abrupt, smooth boundary.

B2—7 to 14 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, medium and coarse, subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; mildly alkaline; abrupt, wavy boundary.

B3—14 to 18 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine tubular pores; slightly calcareous; moderately alkaline; clear, wavy boundary.

C1ca—18 to 28 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (10YR 5/2) moist; weak, medium and coarse, subangular blocky structure in upper part and massive in lower; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; lower part is 10 percent very hard nodules that are weakly cemented with silica-lime; 5 percent fine gravel; strongly calcareous, common splotches and few fine spots and veins of lime; moderately alkaline; abrupt, smooth boundary.

IIC2ca—28 to 31 inches, white (10YR 8/2) coarse sandy loam, light brownish gray (10YR 6/2) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; 5 percent fine gravel; strongly calcareous, many fine lime spots and coatings; moderately alkaline; abrupt, smooth boundary.

IIC3—31 to 47 inches, light brownish-gray (10YR 6/2) coarse sand, grayish brown (10YR 5/2) moist; single grained; loose, nonsticky and nonplastic; few very fine and coarse roots; 5 percent gravel; moderately calcareous; strongly alkaline; clear, wavy boundary.

IVC4—47 to 60 inches, variegated gravelly coarse sand; single grained; loose; few very fine roots; 20 percent fine gravel; pebbles slightly lime-coated on lower side; slightly calcareous; strongly alkaline.

The A1 horizon is grayish-brown or light brownish-gray loam or gravelly loam. Depth to the strongly calcareous Cca horizon ranges from 12 to 20 inches. Depth to sand and gravel ranges from 20 to 40 inches.

**PeA—Paniogue loam, 0 to 2 percent slopes.** This nearly level soil is on broad alluvial terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that are strongly affected by salt and alkali, areas of soils that have slopes of more than 2 percent, and small areas of soils that have a gravelly or cobbly surface layer. Also included are areas of Declo, Broncho, and Tickason soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, alfalfa, and pasture. Capability unit IIS-1, irrigated; not assigned to a range site.

**PeB—Paniogue loam, 2 to 4 percent slopes.** This

very gently sloping soil is on alluvial fans and low terraces.

Included with this soil in mapping are small areas of soils that have a gravelly surface layer and areas of soils that have slopes of more than 4 percent. Also included are small areas of Declo, Broncho, and Tickason soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIe-1, irrigated; not assigned to a range site.

**PeC—Paniogue loam, 4 to 8 percent slopes.** This gently sloping soil is on alluvial fans and low terraces.

Included with this soil in mapping are small areas of soils that have a gravelly surface layer, and these areas, where extensive, are indicated on the soil map by the symbol for gravel. Also included are small areas of soils that are strongly affected by salt and alkali and areas of Declo, Tickason, Broncho, and Escalante soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIIe-1, irrigated; not assigned to a range site.

**PeD—Paniogue loam, 8 to 12 percent slopes.** This moderately sloping soil is on low alluvial terraces.

Included with this soil in mapping are small areas of gravelly soils and areas of Declo, Broncho, and Escalante soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for irrigated small grain, hay, and pasture. Capability unit IVe-1, irrigated; not assigned to a range site.

**PfA—Paniogue loam, saline-alkali, 0 to 2 percent slopes.** This nearly level soil is on ridges of fans and terraces. It has a profile similar to the one described as representative of the series, but about 65 percent of the area of this soil is slightly affected by salt and alkali, and about 25 percent in concave areas is moderately affected.

Included with this soil in mapping are small areas of soils that are cobbly and areas of Broncho, Declo, and Tickason soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IVs-8, irrigated; not assigned to a range site.

**PfB—Paniogue loam, saline-alkali, 2 to 4 percent slopes.** This very gently sloping soil is on alluvial fans. It has a profile similar to the one described as representative of the series, but about 65 percent of the area of this soil is slightly affected by salt and alkali, and about 25 percent is moderately affected. In the areas that are moderately affected, the subsoil is moderately slowly permeable.

Included with this soil in mapping are small areas of Tickason, Declo, and Escalante soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, and small grain. Capability unit IVs-8, irrigated; not assigned to a range site.

**PfC—Paniogue loam, saline-alkali, 4 to 8 percent slopes.** This gently sloping soil is on alluvial fans and terraces. It has a profile similar to the one described as representative of the series, but about 70 percent of the area of this soil is slightly affected by salt and alkali, and about 20 percent is moderately affected. In the areas that are moderately affected, the subsoil is moderately slowly permeable.

Included with this soil in mapping are small areas of Tickason, Declo, and Escalante soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IVe-1, irrigated; not assigned to a range site.

**PgA—Paniogue loam, strongly alkali, 0 to 2 percent slopes.** This nearly level soil occupies alluvial fans and terraces. It has a profile similar to the one described as representative of the series, but it is strongly affected by alkali, and the subsoil is very strongly alkaline.

Included with this soil in mapping are areas of other Paniogue soils that are not alkaline; they make up 30 percent of mapped areas. Also included are areas of Broncho, Tickason, and Declo soils and small gravelly areas.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for range. Capability unit VIIs-2, nonirrigated; range site SL8.

**PhA—Paniogue gravelly loam, 0 to 2 percent slopes.** This nearly level soil is in long, narrow areas on tops of alluvial terraces. It has a profile similar to the one described as representative of the series, but the surface layer is gravelly.

Included with this soil in mapping are small areas of soils that are cobbly and small areas of Broncho, Declo, and Escalante soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated small grain, hay, and pasture. Capability unit IIs-1, irrigated; not assigned to a range site.

**PhB—Paniogue gravelly loam, 2 to 4 percent slopes.** This very gently sloping soil is on alluvial fans and terraces. It has a profile similar to the one described as representative of the series, but the surface layer is gravelly.

Included with this soil in mapping are small areas of soils that have a cobbly surface layer and small areas of Broncho, Escalante, and Declo soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated small grain, hay, and pasture. Capability unit IIe-1, irrigated; not assigned to a range site.

## Parehat Series

The Parehat series consists of somewhat poorly drained and poorly drained soils on low terraces and along stream bottoms. These soils formed in alluvium. Slopes are 0 to 2 percent. Elevation ranges from 4,350 to 4,600 feet. Dominant vegetation is dense grasses. The mean annual precipitation is 10 to 13 inches, the mean annual soil temperature is 48° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish-brown silt loam about 9 inches thick. The underlying material is light brownish-gray, gray, and light-gray silt loam to a depth of 53 inches and light-gray loam below this to a depth of 60 inches. The profile is moderately alkaline and strongly alkaline and limy throughout.

Permeability is moderate, and available water capacity is high. The effective rooting depth is influenced by the seasonal high water table, which is at a depth of 24 to 48 inches.

These soils are used for irrigated pasture and for range. Where drainage has reduced wetness, they are used for irrigated potatoes, sugar beets, small grain, and hay.

Representative profile of Parehat silt loam, in SW $\frac{1}{4}$  SE $\frac{1}{4}$  sec. 20, T. 7 S., R. 33 E.:

A1—0 to 9 inches, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, thin and medium, platy structure in upper 2 inches parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine vesicular pores in upper 2 inches and tubular pores in lower part; moderately calcareous; moderately alkaline; gradual, smooth boundary.

C1—9 to 17 inches, light brownish-gray (2.5Y 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, very fine and medium, granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine tubular pores; very few hard nodules that are weakly cemented with silica-lime; moderately calcareous; moderately alkaline; gradual, wavy boundary.

A1b—17 to 36 inches, gray (N 6/0) silt loam, very dark gray (N 3/0) moist; weak, medium, subangular blocky structure parting to weak, very fine, fine, and medium, granular; hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine and few fine tubular pores; common hard nodules that are weakly cemented with silica-lime; moderately alkaline; gradual, wavy boundary.

C2ca—36 to 42 inches, light-gray (N 6/0 and 7/0) silt loam, dark gray (10YR 4/1) moist; few, fine, distinct, dark grayish-brown (10YR 4/2) mottles, very dark brown (10YR 2/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine and fine and few medium tubular pores; moderately calcareous, few fine veins, streaks, and splotches of lime; strongly alkaline; clear, wavy boundary.

C3ca—42 to 53 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine and common fine and medium tubular pores; strongly calcareous, common streaks and splotches of lime; strongly alkaline; clear, smooth boundary.

C4—53 to 60 inches, light-gray (2.5Y 7/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable, nonsticky and nonplastic; few fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline.

The A horizon is grayish brown or dark grayish brown. The C horizon is stratified but is mainly silt loam. Some areas have sandy or gravelly strata below a depth of 40 inches.

**Pk—Parehat silt loam.** This somewhat poorly drained soil is on terraces or along stream bottoms. Slopes range from 0 to 2 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have a sandy or gravelly layer at a depth of 20 to 40 inches, small areas of soils that have a silty clay loam or clay loam subsoil, small areas of soils that have a water table at or near the surface, and areas of soils where there is no water table except in periods of high runoff. Also included are areas of Penoyer, Tickason, and Snake soils.

Runoff is slow, and the hazard of erosion is slight. The water table is at a depth of 36 to 48 inches.

This soil is used mainly for range. A few small areas are used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability units IIw-2, irrigated, and IVw-9, nonirrigated; range site SB8.

**Pm—Parehat silt loam, saline-alkali.** This somewhat poorly drained soil is on low terraces. Slopes range from 0 to 2 percent. The soil has a profile similar to the one described as representative of the series, but it is slightly affected by salt and alkali.

Included with this soil in mapping are small areas of soils that are moderately affected by salt and alkali. These areas range from 10 to 20 feet in diameter and are 1 to 2 acres in size. They make up from 15 to 40 percent of the acreage of mapped areas but average 20 percent. Also included are small areas of soils that have a clay loam surface layer, areas of soils that have silty clay loam within a depth of 40 inches, and small areas of Paniogue and Penoyer soils.

Runoff is slow, and the hazard of erosion is slight. The water table is at a depth of 36 to 48 inches.

This soil is used extensively for range. Where this soil is irrigated, some potatoes, sugar beets, small grain, and hay are grown. Capability units IVs-8, irrigated, and IVw-9, nonirrigated; range site SL8.

**Pn—Parehat silt loam, high water table.** This poorly drained soil is on stream bottoms. Slopes range from 0 to 2 percent.

Included with this soil in mapping are small areas of marsh, areas of soils that have a silty clay loam surface layer, and areas of soils that have sandy underlying material at a depth of 40 to 60 inches. Also included are small areas of Penoyer, Snake, and Peeteet soils.

Runoff is very slow or ponded, and the hazard of erosion is slight. Depth to the water table ranges from 24 to 40 inches.

This soil is used only for range. It is too wet to be cultivated. It furnishes food and cover for waterfowl and other wildlife. Capability unit Vw-2, nonirrigated; range site WL8.

## Pavohroo Series

The Pavohroo series consists of well-drained soils on mountainous uplands. These soils formed in material weathered from limestone. Slopes are 30 to 70 percent. Elevation ranges from 6,000 to 8,000 feet. Dominant vegetation is Douglas-fir and pinegrass understory; some aspen also grow. The mean annual precipitation is 17 to 20 inches, the mean annual soil temperature is 38° to 42° F, and the frost-free season is 20 to 50 days.

In a representative profile the surface layer is dark grayish-brown very cobbly loam about 7 inches thick

over dark grayish-brown and grayish-brown cobbly loam 12 inches thick. The subsoil is brown cobbly loam 18 inches thick. The underlying material is brown very gravelly loam to a depth of 48 inches. It is underlain by limestone. The profile is slightly acid to moderately alkaline and is free of lime except for limestone fragments.

Permeability is moderate, and available water capacity is moderate. The effective rooting depth is 40 to 60 inches.

These soils are used mainly for range, wildlife habitat, recreation, and watershed.

Representative profile of Pavohroo very cobbly loam in an area of Pavohroo gravelly loam, steep, in SW $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 35, T. 9 S., R. 32 E.:

- O1—1 inch to 0, very dark brown (10YR 2/2) slightly decomposed and decayed needles, twigs, and cones; slightly acid; abrupt, wavy boundary.
- A11—0 to 7 inches, dark grayish-brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; strong, very fine and fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine, fine, and medium roots and few coarse and very coarse roots; many very fine interstitial pores; 65 percent cobbles and gravel; neutral; clear, wavy boundary.
- A12—7 to 12 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; strong, very fine and fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine, fine, and medium roots and few coarse and very coarse roots; many very fine interstitial pores; 25 percent cobbles and gravel; slightly acid; clear, smooth boundary.
- A3—12 to 19 inches, grayish-brown (10YR 5/2) cobbly loam, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure parting to moderate, fine and very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse and very coarse roots; many very fine and fine tubular pores; 25 percent cobbles and gravel; slightly acid; clear, wavy boundary.
- B2—19 to 29 inches, brown (10YR 5/3) cobbly loam, dark brown (10YR 4/3) moist; weak, medium and fine, subangular blocky structure parting to moderate, fine and very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores; 25 percent cobbles and gravel; few clay films on peds and in some pores; neutral; clear, wavy boundary.
- B3—29 to 37 inches, brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; 30 percent cobbles and gravel; mildly alkaline; clear, wavy boundary.
- C—37 to 48 inches, brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; 20 percent cobbles and 60 percent gravel; moderately alkaline; abrupt, irregular boundary.
- R—48 to 55 inches, light-gray (10YR 6/1) fractured limestone, stained pale brown (10YR 6/3) and light yellowish brown (2.5Y 6/3); lime coated on top.

Depth to limestone bedrock ranges from 40 to 60 inches. The O1 horizon is absent in places. The A11 horizon is dark gray or dark grayish brown and is gravelly or very cobbly.

**PCG—Pavohroo gravelly loam, steep.** This soil is

on north-facing side slopes of mountains. Slopes range from 30 to 55 percent. It has a profile similar to the one described as representative of the series, but the surface layer is gravelly. A Pavohroo very cobbly loam in an area of this soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Pavohroo soils that are very cobbly and have slopes of 55 to 70 percent, small areas of limestone outcrop, and areas of soils that are free of gravel in the surface layer. Also included are small areas of Moohoo, Ridgecrest, and Hymas soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil has limited use as range. It is also used for wildlife habitat, recreation, and watershed. It can be used for the production of timber, but areas are generally too small for profitable logging. Capability unit VIIe-0, nonirrigated; range site NE4.

## Penoyer Series

The Penoyer series consists of well-drained soils along stream bottoms. These soils formed in alluvium. Slopes are 0 to 4 percent. Elevation ranges from 4,400 to 5,200 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 8 to 11 inches, the mean annual soil temperature is 50° to 52° F, and the frost-free season is 100 to 120 days.

In a representative profile the soil is light brownish-gray silt loam to a depth of 60 inches. The profile is moderately alkaline and is limy throughout.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Some areas are used for range.

Representative profile of Penoyer silt loam, 0 to 2 percent slopes, in SW $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 35, T. 9 S., R. 32 E.:

- A11—0 to 2 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate, very thin and thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; common very fine tubular pores; common very fine vesicular pores in upper  $\frac{1}{2}$  inch; slightly calcareous; moderately alkaline; clear, smooth boundary.
- A12—2 to 5 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, thin and very thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine tubular and interstitial pores; moderately alkaline; abrupt, smooth boundary.
- C1—5 to 11 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline; clear, smooth boundary.
- C2—11 to 22 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots;

common very fine and few fine tubular pores; moderately calcareous; moderately alkaline; clear, smooth boundary.

C3ca—22 to 39 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; few hard firm nodules that are weakly cemented with silica-lime; moderately calcareous, few very fine veins and thin coatings and splotches of lime; moderately alkaline; clear, wavy boundary.

C4—39 to 60 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline.

The A horizon is light brownish gray or pale brown. The Cca horizon is absent in some areas.

**PLB—Penoyer silt loam, 0 to 4 percent slopes.** This nearly level and very gently sloping soil is on long, narrow alluvial fans or stream bottoms adjacent to loess-mantled uplands.

Included with this soil in mapping are small areas of soils that are strongly affected by salt and alkali and areas of Wheeler, McDole, and Pocatello soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for range. Capability unit VIc-1, nonirrigated; range site S11.

**PoA—Penoyer silt loam, 0 to 2 percent slopes.** This nearly level soil is on long, narrow stream bottoms adjacent to loess-mantled uplands. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Wheeler, McDole, Declo, and Tickason soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIc-2, irrigated; not assigned to a range site.

**PoB—Penoyer silt loam, 2 to 4 percent slopes.** This very gently sloping soil is along stream bottoms.

Included with this soil in mapping are small areas of soils that are moderately affected by salt and alkali. Also included are areas of Wheeler, Pocatello, McDole, and Declo soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIe-1, irrigated; not assigned to a range site.

**PpA—Penoyer silt loam, saline-alkali, 0 to 2 percent slopes.** This nearly level soil is in areas along stream bottoms. It has a profile similar to the one described as representative of the series, but it is slightly affected by salt and alkali.

Included with this soil in mapping are areas of soils that are moderately affected by salt and alkali. These areas are 5 to 20 feet in diameter and are identified by stunted vegetation. The areas make up 15 to 30 percent, but average 20 percent, of mapped areas. Also included are small areas of soils that have a weakly cemented hardpan at a depth of 15 to 25 inches and areas of Declo, Wheeler, Pocatello, and Paniogue soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for irrigated small grain, hay, and pasture. Some potatoes and sugar beets are

also grown. Capability unit IVs-8, irrigated; not assigned to a range site.

## Penoyer Variant

The Penoyer variant soils are somewhat poorly drained. These soils are on terraces and along stream bottoms. They formed in mixed alluvium. Slopes are 0 to 2 percent. Elevation ranges from 4,400 to 4,700 feet. Dominant vegetation is grasses and forbs. The mean annual precipitation is 10 to 13 inches, the mean annual soil temperature is 47° to 49° F, and the frost-free season is 105 to 120 days.

In a representative profile the surface layer is light brownish-gray silt loam about 9 inches thick. The underlying material is stratified light brownish-gray and light-gray silt loam and loam to a depth of 60 inches. The profile is limy throughout and is moderately alkaline and strongly alkaline. It is mottled below a depth of 29 inches.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 30 to 40 inches.

These soils are used for range.

Representative profile of Penoyer silt loam, mottled variant, in NE $\frac{1}{4}$ , SW $\frac{1}{4}$  sec. 29, T. 7 S., R. 33 E.:

A11—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure parting to moderate, very fine and fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial and common very fine, fine, and medium tubular pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

A12—3 to 9 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, thick, platy structure parting to weak, fine and medium, granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; common 3- or 4-millimeter worm channels and casts; moderately calcareous, moderately alkaline; clear, smooth boundary.

C1—9 to 16 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; few worm channels and casts; moderately calcareous; moderately alkaline; clear, wavy boundary.

A1b—16 to 29 inches, light-gray (10YR 6/1) heavy silt loam, dark gray (10YR 4/1) moist; weak, fine and very fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; few very hard nodules that are weakly cemented with silica-lime; moderately calcareous, few fine lime veins and coatings on surfaces of peds and nodules; strongly alkaline; clear, wavy boundary.

C2ca—29 to 42 inches, light-gray (2.5Y 7/2) heavy loam, grayish brown (2.5Y 5/2) moist; common, fine, faint, pale-brown (10YR 6/3) mottles, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine, fine and medium roots; common very fine tubular pores; common hard nodules that are weakly cemented

with silica-lime; moderately calcareous, few very fine lime veins and spots; moderately alkaline; gradual, wavy boundary.

C3—42 to 50 inches, light-gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) moist; common, fine, distinct, pale-brown (10YR 6/3) mottles, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

C4—50 to 60 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; few, fine, faint, pale-brown (10YR 6/3) mottles, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; moderately calcareous; moderately alkaline.

In some areas, the A horizon is only slightly calcareous. The C horizon is stratified, but it is mainly silt loam. Mottles are at a depth of 20 to 40 inches. In some areas loam or fine sandy loam is below a depth of 48 inches.

**Pr—Penoyer silt loam, mottled variant.** This soil is in slightly concave areas on low alluvial terraces along streams. Slopes range from 0 to 2 percent.

Included with this soil in mapping are small areas of poorly drained soils and areas of soils that are moderately affected by salt and alkali. Also included are areas of Declo variant soils and Parehat soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for range. Capability unit IVw-9, nonirrigated; range site SB8.

## Peteetneet Series

The Peteetneet series consists of very poorly drained soils on bottom lands. These soils formed in decomposed plant remains. Slopes are 0 to 1 percent. Elevation ranges from 4,350 to 4,400 feet. Dominant vegetation is sedges, rushes, cattails, and other plants that thrive in wet areas. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 48° to 52° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is black, mainly decomposed peat and muck to a depth of 52 inches. It is underlain by gray silty clay loam to a depth of 60 inches. The profile is neutral in the organic layers and moderately alkaline in the mineral layers. It is free of lime.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches. The seasonal high water table is at or near the surface throughout the year.

These soils are used for wildlife habitat and recreation.

Representative profile of Peteetneet peat in SW $\frac{1}{4}$  NE $\frac{1}{4}$  sec. 26, T. 4 S., R. 33 E.:

Oa1—0 to 2 inches, black (10YR 2/1) peat moist, very dark gray (10YR 3/1) dry; plant remains mainly decomposed; massive; nonsticky and nonplastic; neutral; clear, smooth boundary.

Oa2—2 to 19 inches, black (10YR 2/1) peat moist, very dark gray (10YR 3/1) dry; mainly decomposed, but some recognizable plant remains; nonsticky and nonplastic; neutral; clear, smooth boundary.

Oa3—19 to 52 inches, black (10YR 2/1) muck and few fibers moist, very dark gray (10YR 3/1) dry;

massive; nonsticky and slightly plastic; many very fine and fine roots to a depth of 41 inches; neutral; clear, smooth boundary.

IIC—52 to 60 inches, gray (5Y 5/1) light silty clay loam moist, light gray (5Y 7/1) dry; massive; extremely hard, firm, sticky and plastic; many very fine and fine tubular pores; moderately alkaline.

The organic layers are slightly acid to mildly alkaline. They range from 40 inches to more than 60 inches in thickness. The mineral soil is loam to silty clay loam and is neutral to moderately alkaline.

**Ps—Peteetneet peat.** This nearly level soil is in drainageways and swales on bottom lands.

Included with this soil in mapping are small areas of Snake and Philbon soils.

Runoff is ponded, and there is no erosion hazard. The water table is at or near the surface throughout the year.

This soil is used for wildlife habitat and recreation. It is too wet for cultivation or grazing. Capability unit VIIIw-1, nonirrigated; range site NU.

## Peteetneet Variant

The Peteetneet variant soils are poorly drained. These soils are on low terraces. They formed in decomposed plant remains and alluvium. Slopes are 0 to 1 percent. Elevation ranges from 4,300 to 4,400 feet. Dominant vegetation is dense sedges and rushes. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 48° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is very dark gray muck about 6 inches thick. The underlying layer is stratified dark-gray and very dark gray silt loam to a depth of 25 inches, black muck between the depths of 25 and 46 inches, and gray silty clay loam below this, to a depth of 60 inches.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 0 to 20 inches.

These soils are used mainly for range. Some areas that have suitable drainage are used for production of native hay. The soils are also used for wildlife habitat, recreation, and watershed.

Representative profile of Peteetneet muck, clayey subsoil variant, 2,400 feet north and 1,100 feet east of the southwest corner of sec. 10, T. 5 S., R. 33 E.:

Oa—0 to 6 inches, very dark gray (10YR 3/1) muck, black (10YR 2/1) moist; strong, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; neutral; clear, smooth boundary.

IIA11—6 to 15 inches, dark-gray (N 4/0) silt loam, black (N 2/0) moist; few, fine, distinct, brown (10YR 4/3) stains around roots; weak, coarse, prismatic structure; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; moderately low bulk density; slightly calcareous in spots, few 2- to 5-millimeter snail shells; neutral; clear, smooth boundary.

IIA12—15 to 25 inches, very dark gray (N 3/0) heavy silt loam, black (N 2/0) moist; massive; hard, firm, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine tubular pores; neutral; abrupt, smooth boundary.

III0a—25 to 46 inches, black (N 2/0) muck; well decomposed but few plant fibers; fine fibrous; weak, fine, granular structure; very hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine interstitial pores; floats on water and does not wet; neutral; abrupt, smooth boundary.

IVC—46 to 60 inches, gray (N 5/0) silty clay loam, very dark gray (N 3/0) moist; few, fine, yellowish-brown (10YR 5/4) stains around decayed roots; massive; very hard, firm, sticky and plastic; common very fine and few fine tubular pores; mildly alkaline.

**Pt—Peteetneet muck, clayey subsoil variant.** This nearly level soil is adjacent to the Snake River.

Included with this soil in mapping are small areas of soils that have no organic surface layer and small areas of marsh. Also included are small areas of Peteetneet, Parehat, and Snake soils.

Runoff is ponded, and there is no erosion hazard.

This soil is used mainly for range. Some areas that have suitable drainage are used for producing native grass hay. This soil is also used for wildlife habitat, recreation, and watershed. Capability unit Vw-2, non-irrigated; range site WI.8.

## Philbon Series

The Philbon series consists of very poorly drained soils on low terraces and bottom lands. These soils formed in alluvium. Slopes are 0 to 1 percent. Elevation ranges from 4,350 to 4,400 feet. Dominant vegetation is sedges and grasses. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is very dark gray peat about 22 inches thick. The underlying material is very dark gray mucky silt loam about 16 inches thick. It is underlain by stratified, light-gray silty clay loam and loam that extends to a depth of 60 inches. The profile is neutral to moderately alkaline.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches. The water table is at or near the surface throughout the year.

These soils are used for wildlife habitat and recreation.

Representative profile of Philbon peat 2,000 feet south and 200 feet west of the northeast corner of sec. 3, T. 5 S., R. 33 E.:

Oi1—0 to 2 inches, very dark gray (10YR 3/1) peat, black (10YR 2/1) moist; 65 to 75 percent consists of slightly decomposed rush, sedge, and other fibers; neutral; clear, smooth boundary.

Oe2—2 to 13 inches, very dark gray (10YR 3/1) peat, black (10YR 2/1) moist; 70 percent fibers consists of rush, sedge, and other fibers; neutral; clear, smooth boundary.

Oa3—13 to 22 inches, very dark gray (10YR 3/1) peat, black (10YR 2/1) moist; some gray (10YR 5/1) partly decomposed material; weak, medium, granular structure; neutral; clear, smooth boundary.

IIA11b—22 to 26 inches, very dark gray (N 3/0) mucky silt loam, black (N 2/0) moist; few, very fine, yellowish-brown (10YR 8/2 and 5/4) mottles; massive; very hard, friable, slightly sticky and

slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; neutral; clear, smooth boundary.

IIA12b—26 to 38 inches, very dark gray (N 3/0) mucky heavy silt loam, black (N 2/0) moist; weak, coarse, prismatic structure; extremely hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; moderately alkaline; abrupt, smooth boundary.

IIIC—38 to 49 inches, light-gray (5Y 7/1) light silty clay loam, gray (5Y 5/1) moist; massive; extremely hard, firm, sticky and plastic; common fine and medium roots; some decayed, brown, dead roots; many very fine and fine tubular pores; moderately alkaline; clear, smooth boundary.

IIIC2—49 to 60 inches, light-gray (5Y 6/1) loam, dark gray (5Y 4/1) moist; massive; hard, very friable, nonsticky and nonplastic; common fine and medium roots; many very fine and fine tubular pores; moderately alkaline.

The mineral soil is at a depth of 13 to 48 inches. The upper part of the mineral soil is silt loam or silty clay loam.

**Pu—Philbon peat.** This nearly level soil is in long, narrow drainageways on low, poorly drained terraces along the Snake River.

Included with this soil in mapping are small areas of soils that have an organic layer less than 16 inches thick, small areas of soils in which the water table is below a depth of 3 feet in summer, and small areas of soils that have a limy surface layer. Also included are small areas of Peteetneet variant soils, Snake soils, and Parehat soils.

Runoff is ponded, and there is no erosion hazard.

This soil is used only for wildlife habitat and recreation. It is too wet for cultivation or grazing. Capability unit VIIIw-1, nonirrigated; range site NU.

## Pocatello Series

The Pocatello series consists of well-drained soils on high alluvial fans and dissected plateaus. These soils formed in loess. Slopes are 0 to 30 percent. Elevation ranges from 4,500 to 5,000 feet. Dominant vegetation is grasses, shrubs, and scattered juniper. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 48° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray silt loam about 4 inches thick. The underlying material is light brownish-gray, pale-brown, and light-gray silt loam to a depth of 60 inches. The profile ranges from moderately alkaline in the surface layer to very strongly alkaline in the lower part. It is limy below the surface layer.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for irrigated potatoes, sugar beets, and small grain, hay, and pasture. Some areas of these soils are used for range.

Representative profile of Pocatello silt loam, 4 to 8 percent slopes, in NE $\frac{1}{4}$ , SW $\frac{1}{4}$  sec. 10, T. 7 S., R. 32 E.:

A1—0 to 4 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, thin and very thin, platy structure; slightly hard, very friable, slightly sticky and slightly

plastic; many very fine and fine roots; many very fine vesicular pores; moderately alkaline; clear, wavy boundary.

C1—4 to 8 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

C2—8 to 13 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine tubular pores; few hard nodules that are weakly cemented with silica-lime; moderately calcareous; strongly alkaline; clear, wavy boundary.

C3—13 to 18 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine tubular pores; moderately calcareous; very few hard nodules that are weakly cemented with silica-lime; strongly alkaline; clear, wavy boundary.

C4ca—18 to 38 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine tubular pores; 15 percent hard and very hard nodules that are weakly cemented with silica-lime; moderately calcareous, common fine veins and small splotches of lime; very strongly alkaline; gradual, wavy boundary.

C5—38 to 60 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; few hard nodules that are weakly cemented with silica-lime; moderately calcareous, very few fine lime veins; very strongly alkaline.

The A horizon is generally calcareous in cultivated areas. Depth to the limy horizon ranges from 8 to 20 inches. The soil is moderately alkaline to very strongly alkaline below the Cca horizon.

**PvA—Pocatello silt loam, 0 to 2 percent slopes.** This nearly level soil is on tops of benches on slightly dissected plateaus.

Included with this soil in mapping are small areas of soils that have slopes of more than 2 percent and small areas of Wheeler, Portneuf, Neeley, Kucera, and Penoyer soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIc-2, irrigated; not assigned to a range site.

**PvB—Pocatello silt loam, 2 to 4 percent slopes.** This very gently sloping soil is on loess-mantled fans and dissected plateaus.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and areas of Wheeler, Portneuf, Neeley, and Penoyer soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIe-1, irrigated; not assigned to a range site.

**PvC—Pocatello silt loam, 4 to 8 percent slopes.** This gently sloping soil is on dissected plateaus. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent, small areas of soils that have slopes of more than 8 percent, and areas of Wheeler, Kucera, and Neeley soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIIe-1, irrigated; not assigned to a range site.

**PvD—Pocatello silt loam, 8 to 12 percent slopes.** This moderately sloping soil is on dissected loess-mantled alluvial fans and plateaus.

Included with this soil in mapping are small areas of soils that have slopes of less than 8 percent, small areas of soils that have slopes of more than 12 percent, and areas of Wheeler, Kucera, Neeley, and Penoyer soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IVe-1, irrigated; not assigned to a range site.

**PvF—Pocatello silt loam, 20 to 30 percent slopes.** This moderately steep soil is on dissected fans and plateaus.

Included with this soil in mapping are small areas of soils that have slopes of less than 20 percent, small areas of soils that have slopes of more than 30 percent, and areas of Wheeler, Kucera, Penoyer, and Neeley soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used mainly for range. Capability unit VIe-1, nonirrigated; range site SII.

**PWB—Pocatello silt loam, 0 to 4 percent slopes.** This nearly level and very gently sloping soil is on dissected fans and plateaus.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and areas of Portneuf, Wheeler, Kucera, Penoyer, and Neeley soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used to a limited extent for dryfarmed small grain. It is used extensively for range. Capability unit VIc-1, nonirrigated; range site SII.

**PWD—Pocatello silt loam, 4 to 12 percent slopes.** This gently sloping to moderately sloping soil is on dissected plateaus and fans.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent, small areas of soils that have slopes of more than 12 percent, and small areas of Wheeler, Kucera, and Neeley soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used to a limited extent for dryfarmed small grain. It is used mainly for range. Capability unit VIe-1, nonirrigated; range site SII.

**PWE—Pocatello silt loam, 12 to 20 percent slopes.** This strongly sloping soil is on dissected plateaus.

Included with this soil in mapping are small areas of soils that have slopes of more than 20 percent and other areas of soils that have slopes of less than 12 percent. Also included are areas of Wheeler, Kucera, and Neeley soils.

Runoff is rapid, and the hazard of erosion is very high.

Most of this soil is used for range. Capability unit VIe-1, nonirrigated; range site S11.

**PWF—Pocatello silt loam, rolling.** This soil is on loess-mantled fans and plateaus. Slopes range from 4 to 20 percent.

Included with this soil in mapping are small areas of nearly level and very gently sloping soils and small areas of moderately steep soils. Also included are areas of Wheeler, Portneuf, Kucera, Penoyer, and Neeley soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used for range. Seeding to crested wheat-grass is effective in managing range. Capability unit VIe-1, nonirrigated; range site S11.

## Portneuf Series

The Portneuf series consists of well-drained soils on low dissected alluvial fans and plateaus. These soils formed in loess. Slopes are 0 to 12 percent. Elevation ranges from 4,500 to 4,900 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 10 or 11 inches, the mean annual soil temperature is 49° to 51° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray silt loam about 5 inches thick. The subsoil is light brownish-gray silt loam about 10 inches thick. The underlying material is light-gray and pale-brown silt loam to a depth of 60 inches. The soil ranges from neutral to strongly alkaline.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for irrigated potatoes, sugar beets, small grain, hay, and pasture. Some dry-farmed small grain is grown. Extensive areas are used for range.

Representative profile of Portneuf silt loam, 0 to 2 percent slopes, in SW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 15, T. 7 S., R. 32 E.:

- A1—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, very thin, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine vesicular pores; neutral; clear, smooth boundary.
- A3—3 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine and few medium roots; many very fine tubular pores; neutral; clear, smooth boundary.
- B1—5 to 8 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; common very fine tubular pores; slightly calcareous; neutral; clear, smooth boundary.
- B2—8 to 15 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium and fine, subangular blocky structure; slightly hard, very friable, slightly sticky

and slightly plastic; common very fine and fine and few medium roots; common very fine tubular pores; moderately calcareous; moderately alkaline; clear, smooth boundary.

C1casi—15 to 24 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; moderate, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; about 20 percent very hard nodules that are weakly cemented with silica-lime; strongly calcareous; moderately alkaline; clear, smooth boundary.

C2casi—24 to 32 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 20 percent very hard nodules that are cemented with silica-lime; strongly calcareous, common fine and medium lime splotches around nodules; strongly alkaline; clear, smooth boundary.

C3casi—32 to 45 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; 5 percent hard nodules that are cemented with silica-lime; strongly calcareous, few fine spots of lime; strongly alkaline; gradual, smooth boundary.

C4—45 to 60 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; strongly calcareous; moderately alkaline.

The A horizon is generally noncalcareous. It is calcareous in places in which lime has been brought to the surface by tillage, land leveling, or rodent activity. The strongly calcareous Ccasi horizon is at a depth of 5 to 21 inches.

**PxA—Portneuf silt loam, 0 to 2 percent slopes.** This nearly level soil is on broad plateaus in loess-mantled uplands. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 2 percent and areas of Pocatello, Wheeler, Neeley, and Penoyer soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIC-2, irrigated; not assigned to a range site.

**PxB—Portneuf silt loam, 2 to 4 percent slopes.** This gently sloping soil is on broad, uniformly sloping fans and plateaus at lower elevations of loess-mantled uplands.

Included with this soil in mapping are small areas of soils that have slopes of less than 2 percent, small areas of soils that have slopes of more than 4 percent, and small areas of Pocatello, Wheeler, Kucera, and Neeley soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIE-1, irrigated; not assigned to a range site.

**PYB—Portneuf silt loam, 0 to 4 percent slopes.** This nearly level to gently sloping soil is on uniformly sloping fans and plateaus at lower elevations of loess-mantled uplands.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and small areas of Pocatello, Wheeler, Neeley, Kucera, and Penoyer soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used to a limited extent for dryfarmed small grain. It is mainly used for range. Capability unit VIc-1, nonirrigated; range site S11.

**PYC—Portneuf silt loam, undulating.** This soil is on broad plateaus and fans in loess-mantled uplands. Slopes range from 2 to 8 percent.

Included with this soil in mapping are small areas of soils that have slopes of less than 2 percent and small areas of soils that have slopes of more than 8 percent. Also included are small areas of Pocatello, Wheeler, Kucera, and Penoyer soils.

Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for range. Capability unit VIe-1, nonirrigated; range site S11.

**PYD—Portneuf silt loam, 4 to 12 percent slopes.** This gently sloping to moderately sloping soil is on uniformly sloping dissected fans and plateaus at lower elevations.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent, small areas of soils that have slopes of more than 12 percent, and areas of Pocatello, Wheeler, Kucera, and Penoyer soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used to a limited extent for dryfarmed small grain. It is mainly used for range. Capability unit VIe-1, nonirrigated; range site S11.

## Quincy Series

The Quincy series consists of excessively drained soils. They are generally on low plateaus. These soils formed in colian sand. Slopes are 2 to 15 percent. Elevation ranges from 4,400 to 4,700 feet. Dominant vegetation is sparse grasses and shrubs. The mean annual precipitation is 10 to 11 inches, the mean annual soil temperature is 53° to 54° F, and the frost-free season is 105 to 120 days.

In a representative profile the surface layer is dark grayish-brown sand about 3 inches thick. The underlying layer is stratified dark grayish-brown, grayish-brown, light-gray, and very dark gray sand and coarse sand to a depth of 60 inches. The profile is neutral or mildly alkaline throughout and is limy below a depth of 11 inches.

Permeability is very rapid, and available water capacity is low or very low. The effective rooting depth is mainly more than 60 inches, but it is 20 to 40 inches in the moderately shallow Quincy soil.

These soils are used mainly for range. Small areas are used for irrigated crops.

Representative profile of Quincy sand, undulating, in SE $\frac{1}{4}$  sec. 26, T. 3 S., R. 35 E.:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) sand, very dark brown (10YR 2/2) moist; single grained; loose dry and moist; many very fine and common fine and medium roots; many very fine interstitial pores; mildly alkaline; abrupt, smooth boundary.

C1—3 to 11 inches, dark grayish-brown (10YR 4/2) sand, very dark brown (10YR 2/2) moist; single grained;

loose dry and moist; common very fine and fine roots; many very fine interstitial pores; neutral; gradual, wavy boundary.

C2—11 to 27 inches, grayish-brown (10YR 5/2) sand, very dark grayish brown (10YR 3/2) moist; single grained; loose dry and moist; few very fine and fine roots; many very fine interstitial pores; slightly calcareous; mildly alkaline; gradual, wavy boundary.

C3—27 to 48 inches, dark grayish-brown (10YR 4/2) sand, dark grayish brown (10YR 4/2) moist; single grained; loose dry and moist; slightly calcareous; mildly alkaline; gradual, wavy boundary.

C4—48 to 60 inches, light-gray (10YR 6/1) and very dark gray (10YR 3/1) coarse sand, gray (10YR 5/1) and very dark gray (10YR 3/1) moist; single grained; loose dry and moist; few fine roots; many very fine interstitial pores; slightly calcareous; mildly alkaline.

The A horizon is dark grayish brown or grayish brown. Bedrock is commonly at a depth of more than 5 feet, but in some areas it is at a depth of 20 to 40 inches.

**QnB—Quincy sand, 2 to 4 percent slopes.** This very gently sloping soil is on terraces or low plateaus.

Included with this soil in mapping are small areas of soils that have slopes of less than 2 percent, small areas of soils that have slopes of more than 4 percent, and areas of active sand dunes. Also included are small areas of Feltham, Tindahay, and Chedehap soils.

Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is very high. Available water capacity is low. Depth to bedrock is more than 5 feet.

This soil is used for irrigated potatoes, small grain, hay, and pasture. Capability unit IVe-5, irrigated; not assigned to a range site.

**QnC—Quincy sand, 4 to 8 percent slopes.** This gently sloping soil is on small, dunelike ridges on terraces in irrigated areas.

Included with this soil in mapping are small areas of active sand dunes and areas of Tindahay, Feltham, and Chedehap soils.

Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is very high. Available water capacity is low. Depth to bedrock is more than 5 feet.

This soil is used for irrigated hay and pasture. Capability unit IVe-5, irrigated; not assigned to a range site.

**QUF—Quincy sand, undulating.** This soil is in sandy areas on low plateaus. Slopes range from 5 to 15 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are areas of soils that have slopes of more than 15 percent, some of which are on breaks from the uplands and have slopes of almost 40 percent. Also included are areas of active sand dunes and areas of rock outcrop, areas of stony soils, and areas of Feltham, Tindahay, Chedehap, and Pocatello soils.

Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is very high. Available water capacity is low. Depth to bedrock is more than 5 feet.

This soil is used for range. Capability unit VIIe-0, nonirrigated; range site SA1.

**QVD—Quincy very stony sand, moderately shallow,**

**undulating.** This soil is on ridgetops in basalt uplands. Slopes range from 2 to 10 percent. The profile of this soil is similar to the one described as representative of the series, but it is 20 to 40 inches deep over basalt, and the surface layer is very stony and is about 5 percent stones.

Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is very high. Available water capacity is very low.

This soil is used for range. Capability unit VII<sub>s</sub>-2, nonirrigated; range site SA1.

## Rexburg Series

The Rexburg series consists of well-drained soils on rolling to steep plateaus. These soils formed in loess. Slopes are 0 to 55 percent. Elevation ranges from 5,200 to 6,200 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 12 to 15 inches, the mean annual soil temperature is 45° to 47° F, and the frost-free season is 75 to 100 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 12 inches thick. The subsoil is brown and light brownish-gray silt loam about 11 inches thick. The underlying material is light-gray silt loam to a depth of 60 inches or more. The profile is neutral to moderately alkaline and is limy below a depth of 19 inches.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for range. They are also used extensively for dryfarmed small grain.

Representative profile of Rexburg silt loam, 0 to 4 percent slopes, 150 feet north of Simplot Mine Road near sec. 29, T. 4 S., R. 37 E.:

- A11—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate, very thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine interstitial pores; abrupt, smooth boundary.
- A12—3 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, common fine, and few medium roots; many very fine and few fine tubular pores; neutral; clear, smooth boundary.
- A13—6 to 12 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, very fine, fine, and medium, subangular blocky and weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; many very fine and few fine tubular pores; neutral; clear, wavy boundary.
- B2—12 to 19 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and few fine tubular pores; gradual, wavy boundary.
- B3—19 to 23 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly

plastic; few very fine and fine roots; common very fine tubular pores; moderately calcareous, very few fine spots and veins of lime; mildly alkaline; abrupt, smooth boundary.

- C1ca—23 to 42 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; moderate, fine and medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; 15 percent, very hard, 0.6 inch in diameter nodules that are weakly cemented with silica-lime; strongly calcareous, many very thin splotches and veins of lime; moderately alkaline; gradual, smooth boundary.

- C2—42 to 60 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; few nodules cemented with silica-lime; strongly calcareous; moderately alkaline.

The A horizon is dark grayish brown or grayish brown and ranges from 10 to 16 inches in thickness. The upper 3 inches of this horizon has many fine vesicular pores in areas where there is no vegetation. The B horizon is 8 to 17 inches thick. The Cca horizon is at a depth of 14 to 33 inches.

**RBB—Rexburg silt loam, 0 to 4 percent slopes.** This nearly level and very gently sloping soil is on ridgetops on low plateaus in loess-mantled uplands.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and areas of Neeley, Lanoak, and McDole soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for dryfarmed small grain and for range. Capability unit III<sub>c</sub>-4, nonirrigated; range site SI2.

**RBC—Rexburg silt loam, 4 to 12 percent slopes.** This gently sloping and moderately sloping soil is on loess-mantled, dissected plateaus.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent, small areas of soils that have slopes of more than 12 percent, and areas of Neeley, Pocatello, Lanoak, Robin, and McDole soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryfarmed small grain and for range. Capability unit III<sub>e</sub>-4, nonirrigated; range site SI2.

**RBE—Rexburg silt loam, 12 to 20 percent slopes.** This strongly sloping soil is on dissected, loess-mantled plateaus.

Included with this soil in mapping are small areas of soils that have slopes of less than 12 percent, small areas of soils that have slopes of more than 20 percent, and areas of Neeley, Pocatello, Lanoak, and Robin soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range and to a limited extent for small grain. Capability unit III<sub>e</sub>-4, nonirrigated; range site SI2.

**RBF—Rexburg silt loam, rolling.** This soil is on uplands. Slopes range from 4 to 20 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of less than 4 percent and small areas of soils that have slopes of more than 20 percent. Also included are small areas of Neeley, Lanoak, Robin, and McDole soils.

Runoff is medium to rapid, and the hazard of erosion is high.

This soil is used for range. It can be used for dry-farmed small grain. Capability unit IIIe-4, nonirrigated; range site SI2.

**RBG—Rexburg silt loam, steep.** This soil is on dissected, low plateaus. Slopes range from 20 to 55 percent.

Included with this soil in mapping are small areas of soils that have slopes of less than 30 percent and areas of Lanoak, Robin, and Neeley soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for range. Capability unit VIIe-0, nonirrigated; range site ST2.

## Ricrest Series

The Ricrest series consists of well-drained soils on mountain ridges and side slopes. These soils formed in loess, limestone residuum, and colluvium. Slopes are 8 to 55 percent. Elevation ranges from 5,500 to 8,000 feet. Dominant vegetation is big sagebrush, bitterbrush, serviceberry, Nevada bluegrass, Douglas-fir, aspen, and snowberry. The mean annual precipitation is 16 to 19 inches, the mean annual soil temperature is 40° to 45° F, and the frost-free season is 50 to 70 days.

In a representative profile the surface layer is dark grayish-brown cobbly loam about 5 inches thick over dark grayish-brown gravelly loam 19 inches thick. The underlying material is pale-brown gravelly loam and is underlain by limestone at a depth of 43 inches. The profile is mildly alkaline and moderately alkaline. It is limy throughout, and the content of lime increases as depth increases.

Permeability is moderate, and available water capacity is moderate. The effective rooting depth is 40 to 60 inches.

These soils are used for range, watershed, recreation, and wildlife habitat.

Representative profile of Ricrest cobbly loam in an area of Ricrest-Ridgecrest cobbly loams, steep, in NW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 27, T. 3 S., R. 37 E.:

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; about 25 percent angular limestone cobbles and gravel; slightly calcareous in spots; mildly alkaline; clear, smooth boundary.

A12—5 to 14 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores; about 20 percent angular limestone gravel and some cobbles and stones; very slightly calcareous in spots; mildly alkaline; gradual, wavy boundary.

A13—14 to 24 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine

and fine tubular pores; 25 percent gravel and some angular cobbles; moderately calcareous; moderately alkaline; clear, wavy boundary.

C1ca—24 to 32 inches, pale-brown (10YR 6/3) gravelly loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; 30 percent angular limestone gravel and some cobbles and stones; strongly calcareous, many veins and fine spots of lime; moderately alkaline; clear, wavy boundary.

C2ca—32 to 43 inches, pale-brown (10YR 6/3) and 30 percent pinkish-white (7.5YR 8/2) gravelly loam, brown (10YR 5/3) and light brown (7.5YR 6/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; 40 percent angular limestone gravel, cobbles, and stones coated with lime; strongly calcareous, splotches and veins of lime; moderately alkaline; abrupt, irregular boundary.

IIR—43 to 50 inches, dark-gray (10YR 4/1), fractured limestone.

The A horizon is dark grayish brown or very dark grayish brown. The profile is underlain by bedrock at a depth of 40 to 60 inches.

**RCF—Ricrest-Ridgecrest gravelly loams, hilly.** This complex has slopes of 8 to 30 percent. It is about 45 percent Ricrest gravelly loam and 40 percent Ridgecrest gravelly loam. These soils are in such intricate patterns that it is not practical to map them separately.

The Ricrest soil is in concave areas on north-facing side slopes. It has a profile similar to the one described as representative of the series, but the surface layer is gravelly. The Ridgecrest soil is in convex areas. It generally is on north-facing side slopes, but at higher elevations it is on south-facing side slopes.

Included with these soils in mapping are small areas of soils that have slopes of more than 30 percent, areas of rock outcrop, areas of soils that are stony, and small areas of Highams soils.

Runoff is medium to rapid, and the hazard of erosion is very high.

These soils are used mainly for range. They are also used for recreation, wildlife habitat, and watershed. Capability unit VIe-1, nonirrigated; range site SI3.

**RDG—Ricrest-Ridgecrest cobbly loams, steep.** This complex has slopes of 30 to 55 percent. It is about 50 percent Ricrest cobbly loam and 35 percent Ridgecrest cobbly loam. These soils are in such intricate patterns that it is not practical to map them separately.

The Ricrest soil is in concave areas on north-facing side slopes. A Ricrest soil in an area of this complex has the profile described as representative of the series. The Ridgecrest soil is in convex areas. It generally is on north-facing side slopes, but at higher elevations it is on south-facing side slopes. It has a profile similar to the one described as representative of the series, but the surface layer is cobbly.

Included with these soils in mapping are small areas of rock outcrop, areas of soils that are stony, and areas of Highams soils.

Runoff is rapid, and the hazard of erosion is very high.

These soils are used mainly for range. They are also

used for recreation, wildlife habitat, and watershed. Capability unit VIIIe-0, nonirrigated; range site S13.

### Ridgecrest Series

The Ridgecrest series consists of well-drained soils in mountainous areas. These soils formed in residuum from limestone. Slopes are 4 to 70 percent. Elevation ranges from 5,500 to 8,000 feet. Dominant vegetation is dense shrubs and grasses. The mean annual precipitation is 15 to 17 inches, the mean annual soil temperature is 45° to 47° F, and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is grayish-brown gravelly loam about 7 inches thick. The underlying material is grayish-brown very gravelly loam to a depth of 11 inches; pale-brown very gravelly loam between the depths of 11 and 20 inches; and very pale brown very gravelly loam below this, to a depth of 30 inches. It is underlain by fractured limestone. The profile is neutral to moderately alkaline and is limy throughout.

Permeability is moderate, and available water capacity is low. The effective rooting depth is 20 to 40 inches.

These soils are used for range, recreation, watershed, and wildlife habitat.

Representative profile of Ridgecrest gravelly loam in an area of Ridgecrest-Hymas gravelly loams, hilly, in SW $\frac{1}{4}$  sec. 33, T. 3 S., R. 38 E.:

A11—0 to 2 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, very thin, platy structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; 35 percent dark-gray (N 4/0) fine angular limestone gravel; strongly calcareous; few limestone fragments weakly coated with lime on lower side; neutral reaction; clear, smooth boundary.

A12—2 to 7 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; 40 percent fine angular limestone gravel; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1—7 to 11 inches, grayish-brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky and weak, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; common very fine tubular pores; 55 percent angular limestone gravel, larger pebbles coated with lime on lower sides; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2—11 to 20 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; few very fine tubular pores; 70 percent dark gray (N 4/0) angular limestone gravel and cobbles, large fragments coated with lime on lower sides; strongly calcareous; moderately alkaline; clear, smooth boundary.

C3—20 to 30 inches, very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; 60 percent dark gray (N 4/0)

angular limestone gravel and cobbles, large fragments coated with 0.1 to 2 millimeters of lime and in places with dark yellowish-brown (10YR 4/4) stains; strongly calcareous; moderately alkaline; abrupt, irregular boundary.

R—30 to 34 inches, dark-gray (N 4/0) fractured and slightly weathered limestone.

The depth to bedrock ranges from 20 to 40 inches. The A horizon is grayish brown or dark grayish brown and is gravelly, cobby, very cobby, or extremely stony.

**REF—Ridgecrest-Hymas gravelly loams, hilly.** This complex is on mountainous uplands. Slopes range from 8 to 30 percent. The complex is about 50 percent Ridgecrest gravelly loam and 35 percent Hymas gravelly loam. The Ridgecrest soil in an area of this complex has the profile described as representative of the series. The Hymas soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly. These soils are in such intricate patterns that it is not practical to map them separately.

Included with these soils in mapping are small areas of limestone rock outcrop and areas of soils that have a stony or extremely stony surface layer. Also included are small areas of Wahtigup, Highams, and Pavohroo soils.

Runoff is medium to very rapid, and the hazard of erosion is very high.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed. Capability unit VIe-1, nonirrigated; range site S13.

**RGF—Ridgecrest-Hymas very cobby loams, hilly.** This complex is on mountainous uplands. Slopes range from 4 to 30 percent. The complex is about 50 percent Ridgecrest very cobby loam and 35 percent Hymas very cobby loam. These soils have profiles similar to the ones described as representative of their respective series, but the surface layer is very cobby. They are in such intricate patterns that it is not practical to map them separately.

Included with these soils in mapping are small areas of soils that have slopes of less than 4 percent and small areas of soils that have slopes of more than 30 percent. Also included are small areas of rock outcrop and areas of soils that have a stony or very stony surface layer.

Runoff is rapid, and the hazard of erosion is high.

These soils are used mainly for range, wildlife habitat, recreation, and watershed. Capability unit VIIs-2, nonirrigated; range site RY3.

**RGG—Ridgecrest-Hymas very cobby loams, steep.** This complex is on mountainous uplands. Slopes range from 30 to 55 percent. The complex is about 45 percent Ridgecrest very cobby loam and 35 percent Hymas very cobby loam. These soils have profiles similar to the ones described as representative of their respective series, but the surface layer is very cobby. These soils are in such intricate patterns that it is not practical to map them separately.

Included with these soils in mapping are small areas of rock outcrop and areas of soils that have a very stony or extremely stony surface layer. Also included are small areas of Wahtigup, Highams, Nagitsy, and Pavohroo soils.

Runoff is rapid, and the hazard of erosion is very high.

These soils are used for range, recreation, watershed, and wildlife habitat. Capability unit VIIIs-2, nonirrigated; range site ST3.

**RHG—Ridgecrest-Hymas extremely stony loams, very steep.** This complex is on mountains. Slopes range from 55 to 70 percent. The complex is about 50 percent Ridgecrest extremely stony loam and 35 percent Hymas extremely stony loam. The Ridgecrest soil has a profile similar to the one described as representative of the series, but the surface layer is extremely stony. These soils are in such intricate patterns that it is not practical to map them separately.

Included with these soils in mapping are small areas of rock outcrop and areas of soils that have a gravelly or cobbly surface layer.

Runoff is very rapid, and the hazard of erosion is very high.

These soils are used for recreation, wildlife habitat, and watershed. Capability unit VIIIIs-1, nonirrigated; range site NU.

## Riverwash

**Rw—Riverwash.** This miscellaneous land type consists of nearly level, stratified sand and gravel bars along the Snake River. Elevation ranges from 4,350 to 4,400 feet. Areas have little or no vegetation. They are generally less than 3 feet higher than the river. They change in size and location even during normal river stages, but during floods the changes are extreme. This land type is used for recreation, for wildlife habitat, and as a source of sand and gravel. Capability unit VIIIw-1, nonirrigated; range site NU.

## Robin Series

The Robin series consists of well-drained soils on undulating to steep uplands. These soils formed in loess. Slopes are 4 to 55 percent. Elevation ranges from 5,400 to 6,000 feet. Dominant vegetation is dense aspen or brush. The mean annual precipitation is 17 to 20 inches, the mean annual soil temperature is 42° to 44° F, and the frost-free season is 60 to 75 days.

In a representative profile the surface layer is very dark grayish-brown and dark grayish-brown silt loam about 27 inches thick. The subsoil is brown heavy silt loam to a depth of 60 inches. The profile is leached of lime and is medium acid.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for range, dryfarmed small grain, wildlife habitat, recreation, and watershed.

Representative profile of Robin silt loam, 4 to 20 percent slopes, in SE $\frac{1}{4}$  sec. 23, T. 3 S., R. 37 E.:

A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak, very thin, platy structure parting to moderate, very fine, granular; soft, very friable, non-sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial pores; medium acid; abrupt, smooth boundary.

A12—3 to 11 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; few 1- to 2-millimeters brown (10YR 5/3) spots; weak,

coarse, prismatic structure parting to moderate, medium, subangular blocky and weak, fine, granular; soft, friable, nonsticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores; medium acid; gradual, smooth boundary.

A13—11 to 27 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky and moderate, fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores; few partly uncoated silt grains on peds; medium acid; gradual, wavy boundary.

B1t—27 to 39 inches, brown (10YR 5/3) heavy silt loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to moderate, fine, subangular blocky and weak, medium and fine, granular; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores; many dark grayish-brown (10YR 4/2) krotovinas; thin patchy clay films on peds and in pores; common uncoated silt grains on peds; medium acid; clear, wavy boundary.

B2t—39 to 60 inches, brown (10YR 5/3) heavy silt loam, brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, fine, subangular blocky and weak, medium and fine, granular; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; thin patchy clay films on peds and in pores; many uncoated silt grains on peds; medium acid.

The A horizon ranges from 15 to 33 inches in thickness. The solum ranges from 40 inches to several feet in thickness.

**RKE—Robin silt loam, 4 to 20 percent slopes.** This gently sloping to strongly sloping soil is on north-facing exposures on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 20 percent and areas of Lanoak, Rexburg, and Moohoo soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly for range, watershed, wildlife habitat, and recreation. Small areas are used for dryfarmed small grain. Capability unit IIIe-9, nonirrigated; range site MP4.

**RKF—Robin silt loam, 20 to 30 percent slopes.** This moderately steep soil is on foothills.

Included with this soil in mapping are small areas of soils that have slopes of less than 20 percent, small areas of soils that have slopes of more than 30 percent, and small areas of soils that contain quartzite fragments below a depth of 40 inches. Also included are small areas of Lanoak, Buckskin, and Moohoo soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used mainly for range. The short growing season is a concern if dryfarmed small grain is grown. Capability unit IIIe-9, nonirrigated; range site MP4.

**RKG—Robin silt loam, steep.** This soil is on north- and east-facing exposures on uplands. Slopes range from 30 to 55 percent.

Included with this soil in mapping are small areas

of soils that have slopes of less than 30 percent and areas of Dranyon, Lanoak, and Moohoo soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used mainly for range. Forage production is generally low because the aspen cover is dense. In places as much as 30 feet of snow accumulates on this soil and causes a short growing season. Livestock use areas of the soil mainly for shade and for protection from storms. Other uses of this soil are wildlife habitat, recreation, and watershed. Capability unit VIIe-0, nonirrigated; range site NE4.

## Rock Land

**RL—Rock land.** This miscellaneous land type is in steep mountainous areas in the vicinity of Mount Putnam. Slopes range from 12 to 55 percent. Included in mapping are large areas of quartzite outcrop and areas between outcrops that consist of stony or extremely stony soils that are less than 15 inches deep. Also included are small areas of Nagitsy and Moohoo soils.

Runoff is very rapid, and the hazard of erosion is very high.

Very little vegetation grows on this land type; it is used for wildlife habitat, recreation, and watershed. Capability unit VIIIs-1, nonirrigated; range site NU.

## Rudeen Series

The Rudeen series consists of well-drained soils on dissected plateaus. These soils formed in mixed loess, tuff, and rhyolite. Slopes are 4 to 65 percent. Elevation ranges from 4,900 to 6,000 feet. Dominant vegetation is grasses, shrubs, and scattered juniper. The mean annual precipitation is 11 to 13 inches, the mean annual soil temperature is 45° to 47° F, and the frost-free season is 100 to 110 days.

In a representative profile the surface layer is grayish-brown extremely stony loam about 10 inches thick. The underlying material is light-gray and very pale brown channery loam and very channery loam to a depth of 38 inches. It is underlain by tuff. The soil ranges from moderately alkaline in the surface layer to very strongly alkaline in the lower part. It is limy below a depth of 4 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is 20 to 40 inches.

These soils are used mainly for range. Small areas are used for dryfarmed small grain. The soils are also used for wildlife habitat, watershed, and recreation.

Representative profile of Rudeen extremely stony loam, hilly, in SW $\frac{1}{4}$ , NE $\frac{1}{4}$  sec. 9, T. 8 S., R. 32 E.:

A11—0 to 4 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; weak, medium, platy structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; 25 percent white (N 8/0) angular tuff fragments ranging from gravel to stones; moderately alkaline; clear, smooth boundary.

A12—4 to 10 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; 25 percent white (N 8/0) coarse tuff fragments ranging from gravel to stones; slightly calcareous, coarse fragments slightly coated with lime on lower sides; moderately alkaline; clear, wavy boundary.

C1ca—10 to 16 inches, light-gray (10YR 7/2) channery loam, brown (10YR 5/3) moist; weak, medium, prismatic structure parting to weak, fine and very fine, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; 35 percent white (N 8/0) coarse tuff fragments ranging from angular gravel to stones, coated with lime on bottoms, sides, and tops; strongly calcareous, few lime spots; moderately alkaline; clear, wavy boundary.

C2ca—16 to 28 inches, light-gray (10YR 7/2) very channery loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; 60 percent coarse tuff fragments ranging from angular gravel to stones, coated with lime on bottoms, sides, and tops; strongly calcareous; very strongly alkaline; gradual, wavy boundary.

C3—28 to 38 inches, very pale brown (10YR 7/3) very channery loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and slightly plastic; no roots; many very fine tubular pores; 60 percent white (N 8/0) coarse tuff fragments ranging from angular gravel to stones and stained very pale brown (10YR 7/3); most rock fragments not coated with lime, strongly calcareous; very strongly alkaline; abrupt, irregular boundary.

R—38 to 60 inches, white (N 8/0) hard tuff.

The A horizon is grayish-brown or dark grayish-brown loam or extremely stony loam. In places the upper few inches of the surface layer is noncalcareous. Depth to tuffaceous bedrock ranges from 20 to 40 inches.

**RNC—Rudeen loam, 4 to 12 percent slopes.** This gently sloping to moderately sloping soil is on dissected plateaus. It has a profile similar to the one described as representative of the series, but the surface layer is not stony.

Included with this soil in mapping are small areas of soils that have a gravelly or stony surface layer and areas of Waycup, Pocatello, Neeley, and Wahtigup soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryfarmed small grain, but yields are very low. This soil is also used for range. Capability unit VIe-1, nonirrigated; range site SI2.

**RNE—Rudeen loam, 12 to 20 percent slopes.** This strongly sloping soil is on dissected, low plateaus. It has a profile similar to the one described as representative of the series, but the surface layer is not stony.

Included with this soil in mapping are small areas of soils that are less than 20 inches deep over bedrock, small areas of rock outcrop, and small areas of sandy loam that are more than 40 inches deep over bedrock. Also included are small areas of Waycup, Wahtigup, Pocatello, and Neeley soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used for range. Capability unit VIe-1, nonirrigated; range site SI2.

**RNF—Rudeen loam, hilly.** This soil is on dissected plateaus. Slopes range from 8 to 30 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is not stony.

Included with this soil in mapping are small areas of sandy loam that is generally more than 40 inches deep over bedrock. Also included are areas of soils that have a stony or gravelly surface layer and areas of Wahtigup, Waycup, Pocatello, and Neeley soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range. Capability unit VIe-1, nonirrigated; range site SI2.

**RUE—Rudeen extremely stony loam, hilly.** This soil is on ridgetops on uplands. Slopes range from 8 to 30 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of sandy loam that are generally noncalcareous, are more than 40 inches deep over bedrock, and are less than 20 percent coarse fragments. Also included are small areas of Waycup, Pocatello, and Neeley soils.

Runoff is rapid, and the hazard of erosion is high.

This soil is used mainly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIIs-2, nonirrigated; range site RY2.

**RUF—Rudeen extremely stony loam, steep.** This soil is on uplands. Slopes range from 30 to 55 percent.

Included with this soil in mapping are small areas of bedrock outcrop, areas of soils that are less than 20 inches deep over bedrock, and areas of soils that have a gravelly surface. Also included are areas of Waycup, Wheeler, and Wahtigup soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used to a limited extent for range. Capability unit VIIs-2, nonirrigated; range site ST2.

**RUG—Rudeen extremely stony loam, very steep.** This soil is on dissected plateaus. Slopes range from 55 to 65 percent.

Included with this soil in mapping are small areas of soils that are less than 20 inches deep over bedrock and areas of bedrock outcrop. Also included are areas of Waycup and Wheeler soils.

The use of this soil is limited to wildlife habitat, recreation, and watershed. Capability unit VIIIs-1, nonirrigated; range site NU.

## Snake Series

The Snake series consists of somewhat poorly drained soils on low terraces. These soils formed in calcareous alluvium. Slopes are 0 to 2 percent. Elevation ranges from 4,350 to 4,400 feet. Dominant vegetation is grasses. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 47° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish-brown silt loam about 8 inches thick. It is underlain by light brownish-gray silt loam about 5 inches thick. Below this is pinkish-gray, white, and light-gray silty clay loam about 45 inches thick. The profile is moderately alkaline and strongly alkaline. It is limy throughout.

Permeability is slow, and available water capacity

is high. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 20 to 48 inches.

These soils are used mainly for range. They are also used for wildlife habitat and recreation.

Representative profile of Snake silt loam, 1,900 feet north and 1,200 feet west of the southeast corner of sec. 34, T. 4 S., R. 33 E.:

A1ca—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish-brown (10YR 3/2) moist; weak, medium, platy structure in upper 3 inches and moderate, fine and very fine, granular below; slightly hard, friable, sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial and very fine tubular pores; strongly calcareous; strongly alkaline; clear, smooth boundary.

C1ca—8 to 13 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to moderate, fine and very fine, granular; slightly hard, friable, sticky and plastic; many very fine, fine, and medium roots; many very fine interstitial pores and many very fine and few fine tubular pores; strongly calcareous, few lighter colored and more calcareous splotches; strongly alkaline; clear, wavy boundary.

C2ca—13 to 23 inches, pinkish-gray (7.5YR 7/2) silty clay loam, brown (7.5YR 4/2) moist, splotches of white (7.5YR 8/1); weak, very fine, subangular blocky and moderate, fine and very fine, granular structure; slightly hard, friable, sticky and plastic; common very fine, fine, and medium roots; common very fine interstitial pores and many very fine and few fine tubular pores; very strongly calcareous; strongly alkaline; gradual, smooth boundary.

C3ca—23 to 34 inches, pinkish-gray (7.5YR 7/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak, medium and fine, subangular blocky structure; hard, friable, sticky and plastic; few fine and medium roots; many very fine and few fine tubular pores; very strongly calcareous; moderately alkaline; clear, wavy boundary.

C4ca—34 to 48 inches, white (10YR 8/2) silty clay loam, light brownish gray (10YR 6/2) moist; weak, medium, fine, and very fine subangular blocky structure; few, coarse, faint mottles, dark yellowish brown (10YR 4/4) moist; hard, firm, sticky and plastic; few fine roots; many very fine and few fine tubular pores; few snail shells; moderately calcareous, few indurated calcium-carbonate concretions; moderately alkaline; clear, smooth boundary.

C5g—48 to 58 inches, light-gray (2.5Y 7/1) silty clay loam, dark gray (2.5Y 4/1) moist; many, medium and coarse, prominent, grayish-green (5G 5/2), black (5Y 2/1), and dark-brown (10YR 3/3) (moist) mottles; massive; very hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; common black nodules; slightly calcareous; moderately alkaline.

The A1ca horizon is grayish brown or light brownish gray and is moderately calcareous or strongly calcareous. The C5g horizon is stratified with silty clay or sandy loam.

**Sn—Snake silt loam.** This nearly level soil is on terraces dissected by stream channels and by water from many springs. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that are moderately affected by salt and alkali and areas of very poorly drained soils. Also included are areas of soils that have a surface layer of silty clay loam and areas of Peteetneet and Parehat soils.

Runoff is slow, and the hazard of erosion is slight.

Depth to the water table ranges from 30 to 48 inches.

This soil is used mainly for range. It also provides food and cover for upland game birds and waterfowl. The soil makes up an important part of the wildlife habitat and recreation sites in the Fort Hall Area. Capability unit IVw-9, nonirrigated; range site SB8.

**Ss—Snake silt loam, saline-alkali.** This nearly level soil is on bottom lands dissected by stream channels and by water from springs. It has a profile similar to the one described as representative of the series, but it is moderately affected by salt and alkali.

Included with this soil in mapping are small areas of poorly drained and very poorly drained soils, small slick spots, and areas of Peteetneet and Parehat soils.

Runoff is slow, and the hazard of erosion is slight. Depth to the seasonal high water table ranges from 30 to 48 inches.

This soil is used mainly for range. Capability unit VIw-1, nonirrigated; range site SL8.

**St—Snake silt loam, high water table.** This nearly level soil is in long, narrow, slightly concave drainage-ways on low terraces. It has a profile similar to the one described as representative of the series, but the water table is at a depth of 1½ to 3 feet.

Included with this soil in mapping are small areas of very poorly drained soils and areas of soils that are moderately affected by salt and alkali. Also included are areas of Peteetneet and Parehat soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for range. It is also used extensively for native hay and for winter feeding ground for livestock. The soil also provides cover and nesting for waterfowl and upland game birds. The many spring-fed streams that dissect the area are well suited to trout and other game fish. Capability unit Vw-2, nonirrigated; range site WL8.

## Tahquats Series

The Tahquats series consists of well-drained soils on fans. These soils formed in stony alluvium from quartzite. Slopes are 2 to 20 percent. Elevation ranges from 5,500 to 7,000 feet. Dominant vegetation is grasses. The mean annual precipitation is 15 to 20 inches, the mean annual soil temperature is 38° to 43° F, and the frost-free season is 50 to 70 days.

In a representative profile the surface layer is dark grayish-brown very stony loam and cobbly heavy loam about 12 inches thick. The upper 22 inches of the subsoil is brown and light-brown gravelly light clay loam, and the lower 10 inches is light-brown gravelly sandy clay loam. The underlying material is light-brown gravelly sandy loam to a depth of 60 inches. The profile is medium acid and slightly acid.

Permeability is moderately slow, and available water capacity is moderate. The effective rooting depth is more than 60 inches.

These soils are used mainly for range. Small areas are cultivated and used for dryfarmed small grain.

Representative profile of Tahquats very stony loam, rolling, in NW¼ sec. 30, T. 5 S., R. 38 E.:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) very stony loam, very dark brown (10YR 2/2) moist; moderate, fine and very fine, granular structure;

slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few coarse roots; many very fine and fine pores; few uncoated silt and sand grains; 5 percent stones and 15 percent angular gravel, mainly dark-gray (10YR 4/1) quartzite; medium acid; clear, smooth boundary.

A3—7 to 12 inches, dark grayish-brown (10YR 4/2) cobbly heavy loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, subangular blocky structure parting to weak, fine, granular; hard, friable, slightly sticky and slightly plastic; common fine and few coarse roots; common very fine and fine tubular pores; few uncoated silt grains; 25 percent stones, cobbles, and gravel; medium acid; clear, wavy boundary.

B21t—12 to 27 inches, brown (10YR 5/3) gravelly light clay loam, dark brown (7.5YR 4/3) moist; moderate, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; many very fine tubular pores; thin patchy clay films on peds and moderately thick continuous clay films in some pores; common uncoated silt grains; 35 percent stones, cobbles, and gravel, mainly quartzite; medium acid; clear, smooth boundary.

B22t—27 to 34 inches, light-brown (7.5YR 6/3) gravelly light clay loam, brown (7.5YR 4/3) moist; moderate, fine and very fine, subangular blocky structure; hard, friable, slightly sticky and plastic; few fine roots; many very fine and few fine tubular pores; thin patchy clay films on peds and moderately thick nearly continuous clay films in some channels; few uncoated silt and sand grains; 35 percent white (10YR 8/1) and pinkish-gray (5YR 7/2) quartzite gravel and cobbles; medium acid; clear, wavy boundary.

B3t—34 to 44 inches, light-brown (7.5YR 6/3) gravelly sandy clay loam, brown (7.5YR 4/3) moist; weak, fine and very fine, subangular blocky structure; hard, friable, slightly sticky and plastic; few fine roots; few very fine tubular pores; thin patchy clay films on peds and in pores; few fine spots of light-gray (10YR 7/2) uncoated silt and sand grains; 45 percent pinkish-gray quartzite stones, cobbles, and gravel; medium acid; gradual, wavy boundary.

C—44 to 60 inches, light-brown (7.5YR 6/3) gravelly sandy loam, brown (7.5YR 4/3) moist; massive; hard, friable, slightly sticky and plastic; few fine roots; common very fine pores; 45 percent quartzite gravel, cobbles, and stones; common, fine, black concretions; slightly acid.

The A horizon is dark grayish-brown or very dark grayish-brown loam, cobbly loam, or stony loam. It ranges from medium acid to neutral. In some areas, the soil is extremely stony below a depth of 40 inches.

**TAC—Tahquats loam, undulating.** This soil is on alluvial fans and mountainous foot slopes. Slopes range from 2 to 8 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is not very stony.

Included with this soil in mapping are small areas of soils that have a gravelly or cobbly surface layer and areas of Dranyon, Lanoak, and Tickason soils.

Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryfarmed small grain. It is also used for range, wildlife habitat, recreation, and watershed. Capability unit IIIe-9, nonirrigated; range site CY3.

**TBC—Tahquats very stony loam, rolling.** This soil is on extensive alluvial fans and on mountainous foot slopes. Slopes range from 4 to 20 percent. The soil

has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that are not stony but are gravelly or cobbly and areas of Dranyon, Nagitsy, Mookoo, and Lanoak soils.

Runoff is medium to rapid, and the hazard of erosion is high.

This soil is used mainly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VII<sub>s</sub>-2, nonirrigated; range site CY3.

## Tahquats Variant

The Tahquats variant soils are well drained and are on uplands. These soils formed in material weathered from quartzite. Slopes are 4 to 20 percent. Elevation ranges from 5,000 to 6,500 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 17 to 20 inches, the mean annual soil temperature is 44° to 48° F, and the frost-free season is 80 to 95 days.

In a representative profile the surface layer is dark grayish-brown and very dark grayish-brown stony loam about 6 inches thick. The subsoil is dark-brown and brown heavy clay loam and light clay about 30 inches thick. The underlying material is brown and white heavy clay loam to a depth of 60 inches. The profile is neutral to moderately alkaline and is limy below a depth of 28 inches.

Permeability is slow, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed.

Representative profile of Tahquats stony loam, heavy variant, rolling, 600 feet east and 100 feet south of center of north line of sec. 18, T. 5 S., R. 38 E.:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) stony loam, very dark brown (10YR 2/2) moist; weak, fine and medium, platy structure parting to moderate, fine and medium, granular; hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial pores; 20 percent gravel, cobbles, and stones; neutral; clear, smooth boundary.

A12—2 to 6 inches, very dark grayish-brown (10YR 3/2) stony heavy loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, granular structure; hard, friable, sticky and plastic; common very fine, fine, and medium roots; many very fine interstitial and very fine tubular pores; 20 percent subangular gravel, cobbles, and stones, mainly light-gray (N 7/0) quartzite; common uncoated silt and sand grains on peds; neutral; clear, wavy boundary.

B21t—6 to 15 inches, dark-brown (7.5YR 4/2) heavy clay loam, dark brown (7.5YR 3/2) moist; weak, medium, prismatic structure parting to strong, very fine and fine, angular blocky; very hard, firm, very sticky and very plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; 10 percent gravel and cobbles; moderately thick continuous clay films on peds and in pores; few uncoated silt and sand grains on peds; some slightly darker colored coatings on vertical ped surfaces; neutral; clear, wavy boundary.

B22t—15 to 28 inches, brown (7.5YR 4/2) light clay, dark brown (7.5YR 4/2) moist; weak, medium and coarse, prismatic structure parting to weak, medium and fine, angular and subangular blocky; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine and fine tubular pores; 10 percent gravel and cobbles; mod-

erately thick continuous clay films on peds and in pores; few uncoated silt and sand grains on peds; neutral; clear, wavy boundary.

B3ca—28 to 36 inches, 60 percent brown (7.5YR 5/4) and about 40 percent pinkish-gray (7.5YR 7/2) heavy clay loam, brown (7.5YR 4/4) and light brown (7.5YR 6/4) moist; weak, medium, prismatic structure parting to weak, coarse and medium, angular and subangular blocky; very hard, firm, sticky and plastic; few fine roots; few very fine tubular pores; 10 percent gravel and cobbles; thin patchy clay films on few peds; moderately calcareous, many splotches and spots of lime; moderately alkaline; clear, irregular boundary.

Cca—36 to 60 inches, 60 percent brown (7.5YR 5/4) and 40 percent white (10YR 8/2) heavy clay loam, brown (7.5YR 4/4) and very pale brown (10YR 7/3) moist; weak, medium and fine, angular and subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few very fine tubular pores; 10 percent gravel and cobbles; few black semihard concretions; strongly calcareous, many large lime splotches; moderately alkaline.

The A horizon is dark grayish brown, very dark grayish brown, or brown. Depth to the B3ca horizon ranges from 18 to 30 inches.

## TCD—Tahquats stony loam, heavy variant, rolling.

This soil is on ridgetops on uplands. Slopes range from 4 to 20 percent.

Included with this soil in mapping are small areas of soils that have a cobbly or very stony surface layer and small areas of soils that have slopes of more than 20 percent. Also included are small areas of Dranyon, Tahquats, Nagitsy, and Lanoak soils.

Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used mainly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VI<sub>e</sub>-1, nonirrigated; range site CY3.

## Tickason Series

The Tickason series consists of well-drained soils on low terraces or stream bottoms. These soils formed in alluvium. Slopes are 0 to 12 percent. Elevation ranges from 4,400 to 4,700 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 11 to 13 inches, the mean annual soil temperature is 48° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish-brown loam and sandy loam about 12 inches thick. The subsoil is grayish-brown and light brownish-gray loam and silt loam about 8 inches thick. The underlying material is light-gray and light brownish-gray silt loam to a depth of 54 inches and light brownish-gray loamy sand to a depth of 60 inches. The soil is neutral to moderately alkaline. It is limy below a depth of 18 inches.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for irrigated crops, hay, and pasture. They are also used for range.

Representative profile of Tickason loam, 0 to 2 percent slopes, in NE $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 2, T. 6 S., R. 32 E.:

A11—0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate,

very thin and thin, platy structure parting to weak, very fine, granular; soft, very friable, non-sticky and nonplastic; many very fine and fine roots; many very fine pores; neutral; clear, smooth boundary.

A12—3 to 12 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, very fine, granular; soft, very friable, non-sticky and nonplastic; common very fine and fine roots; common very fine tubular pores; neutral; gradual, wavy boundary.

B2—12 to 18 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to weak, medium and coarse, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; few very hard nodules that are weakly cemented with silica-lime; neutral; clear, wavy boundary.

B3—18 to 20 inches, light brownish-gray (10YR 6/2) light silt loam, dark grayish brown (10YR 4/2) moist; weak, medium, prismatic structure parting to weak, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; few very hard nodules that are weakly cemented with silica-lime; slightly calcareous; mildly alkaline; gradual, smooth boundary.

C1ca—20 to 44 inches, light-gray (10YR 7/2) light silt loam, grayish brown (10YR 5/2) moist; weak, fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; few very hard nodules that are weakly cemented with silica-lime; strongly calcareous, many soft splotches and thin coatings of lime; moderately alkaline; gradual, wavy boundary.

C2—44 to 54 inches, light brownish-gray (10YR 6/2) light silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine tubular pores; moderately calcareous, few lime veins and spots; moderately alkaline; abrupt, smooth boundary.

IIC3—54 to 60 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; single grained; loose dry and moist; slightly calcareous; moderately alkaline.

The A horizon is grayish-brown or dark grayish-brown loam, sandy loam, or gravelly loam. The soils are stratified, and in some areas sand and gravel are below a depth of 40 inches.

**TdA—Tickason loam, 0 to 2 percent slopes.** This nearly level soil is on low alluvial terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 2 percent, small areas of soils that have a gravelly or sandy surface layer, and small areas of McDole, Paniogue, Declo, and Penoyer soils.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, sugar beets, small grain, hay, and pasture. Capability unit IIC-2, irrigated; not assigned to a range site.

**TEB—Tickason loam, 0 to 4 percent slopes.** This nearly level to very gently sloping soil is on alluvial terraces and fans.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent, small areas of soils that are moderately affected by salt and alkali, and small areas of soils that have a weakly cemented layer in the subsoil. Also included are areas of slightly wet soils that are indicated on the soil map by the symbol for wet spots.

Runoff is slow, and the hazard of erosion is slight.

This soil is used for range. Capability unit VIC-1, nonirrigated; range site SI2.

**TGD—Tickason gravelly loam, 4 to 12 percent slopes.** This gently sloping and moderately sloping soil is on shoulders of terrace escarpments. It has a profile similar to the one described as representative of the series, but the surface layer is gravelly.

Included with this soil in mapping are small areas of soils that have a cobbly surface layer and small areas of soils that have slopes of more than 12 percent. Also included are small areas of Pocatello, Wheeler, Penoyer, and Wahtigup soils.

Runoff is medium, and the hazard of erosion is high.

This soil is used for range. Capability unit VIe-1, nonirrigated; range site SI1.

## Tindahay Series

The Tindahay series consists of somewhat excessively drained soils on alluvial fans and terraces. These soils formed in mixed alluvium and eolian deposits. Slopes are 0 to 20 percent. Elevation ranges from 4,400 to 4,700 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 9 to 11 inches, the mean annual soil temperature is 50° to 53° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is grayish-brown loamy coarse sand about 2 inches thick. The underlying material is pale-brown and brown loamy coarse sand and sandy loam to a depth of 24 inches and light brownish-gray and light-gray coarse sand and sand below this, to a depth of 60 inches. The profile is neutral and mildly alkaline. It is leached of lime to a depth of 24 inches.

Permeability is moderately rapid, and available water capacity is low. The effective rooting depth is more than 60 inches.

These soils are used for range, irrigated crops, and pasture.

Representative profile of Tindahay loamy coarse sand, 0 to 2 percent slopes, near the southeast corner of the NE $\frac{1}{4}$  sec. 34, T. 4 S., R. 34 E.:

A1—0 to 2 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, thin, platy structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; neutral; clear, smooth boundary.

C1—2 to 6 inches, pale-brown (10YR 6/3) loamy coarse sand, dark brown (10YR 3/3) moist; weak, very thin, platy structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine tubular pores; neutral; clear, smooth boundary.

C2—6 to 13 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak, coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine tubular pores; neutral; clear, smooth boundary.

C3—13 to 19 inches, brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) moist; weak, coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine tubular pores; 5 percent fine gravel; neutral; clear, smooth boundary.

C4—19 to 24 inches, pale-brown (10YR 6/3) loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine tubular pores; 5 percent fine gravel; neutral; clear, smooth boundary.

C5ca—24 to 36 inches, light brownish-gray (10YR 6/2) coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine tubular pores; 5 percent fine gravel; few slightly hard nodules; moderately calcareous; mildly alkaline; clear, wavy boundary.

C6ca—36 to 60 inches, light-gray (10YR 7/1) and dark-gray (10YR 4/1) sand, grayish brown (10YR 5/2) and black (10YR 2/1) moist; single grained; loose dry and moist; few very fine and fine roots; many very fine interstitial pores; 5 percent fine gravel; moderately calcareous; mildly alkaline.

The A horizon is grayish-brown or light brownish-gray loamy coarse sand or loamy sand. The soil is stratified between depths of 10 and 40 inches but is generally loamy sand, loamy coarse sand, or coarse sand.

**ThA—Tindahay loamy coarse sand, 0 to 2 percent slopes.** This nearly level soil is on alluvial terraces and fans. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have gravelly underlying material below a depth of 20 inches and small areas of active sand dunes. Also included are small areas of Feltham, Quincy, Escalante, and Declo soils.

Runoff is slow, the hazard of water erosion is slight, and the hazard of soil blowing is very high.

This soil is used mainly for range, but some areas are used for irrigated potatoes and small grain, hay, and pasture. Capability units IVE-5, irrigated, VIIe-0, nonirrigated; range site SA1.

**ThB—Tindahay loamy coarse sand, 2 to 4 percent slopes.** This very gently sloping soil is on alluvial terraces and fans.

Included with this soil in mapping are small areas of soils that have slopes of more than 4 percent and small areas of active sand dunes. Also included are small areas of Quincy, Feltham, Escalante, and Declo soils.

Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is very high.

This soil is used mainly for range, but some areas are used for irrigated small grain, potatoes, hay, and pasture. Capability units IVE-5, irrigated, and VIIe-0, nonirrigated; range site SA1.

**ThC—Tindahay loamy coarse sand, 4 to 8 percent slopes.** This gently sloping soil is on terraces.

Included with this soil in mapping are small areas of active sand dunes and areas of Feltham, Quincy, Escalante, and Declo soils.

Runoff is slow, the hazard of water erosion is moderate, and the hazard of soil blowing is very high.

This soil is used mainly for range, but some areas are irrigated and are used for small grain, potatoes, hay, and pasture. Capability units IVE-5, irrigated, and VIIe-0, nonirrigated; range site SA1.

**ThE—Tindahay loamy coarse sand, 12 to 20 percent slopes.** This strongly sloping soil is on terraces or terrace escarpments.

Included with this soil in mapping are areas of soils

that have a gravelly or cobbly surface layer and areas of Feltham, Quincy, and Broncho soils.

Runoff is very rapid, and the hazards of soil blowing and water erosion are very high.

This soil is used mainly for range, but some areas are used for irrigated pasture. Capability units VIe-2, irrigated, and VIIe-0, nonirrigated; range site SA1.

**TNF—Tindahay loamy sand, undulating.** This soil is on terraces. Slopes range from 2 to 8 percent.

Included with this soil in mapping are small areas of soils that have slopes of more than 8 percent and areas of Feltham and Quincy soils.

Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is very high.

This soil is used for range. Capability unit VIIe-0, nonirrigated; range site SA1.

## Wahtigup Series

The Wahtigup series consists of well-drained soils in mountainous areas. These soils formed in colluvium and local alluvium weathered from limestone and some loess. Slopes are 8 to 55 percent. Elevation ranges from 5,000 to 6,000 feet. Dominant vegetation is grasses, shrubs, and scattered juniper. The mean annual precipitation is 11 to 15 inches, the mean annual soil temperature is 46° to 47° F, and the frost-free season is 90 to 110 days.

In a representative profile the surface layer is grayish-brown gravelly loam about 8 inches thick. The underlying material is grayish-brown, light-gray, and white gravelly loam to a depth of 41 inches. It is underlain by fractured, dark-gray limestone. The profile is moderately alkaline and strongly alkaline. It is limy throughout.

Permeability is moderate, and available water capacity is moderate. The effective rooting depth is 40 to 60 inches.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed.

Representative profile of Wahtigup gravelly loam, hilly, in NW¼,NW¼ sec. 30, T. 4 S., R. 37 E.:

A11—0 to 3 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine and medium roots; many very fine interstitial and common very fine tubular pores; 20 percent angular gravel and some cobbles; moderately calcareous; moderately alkaline; clear, smooth boundary.

A12—3 to 8 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; 20 percent angular gravel and a few cobbles; moderately calcareous; moderately alkaline; clear, smooth boundary.

C1—8 to 13 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, medium and fine, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; 25 percent angular gravel and a few cobbles; moderately calcareous, gravel slightly coated

with lime on lower sides; moderately alkaline; abrupt, wavy boundary.

C2—13 to 20 inches, light-gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; weak, very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; 30 percent angular gravel and cobbles; few hard nodules that are weakly cemented with silica-lime; strongly calcareous, rock fragments coated with lime on lower sides and thinly coated on upper sides; moderately alkaline; clear, wavy boundary.

C3—20 to 41 inches, white (10YR 8/2) gravelly loam, light brownish gray (10YR 6/2) moist; weak, very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; 35 percent angular gravel and cobbles; very strongly calcareous; strongly alkaline; abrupt, irregular boundary.

R—41 to 47 inches, dark-gray (N 4/0) fractured limestone; 3 millimeters thick, brown (10YR 5/3), silica-lime, indurated, discontinuous, laminar layer on top of the limestone.

The A horizon is grayish-brown or dark grayish-brown gravelly loam or very cobbly loam. It ranges from 4 to 16 inches in thickness. The soil is underlain by bedrock at a depth of 40 to 60 inches.

**WAF—Wahtigup gravelly loam, hilly.** This soil is on ridgetops and mountain side slopes. Slopes range from 8 to 30 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of more than 30 percent, small areas of soils that have a cobbly or stony surface layer, and areas of limestone bedrock outcrop. Also included are areas of Highams, Hymas, and Neeley soils.

Runoff is medium, and the hazard of erosion is high.

This soil is used for range. Capability unit VIe-1, nonirrigated; range site RY2.

**WBF—Wahtigup very cobbly loam, hilly.** This soil is on ridgetops and side slopes of mountainous uplands. Slopes range from 8 to 30 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is very cobbly.

Included with this soil in mapping are small areas of soils that have limestone bedrock at a depth of less than 40 inches, areas of soils that have slopes of more than 30 percent, areas of soils that have a gravelly surface layer, and small areas of bedrock outcrop. Also included are areas of Highams, Ridgecrest, Hymas, Pocatello, and Neeley soils.

Runoff is medium, and the hazard of erosion is high.

This soil is used for range. Capability unit VIIs-2, nonirrigated; range site RY2.

**WBG—Wahtigup very cobbly loam, steep.** This soil is on mountainous uplands. Slopes range from 30 to 55 percent. The profile of this soil is similar to the one described as representative of the series, but the surface layer is very cobbly.

Included with this soil in mapping are small areas of gravelly soils and areas of rock outcrop. Also included are areas of Highams, Hymas, and Wheeler soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for range. Capability unit VIIs-2, nonirrigated; range site SW2.

## Waycup Series

The Waycup series consists of well-drained soils on mountainous foot slopes or basalt ridges. These soils formed in mixed loess and material weathered from basalt. Slopes are 8 to 55 percent. Elevation ranges from 4,500 to 5,200 feet. Dominant vegetation is grasses and shrubs. The mean annual precipitation is 8 to 12 inches, mean annual soil temperature is 48° to 50° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray extremely stony loam about 9 inches thick. The subsoil is light brownish-gray extremely stony loam about 5 inches thick. The underlying material is pale-brown, very pale brown, and white extremely stony loam and very gravelly loam to a depth of 51 inches. It is underlain by fractured basalt. The profile is moderately alkaline and strongly alkaline. It is limy throughout.

Permeability is moderate, and available water capacity is low. The effective rooting depth is 40 to 60 inches.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed.

Representative profile of Waycup extremely stony loam, steep, in SW $\frac{1}{4}$  sec. 28, T. 7 S., R. 33 E.:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; moderate, very thin, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine vesicular pores; 20 percent angular stones, cobbles, and gravel; slightly calcareous; moderately alkaline; abrupt, smooth boundary.

AB—3 to 9 inches, light brownish-gray (10YR 6/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, subangular blocky structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine tubular pores; slightly calcareous; 20 percent angular stones, cobbles, and gravel; rock fragments slightly coated with lime on lower sides; moderately alkaline; clear, smooth boundary.

B2—9 to 14 inches, light brownish-gray (10YR 6/2) extremely stony loam, dark grayish brown (10YR 4/2) moist; weak, medium, prismatic structure parting to weak, fine and medium, subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and few fine tubular pores; moderately calcareous; 40 percent stones, cobbles, and gravel; rock fragments moderately coated with lime on lower sides; moderately alkaline; clear, wavy boundary.

C1ca—14 to 22 inches, pale-brown (10YR 6/3) extremely stony loam, brown (10YR 4/3) moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; strongly calcareous; 45 percent stones, cobbles, and gravel; rock fragments moderately coated with lime on lower sides; moderately alkaline; clear, wavy boundary.

C2ca—22 to 27 inches, very pale brown (10YR 7/3) extremely stony loam, brown (10YR 5/3) moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; strongly calcareous; many large splotches of lime material; 45 percent stones, cobbles, and gravel; rock fragments thickly coated

with lime on lower sides; strongly alkaline; clear, wavy boundary.

**C3ca**—27 to 38 inches, white (10YR 8/2) extremely stony loam, pale brown (10YR 6/3) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; strongly calcareous; 50 percent stones, cobbles, and gravel; rock fragments thickly coated with lime on lower sides; very strongly alkaline; clear, wavy boundary.

**C4ca**—38 to 51 inches, white (10YR 8/2) very gravelly loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; common fine tubular pores; 70 percent gravel, cobbles, and stones; fragments thickly coated with lime; moderately alkaline; abrupt, wavy boundary.

**R**—51 to 60 inches, fractured basalt; cracks coated with lime.

The A horizon is light brownish-gray or grayish-brown gravelly loam, cobbly loam, or extremely stony loam. It is 3 to 11 inches thick. Depth to bedrock ranges from 40 to 60 inches.

**WcD—Waycup gravelly loam, 8 to 12 percent slopes.**

This moderately sloping soil is on dissected, high plateaus. It has a profile similar to the one described as representative of the series, but the surface layer is gravelly.

Included with this soil in mapping are small areas of soil that are less than 20 inches deep over bedrock and areas of rock outcrop. Also included are areas of soils that are very stony, areas of soils that are very gravelly, and areas of Pocatello, Portneuf, and Hondo-ho soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for irrigated small grain, hay, and pasture. It is generally cultivated with soils that are more suited to crops. Capability unit VIe-2, irrigated; not assigned to a range site.

**WDF—Waycup cobbly loam, hilly.** This soil is in long eroded areas on dissected uplands. Slopes range from 12 to 30 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is cobbly.

Included with this soil in mapping are areas of Wheeler, Neeley, and Hondo-ho soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used for range, wildlife habitat, and watershed. Capability unit VIe-1, nonirrigated; range site SI1.

**WEF—Waycup extremely stony loam, hilly.** This soil is on foothills of mountains. Slopes range from 8 to 30 percent.

Included with this soil in mapping are small areas of basalt bedrock outcrop and areas of shallow and moderately deep soils. Also included are areas of soils that are gravelly, areas of soils that have fewer stones than this Waycup soil, and small areas of Rudeen, Wheeler, and Hondo-ho soils.

Runoff is medium to rapid, and the hazard of erosion is moderate to high on this nonirrigated soil.

This soil is used for range. Capability unit VIIs-2, nonirrigated; range site RY1.

**WEG—Waycup extremely stony loam, steep.** This soil is on foothills of mountains. Slopes range from 30

to 55 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of rock outcrop and areas of Wheeler, Hondo-ho, and Rudeen soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for wildlife habitat, recreation, and watershed. Capability unit VIIIs-1, nonirrigated; range site NU.

## Wheeler Series

The Wheeler series consists of well-drained soils on dissected alluvial fans and low plateaus. These soils formed in loess. Slopes are 8 to 75 percent. Elevation ranges from 4,500 to 5,400 feet. Dominant vegetation is grasses. The mean annual precipitation is 8 to 12 inches, the mean annual soil temperature is 50° to 52° F, and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray silt loam about 3 inches thick. The underlying material is light brownish-gray and very pale brown silt loam to a depth of 60 inches. The profile is mildly alkaline and moderately alkaline. It is limy throughout.

Permeability is moderate, and available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used mainly for range. Small areas are used for irrigated potatoes, sugar beets, small grain, hay, and pasture.

Representative profile of Wheeler silt loam, 12 to 30 percent slopes, in SE $\frac{1}{4}$ SW $\frac{1}{4}$  sec. 36, T. 2 S., R. 36 E.:

**A1**—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, very thin, platy structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine vesicular pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

**C1**—3 to 14 inches, light brownish-gray (10YR 6/2) silt loam; dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine tubular pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

**C2**—14 to 24 inches, very pale brown (10YR 7/3) silt loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine and few fine tubular pores; strongly calcareous; few very fine white gypsum veins; moderately alkaline; gradual, wavy boundary.

**C3**—24 to 46 inches, very pale brown (10YR 7/3) silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; common very fine and few fine tubular pores; many very fine gypsum veins; strongly calcareous; moderately alkaline; gradual, wavy boundary.

**C4**—46 to 60 inches, very pale brown (10YR 7/3) silt loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and few fine tubular pores; many white very fine veins of gypsum in vertical cracks

or as streaks; strongly calcareous; moderately alkaline.

The A1 horizon is light brownish gray or pale brown and is moderately calcareous or strongly calcareous. In some areas, the A1 horizon is absent.

**WhD—Wheeler silt loam, 8 to 12 percent slopes.** This moderately sloping soil is on south-facing side slopes of loess-mantled high alluvial fans and dissected low plateaus.

Included with this soil in mapping are small areas of soils that have slopes of more than 12 percent and areas of Pocatello, Portneuf, and Penoyer soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for irrigated crops and range. Capability units IVE-1, irrigated, and VIe-1, nonirrigated; range site SI1.

**WhF—Wheeler silt loam, 30 to 55 percent slopes.** This steep soil is on south-facing exposures of loess-mantled high alluvial fans and dissected low plateaus.

Included with this soil in mapping are small areas of moderately steep and very steep soils and areas of Pocatello, Penoyer, and Neeley soils.

This soil is used for range. Capability unit VIIe-0, nonirrigated; range site SI1.

**WLE—Wheeler silt loam, 12 to 30 percent slopes.** This strongly sloping and moderately steep soil is on south-facing side slopes of loess-mantled dissected alluvial fans and low plateaus. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have slopes of less than 12 percent and areas of Pocatello, Penoyer, and Neeley soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for range. Capability unit VIe-1, nonirrigated; range site SI1.

**WLF—Wheeler silt loam, steep.** This soil is on south-facing side slopes of loess-mantled dissected fans and plateaus. Slopes range from 30 to 55 percent.

Included with this soil in mapping are small areas of moderately steep soils and areas of Pocatello, Penoyer, Neeley, and Waycup soils.

Runoff is rapid, and the hazard of erosion is very high.

This soil is used for range and wildlife habitat. Capability unit VIIe-0, nonirrigated; range site SI1.

**WLG—Wheeler silt loam, very steep.** This soil is on south-facing side slopes of dissected low fans and plateaus of loess-mantled uplands. Slopes range from 55 to 75 percent.

Included with this soil in mapping are small areas of soils that have slopes of less than 55 percent and areas of Pocatello, Neeley, and Waycup soils.

Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for wildlife habitat, recreation, and watershed. Capability unit VIIIe-1, nonirrigated; range site NU.

## Zunhall Series

The Zunhall series consists of somewhat poorly drained soils along stream bottoms. These soils formed

in alluvium. Slopes are 0 to 2 percent. Elevation ranges from 5,000 to 7,000 feet. Dominant vegetation is grasses. The mean annual precipitation is 11 to 15 inches, the mean annual soil temperature is 45° to 47° F, and the frost-free season is 85 to 100 days.

In a representative profile the surface layer is gray silt loam about 6 inches thick. The underlying material is light gray and white heavy silt loam and light silty clay loam to a depth of 60 inches. The profile is strongly alkaline and moderately alkaline, and the content of lime is high.

Permeability is moderately slow, and available water capacity is very high. The effective rooting depth is more than 60 inches. The water table fluctuates between 10 and 40 inches.

These soils are used mainly for range. They are also used for wildlife habitat, recreation, and watershed.

Representative profile of Zunhall silt loam, in NE $\frac{1}{4}$ , NE $\frac{1}{4}$  sec. 3, T. 6 S., R. 38 E.:

- A11ca—0 to 2 inches, gray (N 6/0) silt loam, dark gray (N 4/0) moist; weak, thin, platy structure parting to strong, fine and very fine, granular; hard, friable, slightly sticky and slightly plastic; root mat; many very fine interstitial pores; very strongly calcareous; strongly alkaline; abrupt, smooth boundary.
- A12ca—2 to 6 inches, gray (N 6/0) silt loam, very dark gray (N 3/0) moist; moderate, thin, platy structure parting to moderate, very fine, subangular and angular blocky and weak, fine and very fine, granular; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; very strongly calcareous; very strongly alkaline; clear, smooth boundary.
- C1ca—6 to 17 inches, light-gray (N 6/0) heavy silt loam, dark gray (N 4/0) moist; weak, medium, platy structure parting to moderate, fine and very fine, granular; slightly hard, very friable, sticky and plastic; many very fine and fine roots; many very fine tubular pores; very strongly calcareous; strongly alkaline; clear, wavy boundary.
- C2ca—17 to 23 inches, light-gray (N 7/0) light silty clay loam, gray (N 5/0) moist; weak, very fine and fine, granular structure; hard, very friable, sticky and plastic; many very fine and fine roots; many very fine tubular pores; very strongly calcareous; strongly alkaline; clear, wavy boundary.
- C3ca—23 to 37 inches, light-gray (N 7/0) light silty clay loam, gray (N 5/0) moist; few, fine, distinct, yellowish-brown (10YR 5/4) mottles, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; very strongly calcareous and common 1-millimeter spots of lime; moderately alkaline; gradual, wavy boundary.
- C4ca—37 to 46 inches, white (2.5Y 8/2) light silty clay loam, light brownish gray (2.5Y 6/2) moist; few, fine, distinct, yellowish-brown (10YR 5/6) moist, mottles; massive; hard, friable, sticky and plastic; common very fine tubular pores; common knobby lime indurated concretions; very strongly calcareous; moderately alkaline; gradual, wavy boundary.
- C5ca—46 to 60 inches, white (2.5Y 8/2) heavy silt loam, light brownish gray (2.5Y 6/2) moist; few, fine, distinct, yellowish-brown (10YR 5/6) moist, mottles; massive; hard, friable, sticky and plastic; common very fine tubular pores; many knobby lime-indurated and strongly lime-cemented concretions; very strongly calcareous; moderately alkaline.

The A horizon is gray, grayish brown, or light brownish gray. It is mildly alkaline to very strongly alkaline. Faint or distinct mottles are between depths of 20 and 30 inches.

**ZN—Zunhall silt loam.** This nearly level soil is on

valley bottoms. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of poorly drained soils and areas of Fury and Neeley soils.

Runoff is slow, and the hazard of erosion is slight. The water table is at a depth of 20 to 40 inches.

This soil is used for range. Capability unit VIw-1, nonirrigated; range site SL8.

**ZU—Zunhall silt loam, high water table.** This nearly level soil is on valley bottoms.

Included with this soil in mapping are small areas of soils that are moderately affected by salt and alkali and areas of Fury and Neeley soils.

Runoff is slow, and the hazard of erosion is slight. The water table is at a depth of 10 to 24 inches.

This soil is used for range. Capability unit Vw-2, nonirrigated; range site WL8.

## *Use and Management of the Soils*

This section describes the general management of soils in the Fort Hall Area. It explains the system of capability grouping used by the Soil Conservation Service, describes the capability units in the survey area, and gives suggestions for use and management of soils in each unit. In addition, estimated yields of the principal crops are provided. Also described is use of the soils for range, woodland, wildlife, and recreation. The properties and features that affect use of the soils for engineering are given, mainly in tables.

## **Capability Grouping**

Some readers, particularly those who farm on a large scale, find it impractical to use and manage alike some of the different kinds of soil on their farm. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

This grouping is based on limitations of the soils when used for field crops, the risk of damage when they are farmed, and the way the soils respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range, for forest trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: the class, the subclass, and the unit. The eight classes in the capability system and the subclasses and units are described in the pages that follow.

**CAPABILITY CLASSES**, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in the Fort Hall Area.)

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

**CAPABILITY SUBCLASSES** are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils, the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I, there are no subclasses, because the soils in this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

**CAPABILITY UNITS** are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

### *Management by capability units*

In the following pages, the capability units in the

Fort Hall Area are described and suggestions for the use and management of the soils are given. Because all of the capability units in Idaho are not represented in the Fort Hall Area, the units are not numbered consecutively.

Unless otherwise noted, depth refers to the thickness of the soils to bedrock or to hardpan that restricts root development of plants commonly grown in the area.

#### CAPABILITY UNIT IIc-1, IRRIGATED

This unit consists of silt loams, loams, sandy loams, and gravelly loams. The soils are well drained. They are more than 60 inches deep. Slopes are 2 to 4 percent.

Available water capacity is high, and permeability is moderate or moderately slow. The frost-free season ranges from 100 to 120 days. Runoff is medium, and the hazard of erosion is moderate. The hazard of soil blowing is moderate on some soils, and special care is needed to control blowing.

The soils in this unit are used for sugar beets, potatoes, small grain, alfalfa, and pasture.

Growing soil-improving crops at least 30 percent of the time and plowing under all crop residue helps to improve tilth. Fall tillage is advisable before row crops, but where soil blowing is a hazard, leaving crop residue on the surface until spring helps to control the blowing.

A suitable cropping system consists of 2 or 3 years of alfalfa-grass hay, 2 years of potatoes or sugar beets, 1 year of grain, and 1 year of grain and a new seeding of alfalfa and grass.

Irrigation water can be applied by furrows, corrugations, or sprinklers. Care is needed in applying irrigation water to ensure minimum loss of soil. Water should be applied cross slope. Deep cuts should be avoided when leveling or smoothing the soil to prevent exposure of the lime layer, which is less fertile than the other layers and requires additional fertilizer.

#### CAPABILITY UNIT IIc-4, IRRIGATED

This unit consists of well-drained sandy loams. The soils are more than 60 inches deep. Slopes are 0 to 2 percent.

Available water capacity is high, and permeability is moderate. The frost-free season ranges from 100 to 120 days. Runoff is slow, the hazard of water erosion is slight, and the hazard of soil blowing is moderate.

The soils in this unit are used for potatoes, sugar beets, small grain, hay, and pasture.

Growing soil-improving crops at least 30 percent of the time and using all crop residue help to maintain or improve tilth. Areas used for row crops or left bare over the winter can be protected from soil blowing by rough tillage and leaving crop residue on the surface. Soil blowing causes difficulty in establishing sugar beets in places. Windbreak plantings can also be used to protect the soil from blowing.

A suitable cropping system is 3 years of alfalfa, 1 year of potatoes, 1 year of grain, 1 year of potatoes, and 1 year of grain together with a new seeding of alfalfa and grass.

Irrigation water can be applied by sprinkler, corrugation, or furrow systems. It should be carefully distributed to control erosion and limit water loss.

#### CAPABILITY UNIT IIw-2, IRRIGATED

This unit consists of silt loams and fine sandy loams. The soils are mainly somewhat poorly drained, but some are moderately well drained and are subject to overflow. They are more than 60 inches deep. Slopes are 0 to 2 percent.

Available water capacity is moderate or high, and permeability is moderately rapid to slow. The frost-free season ranges from 100 to 120 days. Runoff is ponded or slow, and the hazard of erosion is slight.

The soils in this unit are used for sugar beets, small grain, alfalfa, pasture, and some potatoes.

Growing soil-improving crops at least 30 percent of the time, returning all crop residue to the soil, using minimum tillage, and providing a system of surface drainage help to maintain crop yields, maintain organic-matter content, and improve soil tilth. Dikes or levees are required to protect the soils that are subject to damaging overflow.

A suitable cropping system consists of 3 years of alfalfa or alfalfa-grass hay, 2 years of sugar beets or potatoes, 1 year of grain, and 1 year of grain together with a new seeding of alfalfa or grass.

Irrigation water can be applied by sprinkler, border, furrow, or corrugation systems. Carefully planned irrigation helps to control the water table. In places drainage is needed to reduce the risk of salt accumulation and to control extreme fluctuation of the water table, which can be damaging to crop roots.

#### CAPABILITY UNIT IIc-1, IRRIGATED

This unit consists of loams, gravelly loams, and sandy loams. The soils are well drained or moderately well drained. The soils are very deep. They are mainly 20 to 40 inches deep over sand and gravel, but some of the soils in this unit are 60 inches deep or more over sand and gravel. Slopes are mainly 0 to 2 percent but range to 4 percent.

Available water capacity is mainly moderate but ranges to high. Permeability is mainly moderate to moderately rapid but is slow in some soils. The growing season ranges from 100 to 120 days. Runoff is slow, and the hazard of erosion is slight.

The soils in this unit are used for sugar beets, potatoes, small grain, alfalfa, and pasture.

Returning all crop residue to the soil, using minimum tillage, and fall plowing after row crops help to control erosion, maintain organic-matter content, and improve tilth.

A suitable cropping system consists of 2 or 3 years of alfalfa or alfalfa-grass hay, 1 or 2 years of sugar beets or potatoes, 1 year of grain, and 1 year of grain together with a new seeding of alfalfa or grass. Care is needed when land leveling to avoid cutting to the underlying sand, gravel, or hardpan.

Irrigation water can be applied by sprinkler, border, corrugation, or furrow systems. Border systems are not suited to the more sloping soils.

#### CAPABILITY UNIT IIc-2, IRRIGATED

This unit consists of loams and silt loams. The soils are well drained. They are more than 60 inches deep. Slopes are 0 to 2 percent.

Available water capacity is high, and permeability is moderate or moderately slow. The frost-free season ranges from 100 to 120 days. Runoff is slow, and the hazard of erosion is slight.

The soils in this unit are used for potatoes, sugar beets, small grain, hay, and pasture. The relatively short growing season limits the number of crops that can be grown and restricts the number of hay cuttings in any year.

Growing soil-improving crops at least 30 percent of the time, plowing under all crop residue, and fall rough plowing after row crops help to control erosion and improve tilth.

A suitable cropping system is 3 years of alfalfa or alfalfa-grass hay, 2 years of sugar beets or potatoes, 1 year of grain, and 1 year of grain together with a new seeding of alfalfa or grass seeded with the grain.

Irrigation water can be applied by a sprinkler system or by any gravity system.

#### CAPABILITY UNIT III-1, IRRIGATED

This unit consists of loams and silt loams. The soils are well drained. They are more than 60 inches deep. Slopes are 4 to 8 percent.

Available water capacity is high, and permeability is moderate. The frost-free season ranges from 100 to 120 days. Runoff is rapid, and the hazard of erosion is high.

The soils in this unit are used for sugar beets, potatoes, small grain, hay, and pasture.

Growing soil-improving crops at least 50 percent of the time, plowing under all crop residue, keeping tillage to a minimum, and fall plowing help to control erosion and improve tilth.

A suitable cropping system consists of 3 years of alfalfa or alfalfa-grass hay, 1 year of sugar beets or potatoes, 1 year of grain, and 1 year of grain together with a new seeding of alfalfa or grass seeded with grain. Where sprinkler irrigation is used, row crops can be increased by 1 year.

Irrigation water can be applied by sprinkler, furrow, or corrugation systems. Careful application of irrigation water and cross-slope furrow irrigation help to control erosion. Appropriately spaced drop boxes in irrigation ditches can minimize the slope gradient and reduce ditch erosion.

#### CAPABILITY UNIT III-1B, IRRIGATED

This unit consists of well-drained sandy loams. The soils are very deep. They are 20 to 40 inches deep over sand and gravel. Slopes are 2 to 8 percent.

Available water capacity is moderate, and permeability is moderate or moderately rapid. The frost-free season ranges from 100 to 120 days. Runoff is medium, and the hazard of water erosion is moderate to high.

The soils in this unit are used for potatoes, small grain, hay, and pasture.

Growing soil-improving crops at least 50 percent of the time, plowing under all crop residue, and fall plowing after row crops help to control erosion.

A suitable cropping system consists of 4 to 5 years of alfalfa or alfalfa-grass hay, 1 year of potatoes, 1 year of grain, and 1 year of grain together with a new

seeding of alfalfa or grass seeded with the grain. Leaving crop residue on the surface helps to control soil blowing. Deep cuts should be avoided when leveling because of the limited depth to the underlying sand and gravel.

Irrigation water can be applied safely by sprinklers, but furrow and corrugation systems should be carefully designed to prevent excessive erosion, particularly on the steeper soils. Furrow irrigation should be cross slope to control erosion. Drop boxes should be installed in irrigation ditches to reduce the grade and minimize ditch erosion.

#### CAPABILITY UNIT IV-1, IRRIGATED

This unit consists of loams and silt loams, some of which are saline-alkali. These soils are well drained. They are more than 60 inches deep. Some areas are underlain by sand and gravel at a depth of 20 to 40 inches. Slopes are mainly 8 to 12 percent but are 4 to 8 percent in some areas.

Available water capacity is high, and permeability is moderate. The growing season ranges from 100 to 120 days. Runoff is very rapid, and the hazard of erosion is very high.

The soils in this unit are used for sugar beets, potatoes, small grain, hay, and pasture, but beets and potatoes should not be grown because of the hazard of erosion. Crop response is less favorable on the saline-alkali soils.

Use of close-growing crops helps to minimize soil losses through erosion. Returning all crop residue to the soil helps to maintain organic-matter content.

A suitable cropping system consists of 6 years or more of alfalfa or alfalfa-grass hay, 1 year of small grain, and 1 year of small grain together with a new seeding of alfalfa or grass.

These soils are better suited to sprinkler irrigation than to other methods. Gravity systems can result in excessive erosion unless the systems are carefully designed and managed. Furrow irrigation should be cross slope. Sufficient drop boxes should be installed in irrigation ditches to minimize ditch erosion.

#### CAPABILITY UNIT IV-5, IRRIGATED

This unit consists of sands, loamy sands, and loamy coarse sands. The soils are well drained to excessively drained. They are more than 60 inches deep. Slopes are 0 to 8 percent.

Available water capacity is low or moderate, and permeability is moderately rapid to very rapid. The frost-free season ranges from 100 to 120 days. Runoff is slow, the hazard of water erosion is slight to moderate, and the hazard of soil blowing is high or very high.

The soils in this unit are used for small grain, potatoes, hay, and pasture.

Growing soil-improving crops at least 75 percent of the time and returning crop residue to the soil help to maintain organic-matter content. Plowing should be done in spring so that plant cover is left on the surface in winter to minimize soil blowing losses. Fall seeding of grasses or legumes in grain stubble, planting field windbreaks, using minimum tillage, and planting close-growing crops help to protect the soil from blowing.

Irrigation water can be applied by gravity or sprinkler systems, but a sprinkler system is better suited to these soils. Frequent, short-duration irrigation is necessary to maintain adequate moisture for plant growth.

#### CAPABILITY UNIT IV-1, IRRIGATED

Broncho gravelly loam, 2 to 4 percent slopes, is the only soil in this capability unit. This soil is somewhat excessively drained. It is very deep but only 10 to 20 inches thick over gravel and sand.

Available water capacity is low, and permeability is moderate. The mean annual precipitation ranges from 9 to 10 inches, and the growing season ranges from 100 to 120 days. Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for small grain, hay, and pasture.

Growing soil-improving crops at least 75 percent of the time and returning all crop residue to the soil help to maintain organic-matter content and control erosion.

Irrigation water can be applied by sprinkler or gravity systems. Light, frequent irrigation is required to maintain adequate moisture for plant growth. Leveling cuts must be less than 5 inches deep to avoid exposing the underlying gravel and sand, but some small sacrifice areas can be expected.

#### CAPABILITY UNIT IV-8, IRRIGATED

This unit consists of saline-alkali affected silt loams, loams, and sandy loams. The soils are mainly well drained but range to somewhat poorly drained. They are more than 60 inches deep. Slopes are 0 to 4 percent.

Available water capacity is moderate to high, and permeability is moderately rapid to moderately slow. The frost-free season ranges from 100 to 120 days. Runoff is slow, and the hazard of erosion is slight.

The soils in this unit are used for potatoes, sugar beets, small grain, alfalfa, and pasture. Only the more salt- and alkali-tolerant crops, such as sugar beets, small grain, and alfalfa, should be grown.

Plowing under all crop residue, providing adequate surface and subsurface drainage, and leaching excess salt and alkali help to maintain crop productivity.

A suitable cropping system consists of 4 years or more of salt-tolerant grasses or legumes, 1 year of sugar beets, 1 year of barley, and 1 year of barley together with a new seeding of grasses or legumes.

Irrigation water can be applied by sprinkler, corrugation, furrow, or border systems. Border systems should only be used in combination with corrugation systems on the more sloping soils. Frequent, light irrigation is needed to aid germination and start new seedings. A heavy application of irrigation water in the spring is desirable to reduce the salt content.

#### CAPABILITY UNIT VI-2, IRRIGATED

This unit consists of gravelly loams and very cobbly loams. The soils are somewhat excessively drained. Some of these soils are underlain by sand and gravel at a depth of 10 to 20 inches. Slopes range from 2 to 15 percent.

Available water capacity is low, and permeability is

moderate. The frost-free season ranges from 100 to 120 days. Runoff is medium to very rapid, and the hazard of erosion is high to very high.

Because of their slope and texture, the soils in this unit are not suited to most cultivated crops. They are suited to pasture that can be cultivated occasionally and reseeded. They are better suited to sprinkler irrigation than to most other methods.

#### CAPABILITY UNIT III-4, NONIRRIGATED

This unit consists of well-drained silt loams. The soils are 60 inches deep. Slopes are generally 4 to 20 percent, but some range to 30 percent.

Available water capacity is high, and permeability is moderate. The mean annual precipitation ranges from 12 to 17 inches, and the frost-free season is 75 to 100 days. Runoff is medium to rapid, and the hazard of erosion is moderate or high.

The soils in this unit are used for dryfarmed small grain, hay, and pasture.

Stubble mulching should be used following winter wheat to help control erosion during the fallow period. Minimum tillage and returning crop residue to the soil help to improve structure and minimize compaction. Seeding and tillage should be done on the contour to reduce runoff, increase water intake, and control erosion.

A suitable cropping system consists of 8 to 10 years of alternate small grain and summer fallow, followed by 4 to 6 years of legume and grass mixture for hay or pasture. Small grain responds to applications of nitrogen.

Grassed waterways are needed where runoff concentrates. On long slopes, basin terraces help to control erosion, but diversion terraces are not suitable for soils that have slopes of more than 12 percent. Chiseling or subsoiling improves water intake and reduces compaction.

#### CAPABILITY UNIT III-9, NONIRRIGATED

This unit consists of silt loams and loams. These soils are well drained. They are more than 40 inches deep. Slopes are mainly 4 to 20 percent but range to 30 percent.

Available water capacity is moderate to high, and permeability is moderate to slow. The mean annual precipitation ranges from 15 to 25 inches. The frost-free season ranges from 50 to 75 days. Runoff is medium or rapid. The hazard of erosion is mainly moderate or high, but it is very high where slopes are more than 20 percent.

The soils in this unit are used mainly for small grain, hay, and pasture, but some areas are used for range. In some years the small grain is cut for hay because of the short growing season. Legumes grown for hay and pasture should be frost tolerant because of the short growing season.

Returning all crop residue to the soil helps to maintain organic-matter content. Stubble mulching and contour tillage and seeding operations help to reduce erosion and runoff. Chiseling and subsoiling increase the intake of moisture and reduce compaction. Minimum tillage helps to maintain soil structure and reduce compaction.

A suitable cropping system consists of 8 to 10 years of alternate small grain and summer fallow, followed by 4 to 8 years of a grass-legume mixture. These soils can also be cropped to small grain annually.

Basin terraces are needed on long slopes in places. Grassed waterways are needed where runoff concentrates.

#### CAPABILITY UNIT IIIc-4, NONIRRIGATED

This unit consists of well-drained silt loams. The soils are more than 60 inches deep. Slopes are 0 to 4 percent.

Available water capacity is high, and permeability is moderate. The mean annual precipitation ranges from 12 to 17 inches, and the frost-free season ranges from 75 to 100 days. Runoff is slow, and the hazard of erosion is slight.

The soils in this unit are used for small grain, range, and pasture.

Contour tillage and seeding are not necessary, because the hazard of erosion is slight. Returning all crop residue to the soil and using minimum tillage help to maintain structure and reduce compaction.

A suitable cropping system consists of 8 to 10 years of alternate small grain and summer fallow followed by 4 to 6 years of a legume and grass mixture. Summer fallow is required because of the limited precipitation.

Grassed waterways are needed where runoff concentrates from higher-lying soils. Chiseling and subsoiling improve water intake rate and reduce compaction.

#### CAPABILITY UNIT IVc-45, NONIRRIGATED

This unit consists of well-drained silt loams. The soils are more than 60 inches deep. Slopes are 4 to 12 percent.

Available water capacity is high, and permeability is moderate. The mean annual precipitation is 11 to 14 inches, and the frost-free season is 100 to 115 days. Runoff is medium, and the hazard of erosion is moderate.

The soils in this unit are used for small grain and pasture.

Stubble mulching should be used during the fallow period to control erosion. All tillage and seeding should be on the contour to increase water intake rates, reduce runoff, and control erosion. Using minimum tillage and plowing under most crop residue help to improve tilth and reduce compaction.

An alternate small grain and summer fallow system is needed because of the limited precipitation.

Basin terraces on the longer slopes help to control runoff and erosion. Grassed waterways are needed where runoff concentrates. Chiseling and subsoiling improve water intake rate and reduce runoff. Contour strip cropping can be used where fields are large.

#### CAPABILITY UNIT IVc-45, NONIRRIGATED

This unit consists of well-drained silt loams. The soils are more than 60 inches deep. Slopes are 0 to 4 percent.

Available water capacity is high, and permeability is moderate. The mean annual precipitation ranges

from 11 to 14 inches, and the frost-free season ranges from 100 to 115 days. Runoff is slow, and the hazard of erosion is slight.

The soils in this unit are used for small grain, range, and pasture.

Returning all crop residue to the soil and stubble mulching is desirable on small grain. Chiseling and subsoiling in the fall reduce runoff and increase moisture intake. Minimum tillage helps to reduce compaction and retain structure. A suitable cropping system consists of alternate small grain and summer fallow because precipitation is limited.

Basin terraces can be used on long slopes to prevent runoff. Grassed waterways are needed where runoff from higher lying soils concentrates. Contour tillage and seeding are not necessary, because the hazard of erosion is slight, but they can be used to reduce runoff and increase moisture intake.

#### CAPABILITY UNIT IVw-9, NONIRRIGATED

This unit consists of silt loams, loams, and fine sandy loams. The soils are mostly somewhat poorly drained and poorly drained but range to moderately well drained. They are more than 60 inches deep. Slopes are 0 to 2 percent. Some soils have a hardpan that restricts root penetration.

Available water capacity is moderate to high, and permeability is moderate to slow. The mean annual precipitation ranges from 9 to 15 inches, but additional moisture is also received from the water table. The frost-free season ranges from 80 to 120 days. Runoff is slow or ponded, and the hazard of erosion is slight. The water table is at a depth of about 5 feet in spring, but it is within a depth of 1½ to 2 feet at times.

The soils in this unit are used mainly for permanent hay and pasture. Some small grain is grown. Alfalfa is generally short-lived because the water table fluctuates during spring.

These soils generally have ample moisture for crop establishment and growth in spring and early in summer, but they generally are moisture deficient late in summer. Wetness in spring delays planting, and the production of cultivated crops is hazardous. The soils are better suited to permanent grasses and legumes for either hay or pasture. They should only be plowed out to reestablish the stand. Fall tillage helps to offset spring wetness.

#### CAPABILITY UNIT Vw-2, NONIRRIGATED

This unit consists of silt loams and mucks. The soils are poorly drained and very poorly drained. They are more than 60 inches deep. Slopes are 0 to 2 percent.

Available water capacity is high, and permeability is moderate to slow. The frost-free season ranges from 85 to 120 days. Runoff is slow or ponded, and the hazard of water erosion is slight or none. The water table is at or near the surface most of the time.

The soils in this unit are too wet to be cultivated. They are used for native pasture, and they are better suited to this use than to most others. Occasionally the pasture can be cut for hay.

#### CAPABILITY UNIT VIc-1, NONIRRIGATED

This unit consists of channery loams, cobbly loams,

fine sandy loams, gravelly loams, loams, sandy loams, silt loams, stony loams, and very gravelly loams. The soils are well drained and somewhat excessively drained. They are mainly more than 20 inches deep over bedrock but are as shallow as 10 inches. Slopes range from 0 to 30 percent.

Available water capacity mainly ranges from low to high, but it is very low in a few soils. Permeability is moderately slow or moderate. The mean annual precipitation is 8 to 20 inches, and the average frost-free season ranges from 30 to 120 days. Runoff is slow to very rapid, and the hazard of water erosion is slight to very high.

The soils in this unit are used mainly for range or for woodland and wildlife habitat. They can be seeded to suited grasses in areas where range grasses are depleted.

#### CAPABILITY UNIT VI<sub>w</sub>-1, NONIRRIGATED

This unit consists of fine sandy loams and silt loams. The soils are mainly somewhat poorly drained, but some are moderately well drained soils and are subject to overflow during runoff in spring. Slopes are 0 to 2 percent.

Available water capacity is high, and permeability is moderately rapid, moderately slow, or slow. The frost-free season ranges from 85 to 120 days. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate in some of the soils. The water table is mainly at a depth of 2 to 4 feet, but it drops to a depth of more than 5 feet at times.

Without irrigation the soils in this unit are not suited to intensive cultivation. They can be prepared for a seedbed of alkali- and water-tolerant grasses and legumes.

#### CAPABILITY UNIT VI<sub>c</sub>-1, NONIRRIGATED

This unit consists of well-drained silt loams. The soils are more than 60 inches deep. Slopes are 0 to 4 percent.

Available water capacity is high, and permeability is moderately slow or moderate. The mean annual precipitation ranges from 8 to 15 inches, and the frost-free season ranges from 100 to 120 days. Runoff is slow, and the hazard of erosion is slight.

The soils in this unit are used mainly for range, but they can be tilled, and adapted grass can be seeded. Some areas are dryfarmed to small grain, but the soils are better suited to grasses.

#### CAPABILITY UNIT VII<sub>c</sub>-0, NONIRRIGATED

This unit consists of sands, loamy sands, loamy coarse sands, silt loams, and gravelly, very gravelly, and cobbly loams. The soils are well drained to excessively drained. They are more than 10 inches deep over bedrock. Slopes range from 0 to 55 percent.

Available water capacity ranges from very low to high, and permeability is moderately slow to very rapid. The mean annual precipitation ranges from 8 to 25 inches, and the frost-free season ranges from 20 to 120 days. Runoff ranges from slow to very rapid, and the hazard of erosion is moderate to very high. The hazard of soil blowing is very high in some of these soils.

The soils in this unit are used mainly for grazing, some timber production, wildlife habitat, and recreation. They are not suited to seeding, because of the hazard of erosion, the slope, or the very gravelly surface layer. They need careful grazing management to maintain production and control erosion.

#### CAPABILITY UNIT VII<sub>w</sub>-2, NONIRRIGATED

This unit consists of very stony sands; very cobbly, stony, extremely stony, and extremely rocky loams that are more than 10 inches deep over bedrock; and alkali-affected loams and silt loams. The soils are well drained and excessively drained. Slopes are 0 to 55 percent.

Available water capacity ranges from very low to high, and permeability is slow to very rapid. The mean annual precipitation ranges from 8 to 20 inches, and the frost-free season ranges from 30 to 120 days. Runoff is slow to very rapid, and the hazard of water erosion is slight to very high. The hazard of soil blowing is very high in some of the soils.

The soils in this unit are used mainly for grazing. They are too stony, shallow, steep, or alkali-affected to seed. Very careful range management is needed to protect the soils from erosion and keep them productive.

#### CAPABILITY UNIT VIII<sub>c</sub>-1, NONIRRIGATED

Wheeler silt loam, very steep, is the only soil in this capability unit. The soil is well drained. It is more than 60 inches deep. Slopes range from 55 to 75 percent.

Available water capacity is high, and permeability is moderate. The mean annual precipitation is 8 to 12 inches, and the frost-free season ranges from 100 to 120 days. Runoff is very rapid, and the hazard of erosion is very high.

The soil in this unit has a cover of grass and sagebrush. Because the slopes are very steep and the hazard of erosion is very high, this soil should not be grazed. Its chief value is for wildlife habitat, watershed, and recreation.

#### CAPABILITY UNIT VIII<sub>w</sub>-1, NONIRRIGATED

This unit consists of Alluvial land, Riverwash, and very poorly drained peats. They are on flood plains along streams and rivers and are subject to flooding or have a water table that is near or above the surface during much of the year. The principal vegetation is cattails, rushes, sedges, and scattered willows and cottonwoods.

These areas are so wet or are so subject to flooding that they are limited to use as wildlife habitat, watershed, and recreation, and they should be protected to maintain or increase their value for these uses. Protection from fire and from trampling by livestock is important.

#### CAPABILITY UNIT VIII<sub>c</sub>-1, NONIRRIGATED

This unit consists of very cobbly and extremely stony soils. Slopes range from 12 to 70 percent. There is little or no vegetation.

The soils in this unit have little value for farming. Because the surface is stony or cobbly and the vegeta-

tion is scarce, they are generally avoided by livestock. Their chief value is for wildlife habitat, watershed, and recreation.

### Estimated Yields

Table 2 gives estimated yields per acre of the principal irrigated and nonirrigated crops grown in the survey area.

Yield estimates are based on the observations of soil scientists who surveyed the area and on information furnished by farmers and ranchers and by personnel of the Bureau of Indian Affairs, the Agricultural Extension Service, and the Soil Conservation Service. If information for a particular soil was not available, estimates were made on the basis of information pertaining to a similar soil.

The main climatic limitation, soil moisture, can be overcome by the use of irrigation water. The relatively short growing season, 100 to 120 days, then becomes an overall climatic limitation. Although this is not a severe limitation, it does reduce yields and the selection of crops that can be grown.

Yields shown for irrigated crops are those expected under a high level of management. This includes systematic crop rotation or a management system that includes periodically returning large amounts of organic matter, such as crop residue or green manure, to the soil; applying fertilizers to meet the needs of the growing crop; maintaining moisture at the optimum level at all times; and applying soil amendments or other practices as needed. The soil is prepared, and irrigation systems are developed that supply the water requirements of the crops uniformly over each field. Drainage systems are installed to remove excess irrigation or ground water, and toxic salt or alkali are reduced or eliminated. Harmful insects and weeds are controlled.

The principal crops where the soils are not irrigated are small grain and forage for grazing. The major limitations on yields for these soils is the amount of precipitation and the length of the growing season.

Areas used for nonirrigated small grain are not extensive, but their use is more intensive than when used for livestock grazing. At the lower elevations, where the growing season is most favorable for nonirrigated cropping (100 to 120 days), the moisture supply is critical. At higher elevations, moisture supply is not so critical, but the growing season becomes critically short. A heavy rain late in May or early in June generally produces a bumper crop, but no rain during this period produces a below-average crop.

Only those soils that are well suited to cultivation are used for nonirrigated small grain production, so yields are generally not related to physical soil characteristics. The climatic factors and management of the soils to overcome unfavorable climatic factors or take advantage of favorable climatic factors are the main influences on the yields of nonirrigated small grain.

Winter wheat is the principal crop. Spring plantings are usually not successful, because spring is late and moisture is lacking.

To obtain dryfarmed yields given in table 2, farmers

use a grain-fallow cropping system and stubble mulch tillage during the fallow year. Tillage operations are timely, and careful attention is given to control of weeds, disease, and insects and to timeliness of tillage, planting, and harvesting.

The crop yields are averages that can be obtained over a period of years when using a high level of management. These yields can change greatly in the future as new crop varieties and cultural practices are introduced or a new plant disease or insect pest appears.

The yield data for grazing are average per acre potential total annual yields for favorable and unfavorable years. More detailed information on yields and management of range are given in the 1963 publication of the Bureau of Indian Affairs "Grazing Resource Inventory, Fort Hall Indian Reservation." See the section on range for more information.

### Range

Different kinds of soil vary in their capacity to produce grasses and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

In 1963, the United States Department of the Interior, Bureau of Indian Affairs, published an inventory of grazing resources.<sup>4</sup> This publication contains maps of range, discusses range site, and describes the condition of the range. It also discusses management of range and reports usable forage yields for favorable and unfavorable years. Copies of the inventory are on file at the office of the Fort Hall Indian Agency, Bureau of Indian Affairs, Fort Hall, Idaho. The symbol for the site in which each soil in the survey area has been placed can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

### Woodland

Woodlands and forests in the Fort Hall Area make up about 20,000 acres, or about 4 percent, of the total land area. These areas can be divided into four major vegetative types. Cottonwood and willows are adjacent to the Snake River. Dense groves or scattered individual juniper are mainly on dry, droughty soils where slopes face south. Small to large groves of quaking aspen are mainly on strongly sloping to steep soils where slopes face north. These groves are on loess-mantled uplands and in mountainous areas. Conifer trees are on moderately sloping to very steep soils where slopes face north in mountainous areas. These trees are mainly Douglas-fir and some alpine fir, lodgepole pine, and limber pine. Most of these areas are used for grazing, except where the timber is too thick or the slopes are too steep. Forage production for grazing varies widely, depending on the overstory density and annual precipitation.

The cottonwood and willow areas adjacent to the Snake River are generally subject to overflow during

<sup>4</sup> United States Department of Interior. Grazing Resource Inventory, Fort Hall Indian Reservation, Idaho. 123 pp., illus. 1963.

TABLE 2.—Estimated average yields per acre

[Yields are those that can be expected under a high level of management. Absence of a yield estimate indicates that the crop is

Map symbol	Soil name	Irrigated crops			
		Potatoes	Sugar beets	Spring wheat	Mixed grain
		<i>Cwt</i>	<i>Tons</i>	<i>Bu</i>	<i>Bu</i>
BoB	Broncho gravelly loam, 2 to 4 percent slopes	125	11	30	30
BoC	Broncho gravelly loam, 4 to 10 percent slopes				
BoF	Broncho gravelly loam, 20 to 40 percent slopes				
BrD	Broncho very cobbly loam, 2 to 15 percent slopes				
BUE	Buckskin silt loam, rolling				
ChA	Chedehap sandy loam, 0 to 2 percent slopes	250	18	70	60
ChB	Chedehap sandy loam, 2 to 4 percent slopes	250	18	70	60
ChC	Chedehap sandy loam, 4 to 8 percent slopes	225	17	65	55
ChE	Chedehap sandy loam, 12 to 20 percent slopes				
CkA	Chedehap sandy loam, saline-alkali, 0 to 2 percent slopes	220	17	50	50
CkB	Chedehap sandy loam, saline-alkali, 2 to 4 percent slopes	220	17	50	50
DcA	Declo loam, 0 to 2 percent slopes	250	22	70	60
DcB	Declo loam, 2 to 4 percent slopes	250	22	70	60
DcC	Declo loam, 4 to 8 percent slopes			70	60
DDD	Declo loam, undulating				
DeA	Declo loam, saline-alkali, 0 to 2 percent slopes	200	20	60	55
DeB	Declo loam, saline-alkali, 2 to 4 percent slopes	200	20	60	55
DeC	Declo loam, saline-alkali, 4 to 8 percent slopes			60	50
DHB	Declo loam, hardpan variant, 0 to 4 percent slopes		19	50	65
DRF	Dranyon silt loam, rolling				
EnA	Escalante sandy loam, 0 to 2 percent slopes	250	18	70	60
EnB	Escalante sandy loam, 2 to 4 percent slopes	250	18	70	60
EnC	Escalante sandy loam, 4 to 8 percent slopes	230	18	65	60
EOC	Escalante sandy loam, undulating				
EsA	Escalante sandy loam, saline-alkali, 0 to 2 percent slopes	200	16	50	50
EsB	Escalante sandy loam, saline-alkali, 2 to 4 percent slopes	200	16	50	50
FeB	Feltham loamy sand, 0 to 4 percent slopes	250		65	55
FeC	Feltham loamy sand, 4 to 8 percent slopes	230		65	55
FLF	Feltham loamy sand, undulating				
Fr	Firth fine sandy loam			65	65
FU	Fury silt loam				
He	Heiseton fine sandy loam	250		70	60
HGE	Highams very gravelly loam, hilly				
HGF	Highams very gravelly loam, steep				
HOF	Hondoho very cobbly loam, hilly				
HYG	Hymas extremely stony loam, steep				
KN	Knoll silt loam				
KUE	Kucera silt loam, 12 to 30 percent slopes				
LAB	Lanoak silt loam, 0 to 4 percent slopes				
LAC	Lanoak silt loam, 4 to 12 percent slopes				
LAE	Lanoak silt loam, 12 to 20 percent slopes				
LAF	Lanoak silt loam, hilly				
MdA	McDole silt loam, 0 to 2 percent slopes	250	21	70	60
MEB	McDole silt loam, 0 to 4 percent slopes				
MEC	McDole silt loam, 4 to 12 percent slopes				
MHF	Moohoo-Dranyon association, hilly				
MHG	Moohoo-Dranyon association, steep				
NAF	Nagitsy gravelly loam, hilly				
NGF	Nagitsy very gravelly loam, 4 to 30 percent slopes				
NHF	Nagitsy-Nielsen extremely stony loams, hilly				
NHG	Nagitsy-Nielsen extremely stony loams, steep				
NLB	Neeley silt loam, 0 to 4 percent slopes				
NLC	Neeley silt loam, 4 to 12 percent slopes				
NLE	Neeley silt loam, 12 to 20 percent slopes				
NLF	Neeley silt loam, rolling				
NLG	Neeley silt loam, steep				
NRF	Nielsen extremely rocky loam, steep				
NTF	Nielsen-Nagitsy extremely stony loams, steep				
PAF	Pandoah channery loam, hilly				
PBG	Pandoah very cobbly loam, steep				
PCG	Pavohroo gravelly loam, steep				
PeA	Paniogue loam, 0 to 2 percent slopes	250	20	70	60
PeB	Paniogue loam, 2 to 4 percent slopes	250	20	70	60
PeC	Paniogue loam, 4 to 8 percent slopes	230	19	65	55
PeD	Paniogue loam, 8 to 12 percent slopes	125	14	50	50
PfA	Paniogue loam, saline-alkali, 0 to 2 percent slopes	170	16	55	50
PfB	Paniogue loam, saline-alkali, 2 to 4 percent slopes	160	15	55	50
PfC	Paniogue loam, saline-alkali, 4 to 8 percent slopes	150	14	50	50
PgA	Paniogue loam, strongly alkali, 0 to 2 percent slopes				
PhA	Paniogue gravelly loam, 0 to 2 percent slopes			70	60
PhB	Paniogue gravelly loam, 2 to 4 percent slopes			70	60
Pk	Parehat silt loam	200	19	65	55

of principal irrigated and nonirrigated crops

not suited to the soil or that it is commonly not grown on the soil. Only soils suitable for crops are considered in this table]

Irrigated crops—cont.		Nonirrigated crops					
Alfalfa	Pasture	Winter wheat	Barley	Potential native plant community in—		Potential production of seeded range in—	
				Favorable years	Unfavorable years	Favorable years	Unfavorable years
<i>Tons</i>	<i>AUM</i> <sup>1</sup>	<i>Bu</i>	<i>Bu</i>	<i>Lb</i>	<i>Lb</i>	<i>Lb</i>	<i>Lb</i>
2.8	5.0			900	450	1,100	600
2.5	5.0			600	300	700	400
	4.0			700	350		
		40	50	1,600	1,400	3,000	1,800
3.5	8.0						
3.5	8.0						
3.4	7.0						
				700	500	900	700
3.7	8.0						
3.7	8.0						
4.0	12.0						
4.0	12.0						
4.0	10.0			700	500	1,000	800
3.0	12.0						
3.0	12.0						
2.5	10.0						
2.8	10.0			700	450	1,200	600
				1,500	1,200	2,000	1,500
4.0	8.0						
4.0	8.0						
3.8	7.0						
				700	500	900	700
3.8	8.0						
3.8	8.0						
3.0	6.0			600	400	800	500
3.0	6.0			600	400	800	500
				600	400	800	500
2.8	8.0			1,200	700	1,600	1,000
				1,200	900	2,000	1,300
3.5	8.0			600	400	800	500
				600	400		
				600	300		
				800	500	1,200	700
				800	600		
				600	200	700	300
				900	600	1,400	900
		30	30	1,600	1,400	2,500	1,700
		30	30	1,600	1,300	2,400	1,600
		30	30	1,400	1,200	2,200	1,500
				1,600	1,200	2,500	1,500
4.0	12.0						
		20	20	1,100	800	1,500	1,000
		20	20	1,100	800	1,500	1,000
				1,500	1,100	2,000	1,500
				1,400	900		
				1,500	1,100		
				1,300	1,000		
				1,200	900		
				1,100	800		
		20	20	1,000	700	1,500	1,100
		20	20	1,000	700	1,400	1,000
				1,000	700	1,400	1,000
				900	600	1,300	900
				900	500		
				800	600		
				700	500		
				800	600		
				700	500		
				1,500	1,100		
4.0	12.0						
4.0	12.0						
3.8	10.0						
3.0	10.0						
3.2	10.0						
3.2	10.0						
2.0	8.0						
				600	350		
3.7	10.0						
3.7	10.0						
3.7	12.0			1,400	800	2,000	1,500

TABLE 2.—Estimated average yields per acre of

Map symbol	Soil name	Irrigated crops			
		Potatoes	Sugar beets	Spring wheat	Mixed grain
		<i>Cwt</i>	<i>Tons</i>	<i>Bu</i>	<i>Bu</i>
PLB	Penoyer silt loam, 0 to 4 percent slopes				
Pm	Parehat silt loam, saline-alkali	170	17	50	50
Pn	Parehat silt loam, high water table				
PoA	Penoyer silt loam, 0 to 2 percent slopes	250	20	70	60
PoB	Penoyer silt loam, 2 to 4 percent slopes	250	20	70	60
PpA	Penoyer silt loam, saline-alkali, 0 to 2 percent slopes	170	16	55	50
Pr	Penoyer silt loam, mottled variant				
Pt	Peteetneet muck, clayey subsoil variant				
PvA	Pocatello silt loam, 0 to 2 percent slopes	250	20	70	60
PvB	Pocatello silt loam, 2 to 4 percent slopes	250	20	70	60
PvC	Pocatello silt loam, 4 to 8 percent slopes	220	18	60	55
PvD	Pocatello silt loam, 8 to 12 percent slopes	220	18	60	55
PvF	Pocatello silt loam, 20 to 30 percent slopes				
PWB	Pocatello silt loam, 0 to 4 percent slopes				
PWD	Pocatello silt loam, 4 to 12 percent slopes				
PWE	Pocatello silt loam, 12 to 20 percent slopes				
PWF	Pocatello silt loam, rolling				
PxA	Portneuf silt loam, 0 to 2 percent slopes	250	20	70	60
PxB	Portneuf silt loam, 2 to 4 percent slopes	250	20	70	60
PYB	Portneuf silt loam, 0 to 4 percent slopes				
PYC	Portneuf silt loam, undulating				
PYD	Portneuf silt loam, 4 to 12 percent slopes				
QnB	Quincy sand, 2 to 4 percent slopes	250		60	50
QnC	Quincy sand, 4 to 8 percent slopes				
QUF	Quincy sand, undulating				
QVD	Quincy very stony sand, moderately shallow, undulating				
RBB	Rexburg silt loam, 0 to 4 percent slopes				
RBC	Rexburg silt loam, 4 to 12 percent slopes				
RBE	Rexburg silt loam, 12 to 20 percent slopes				
RBF	Rexburg silt loam, rolling				
RBG	Rexburg silt loam, steep				
RCF	Ricrest-Ridgecrest gravelly loams, hilly				
RDG	Ricrest-Ridgecrest cobbly loams, steep				
REF	Ridgecrest-Hymas gravelly loams, hilly				
RGF	Ridgecrest-Hymas very cobbly loams, hilly				
RGG	Ridgecrest-Hymas very cobbly loams, steep				
RKE	Robin silt loam, 4 to 20 percent slopes				
RKF	Robin silt loam, 20 to 30 percent slopes				
RKG	Robin silt loam, steep				
RNC	Rudeen loam, 4 to 12 percent slopes				
RNE	Rudeen loam, 12 to 20 percent slopes				
RNF	Rudeen loam, hilly				
RUE	Rudeen extremely stony loam, hilly				
RUF	Rudeen extremely stony loam, steep				
Sn	Snake silt loam				
Ss	Snake silt loam, saline-alkali				
St	Snake silt loam, high water table				
TAC	Tahquats loam, undulating				
TBC	Tahquats very stony loam, rolling				
TCD	Tahquats stony loam, heavy variant, rolling				
TdA	Tickason loam, 0 to 2 percent slopes	250	20	70	60
TEB	Tickason loam, 0 to 4 percent slopes				
TGD	Tickason gravelly loam, 4 to 12 percent slopes				
ThA	Tindahay loamy coarse sand, 0 to 2 percent slopes	250		60	50
ThB	Tindahay loamy coarse sand, 2 to 4 percent slopes	250		60	50
ThC	Tindahay loamy coarse sand, 4 to 8 percent slopes	230		60	50
ThE	Tindahay loamy coarse sand, 12 to 20 percent slopes				
TNF	Tindahay loamy sand, undulating				
WAF	Wahtigup gravelly loam, hilly				
WBF	Wahtigup very cobbly loam, hilly				
WBG	Wahtigup very cobbly loam, steep				
WcD	Waycup gravelly loam, 8 to 12 percent slopes			60	50
WDF	Waycup cobbly loam, hilly				
WEF	Waycup extremely stony loam, hilly				
WEG	Waycup extremely stony loam, steep				
WhD	Wheeler silt loam, 8 to 12 percent slopes	120	13	25	25
WhF	Wheeler silt loam, 30 to 55 percent slopes				
WLE	Wheeler silt loam, 12 to 30 percent slopes				
WLF	Wheeler silt loam, steep				
ZN	Zunhall silt loam				
ZU	Zunhall silt loam, high water table				

<sup>1</sup> AUM (animal-unit-months) is the number of months 1 acre provides grazing for one animal unit (one cow, steer, or horse; or five hogs; or seven sheep or goats) without injury to the pasture.

principal irrigated and nonirrigated crops—Continued

Irrigated crops—cont.				Nonirrigated crops			
Alfalfa	Pasture	Winter wheat	Barley	Potential native plant community in—		Potential production of seeded range in—	
				Favorable years	Unfavorable years	Favorable years	Unfavorable years
<i>AUM</i> <sup>1</sup>	<i>Bu</i>	<i>Bu</i>	<i>Bu</i>	<i>Lb</i>	<i>Lb</i>	<i>Lb</i>	<i>Lb</i>
3.4	10.0			800	600	1,200	900
				1,200	600	1,700	1,300
				1,700	1,100	2,000	1,600
4.0	12.0						
4.0	12.0						
3.2	10.0						
				1,200	800	1,700	1,000
				2,500	1,500		
4.0	12.0						
4.0	12.0						
3.8	10.0						
3.8	10.0						
				700	550	1,000	700
				800	600	1,200	900
				800	600	1,200	900
				700	550	1,000	700
				800	550	1,200	700
4.0	12.0						
4.0	12.0						
				800	600	1,200	700
				800	600	1,200	700
				800	600	1,200	700
3.5	6.0						
3.4	6.0						
				600	300	750	450
				500	300		
		30	30	1,200	1,000	2,000	1,600
		30	30	1,200	1,000	1,900	1,500
		30	30	1,100	900	2,000	1,300
				1,200	900	2,000	1,300
				1,100	900		
				1,400	1,000		
				1,200	900		
				1,100	850	1,400	1,000
				1,000	850		
				1,000	700		
		40	50	1,600	1,400	2,500	1,900
		35	40	1,600	1,200	2,500	1,700
				1,200	800		
				800	600	1,300	800
				800	600	1,300	800
				900	600	1,300	800
				700	500		
				600	450		
				600	450		
				400	200		
				1,400	700		
		20	20	1,200	900	1,800	1,200
				900	600		
4.0	12.0			650	450	700	500
				900	700	1,200	800
				600	400	800	500
				600	300		
				600	300		
				600	300		
				500	250		
				600	300		
				750	600		
				750	600		
				750	600		
3.0	10.0						
				500	850		
				600	300		
				550	400		
				500	300		
				500	300		
				500	300		
				500	300		
				500	300		
				1,200	900	1,700	1,100
				1,400	1,000	2,000	1,200

periods of high runoff. These areas are mainly Alluvial land, which is generally droughty late in spring and in summer. Timber produced has very little commercial value. It is used locally as firewood and, to a limited extent, for fenceposts.

The juniper-covered areas are scattered throughout the lower elevations of the Area. They occur mainly on slopes that face south on the loess-mantled uplands; on shallow, droughty foot slopes; and on sandy alluvial terraces. The juniper trees are scattered or are extensive areas of dense groves. Scattered areas of juniper grow mainly on Pandoah, Pocatello, Rudeen, and Wahtigup soils.

The groves of quaking aspen range from 1 to 2 acres to extensive areas of 200 to 300 acres. These groves are generally in areas of soils that are moderately steep to steep and where snowdrifts accumulate. The canopy is generally dense to closed, and there is very little grazable understory. Although grazing production is generally low, livestock use these areas for shade. Because of the dense growth of trees and the heavy accumulations of snow, the individual trees are generally deformed and small. Commercial value in most areas is limited to local use as firewood and fenceposts. Areas of aspen are mainly on Dranyon and Pavohroo soils, but some of these areas are on Buckskin, Lanoak, and Moohoo soils.

The conifer trees are only on slopes that face north at elevations above 7,000 feet. Douglas-fir is the main species. It generally forms a dense canopy, but some areas have a partial canopy, and others have a closed canopy. This timber is scattered throughout the mountainous areas and is mainly on Moohoo and Pavohroo soils. Commercial value ranges from moderate to low depending mainly on canopy density. As the density increases, the quality of saw logs is lowered. Because the timber that has commercial value is scattered, profitable logging is difficult. Alpine fir, lodgepole, and limber pine have very low commercial value.

## Wildlife and Recreation

Most of the soils of the Fort Hall Area are suited to and support one or more species of wildlife. Some species spend most or all of their time in wooded areas; others thrive in the extensive areas of open grassland; some prefer irrigated or dryfarmed crops; and many, such as fish, beaver, duck, and geese, require water for their habitat.

Numerous deer and grouse and a few elk are in the area of the Moohoo-Nagitsy-Dranyon association. This association is in mountainous areas in the vicinity of Mount Putnam and Bannock Peak. These areas have many springs and perennial streams with rainbow and cutthroat trout and beaver. Open grassland used for grazing supports various game birds, such as sage grouse, quail, pheasant, and mourning dove, as well as numerous nongame birds. These large areas are in the Pocatello-Wheeler-Portneuf association, the Neeley-Rexburg association, the Nagitsy-Nielsen-Lanoak association, and the Wahtigup-Highams-Hymas association. Small streams flowing through the areas support trout and beaver. Cultivated areas support a large population of pheasants, mourning doves, and nongame

birds. Most of the cultivated soils are in the Penoyer-Parehat association, the Parehat-McDole association, the Paniogue-Declo association, the Paniogue-Broncho association, the Tindahay-Escalante association, the Quincy-Feltham association, and the Pocatello-Wheeler-Portneuf association.

Bottom lands along rivers and major streams are well suited to wild ducks and geese, and the streams support trout and other fish as well as beaver and muskrat. Most of the soils of these areas are in the Penoyer-Parehat association and the Parehat-McDole association. The Fort Hall Bottoms, mainly in the Snake-Philbon association, are adjacent to the Snake River and the American Falls Reservoir; they make up the main part of these soils. Thousands of waterfowl migrate to this area each year. The extensive areas of open water and adjacent cultivated areas provide ideal conditions for wintering, while the marshy areas of reeds and cattails are ideal for summer nesting. The Fort Hall Bottoms contain numerous springs and streams that flow into the Snake River and the American Falls Reservoir. These large streams support many trout and are favorite spawning grounds for large trout from the American Falls Reservoir. Other stream valleys, such as the Portneuf River, the Portneuf Reservoir, Blackfoot River, Bannock Creek, Ross Fort Creek, and Lincoln Creek, also provide food and cover for waterfowl and trout.

Hunting, fishing, and other forms of recreation in the survey area are generally restricted to enrolled members of the Shoshone-Bannock Tribes. Permits for fishing and waterfowl hunting in parts of the Fort Hall Bottom are sold each year by the Tribes. These permits allow nonmembers to hunt and fish according to State and Federal laws applicable to the Area. Limited facilities are also available for other recreational purposes, such as picnicking. A large potential exists for recreational development in the Area. Many uses have been suggested for development as a source of revenue for the Tribes. Some of these that have been discussed and may be developed include a ski resort, camping and picnic facilities, and upland game bird hunting.

Facilities for picnics, camping, and other recreation areas are mainly in mountainous areas where timber and water are available in the vicinity of Mount Putnam and Bannock Peak. Most of these areas are in the Moohoo-Nagitsy-Dranyon soil association. Picnic facilities for tourists, fishermen, and hunters could be developed in the Fort Hall Bottoms. The American Falls Reservoir has potential for areas for boating and other recreational facilities.

Development of a winter sport resort area in the vicinity of Mount Putnam is under study. This area has a high potential for winter sports.

The success of wildlife areas and recreational facilities in the Fort Hall Area is highly dependent on their use by people from Pocatello, Blackfoot, Idaho Falls, American Falls, and other adjacent towns.

## Engineering Uses of the Soils

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can

benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 3 and 4, which show, respectively, several estimated soil properties significant to engineering and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 3 and 4, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths more than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially of small ones, is needed because many delineated areas of a given mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have different meanings in soil science than in engineering. The Glossary defines many of these terms as they are commonly used in soil science.

### **Engineering soil classification systems**

The two systems most commonly used in classifying samples of soils for engineering are the Unified system,<sup>5</sup> used by the SCS engineers, Department of Defense, and others, and the AASHTO system,<sup>6</sup> adopted

by the American Association of State Highway and Transportation Officials.

The Unified system is used to classify soils according to those properties that affect use as a construction material for purposes other than highway construction and maintenance and as a foundation material.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly or sandy soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. One group, A-8, is provided for peat, muck, or similar highly organic soils. This group is classified on the basis of visual inspection of the organic material. Soils in group A-8 are highly compressible and have low strength. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The estimated classification, without group index numbers, is given in table 3 for all soils mapped in the survey area.

### **Estimated properties significant to engineering**

Estimates of soil properties significant in engineering are given in table 3. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 3.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

<sup>5</sup> American Society for Testing and Materials. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69 *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus. 1974.

<sup>6</sup> American Association of State Highway [and Transportation] Officials. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 v., illus. 1970.

TABLE 3.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. Fully the instructions for referring to other series that appear in the first

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction more than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
Alluvial land: Al -----	<i>Feet</i> >5	<i>Feet</i> 1½-3	<i>Inches</i> 0-10 10-60	Loam and loamy sand Stratified sand, gravel, and cobbles.	SM GW or GP	A-2 or A-4 A-1	0-10 20-30
Broncho: BoB, BoC, BoF, BrD.	>5	>5	0-14 14-60	Gravelly loam ----- Very gravelly coarse sand.	GM or SM GW or GP	A-4 or A-2 A-1	0-5 20-30
Buckskin: BUE -----	>5	>5	0-12 12-61 61-70	Silt loam ----- Silty clay loam and silty clay. Silt loam -----	ML, CL-ML, CL ML	A-4 A-6 A-4	----- ----- -----
Chedehap: ChA, ChB, ChC, ChE, CkA, CkB.	>5	>5	0-22 22-54	Sandy loam ----- Coarse sandy loam, loamy coarse sand, and sand.	SM SM	A-2 or A-4 A-1 or A-2	----- 0-5
Declo: DcA, DcB, DcC, DDD, DeA, DeB, DeC.	>5	>5	0-47 47-60	Loam and silt loam ----- Loamy coarse sand and coarse sand.	ML SM	A-4 A-1 or A-2	----- -----
Declo variant: DHB -----	>5	4-5	0-60	Silt loam and loam -----	ML, CL-ML, CL	A-4	-----
Dranyon: DRF -----	>3½	>5	0-26 26-48 48-55 55	Silt loam ----- Clay loam and gravelly sandy clay loam. Very gravelly loam ----- Quartzite bedrock.	ML, CL-ML, CL GC GM, SW-SM, GP-GM	A-4 A-4 A-6 or A-2 A-1	----- 0-5 0-10
Escalante: EnA, EnB, EnC, EOC, EsA, EsB.	>5	>5	0-60	Sandy loam and fine sandy loam.	SM	A-4	-----
Feltham: FeB, FeC, FLF ---	>5	>5	0-22 22-60	Loamy sand ----- Sandy loam and loam -----	SM SM or ML	A-2 A-4	----- -----
Firth: Fr -----	>5	2-3½	0-45 45-60	Fine sandy loam and sandy loam. Very gravelly coarse sandy loam.	SM SW-SM or SM	A-4 A-1	----- 0-5

significant to engineering

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow care-column of this table. Symbol > means more than; symbol < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to uncoated steel	Potential frost action
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)									
75-95 40-50	75-90 30-50	50-70 15-40	20-50 0-5	Percent ----- -----	<sup>1</sup> NP NP	In per hr 2.0-20 >20	In per in of soil 0.03-0.05 0.03-0.05	pH 7.4-8.4 7.4-8.4	None None	Low Low	Low Low	Low. Low.
55-80 25-40	50-75 20-35	40-70 10-20	30-50 0-5	----- -----	NP NP	0.6-2.0 >20	0.14-0.16 0.03-0.05	7.9-8.4 8.5-9.0	None None	Low Low	Moderate. Low.	Low.
----- -----	100 100	95-100 95-100	90-100 90-100	20-30 25-40	NP-10 10-20	0.06-2.0 0.06-0.2	0.19-0.21 0.19-0.21	6.6-7.3 6.6-7.3	None None	Low Moderate.	High High.	Moderate.
----- -----	100 90-100	95-100 55-70	90-100 30-40	25-35 -----	NP-10 NP	0.6-2.0 2.0-6.0	0.19-0.21 0.11-0.13	7.9-8.4 7.4-8.4	None None	Low Low	High. Moderate.	Moderate.
85-100	80-100	40-70	15-30	-----	NP	6.0-20	0.08-0.10	7.4-8.4	None in ChA, ChB, ChC, and ChE; low in CkA and CkB	Low	Moderate.	Moderate.
95-100 90-100	95-100 90-100	80-95 45-75	70-85 15-35	25-35 -----	NP-10 NP	0.6-2.0 6.0-20	0.18-0.20 0.05-0.07	7.4-8.4 7.9-8.4	None None in DcA, DcB, DcC, and DDD; low in DeA, DeB, and DeC.	Low Low	High High.	Moderate.
95-100	95-100	80-95	70-85	20-30	NP-10	0.06-0.2	0.18-0.20	7.9-9.3	Low	Low	High	Moderate.
85-100	85-100	80-100	70-85	20-30	NP-10	0.6-2.0	0.19-0.21	5.6-6.5	None	Low	Moderate.	Moderate.
50-75	50-70	45-65	25-50	25-35	10-15	0.2-0.6	0.15-0.17	6.1-6.5	None	Moderate.	Moderate.	Moderate.
20-40	20-35	15-30	10-25	-----	NP	0.6-2.0	0.05-0.07	6.1-6.5	None	Low	Moderate.	Moderate.
95-100	95-100	60-75	35-50	-----	NP	0.6-2.0	0.13-0.15	7.4-7.8	None in EnA, EnB, EnC, and EOC; moderate in EsA and EsB.	Low	Moderate.	Moderate.
100 100	100 100	50-80 65-85	15-30 35-60	----- -----	NP NP	2.0-6.0 2.0-6.0	0.06-0.08 0.14-0.16	7.4-8.4 7.9-9.0	None None	Low Low	Low Low	Low. Low.
100	100	65-80	35-50	NP	NP	0.6-2.0	0.08-0.13	7.4-8.4	None	Low	High	High.
60-75	20-35	10-25	5-15	-----	NP	2.0-6.0	0.05-0.07	7.4-8.4	None	Low	High.	High.

TABLE 3.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction more than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
Fury: FU .....	<i>Feet</i> >5	<i>Feet</i> 2-3½	<i>Inches</i> 0-60	Silt loam, silty clay loam.	CL	A-6 or A-7	-----
Heiseton: He .....	>5	* >5	0-60	Stratified fine sandy loam, loam, sandy loam, and silty clay loam.	ML or SM	A-4	0-10
Highams: HGE, HGF, HHF, HHG.	1-1½	>5	0-19 19-30	Very gravelly loam or extremely stony loam. Limestone.	GW-GM or GM	A-1 or A-2	10-35
Hondoho: HOF, HOG .....	>5	>5	0-24 24-60	Cobbly and very cobbly loam. Cobbly and very cobbly sandy clay loam.	GC GC	A-6 or A-2 A-2	30-40 50-60
Hymas: HYG .....	1-1½	>5	0-19 19	Extremely stony loam and gravelly loam. Limestone.	GM	A-4 or A-2	15-35
Knull: KN .....	>5	>5	0-7	Silt loam .....	ML	A-4	-----
			7-16	Silt loam .....	CL	A-6	-----
			16-60	Silt loam .....	ML	A-4	-----
Kucera: KUE .....	>5	>5	0-65	Silt loam .....	ML	A-4	-----
Lanoak: LAB, LAC, LAE, LAF.	>5	>5	0-60	Silt loam .....	CL-ML or CL	A-4 or A-6	-----
McDole: MdA, MEB, MEC ..	>5	>5	0-60	Silt loam .....	ML	A-4	-----
*Moohoo: MHF, MHG .....	3½-5	>5	0-20	Gravelly silt loam .....	ML or GM	A-4	5-15
For Dranyon part, see Dranyon series.			20-56	Gravelly and very gravelly loam. Quartzite.	GM	A-1	10-15
			56	Quartzite.			
*Nagitsy: NAF, NGF, NHF, NHG.	1½-3½	>5	0-34	Gravelly loam and very gravelly loam. Quartzite.	GM	A-2	0-10
For Nielson part of NHF and NHG, see Nielsen series.			34	Quartzite.			
Neeley: NLB, NLC, NLE, NLF, NLG.	>5	>5	0-60	Silt loam .....	ML	A-4	-----
*Nielson: NMG, NRF, NTF ..	1-1½	>5	0-9	Extremely stony loam and channery loam.	ML	A-4	25-35
			9-19	Channery loam and very channery loam. Sandstone.	GM-GC or GC	A-2	40-60
			19	Sandstone.			
Pandoah: PAF, PBG .....	1½-3½	>5	0-26 26	Very cobbly loam and channery and very channery loam. Sandstone.	GM or GM-GC	A-2 or A-4	30-40
Paniogue: PeA, PeB, PeC, PeD, PfA, PfB, PfC, PgA, PhA, PhB.	>5	>5	0-28	Loam and silt loam .....	ML or CL-ML	A-4	-----
			28-60	Coarse sand and gravelly coarse sand.	SP or SP-SM	A-1	0-5

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to uncoated steel	Potential frost action
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)									
90-100	90-100	90-95	80-95	Percent 35-50	15-30	In per hr 0.2-0.6	In per in of soil 0.18-0.20	pH 6.6-7.3	None	Moderate	High	High.
90-100	85-100	65-85	40-60	25-35	NP-10	2.0-6.0	0.13-0.15	7.9-8.4	None	Low	High	Moderate.
35-50	20-35	15-30	10-25	25-35	NP-10	0.6-2.0	0.05-0.07	7.9-8.4	None	Low	High	Moderate.
50-70	40-65	35-60	25-40	20-40	10-25	0.6-2.0	0.08-0.10	6.6-8.4	None	Moderate	Moderate	Moderate.
40-50	35-45	30-40	15-25	30-40	15-25	0.6-2.0	0.06-0.08	7.9-8.4	None	Moderate	High.	
50-65	45-60	40-55	25-40	25-35	NP-10	0.6-2.0	0.04-0.06	7.9-8.4	None	Low	Moderate	Moderate.
100	100	90-100	75-95	25-35	NP-10	0.6-2.0	0.19-0.21	7.4-7.8	High	Low	Moderate	Moderate.
100	100	95-100	80-95	30-40	10-20	0.06-0.2	0.19-0.21	7.4-8.4	High	Moderate	High.	
100	100	90-100	75-95	25-35	NP-10	0.2-0.6	0.19-0.21	7.8-9.0	High	Low	High.	
100	100	90-100	80-95	25-35	NP-10	0.6-2.0	0.19-0.21	7.4-8.4	None	Low	High	High.
100	100	95-100	80-95	25-35	5-15	0.6-2.0	0.19-0.21	6.1-7.8	None	Moderate	High	High.
100	100	95-100	80-95	25-35	NP-10	0.6-2.0	0.19-0.21	7.9-9.0	None	Low	High	High.
65-80	60-75	50-75	45-65	20-30	NP-5	0.6-2.0	0.10-0.13	5.1-5.5	None	Low	High	Moderate.
35-45	25-35	20-30	15-25	20-30	NP-5	0.6-2.0	0.05-0.07	5.1-5.5	None	Low	High.	
40-55	35-50	30-45	25-35	20-30	NP-5	0.6-2.0	0.07-0.09	6.1-6.5	None	Low	Moderate	Moderate.
100	100	95-100	80-95	25-35	NP-10	0.6-2.0	0.19-0.21	7.4-9.6	None	Low	High	High.
90-100	85-95	75-90	55-70	20-30	NP-5	0.2-0.6	0.04-0.06	6.6-7.3	None	Low	Moderate	Moderate.
30-40	25-35	20-30	15-25	25-35	5-15	0.2-0.6	0.04-0.06	6.6-7.3	None	Low	Moderate	
55-56	50-60	40-55	30-45	15-25	NP-5	0.6-2.0	0.06-0.08	7.9-8.4	None	Low	High	Moderate.
85-100	80-100	70-95	50-80	10-20	NP-5	0.6-2.0	0.18-0.20	7.4-9.6	None	Low	High	Low.
70-90	70-80	10-30	0-10	.....	NP	>20	0.04-0.06	8.5-9.0	Low, except moderate in some areas of PFA, PIB, and PIC and high in some areas of Pga.	Low	Moderate	

TABLE 3.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction more than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
Parehat: Pk, Pm, Pn -----	<i>Feet</i> >5	<i>Feet</i> 2-4	<i>Inches</i> 0-60	Silt loam -----	ML	A-4	-----
Pavohroo: PCG -----	3½-5	>5	0-37	Very cobbly loam and cobbly loam.	GM or GC	A-2 or A-4	20-30
			37-48 48	Very gravelly loam Limestone.	GP	A-1	25-40
Penoyer: PLB, PoA, PoB, PoA.	>5	>5	0-60	Silt loam -----	ML, CL, CL-ML	A-4	-----
Penoyer variant: Pr -----	>5	2½-3½	0-60	Loam and silt loam -----	ML, CL, CL-ML	A-4	-----
Peteetneet: Ps -----	>5	0	0-52	Peat and muck -----	Pt	A-8	-----
			52-60	Light silty clay loam -----	CL	A-6 or A-7	-----
Peteetneet variant: Pt -----	>5	0-1½	0-60	Stratified muck, silt loam, silty clay loam.	OL, OH	A-5	-----
Philbon: Pu -----	>5	0	0-22	Peat -----	Pt	A-8	-----
			22-38	Mucky silt loam -----	OL	A-5	-----
			38-65	Silty clay loam and loam.	CL	A-6	-----
Pocatello: PvA, PvB, PvC, PvD, PvF, PWB, PWD, PWE, PWF.	>5	>5	0-60	Silt loam -----	ML	A-4	-----
Portneuf: PxA, PxB, PYB, PYC, PYD.	>5	>5	0-60	Silt loam -----	ML, CL, or CL-ML	A-4	-----
Quincy: QnB, QnC, QUF -----	>5	>5	0-48	Sand -----	SP-SM or SM	A-2 or A-3	-----
			48-60	Coarse sand -----	SP-SM or SM	A-1	-----
			QVD -----	1½-3½	>5	0-30	Sand -----
			30	Basalt.			
Rexburg: RBB, RBC, RBE, RBF, RBG.	>5	>5	0-63	Silt loam -----	ML, CL-ML, CL	A-4	-----
*Ridgcrest: RCF, RDG ----- For Ridgcrest part, see Ridgcrest series.	3½-5	>5	0-43 43	Cobbly loam and gravelly loam. Limestone.	SM or GM	A-4	5-25
*Ridgcrest: REF, RGF, RGG, RHG. For Hymas part, see Hymas series.	1½-3½	>5	0-30 30	Gravelly loam and very gravelly loam. Limestone.	GM	A-2	25-40

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to uncoated steel	Potential frost action
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)									
100	100	95-100	80-95	Percent 20-35	NP-10	In per hr 0.6-2.0	In per in of soil 0.18-0.20	pH 7.9-9.0	None, except moderate in some areas of Pm.	Low	High	High.
60-70	50-65	40-45	30-40	20-35	NP-10	0.6-2.0	0.08-0.13	6.1-7.8	None	Low	Moderate.	Moderate.
15-30	10-20	5-10	0-5	20-35	NP-5	0.6-2.0	0.09-0.11	7.9-8.4	None	Low	High.	
100	100	95-100	80-95	20-30	NP-10	0.2-0.6	0.19-0.21	7.9-8.4	None, except moderate in some areas of PpA.	Low	High	Moderate.
100	100	85-100	60-80	20-30	NP-10	0.6-2.0	0.18-0.20	7.9-9.0	None	Low	High	Moderate.
100	100	95-100	90-100	35-45	20-30	0.6-2.0	0.25-0.30	6.6-7.3	None	Low	High	High.
100	100	95-100	85-100	45-60	NP-10	0.6-2.0	0.18-0.20	6.6-8.4	None	High	High.	
100	100	95-100	85-100	40-50	NP-5	0.6-2.0	0.40-0.50	6.6-7.3	None	Low	High	High.
100	100	90-100	70-90	25-40	10-25	0.6-2.0	0.25-0.35	6.6-8.4	None	Low	High.	
100	100	90-100	70-90	25-40	10-25	0.6-2.0	0.19-0.21	7.9-8.4	None	Moderate.	High.	Moderate.
100	100	95-100	90-100	25-35	NP-10	0.6-2.0	0.19-0.21	7.9-9.6	None	Low	High	
100	100	95-100	90-100	20-30	NP-10	0.6-2.0	0.19-0.21	6.6-9.0	None above a depth of 24 inches, moderate below 24 inches.	Low	High	Moderate.
100	100	50-60	5-15	-----	NP	>20	0.05-0.07	6.6-7.8	None	Low	Low	Low.
100	100	40-50	5-15	-----	NP	>20	0.04-0.06	7.4-7.8	None	Low	Low.	Low.
95-100	95-100	50-70	5-15	-----	NP	>20	0.05-0.07	6.6-7.8	None	Low	Low	
100	100	95-100	90-100	20-30	NP-10	0.6-2.0	0.19-0.21	6.6-8.4	None	Low	High	Moderate.
65-85	60-80	55-75	35-50	25-40	NP-10	0.6-2.0	0.11-0.13	7.4-8.4	None	Low	High	Moderate.
45-60	35-50	30-45	20-35	30-40	NP-10	0.6-2.0	0.10-0.12	6.6-8.4	None	Low	High	Moderate.

TABLE 3.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction more than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
Riverwash: Rv -----	<i>Feet</i> >5	<i>Feet</i> ( <sup>2</sup> )	<i>Inches</i> 0-60	Stratified sand and gravel.	GW or GP	A-1	20-30
Robin: RKE, RKF, RKG -----	>5	>5	0-27 27-60	Silt loam ----- Silt loam -----	ML CL-ML or CL	A-4 A-4 or A-6	----- -----
Rock land: RL. Properties too variable to be estimated.							
Rudeen: RNC, RNE, RNF, RUE, RUF, RUG.	1½-3½	>5	0-10 10-38 38	Extremely stony loam, loam. Channery and very channery loam. Tuff.	ML or GM GM	A-4 A-4	0-15 35-55
Snake: Sn, Ss, St -----	>5	1½-4	0-58	Heavy silt loam and silty clay loam.	CL	A-6 or A-7	-----
Tahquats: TAC, TBC -----	>5	>5	0-12 12-44 44-58	Very stony loam, loam, or cobbly loam. Gravelly light clay loam and gravelly sandy clay loam. Gravelly sandy loam	SM GM or GC GM	A-4 A-6 or A-7, A-2 A-2, A-1	5-15 15-30 15-30
Tahquats variant: TCD -----	>5	>5	0-60	Clay loam, clay, and stony loam.	CL	A-6 or A-7	5-25
Tickason: TdA, TEB, TGD -----	>5	>5	0-54 54-60	Stratified loam, silt loam, sandy loam. Loamy sand -----	CL-ML or CL SM	A-4 A-2	----- -----
Tindahay: ThA, ThB, ThC, ThE, TNF.	>5	>5	0-24 24-60	Loamy coarse sand and sandy loam. Coarse sand and sand	SM SP-SM or SM	A-2 A-2 or A-3	----- -----
Wahtigup: WAF, WBF, WBG.	3½-5	>5	0-41 41	Gravelly loam ----- Limestone.	GM	A-4	5-15
Waycup: WcD, WDF, WEF, WEG.	3½-5	>5	0-51 51	Extremely stony loam and very gravelly loam. Basalt.	GM or SM	A-4	30-40
Wheeler: WhD, WhF, WLE, WLF, WLG.	>5	>5	0-60	Silt loam -----	ML	A-4	-----
Zunhall: ZN, ZU -----	>5	1-3½	0-60	Silt loam and silty clay loam.	CL or MH	A-7	-----

<sup>1</sup> NP = Nonplastic.<sup>2</sup> Subject to occasional flooding.

Texture is described in table 3 in the standard terms used by the United States Department of Agriculture (USDA). These terms take into account relative percentages of sand, silt, and clay in the soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles

coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to uncoated steel	Potential frost action
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)									
40-50	30-50	15-30	0-5	Percent -----	NP	In per hr >20	In per in of soil <0.06	pH -----	None ----	Low ----	Moderate.	Low.
100 100	100 100	95-100 95-100	85-95 90-95	20-30 25-35	NP-5 5-15	0.6-2.0 0.6-2.0	0.19-0.21 0.19-0.21	5.6-6.0 5.6-6.0	None ---- None ----	Low ---- Moderate.	Low ---- Low.	High.
70-85	70-80	60-75	45-55	30-40	NP-10	0.6-2.0	0.10-0.12	7.9-8.4	None ----	Low ----	High ----	Moderate.
60-70	55-60	50-55	35-45	30-40	NP-10	0.6-2.0	0.08-0.10	7.9-9.6	None ----	Low ----	High.	
95-100	95-100	90-100	85-95	35-50	15-30	0.06-0.2	0.19-0.21	7.9-9.0	None for Sn and St; moderate for Ss.	Moderate.	High ----	High.
70-80	60-70	50-60	40-50	30-40	NP-10	0.6-2.0	0.14-0.16	5.6-6.0	None ----	Low ----	High ----	Moderate.
55-65	50-60	45-55	30-45	35-45	10-20	0.2-0.6	0.12-0.14	5.6-6.0	None ----	Moderate.	High.	
45-65	40-55	30-45	15-30	-----	NP	0.2-0.6	0.07-0.09	5.6-6.5	None ----	Low ----	Moderate.	
70-95	70-90	65-85	50-70	35-50	15-25	0.06-0.2	0.17-0.19	6.6-8.4	None ----	Moderate.	High ----	Moderate.
100	85-100	75-95	55-75	20-30	5-10	0.6-2.0	0.18-0.20	6.6-8.4	None ----	Low ----	High ----	Low.
100	90-100	50-60	15-25	-----	NP	6.0-20	0.07-0.09	7.9-8.4	None ----	Low ----	High ----	Low.
95-100	90-100	50-65	15-30	-----	NP	2.0-6.0	0.06-0.08	6.6-7.3	None ----	Low ----	Low ----	Low.
95-100	90-100	50-60	5-15	-----	NP	6.0-20	0.04-0.06	7.4-7.8	None ----	Low ----	Moderate.	
60-75	60-70	55-65	40-50	30-40	NP-10	0.6-2.0	0.13-0.15	7.9-9.0	None ----	Low ----	High ----	Moderate.
55-75	50-70	45-60	35-45	20-30	NP-5	0.6-2.0	0.08-0.10	7.9-9.0	None ----	Low ----	High ----	Moderate.
100	100	95-100	90-100	20-30	NP-5	0.6-2.0	0.19-0.21	7.4-8.4	None ----	Low ----	High ----	Moderate.
95-100	95-100	95-100	85-95	40-60	15-25	0.2-0.6	0.19-0.21	7.9-9.0	None ----	Moderate.	High ----	High.

<sup>2</sup> Saline and alkali spots in areas of P1A, P1B, P1C, and P1G have permeability of 0.06 to 0.2 inches per hour.

from a dry state, the material changes from a semisolid to a plastic. If the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic; and the liquid limit, from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range

of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 3.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 3 do not take into account lateral seepage or such

TABLE 4.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. fully the instructions for referring to other

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill <sup>1</sup> (trench type)	Local roads and streets
Alluvial land: Al -----	Severe <sup>2</sup> : floods; wet.	Severe: floods; wet.	Severe: floods; wet.	Severe: floods; wet.	Severe: floods; wet.	Severe: floods; wet.
Broncho: BoB, BoC, BoF, BrD.	Slight where slope is less than 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent. <sup>2</sup>	Severe: very rapidly permeable in substratum; coarse fragments; slope of more than 7 percent.	Severe: gravelly and cobbly below a depth of 10 to 20 inches; slope, where slope is more than 8 percent.	Slight where slope is less than 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Severe: very rapid permeability in substratum; slope, where slope is more than 25 percent.	Moderate: low strength; slope, where slope is 8 to 15 percent; severe where more than 15 percent.
Buckskin: BUE -----	Severe: slow permeability; slope, where slope is more than 15 percent.	Moderate where slope is 4 to 7 percent; severe where more than 7 percent.	Slight where slope is 4 to 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Moderate: low strength, shrink-swell potential, and frost action; slope, where slope is less than 15 percent. Severe where slope is more than 15 percent.	Moderate: silt loam, silty clay loam, and silty clay texture; slope, where slope is more than 15 percent.	Moderate: low strength, shrink-swell potential, and frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Chedehap: ChA, ChB, ChC, ChE, CkA, CkB.	Slight for all except ChE. Severe for ChE: slope hazard.	Severe: moderately rapid permeability; slope, where slope is more than 7 percent.	Slight where slope is less than 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Moderate: frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Moderate: frost action; slope, where slope is more than 15 percent.	Moderate: frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Declo: DcA, DcB, DcC, DDD, DeA, DeB, DeC.	Slight where slope is less than 8 percent; moderate where more than 8 percent.	Moderate: moderate permeability; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is less than 8 percent; moderate where more than 8 percent.	Moderate: low strength and frost action; slope, where slope is 8 to 15 percent.	Slight -----	Moderate: frost action; low strength; slope, where slope is more than 8 percent.
Declo variant: DHB ----	Severe: slow permeability.	Slight where slope is 0 to 2 percent; moderate where slope is 2 to 4 percent.	Moderate: moderately well drained.	Moderate: low strength and frost action.	Slight -----	Moderate: low strength.
Dranyon: DRF -----	Severe: moderately slow permeability; slope, where slope is more than 15 percent.	Moderate where slope is 4 to 7 percent; severe where more than 7 percent.	Moderate: gravelly; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Moderate: frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Slight where slope is less than 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Moderate: low strength and frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.

*engineering properties of the soils*

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow care-series that appear in the first column of this table]

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Good -----	Good: gravel.	Poor: gravelly.	Rapid and very rapid permeability.	High compacted permeability.	Floods; wet --	Floods; droughty.	Floods; droughty.
Good where slope is less than 15 percent; fair where 15 to 25 percent; poor where more than 25 percent.	Good: gravel.	Poor: thin layer; slope, where slope is more than 15 percent.	Moderately permeable to a depth of 10 to 20 inches; very rapid permeability below a depth of 10 to 20 inches; slopes of 2 to 40 percent.	High compacted permeability.	Favorable where slope is less than 4 percent; erodes easily where slope is more than 4 percent.	Droughty; slopes of more than 4 percent erode easily.	Droughty; slopes of more than 4 percent erode easily.
Fair: frost action and shrink-swell potential; low strength; slope, where slope is more than 15 percent.	Unsuited --	Fair: thin layer; slope, where slope is 8 to 15 percent. Poor where slope is more than 15 percent.	Slopes of 4 to 20 percent.	Medium to low shear strength; hard to pack; compressibility.	Not needed --	High available water capacity; erodes easily.	Erodes easily.
Fair: frost action; slope, where slope is more than 15 percent.	Poor <sup>1</sup> : sand; excessive fines.	Good where slope is less than 8 percent; fair where 8 to 15 percent; poor where more than 15 percent. <sup>4</sup>	Moderately rapid permeability; slopes of 0 to 20 percent.	Medium shear strength; piping hazard.	Favorable where slope is less than 2 percent; erosion hazard where slope is more than 2 percent.	Droughty; erosion hazard where slope is more than 2 percent; salt and alkali spots affect CkA and CkB.	Droughty; erodes easily; slope of less than 2 percent; salt and alkali spots affect CkA and CkB.
Fair: frost action; low strength.	Poor <sup>1</sup> : sand; excessive fines.	Good where slope is less than 8 percent; fair where 8 to 15 percent. <sup>4</sup>	Moderately permeable; slopes of 0 to 15 percent.	Medium to low shear strength; piping hazard.	Favorable where slope is less than 2 percent; erosion hazard on steeper slopes.	Favorable where slope is less than 2 percent; erosion hazard on steeper slopes; salt and alkali spots affect DeA, DeB, and DeC.	Erodes easily where sloping; salt and alkali spots affect DeA, DeB, and DeC.
Fair: frost action; low strength.	Unsuited --	Poor: thin layer.	Slopes of 0 to 4 percent.	Medium to low shear strength; piping hazard.	Favorable ---	Rooting depth; slightly wet.	Hardpan influences rooting depth.
Fair: frost action; slope, where slope is 15 to 25 percent. Poor where slope is more than 25 percent.	Poor: sand; excessive fines.	Good where slope is less than 8 percent; fair where 8 to 15 percent; severe where more than 15 percent.	Slopes of 4 to 55 percent.	Medium to low shear strength; hard to pack; compressible.	Not needed --	High available water capacity; erodes easily.	Erodes easily; stony in lower layer.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill <sup>1</sup> (trench type)	Local roads and streets
Escalante: EnA, EnB, EnC, EOC, EsA, EsB.	Slight <sup>2</sup> -----	Moderate: moderate permeability; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight -----	Moderate: frost action.	Slight -----	Moderate: frost action; slope.
Feltham: FeB, FeC, FLF.	Slight <sup>2</sup> where slope is 0 to 8 percent; moderate where more than 8 percent.	Severe: moderately rapid permeability; slope, where slope is more than 7 percent.	Slight where slope is 0 to 8 percent; moderate where more than 8 percent.	Slight where slope is 0 to 8 percent; moderate where more than 8 percent.	Moderate: texture.	Slight where slope is less than 8 percent; moderate where more than 8 percent.
Firth: Fr -----	Severe: high water table.	Severe: high water table.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: wet.	Severe: high frost action.
Fury: Fu -----	Severe: high water table.	Severe: high water table.	Severe: poorly drained.	Severe: poorly drained.	Severe: wet	Severe: high frost action, wet.
Heiseton: He -----	Severe: floods in spring.	Severe: moderately rapid permeability; floods in spring.	Severe: floods in spring.	Severe: floods in spring.	Severe: floods in spring.	Severe: floods.
Highams: HGE, HGF, HHF, HHG.	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Severe: depth to bedrock; slope.	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 25 percent; HHF and HHG have stones.	Severe: depth to bedrock; slope, where slope is more than 15 percent.
Hondoho: HOF, HOG ---	Moderate where slope is 8 to 15 percent; severe where slope is more than 15 percent.	Severe: slope; cobbly.	Moderate where slope is 8 to 15 percent; severe where more than 15 percent.	Moderate where slope is 8 to 15 percent; severe where slope is more than 15 percent.	Moderate where slope is 8 to 15 percent; severe where more than 15 percent.	Moderate: frost action; too clayey; slope, where slope is less than 15 percent. Severe where slope is more than 15 percent.
Hymas: HYG -----	Severe: bedrock at a depth of 10 to 20 inches; extremely stony; slope, where slope is more than 15 percent.	Severe: shallow to bedrock; slope of more than 7 percent.	Severe: shallow to bedrock; extremely stony; slope, where slope is more than 15 percent.	Severe: depth to bedrock; stoniness; slope, where slope is more than 25 percent.	Severe: depth to bedrock; stoniness; slope, where slope is more than 25 percent.	Severe: depth to bedrock; slope, where slope is more than 15 percent.

properties of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: frost action.	Poor <sup>3</sup> : sand; excessive fines.	Good <sup>4</sup> -----	Moderately permeable; slopes of 0 to 8 percent.	Medium shear strength; medium to high piping hazard.	Favorable where slope is less than 2 percent; erosion hazard where slope is more than 4 percent.	Soil blowing hazard; water erosion hazard where slope is more than 2 percent; salt and alkali moderately affect EsA and EsB.	Low precipitation; sloping areas erode easily; salt and alkali moderately affect EsA and EsB.
Good -----	Poor: sand; excessive fines.	Good where slope is less than 8 percent; fair where more than 8 percent.	Moderately rapid permeability; slopes of 0 to 12 percent.	Medium to high piping hazard; medium shear strength.	Erodes easily.	Fair available water capacity; high soil blowing hazard; moderately rapid permeability.	High soil blowing hazard; droughty; low precipitation.
Poor: high frost action.	Poor <sup>3</sup> : sand; excessive fines.	Good -----	Water table at a depth of 20 to 40 inches; moderately permeable.	Medium to high shear strength; piping hazard.	Poor outlets.	Wet -----	Not needed.
Poor: high frost action.	Unsuited --	Poor: wet --	Water table at a depth of 20 to 40 inches; moderately slow permeability.	Medium to low shear strength.	Drains slowly.	Wet; short growing season.	Not needed.
Poor: moderate frost action.	Poor <sup>3</sup> : sand; excessive fines.	Good -----	Moderately rapid permeability.	Medium to low shear strength; medium to high piping hazard.	Favorable, but floods in spring.	Floods in spring; moderately rapid permeability; soil blowing hazard.	Not needed.
Poor: depth to bedrock; slope, where slope is more than 25 percent.	Unsuited --	Poor: thin layer; slope, where slope is more than 15 percent.	Limestone at a depth of 10 to 20 inches; slopes of 12 to 70 percent.	Thin layer --	Not suited --	Shallow rooting depth; high and very high erosion hazard.	Shallow, stony soil.
Fair: frost action; slope, where slope is 15 to 25 percent. Poor where slope is more than 25 percent.	Unsuited --	Poor: cobbly and very cobbly.	Slopes of 8 to 55 percent.	Medium to low shear strength; medium to low piping hazard.	Not needed --	Very cobbly; high and very high erosion hazard.	Droughty; very cobbly.
Poor: depth to bedrock; slope, where slope is more than 25 percent.	Poor: gravel; excessive fines.	Poor: stoniness; slope, where slope is more than 15 percent.	Bedrock at a depth of 10 to 20 inches; slopes of 4 to 70 percent.	Thin layer; medium to low compacted permeability; medium shear strength.	Not needed --	Shallow; droughty; extremely stony.	Shallow; extremely stony.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill <sup>1</sup> (trench type)	Local roads and streets
Knull: KN -----	Severe: slow permeability.	Slight where slope is less than 2 percent; moderate where more than 2 percent.	Slight -----	Moderate: low strength.	Slight -----	Moderate: low strength and frost action.
Kucera: KUE -----	Moderate where slope is less than 15 percent; severe where more than 15 percent.	Severe: slope is more than 7 percent.	Moderate where slope is less than 15 percent; severe where more than 15 percent.	Moderate where slope is less than 15 percent; severe where more than 15 percent.	Slight where slope is less than 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Severe: frost action; slope, where slope is more than 15 percent.
Lanoak: LAB, LAC, LAE, LAF.	Moderate: moderate permeability; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Moderate: moderate permeability; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is 0 to 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Slight where slope is 0 to 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Slight where slope is less than 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Severe: frost action; slope, where slope is more than 15 percent.
McDole: MdA, MEB, MEC.	Slight where slope is 0 to 8 percent; moderate where more than 8 percent.	Moderate: moderate permeability; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is less than 8 percent; moderate where 8 to 12 percent.	Slight where slope is 0 to 8 percent; moderate where 8 to 12 percent.	Slight -----	Severe: high frost action.
*Moohoo: MHF, MHG --- For Dranyon part, see Dranyon series.	Moderate where slope is 8 to 15 percent; severe where more than 15 percent.	Severe: slope is more than 7 percent.	Severe: stoniness; slope, where slope is more than 15 percent.	Severe: stoniness; slope, where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 25 percent.	Moderate: frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
*Nagitsy: NAF, NGF, NHF, NHG. For Nielsen part of NHF and NHG, see Nielsen series.	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 7 percent.	Severe: depth to bedrock; slope, where slope is more than 7 percent.	Slight where slope is less than 8 percent; moderate where slope is 8 to 15 percent; severe where more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 25 percent.	Moderate: frost action; depth to bedrock; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Neeley: NLB, NLC, NLE, NLF, NLG.	Slight where slope is less than 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Moderate: moderately permeable where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is 0 to 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Slight where slope is less than 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Slight where slope is less than 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Severe: frost action; slope, where slope is more than 15 percent.

properties of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: low strength and frost action.	Unsuited --	Poor: excessive salts.	Slopes of 0 to 4 percent.	Medium to low shear strength; piping hazard; hard to pack.	Not needed --	High available water capacity; slowly permeable.	Low precipitation.
Poor: frost action; slope, where slope is more than 25 percent.	Unsuited --	Fair where slope is less than 15 percent; poor where more than 15 percent.	Moderately permeable; slopes of 12 to 30 percent.	Medium to low shear strength; piping hazard; hard to pack.	Not needed --	High available water capacity; strongly sloping to moderately sloping; high erosion hazard.	Short steep slopes; erodes easily.
Poor: frost action; slope, where slope is more than 25 percent.	Unsuited --	Good where slope is less than 8 percent; fair where 8 to 15 percent; poor where more than 15 percent.	Moderately permeable; slopes of 0 to 30 percent.	Medium to low shear strength; piping hazard; hard to pack.	Not needed --	High available water capacity; limited growing season; slopes of 0 to 30 percent.	Short complex slopes; erodes easily.
Poor: high frost action.	Unsuited --	Good where slope is less than 8 percent; fair where more than 8 percent.	Moderately permeable; slopes of 0 to 12 percent.	High piping hazard; medium to low shear strength; hard to pack.	Favorable where slope is 0 to 2 percent.	Favorable, except limited growing season where slope is less than 2 percent; erodibility where slope is more than 2 percent.	Low precipitation; erodes easily.
Fair: frost action; slope, where slope is 15 to 25 percent. Poor where slope is more than 25 percent.	Poor: gravel; excessive fines.	Poor: stoniness; slope, where slope is more than 15 percent.	Moderately permeable; slopes of 8 to 55 percent.	Medium to high piping hazard; medium to low shear strength.	Not needed --	Slopes of 8 to 55 percent; erosion hazard.	Coarse fragments; slope; erodes easily.
Fair: frost action; slope, where slope is 15 to 25 percent. Poor where slope is more than 25 percent.	Fair: gravel; excessive fines.	Poor: small stones; slope, where slope is more than 15 percent.	Moderately permeable; slopes of 4 to 55 percent; bedrock at a depth of 20 to 40 inches.	Thin layer; low to medium compacted permeability.	Not needed --	Moderately deep to bedrock; highly erosive.	Droughty; moderately deep to bedrock.
Poor: frost action; slope, where slope is more than 25 percent.	Unsuited --	Good where slope is less than 8 percent; fair where 8 to 15 percent; poor where more than 15 percent.	Moderately permeable; slopes of 0 to 55 percent.	High piping hazard; medium to low shear strength; hard to pack.	Not needed --	High available water capacity; erosion hazard where slope is more than 2 percent.	Complex slopes; erodes easily.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
*Nielsen: NMG, NRF, NTF. For Nagitsy part of NTF, see Nagitsy series.	Severe: stoniness; depth to bedrock; slope, where slope is more than 15 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope.	Severe: depth to bedrock; stoniness; slope, where slope is more than 15 percent; extremely rocky in NRF.	Severe: stoniness; depth to bedrock; slope, where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 25 percent.	Severe: depth to bedrock; slope, where slope is more than 15 percent.
Pandoah: PAF, PBG	Severe: stoniness; depth to bedrock; slope, where slope is more than 15 percent.	Severe: moderately deep to bedrock; slope is more than 7 percent.	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Moderate: depth to bedrock; slope, where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 25 percent.	Moderate: frost action; slope, where slope is more than 15 percent.
Paniogue: PeA, PeB, PeC, PeD, PfA, PfB, PfC, PgA, PhA, PhB.	Severe where slope is 0 to 8 percent; moderate where 8 to 12 percent; salt and alkali spots severely affect PfA, PfB, PfC, and PgA. <sup>2</sup>	Severe: very rapid permeability; slope is more than 7 percent.	Severe: underlying gravel and sand.	Slight where slope is less than 8 percent; moderate where more than 8 percent.	Severe: very rapid permeability.	Moderate: low strength; slope, where slope is more than 8 percent.
Parehat: Pk, Pm, Pn	Severe <sup>2</sup> : high water table.	Severe: high water table.	Severe: wet	Moderate: wet.	Severe: wet	Severe: high frost action.
Pavohroo: PCG	Severe: steep and very steep.	Severe: steep and very steep.	Severe: slope.	Severe: slope.	Severe: slope; depth to bedrock.	Severe: slope.
Penoyer: PLB, PoA, PoB, PpA.	Severe: moderately slow permeability.	Moderate: difficult to compact.	Slight	Moderate: low strength.	Slight	Moderate: frost action.
Penoyer, variant: Pr	Severe: high water table.	Severe: high water table.	Severe: wet	Moderate: wet.	Moderate: wet.	Moderate: wet; frost action.
Peteetneet: Ps	Severe: high water table.	Severe: high organic-matter content.	Severe: wet	Severe: wet; low strength.	Severe: wet; seepage.	Severe: wet; frost action; low strength.
Peteetneet variant: Pt	Severe: high water table.	Severe: high organic-matter content.	Severe: wet	Severe: wet; low strength.	Severe: wet; seepage.	Severe: wet; frost action; low strength.

properties of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: depth to bedrock; slope, where slope is more than 25 percent.	Unsuited ..	Poor: thin layer; slope, where slope is more than 15 percent.	Bedrock at a depth of 10 to 20 inches; slopes of 8 to 70 percent.	Thin layer ...	Not needed ..	Shallow to bedrock; very high erosion hazard.	Shallow to bedrock; erodes easily; gentle to very steep slopes.
Poor: depth to bedrock; slope, where slope is more than 25 percent.	Unsuited ..	Poor: stoniness; slope, where slope is more than 15 percent.	Moderately permeable; bedrock at a depth of 20 to 40 inches; slopes of 10 to 55 percent.	Thin layer; medium to low compacted permeability.	Not needed ..	Moderately deep to bedrock; channery; very cobbly; high erosion hazard.	Moderately deep to bedrock; moderately sloping to steep; erodes easily.
Good	Fair <sup>1</sup> : sand; excessive fines.	Good where slope is less than 8 percent; fair where more than 8 percent. <sup>4</sup> Poor for PhA and PhB: small stones. <sup>4</sup>	Moderately permeable soil underlain by sand and gravel; slopes of 0 to 12 percent.	Medium to low strength in upper layers; low to high compacted permeability in lower layers; piping hazard.	Favorable where slope is less than 2 percent; erodibility where slope is more than 2 percent.	Droughty; erodibility where slope is more than 2 percent; salt and alkali spots affect PfA, PfB, PfC, and PgA.	Low precipitation; droughty; erodes easily.
Poor: frost action.	Unsuited ..	Good <sup>4</sup> .....	High water table at a depth of 24 to 48 inches.	High piping hazard; medium to low shear strength; hard to pack.	Poor outlets ..	Wet; salt and alkali spots affect Pm.	Wet.
Poor: slope..	Unsuited ..	Poor: slope; small stones.	Slopes of 30 to 70 percent.	Piping hazard; steep and very steep slopes.	Not needed ..	Steep and very steep slopes.	Steep and very steep; gravelly and cobbly.
Fair: frost action; low strength.	Unsuited ..	Good <sup>4</sup> .....	Slopes of 0 to 4 percent.	Medium to low shear strength; piping hazard; hard to pack.	Favorable where slope is less than 2 percent.	Moderately slow permeability; erodibility where slope is more than 2 percent; salt and alkali spots affect PpA.	Favorable.
Fair: wetness; frost action; low strength.	Unsuited ..	Good .....	Water table at a depth of 30 to 40 inches.	Medium to low shear strength; piping hazard; hard to pack.	Poor outlets..	Moderate: slow permeability.	Wet.
Poor: wet; excess humus; frost action; low strength.	Unsuited ..	Poor: wet ..	Excess humus; water table at or near surface.	Not suitable..	Poor outlets..	Wet .....	Wet.
Poor: wet; excess humus; frost action; low strength.	Unsuited ..	Poor: wet ..	Excess humus; water table at or near surface.	Not suitable..	Poor outlets..	Wet .....	Wet.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill <sup>1</sup> (trench type)	Local roads and streets
Philbon: Pu -----	Severe: high water table.	Severe: high organic-matter content.	Severe: wet	Severe: wet; low strength.	Severe: wet; seepage.	Severe: wet; frost action; low strength.
Pocatello: PvA, PvB, PvC, PvD, PvF, PWB, PWD, PWE, PWF.	Slight where slope is 0 to 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Moderate: moderately permeable; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is less than 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Moderate: low strength; slope where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Slight where slope is less than 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Moderate: low strength; frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Portneuf: PxA, PxB, PYB, PYC, PYD.	Moderate: moderate permeability; slope, where slope is more than 8 percent.	Moderate: moderate permeability; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is less than 8 percent; moderate where 8 to 12 percent.	Moderate: low strength; slope, where slope is more than 8 percent.	Slight -----	Moderate: frost action; low strength; slope, where slope is more than 8 percent.
Quincy: QnB, QnC, QUF -----	Slight where slope is 2 to 8 percent; moderate where 8 to 15 percent. <sup>2</sup>	Severe: very rapid permeability.	Severe: cut-banks unstable.	Slight where slope is less than 8 percent; moderate where more than 8 percent.	Severe: too sandy.	Slight where slope is less than 8 percent; moderate where more than 8 percent.
QVD -----	Severe: bedrock at a depth of 20 to 40 inches. <sup>2</sup>	Severe: very rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; cut banks unstable.	Moderate: depth to bedrock stoniness; slope, where slope is more than 8 percent.	Severe: moderately deep to bedrock; too sandy.	Moderate: depth to bedrock; slope, where slope is more than 8 percent.
Rexburg: RBB, RBC, RBE, RBF, RBG.	Moderate: moderately permeable; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Moderate: moderately permeable; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is 0 to 8 percent; moderate where 8 to 15 percent; severe where more than 8 percent.	Moderate: low strength; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Slight where slope is less than 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Moderate: frost action; low strength; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
*Ricrest: RCF, RDG ---- For Ridgecrest part, see Ridgecrest series.	Moderate where slope is 8 to 15 percent; severe where more than 15 percent.	Severe: moderate to steep slopes.	Moderate: depth to bedrock; slope, where slope is less than 15 percent. Severe where slope is more than 15 percent.	Moderate where slope is less than 15 percent; severe where more than 15 percent.	Moderate where slope is less than 25 percent; severe where more than 25 percent.	Moderate: frost action; slope, where slope is less than 15 percent. Severe where slope is more than 15 percent.

properties of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: wet; frost action; excess humus; low strength.	Unsuited ..	Poor: wet ..	Excess humus; water table at or near surface.	Not suitable..	Poor outlets..	Wet .....	Wet.
Fair: frost action; low strength; slope, where slope is 15 to 25 percent. Poor where slope is more than 25 percent.	Unsuited ..	Good where slope is less than 8 percent; fair where 8 to 15 percent; severe where more than 15 percent.	Moderately permeable; slopes of 0 to 30 percent.	High piping hazard; medium to low shear strength; hard to pack.	Favorable where slope is less than 2 percent; erodibility where slope is more than 2 percent.	Favorable where slope is less than 2 percent; complex slopes are steeper and erode easily.	Short complex slopes; erodes easily.
Fair: frost action; low strength.	Unsuited ..	Good where slope is less than 8 percent; fair where 8 to 12 percent.	Moderately permeable; slopes of 0 to 12 percent.	High piping hazard; medium to low shear strength; hard to pack.	Favorable where slope is less than 2 percent; complex slopes; erodes easily.	Favorable where slope is less than 2 percent; complex slopes; erodes easily.	Short complex slopes; erodes easily.
Good .....	Fair <sup>2</sup> : sand; excessive fines.	Poor: too sandy; slope, where slope is 8 to 15 percent.	Very rapid permeability; slopes of 2 to 15 percent.	Medium to high piping hazard; medium to high permeability; medium shear strength.	Complex slopes; erodes easily.	Very high soil blowing hazard; droughty.	Very high soil blowing hazard; droughty.
Poor: thin layer.	Unsuited ..	Poor: too sandy; slope, where slope is more than 8 percent.	Very rapid permeability; bedrock at a depth of 20 to 40 inches; slopes of 2 to 10 percent.	Thin layer; medium shear strength; piping hazard.	Not needed ..	Very high soil blowing hazard; droughty.	Very high soil blowing hazard; droughty.
Fair: frost action; low strength; slope, where slope is 15 to 25 percent. Poor where slope is more than 25 percent.	Unsuited ..	Good where slope is less than 8 percent; fair where 8 to 15 percent; poor where more than 15 percent.	Moderately permeable; slopes of 0 to 55 percent.	Medium to low shear strength; piping hazard; hard to pack.	Not needed ..	Favorable where slope is less than 2 percent; complex slopes are steeper and erode easily.	Short complex slopes; erodes easily on steeper slopes.
Fair: frost action; slope, where slope is 15 to 25 percent. Poor where slope is more than 25 percent.	Unsuited ..	Poor: stoniness; slope, where slope is more than 15 percent.	Slopes of 8 to 55 percent; moderately permeable.	Medium to high piping hazard; medium to low shear strength.	Not needed ..	Very high erosion hazard.	Droughty; gravelly; erodes easily.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill <sup>1</sup> (trench type)	Local roads and streets
*Ridgecrest: REF, RGF, RGG, RHG. For Hymas part, see Hymas series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: depth to bedrock; slope, where slope is more than 7 percent.	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Moderate: depth to bedrock; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 25 percent.	Moderate: depth to bedrock; frost action; slope, where slope is 8 to 15 percent; moderate stoniness in RHG. Severe where slope is more than 25 percent.
Riverwash: Rw -----	Severe <sup>2</sup> : floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Robin: RKE, RKF, RKG ..	Moderate: moderate permeability; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Moderate: moderate permeability; slope, where slope is 4 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is 4 to 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Moderate: low strength; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Slight where slope is 4 to 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Severe: frost action; slope, where slope is more than 15 percent.
Rock land: RL. Too variable for estimates.						
Rudeen: RNC, RNE, RNF -----	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 7 percent.	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Moderate: depth to bedrock; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 25 percent.	Moderate: depth to bedrock; frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
RUE, RUF, RUG -----	Severe: stoniness; depth to bedrock; slope, where slope is more than 15 percent.	Severe: slope; stoniness.	Severe: stoniness; depth to bedrock; slope, where slope is more than 15 percent.	Severe: stoniness; slope, where slope is more than 15 percent.	Severe: depth to bedrock; stoniness; slope, where slope is more than 25 percent.	Moderate: stoniness; depth to bedrock; frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Snake: Sn, Ss -----	Severe: high water table.	Severe: high water table.	Severe: wet ..	Moderate: high water table.	Moderate: wet.	Moderate: wet.
St -----	Severe: high water table.	Severe: high water table.	Severe: wet ..	Severe: wet ..	Severe: wet ..	Severe: wet.

properties of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: thin layer; slope, where slope is more than 25 percent.	Poor: gravel; thin layer; excessive fines.	Poor: stoniness; slope, where slope is more than 15 percent.	Limestone at a depth of 20 to 40 inches; moderately permeable; slopes of 4 to 70 percent.	High to medium shear strength; medium to low piping hazard; medium to low compacted permeability.	Not needed	Moderately deep to bedrock; low available water capacity; high and very high erosion hazard.	Droughty; gravelly; cobbly; erodes easily; moderately deep to bedrock.
Good	Good <sup>4</sup> : gravelly.	Poor: too sandy and gravelly.	Very rapidly permeable; floods.	High compacted permeability.	Floods	Droughty; floods.	Not needed.
Poor: frost action; slope, where slope is more than 25 percent.	Unsuited	Good where slope is less than 8 percent; fair where 8 to 15 percent; severe where more than 15 percent.	Moderately permeable; slopes of 4 to 55 percent.	Medium to low shear strength; piping hazard; hard to pack.	Not needed	Complex slopes; erodes easily.	Short complex slopes; erodes easily.
Poor: thin layer; slope, where slope is more than 25 percent.	Poor: sand; thin layer; excessive fines.	Poor: stoniness; thin layer; slope, where slope is more than 15 percent.	Bedrock at a depth of 20 to 40 inches; slopes of 4 to 30 percent.	Medium shear strength; medium to high piping hazard.	Not needed	Moderately deep; low available water capacity; erodes easily.	Droughty; low precipitation; moderately deep to bedrock.
Poor: thin layer; slope, where slope is more than 25 percent.	Poor: sand; excessive fines.	Poor: stoniness; slope, where slope is more than 15 percent.	Slopes of 8 to 65 percent; bedrock at a depth of 20 to 40 inches; moderately permeable.	Extremely stony; medium to high piping hazard; medium shear strength.	Not needed	Extremely stony.	Extremely stony; droughty; low precipitation; moderately deep to bedrock.
Fair: wet	Unsuited	Fair <sup>4</sup> : thin layer.	High water table at a depth of 30 to 48 inches.	Medium to low shear strength; hard to pack.	Poor outlets; slowly permeable.	Wet	Not needed.
Poor: frost action.	Unsuited	Poor: wet	High water table at a depth of 20 to 40 inches.	Medium to low shear strength; hard to pack.	Poor outlets; slowly permeable.	Wet	Not needed.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill <sup>1</sup> (trench type)	Local roads and streets
Tahquats: TAC -----	Severe: moderately slowly permeable.	Moderate: stoniness; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Severe: stoniness.	Slight -----	Severe: stoniness.	Moderate: frost action; low strength of surface layer.
TBC -----	Severe: moderately slowly permeable; slope, where slope is more than 15 percent.	Moderate: stoniness; slope, where slope is less than 7 percent. Severe where slope is more than 7 percent.	Moderate: stoniness; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Moderate: stoniness; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Moderate: stoniness; too clayey; slope, where slope is more than 15 percent.	Moderate: frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Tahquats variant: TCD --	Severe: slowly permeable; slope, where slope is more than 15 percent.	Moderate where slope is less than 7 percent; severe where more than 7 percent.	Slight where slope is 4 to 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Moderate: low strength; slope, where slope is less than 15 percent. Severe where slope is more than 15 percent.	Moderate: too clayey; slope, where slope is more than 15 percent.	Moderate: low strength; frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Tickason: TdA, TEB, TGD.	Slight where slope is 0 to 8 percent; moderate where 8 to 12 percent.	Moderate: moderately permeable; slope, where slope is 2 to 7 percent. Severe where slope is more than 7 percent.	Slight where slope is 0 to 8 percent; moderate where 8 to 12 percent.	Moderate: low strength; slope, where slope is more than 8 to 12 percent.	Slight -----	Moderate: frost action; low strength; slope, where slope is more than 8 percent.
Tindahay: ThA, ThB, ThC, ThE, TNF.	Slight where slope is 0 to 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent. <sup>2</sup>	Severe: moderately rapid permeability; slope, where slope is more than 7 percent.	Severe: cut banks unstable; slope, where slope is more than 15 percent.	Slight where slope is less than 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.	Moderate: too sandy; slope, where slope is more than 15 percent.	Slight where slope is less than 8 percent; moderate where 8 to 15 percent; severe where more than 15 percent.
Wahtigup: WAF, WBF, WBG.	Moderate: depth to bedrock; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Severe: slope is more than 7 percent.	Moderate: small stones; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.	Moderate where slope is less than 15 percent; severe where more than 15 percent.	Severe: depth to bedrock; slope, where slope is more than 15 percent.	Moderate: frost action; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Waycup: WcD, WDF, WEF, WEG.	Severe: stoniness; slope, where slope is more than 15 percent.	Severe: slope is more than 7 percent.	Severe: stoniness; slope, where slope is more than 15 percent.	Severe: stoniness; slope, where slope is more than 15 percent.	Severe: stoniness; slope, where slope is more than 25 percent.	Moderate: frost action; low strength; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.

properties of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: frost action; coarse fragments.	Poor: sand and gravel; excessive fines.	Poor: thin layer; stoniness.	Slopes of 2 to 8 percent.	Medium to low compacted permeability; high to medium shear strength.	Not needed	Moderate erosion hazard; moderately slowly permeable.	Erodes easily; droughty;
Fair: frost action; slope, where slope is more than 15 percent.	Poor: sand and gravel; excessive fines.	Poor: stoniness; slope, where slope is more than 15 percent.	Slopes of 4 to 20 percent; very stony.	Medium to low compacted permeability; high to medium shear strength.	Not needed	Very stony; high erosion hazard.	Very stony; erodes easily; droughty.
Fair: shrink-swell; frost action; slope, where slope is more than 15 percent.	Unsuited	Poor: stoniness; slope, where slope is more than 15 percent.	Slopes of 4 to 20 percent.	Medium to low shear strength; medium compressibility.	Not needed	Slowly permeable; stoniness; slope.	Stoniness; erodes easily; slowly permeable.
Fair: low strength and frost action.	Unsuited	Good where slope is less than 8 percent; fair where 8 to 12 percent.	Moderately permeable; slopes of 0 to 12 percent.	Medium to low shear strength; medium compressibility.	Not needed	Favorable where slope is less than 2 percent; erodes easily where more than 2 percent.	Low precipitation; erodes easily; slopes of less than 2 percent.
Good where slope is less than 15 percent; fair where more than 15 percent.	Fair: sand; excessive fines.	Poor: too sandy; slope, where slope is more than 15 percent.	Moderately rapidly permeable; slopes of 0 to 20 percent.	Medium to high piping hazard; medium shear strength; high compacted permeability.	Favorable where slope is less than 2 percent; erodes easily on steeper soils.	Droughty; very high soil blowing hazard.	Droughty; very high soil blowing hazard.
Poor: thin layer; slope, where slope is more than 25 percent.	Unsuited	Poor: stoniness; slope, where slope is more than 15 percent.	Limestone at a depth of 40 to 60 inches; moderately permeable; slopes of 8 to 55 percent.	Medium to high shear strength.	Not needed	Erodes easily.	Gravelly and very cobbly; moderately sloping to steep; droughty.
Poor: stoniness.	Unsuited	Poor: stoniness; slope, where slope is more than 15 percent.	Moderately permeable; extremely stony; bedrock at a depth of 40 to 60 inches; slopes of 8 to 55 percent.	Medium to low shear strength.	Extremely stony; erodes easily.	Very high erosion hazard; droughty; WEF and WEG have extremely stony surface layers.	Mostly short complex slopes; low precipitation; droughty.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill <sup>1</sup> (trench type)	Local roads and streets
Wheeler: WhD, WhF, WLE, WLF, WLG.	Moderate where slope is 8 to 15 percent; severe where more than 15 percent.	Severe: slope is more than 7 percent.	Moderate where slope is 8 to 15 percent; severe where more than 15 percent.	Moderate: low strength; slope, where slope is less than 15 percent. Severe where slope is more than 15 percent.	Slight where slope is less than 15 percent; moderate where 15 to 25 percent; severe where more than 25 percent.	Moderate: frost action; low strength; slope, where slope is 8 to 15 percent. Severe where slope is more than 15 percent.
Zunhall: ZN, ZU -----	Severe: high water table.	Severe: high water table.	Severe: wet	Severe: wet	Severe: wet	Severe: wet

<sup>1</sup> Onsite deep studies of the underlying strata, water table, and hazards of aquifer pollution and drainage into ground water should be made for landfill deeper than 5 or 6 feet.

<sup>2</sup> Pollution of ground water is a hazard in places.

<sup>3</sup> Some areas of this soil are a source of sand and gravel.

transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. In table 3, the ratings in millimhos per centimeter are as follows: none equals less than 2; low, 2 to 4; moderate, 4 to 8; high, 8 to 16; and very high, more than 16. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 3, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel. Rate of corrosion of uncoated steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low*

means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures should be used to avoid or minimize damage.

Frost-action potential is the potential effect on structures resulting from freezing and subsequent thawing of soil materials. Frost action in soils pertains not only to heaving as freezing progresses but also to excessive wetting and loss of soil strength upon thawing.

#### *Engineering interpretations of soils*

The estimated interpretations in table 4 are based on the engineering properties of soils shown in table 3, on test data for soils in other survey areas nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the Fort Hall Area. In table 4, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than drainage for crops and pasture; irrigation; pond reservoir areas; dikes, levees, and other embankments; and terraces and diversions. For these particular uses, table 4 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties generally are favorable for the rated use, or in other words, limitations are minor and easily overcome. *Moderate* means some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance. For some uses, the rating of severe is divided to obtain ratings of severe and very severe. *Very severe* means one or more soil properties are so unfavorable for a particular use that overcoming the limitations is most difficult and costly and commonly not practical for the rated use.

Soil suitability is rated by the terms *good*, *fair*, and

properties of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: low strength; frost action; slope, where slope is less than 25 percent.	Unsuited	Fair where slope is 8 to 15 percent; poor where more than 15 percent.	Moderately permeable; slopes of 8 to 75 percent.	High piping hazard; medium to low shear strength; hard to pack.	Complex slopes; erodes easily.	Complex slopes; erodes easily.	Short complex slopes; erodes easily.
Poor: wet	Unsuited	Good for ZN; poor for ZU.	High water table at a depth of 10 to 40 inches.	Low shear strength; hard to pack.	Moderately slowly permeable.	Wet -----	Wet.

\* Areas of CkA, CkB, DeA, DeB, DeC, EsA, EsB, PIA, PFC, Pm, PpA, and Ss are poor sources of topsoil because of their salt and alkali content.

\* Some areas may be good source of sand.

poor, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 4.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic-matter content, and slope, and, if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle

slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings as rated in table 4 are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 4 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but every site should be investigated before it is selected.

Local roads and streets, as rated in table 4, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that affect design and construction of

roads and streets are load supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 4 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that results at the area from which topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges,

constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

## ***Formation and Classification of Soils***

This section discusses the five factors of soil formation. Then it discusses the system of classifying soils and places each soil in the Area in the major categories of that system.

### **Factors of Soil Formation**

Soils are the product of the interaction of five factors of soil formation. These factors are (1) the kinds of parent material in which the soil formed, (2) the climate under which the soil formed, (3) plants and animals that have lived in and on the soil, (4) the relief, or lay of the land, which influences the local climate and modifies soil temperature and moisture content, and (5) the length of time that the soil-forming factors have been active.

Many of the processes of soil formation are complex. Since soils express the interaction of the soil-forming factors, it is difficult to evaluate the effect of any single factor. For instance, to determine the influence of time on soil formation, the factors of climate, plants and animals, relief, and parent material must be considered constant. The extent of such a study is limited by necessity to avoid climatic variability. A step-sequence of alluvial terraces often provides different soil ages with the other factors as constants.

#### ***Parent material***

The soils of the Fort Hall Area formed in several contrasting parent materials. Large areas of sandy eolian and alluvial deposits are on the low plateaus and alluvial fans and terraces in the Fort Hall community and lower Blackfoot River areas. The principal soils that formed in these sediments are the Quincy, Feltham, Tindahay, and Escalante soils. The sandy materials have been blown from alluvial terraces along the Snake and Blackfoot Rivers and from the areas near the mouth of several large streams and creeks.

The alluvial deposits consist of thick strata of water-worn gravel of mixed lithology under loamy or sandy alluvium. Soils of the Paniogue, Declo, and Snake series are the main soils whose parent material originated from the Snake River, Portneuf River, and Blackfoot River drainages. Penoyer and Parehat soils formed in Holocene alluvium near the Ross Fork and Bannock Creeks.

The low, dissected plateaus and the mountain foot slopes in the areas east and northeast of the community of Fort Hall and bordering Bannock Creek are overlain by a thick mantle of loess. In some places, the

loess is more than 200 feet thick. Neeley, Rexburg, Pocatello, and Wheeler soils formed in thick loess, so the profiles do not contain materials derived from the weathering of the underlying rock. Waycup soils formed in thinner loess, so their profile also contains materials weathered from bedrock.

The mountains in the vicinity of Mount Putnam have a thin mantle of loess that is mixed with residual material, mainly weathered from limestone and quartzite. Soils in this area are Pavohroo, Ricrest, Hymas, and Wahtigup soils.

Moohoo and Dranyon soils are in the high mountains and mountain valleys and formed in material derived from sandstone, but they have increments of loess in the upper part of the profile.

The foothills at the base of mountains consist mainly of deep soils formed in loess overlying sandstone, limestone, and associated rocks. In most places, the loess is too thick for the underlying rock to have had an influence on the soils. Lanoak, Robin, and Buckskin soils are common in this area. Hondoho soils are cobbly and stony and, therefore, contain material derived from the underlying bedrock. The poorly drained Fury soils and the somewhat poorly drained poorly drained Zunhall soils are in lower positions in the high mountain valleys and are associated with Lanoak and Robin soils.

The terraces in the American Falls Reservoir area are underlain by sediment deposited in an ancient lake impounded behind a rock barrier that is now the American Falls of the Snake River. Soils formed in this old lake terrace sediment include the Declo and Paniogue soils and some soils in the Snake and Philbon series.

### *Climate*

Climate is an important factor in soil formation if given enough time to act on the soil material. It indirectly affects the kind and amount of vegetation and micro-organism activity, which in turn affects soil formation. Climate directly affects the physical and chemical weathering of minerals, erosion and deposition of soil materials by wind and water, and the amount of water movement through the soil. Climate varies over broad geographic areas but can also differ locally because of slope, exposure, and elevation.

Prevailing winds in the area are from the southwest, but northerly winds are common in the colder months. The northerly winds influence soil formation by affecting temperature, rainfall patterns, drifting of snow, erosion and deposition of soil materials, and evaporation of moisture.

Burrowing animals mix the underlying soil material with the surface horizon. This mixing is obvious in the low mounds or hummocks common in the drier areas. Insects and earthworms make channels and pores in the soil, and, by mixing the horizons, they increase soil aeration and water movement. Compact nodules of soil formed in cicada burrows are a prominent feature of the lower horizons of many Portneuf, Pocatello, and other soils.

The semiarid soils in the western part of the survey area formed in calcareous loess. Precipitation is about 8 to 11 inches a year. Summers are hot and dry, and

winters are cold. Weathering of minerals is slow in this environment, and few mineral components have been leached out of the root zone. Carbonates have been leached to a depth of 6 to 12 inches, and there is little evidence of clay eluviation.

Two temperature zones are recognized in the Fort Hall Area, and the dividing line is along the mountain foot slopes. The warmer zone, where the mean annual soil temperature is more than 47° F, is confined to the lower elevations. In this warmer area, the most extensive soils are mainly Portneuf, Neeley, Declo, and Tindahay soils. The colder zone, where the mean annual soil temperature is less than 47°, is at the higher elevations or on slopes that face north. In the colder area are mainly Rexburg, Lanoak, Nagitsy, and Hymas soils. Although there is secondary accumulation of carbonates (Cca horizons) in some soils, carbonates have been leached from the profiles of other soils. The differences among soils in the degree of carbonate leaching may be caused by differences in microclimate, differences in the initial carbonate content of the parent material, or both.

The low, dissected plateaus and the mountain foot slopes have more rainfall, 11 to 13 inches a year, than the semiarid western part of the Area. A distinct horizon of carbonate accumulation has formed at a depth of about 15 inches, but weathering and translocation of clay has been insufficient to form a horizon of clay accumulation. The main soils in this area are in the Neeley series. Neeley soils differ from Portneuf and Wheeler soils mainly in having a thicker, darker colored A1 horizon and more organic matter.

On the higher benches and lower mountain areas, the annual precipitation is 13 to 16 inches. The greater precipitation at higher elevations has produced more abundant vegetation, so the soils also contain more organic matter. The A1 horizon is darker colored than that of soils that receive less moisture, and carbonates have been leached to a depth of about 25 inches or more. Translocation of clay is evident in the subsoil. These areas are mainly made up of Rexburg soils.

The mountains and mountain valleys have an annual precipitation of about 16 to 20 inches. The higher elevations of the mountains are colder than the mountain valleys. In general, the colder temperature has an effect on soil formation, but soil formation is complicated by slope exposure and other factors. The greater amount of precipitation leaches the calcium carbonate deeper, and the colder climate allows greater production of organic matter. The upper horizons of the soils tend to be more acid. The A1 horizon is thicker and darker colored and contains more organic matter. In these areas, the precipitation and subsequent eluviation are sufficient to cause considerable amounts of clay to accumulate in the subsoil. Carbonates, in many places, are leached to depths greater than 40 inches. Soils in mountain valleys, such as Robin and Lanoak soils, reflect this climatic environment. Some soils in the mountains, such as Hymas, Ricrest, and Pavohroo soils, are too shallow or too young to exhibit the influence of the climate.

### *Plants and animals*

Vegetative cover, or in some places the lack of it,

has appreciably influenced soil formation within the survey area. The low rainfall and consequent sparse vegetation of the drier areas have produced soils that have a thin A1 horizon and low organic-matter content. Some of the river terraces and bottoms receive runoff from the uplands and, therefore, have more vegetation. The greater amount of moisture is reflected in a thicker A1 horizon and higher organic-matter content. On mountains and foot slopes, the amount of vegetation also increases as elevation increases on soils of about equal depth because of the increase in precipitation. The thickness of the A1 horizon and the organic-matter content generally increase in proportion to the increased vegetation.

Pavohroo soils formed where the climate is sufficiently cool and moist for fir trees and other conifers. This type of vegetation causes pronounced differences in soil characteristics. Decaying residue produces organic acids, which leach through the soil and translocate organic matter, bases, and iron. The leaching of basic elements below the root zone results in acid soils. Dranyon soils formed under quaking aspen, have a thicker and darker A horizon, and are somewhat more acid than Pavohroo soils that formed under Douglas-fir.

Burrowing animals mix the underlying soil material with the surface horizon. This mixing is obvious in the low mounds or hummocks common in the drier areas. Insects and earthworms make channels and pores in the soil, and, by mixing the horizons, they increase soil aeration and water movement. Compact nodules of soil formed in cicada burrows are a prominent feature of the lower horizons of many Portneuf, Pocatello, and other soils.

### **Relief**

Relief greatly influences soil formation. Rainfall that does not infiltrate the soils runs off or collects in depressions. In steep areas where slopes face north, the sun is less effective in heating the soil. Thus, vegetation is more dense, and the soils are deeper, are dark colored, and contain more organic matter. The rate of evaporation is higher and soils are warmer on south-facing slopes. Depressions or concave areas tend to be more poorly drained, and salt often accumulates.

The soils on river and lake terraces have been periodically flooded by the river during early stages of their formation. Some soils have also received runoff and sediment from adjacent uplands. In general, sedimentation inhibits soil horizon differentiation. Some of the soils on the lower terraces and bottom lands have a high water table. The restricted drainage of the lower lying areas is shown in Philbon, Snake, and Peteetneet soils, where formation has been influenced more by wetness than by other soil-forming factors. Zunhall and Fury soils formed under similar perennially wet conditions in mountain valleys.

The steep mountainous areas probably received as much loess as the valleys, but erosion has removed much of this material. For this reason, many of the soils in the mountains are strongly influenced by the underlying bedrock. North-facing slopes and protected pockets retain more loess and receive and retain more moisture, so the soils are generally deeper. In these

places, soil-forming processes have been active longer, and the microclimate has been a major factor. Dranyon soils are in these areas.

In the mountain valleys, the soils at higher elevations are leached of calcium carbonate. Clay has accumulated in the subsoil, and bleached silt grains on the ped surfaces provide further evidence of leaching and clay eluviation. Robin soils are representative of soils in the mountain valleys.

At somewhat lower elevations in the valleys, precipitation is less, the soils are warmer, and snow melts earlier in spring. In these areas, Lanoak soils have a thinner A1 horizon and have carbonates within the upper 60 inches as contrasted to Robin soils that formed in the higher mountain valleys.

### **Time**

Soil-forming processes generally require appreciable periods of time to alter parent material. The length of time necessary for significant changes depends on the particular combination of soil-forming factors. In general, soils form more rapidly in humid areas than in dry areas. Mountain soils are generally young and weakly formed because material is constantly removed by erosion. Soils on flood plains and on some alluvial fans are young because of periodic deposition of sediment. Warmth promotes chemical weathering and biological activity in the soil, while cold retards it. Humidity, temperature, and other factors affect the time required to weather parent material.

Soils on loess-mantled uplands of the Snake River plains are weakly formed because of the low precipitation and cool temperature. Insufficient time has passed for the parent material to be greatly altered. The low precipitation caused carbonates to accumulate near the soil surface. The thin A1 horizon is typical of soils that formed in an arid environment. The level of fertility is relatively high because precipitation has been insufficient to leach these elements from the soil during the time the soils have been in place.

Some of the loess has been eroded from uplands and has been redeposited as alluvial fans that coalesce with the higher river terraces. These recent soils show little or no formation and are calcareous throughout the profile. McDole soils are typical of these areas.

Neeley and Rexburg soils on uplands in similar areas have been in place long enough for some soil formation, as evidenced by the leaching of carbonates to form Cca horizons and weak to moderate grades of soil structure.

Pavohroo, Hymas, and Ricrest soils in the mountains are young. Geologic erosion has removed soil at about the same rate as soil formation. The less steep, deeper soils of the lower mountain slopes, particularly in protected areas, exhibit some soil formation. Rexburg soils show evidence of the leaching of carbonates and weak to moderate grades of soil structure.

More soil formation has occurred in the mountain valleys during a similar period of time than in soils with similar parent materials on the Snake River Plains, mainly because of the differences in temperature and precipitation. Examples are Robin soils that formed in loess where annual precipitation is 17 to 19 inches. In these soils, carbonates have been leached

below a depth of 60 inches, and clay has been eluviated into the subsoil to form a Bt horizon. Portneuf soils, which formed in apparently similar loess but in areas where annual precipitation is 8 to 11 inches, show only slight or no translocation of clay, and the carbonates have been leached from only the upper few inches.

Many of the soils in the survey area are apparently quite young, although some have formed distinct profile characteristics suggesting a somewhat longer period of soil formation.

### Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields,

and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965.<sup>7</sup> Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.<sup>8</sup>

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system, the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 5, the soil series of the Fort Hall Area are placed in some categories of the current system. Categories of the current system are briefly described in the following paragraphs, and the classification of Broncho soils is used as an example.

<sup>7</sup> United States Department of Agriculture. Soil classification, a comprehensive system, 7th approximation. 265 pp., illus. 1960. [Supplements issued in March 1967 and September 1968]

<sup>8</sup> SIMONSON, ROY W. Soil classification in the United States. Sci. 137: 1027-1034. 1962.

TABLE 5.—Classification of the soil series

Series	Family	Subgroup	Order
Broncho	Sandy-skeletal, mixed, mesic	Xerollic Camborthids	Aridisols.
Buckskin	Fine, montmorillonitic	Argic Cryoborolls	Mollisols.
Chedehap	Coarse-loamy, mixed, mesic	Xerollic Camborthids	Aridisols.
Declo	Coarse-loamy, mixed, mesic	Xerollic Calciorthids	Aridisols.
Declo variant	Coarse-loamy, mixed, mesic	Durixerollic Calciorthids	Aridisols.
Dranyon	Fine-loamy, mixed	Argic Pachic Cryoborolls	Mollisols.
Escalante	Coarse-loamy, mixed, mesic	Xerollic Calciorthids	Aridisols.
Feltham	Sandy, mixed, mesic	Xeric Torriorthents	Entisols.
Firth	Coarse-loamy, mixed	Aquic Haploborolls	Mollisols.
Fury	Fine-silty, mixed, frigid	Cumulic Haplaquolls	Mollisols.
Heiseton	Coarse-loamy, mixed, calcareous, frigid	Aquic Xerofluvents	Entisols.
Highams	Loamy-skeletal, carbonatic, frigid	Lithic Xeric Torriorthents	Entisols.
Hondoho	Loamy-skeletal, mixed, frigid	Calcic Haploxerolls	Mollisols.
Hymas	Loamy-skeletal, carbonatic, frigid	Lithic Haploxerolls	Mollisols.
Knull	Fine-silty, mixed, mesic	Xerollic Natrargids	Aridisols.
Kucera	Coarse-silty, mixed, frigid	Calcic Pachic Haploxerolls	Mollisols.
Lanoak	Fine-silty, mixed, frigid	Pachic Haploxerolls	Mollisols.
McDole	Coarse-silty, mixed, mesic	Torrifluventic Haploxerolls	Mollisols.
Moohoo	Loamy-skeletal, mixed	Entic Cryumbrepts	Inceptisols.
Nagitsy	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols.
Neeley	Coarse-silty, mixed, mesic	Calciorthidic Haploxerolls	Mollisols.
Nielsen	Loamy-skeletal, mixed	Argic Lithic Cryoborolls	Mollisols.
Pandoah	Loamy-skeletal, mixed, frigid	Calciorthidic Haploxerolls	Mollisols.
Paniogue	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic.	Xerollic Camborthids	Aridisols.
Parehat	Fine-silty, mixed, mesic	Fluvaquentic Haploxerolls	Mollisols.
Pavohroo	Fine-loamy, mixed	Pachic Cryoborolls	Mollisols.
Penoyer	Coarse-silty, mixed (calcareous), mesic	Typic Torrifuvents	Entisols.
Penoyer variant	Fine-loamy, mixed (calcareous), mesic	Aquic Xerofluvents	Entisols.
Peteetneet	Euic, mesic	Typic Medisaprists	Histosols.
Peteetneet variant	Fine-silty, mixed, mesic	Cumulic Histic Haplaquolls	Mollisols.
Philbon	Loamy-mixed, euic, mesic	Teric Medisaprists	Histosols.
Pocatello	Coarse-silty, mixed (calcareous), mesic	Xeric Torriorthents	Entisols.
Portneuf	Coarse-silty, mixed, mesic	Durixerollic Calciorthids	Aridisols.
Quincy	Mixed, mesic	Xeric Torripsamments	Entisols.
Rexburg	Coarse-silty, mixed, frigid	Calcic Haploxerolls	Mollisols.
Ricrest	Fine-loamy, mixed, frigid	Calcic Pachic Haploxerolls	Mollisols.
Ridgecrest	Loamy-skeletal, carbonatic, frigid	Calcic Haploxerolls	Mollisols.
Robin	Fine-silty, mixed	Cryic Pachic Paleborolls	Mollisols.
Rudeen	Loamy-skeletal, mixed, frigid	Aridic Calcixerolls	Mollisols.
Snake	Fine-silty, carbonatic, mesic	Aquic Calcixerolls	Mollisols.

TABLE 5.—*Classification of the soil series—Continued*

Series	Family	Subgroup	Order
Tahquats	Loamy-skeletal, mixed	Argic Cryoborolls	Mollisols.
Tahquats variant	Fine, montmorillonitic	Argic Cryoborolls	Mollisols.
Tickason	Coarse-loamy, mixed, mesic	Calciorthidic Haploxerolls	Mollisols.
Tindahay	Sandy, mixed, mesic	Xeric Torriorthents	Entisols.
Wahtigup	Fine-loamy, mixed, frigid	Calciorthidic Haploxerolls	Mollisols.
Waycup	Loamy-skeletal, mixed, mesic	Xerollic Calciorthids	Aridisols.
Wheeler	Coarse-silty, mixed (calcareous), mesic	Xeric Torriorthents	Entisols.
Zunhall	Fine-silty, carbonatic, frigid	Aquic Calcixerolls	Mollisols.

**ORDERS:** Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Arid-i-sol).

**SUBORDERS:** Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Orthid* (*Orth*, meaning true or common, and *id*, from Aridisols).

**GREAT GROUPS:** Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Camborthids* (*Camb*, meaning to change, *orth* for common, and *id*, from Aridisols).

**SUBGROUPS:** Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Xerollic Camborthids (a Camborthid that is an intergrade to the suborder Xerolls).

**FAMILIES:** Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temper-

ature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae. An example is the sandy-skeletal, mixed, mesic family of Xerollic Camborthids.

### *Climate*<sup>9</sup>

The Fort Hall Area has a dry continental climate. The arid part of the Area is a 10- by 32-mile section of the Snake River Plains extending southeastward from the river. The semiarid hilly sections extend as much as 20 miles south and east into the Eastern Highlands. Elevation of the plains ranges from 4,400 to 5,000 feet, and elevation of the higher peaks ranges from 5,800 to 8,860 feet.

Tables 6 and 7 provide temperature and precipitation data representative of Fort Hall Area. Gradual changes from one season to another are occasionally varied by either persistent weather systems or fast-moving storms. Autumn generally has the most consistent weather. Nights are cool, and the first freezing temperature is in mid-September. Greater variety is shown in the climate of the other seasons. Although winters are cold, the recurring periods of subzero temperatures and snow accumulation are eased by the milder weather caused by a frequent, persistent southwest wind. The wettest and windiest months are in spring, when warming is gradual, and freezing temperatures at night are common through most of April. A sharp decrease in precipitation is noted in summer when most precipitation occurs as local showers. The moderate thunderstorms and their associated lightning do cause some hazard of fire to range. Many summer days are hot, but nights are generally cool.

The influence of temperature and precipitation on the crop-producing plains can be shown in the data in table 6. The desert plain receives only 9 to 11 inches of precipitation annually, and crops depend on irrigation during the growing season. Grazing areas in the highlands receive as much as 15.3 inches at an elevation of 6,200 feet, and high ridges and peaks receive an estimated 25 to 30 inches. Extremes in annual precipitation at Fort Hall have ranged from 5.69 inches in 1934 to 15.71 inches in 1963. Area records show that 28 percent of the moisture is received in spring, 22 percent in summer, 24 percent in

<sup>9</sup> By STANLEY G. HOLBROOK, climatologist for Idaho, National Weather Service, U.S. Department of Commerce.

TABLE 6.—*Temperature and precipitation data*

[All data from Fort Hall Indian Agency, Bingham County, Idaho. Period of record: 1939-68]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly highest maximum	Average monthly lowest minimum	Average total	One year in 10 will have—		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
						Less than—	More than—		
	<sup>°F</sup>	<sup>°F</sup>	<sup>°F</sup>	<sup>°F</sup>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Number</i>	<i>Inches</i>
January	34	13	48	-12	0.8	0.2	1.6	17	3
February	40	19	52	-4	.7	.1	1.4	10	3
March	48	24	64	6	.7	.2	1.4	2	4
April	62	31	76	19	.9	.2	1.7	( <sup>1</sup> )	2
May	70	39	85	27	1.4	.2	2.6	0	0
June	78	45	92	34	1.5	.2	3.1	0	0
July	89	52	94	70	.4	( <sup>2</sup> )	1.2	0	0
August	87	50	96	38	.7	( <sup>2</sup> )	1.5	0	0
September	77	41	91	28	.8	.1	2.2	0	0
October	66	33	81	19	.8	0	1.8	( <sup>1</sup> )	1
November	47	24	63	6	.9	.2	1.9	3	2
December	37	18	52	-5	.8	.3	1.6	9	2
Year	61	32	99	-15	10.4	7.1	13.5	41	2

<sup>1</sup> Less than one-half day.  
<sup>2</sup> Less than 0.05 inch.

<sup>1</sup> Average annual highest temperature.  
<sup>2</sup> Average annual lowest temperature.

TABLE 7.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Fort Hall Indian Agency, Bingham County, Idaho]

Probability	Dates for given probability and temperature				
	16°F	20°F	24°F	28°F	32°F
Spring:					
1 year in 10 later than	April 23	April 29	May 18	May 31	June 15
2 years in 10 later than	April 15	April 22	May 11	May 24	June 8
5 years in 10 later than	March 30	April 8	April 29	May 11	May 27
Fall:					
1 year in 10 earlier than	October 16	October 1	September 18	September 6	August 23
2 years in 10 earlier than	October 23	October 8	September 25	September 13	August 30
5 years in 10 earlier than	November 6	October 21	October 7	September 25	September 11

fall, and 26 percent in winter. Months that have 3 inches or more of moisture occur in 1 year out of 8. The record was 4.97 inches in June 1964. Dry months, or months with no precipitation or only a trace, occur in 1 year out of 3. The driest period was in July and August 1956. Days that have 0.5 inch or more occur on an average of 4 days per year, and days of 1.0 inch or more on 1 day every 3 years. The record maximum precipitation in 24 hours was 2.6 inches at Pocatello in September 1926.

Snow is the dominant form of precipitation in winter. It accounts for 28 percent of the annual precipitation at Pocatello. Seasonal snowfall ranges from 28 to 38 inches on the river plain and from 18 to 80 inches at Pocatello. Greater snowfall occurs on nearby hills and mountains, as recorded in the Mink Creek snow course located 6 miles south-southwest of Pocatello. It shows an average snow depth of 45 inches in April, but it ranged from 21 to 66 inches during the 21 years of record. Maximum 24-hour snowfall at Pocatello totaled 14.6 inches in March 1916.

Mean annual temperature at the higher elevations averages 8° cooler than that of the plains below. Temperature extremes of the Area have ranged from -31°

to -42° F, and from 104° to 108°. Temperatures of 90° and above occur on an average of 32 days per year, 32° or below occur on an average of 177 days per year, and subzero temperatures occur on an average of 11 days per year. Frost depth of 2 to 3 feet is common in winter. The frost-free season on the plain averages 107 days at Fort Hall.

The percentage of possible sunshine that can be received at Pocatello ranges from 38 percent in December and January to 84 percent in July. An average year has 113 clear days, 98 partly cloudy, and 154 cloudy. Annual potential evapotranspiration on the plains averages 23 to 25 inches; 72 percent of this takes place from May through August. Southwest winds prevail at Pocatello in all months, and mean hourly speeds average from 9.2 miles per hour in August to 11.9 miles per hour in April.

### Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has 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 the growth of most crop plants is poor from this cause. **Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

**Available water capacity** (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. Adjective ratings for a soil profile are as follows:

High—> 7.5 inches of water for the effective rooting depth.

Moderate—5.0–7.5 inches of water for the effective rooting depth.

Low—3.5–5.0 inches of water for the effective rooting depth.

Very low—<3.5 inches of water for the effective rooting depth.

**Calcareous soil.** A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. The ratings used in this survey are as follows: *slightly calcareous*—1 to 3 percent calcium carbonate equivalent; *moderately calcareous*—3 to 15 percent; *strongly calcareous*—15 to 30 percent; *very strongly calcareous*—more than 30 percent.

**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.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard and brittle; little affected by moistening.

**Drainage class (natural).** Drainage that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

*Excessively drained* soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

*Somewhat excessively drained* soils are also very permeable and are free from mottling throughout their profile.

*Well-drained* soils are nearly free from mottling and are commonly of intermediate texture.

*Moderately well drained* soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A horizon and upper part of the B horizon and have mottling in the lower part of the B horizon and in the C horizon.

*Somewhat poorly drained* soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

*Poorly drained* soils are wet for long periods; they are light gray and generally mottled from the surface downward, but some have few or no mottles.

*Very poorly drained* soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

**Depth, soil.** Effective depth to which plant roots can readily pen-

etrate and not be impeded by bedrock or a hardpan. The depth classes used in this survey are, as follows:

Shallow .....	6 to 20 inches
Moderately deep .....	20 to 40 inches
Deep .....	40 to 60 inches
Very deep .....	more than 60 inches

**Green manure crop.** A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

**Hardpan.** A hardened or cemented soil horizon, or layer. The soil material may be any texture, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

*O horizon.*—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

*A horizon.*—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

*B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

*C horizon.*—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

*R layer.*—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are—

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Basin.*—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

*Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

*Corrugation.*—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

*Furrow.*—Water is applied in small ditches made by cultivation implements 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.*—Irrigation water, released at high points, flows onto the field without controlled distribution.

**Leaching.** The removal of soluble materials from soils or other material by percolating water.

**Loess.** Wind-blown sediment primarily of silt size (0.002–0.5 mm).

**Mottling, soil.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

**Munsell notation.** A system for designating color by degrees of

the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

**Nutrient, plant.** Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil and carbon, hydrogen, and oxygen obtained largely from the air and water, are plant nutrients.

**Ped.** An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

**Permeability.** The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

**Poorly graded.** A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

pH		pH	
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Very strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	alkaline	9.1 and higher

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Saline soil.** A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

**Saline-alkali soil.** A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The salts, exchangeable sodium, and alkaline reaction occur in the soil in such location that growth of most crop plants is less than normal.

**Sand.** As a soil separate, individual rock or mineral fragments that range from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but the sand may be of any mineral composition. As a textural class soil that is 85 percent or more sand and not more than 10 percent clay.

**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 textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Slope classes.** The words describing the numerical slope range are as follows:

	Percent
Nearly level	0-2
Very gently sloping	2-4
Gently sloping	4-8
Moderately sloping	8-12
Strongly sloping	12-20
Moderately steep	20-30
Steep	30-65
Very steep	>65

**Soil.** A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 together without any regular cleavage, as in many claypans and hardpans).

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Substratum.** Technically, the part of the soil below the solum.

**Surface layer.** The A horizon or the soil ordinarily moved in tillage, or its equivalent in uncultivated soil, generally about 5 to 8 inches in thickness.

**Terrace (geological).** An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Water table.** The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

**Well-graded soil.** A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.



GUIDE TO MAPPING UNITS

For a full description of each mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit, read the introduction to the section it is in for general information about its management. For general information about the use of soils for range, see page 59; for woodland, see page 59; and for wildlife and recreation, see page 64.

High intensity	Low and medium intensity	Mapping unit	Page	Capability unit				Range site
				Irrigated		Nonirrigated		
				Symbol	Page	Symbol	Page	Symbol
A1	---	Alluvial land-----	9	-----	--	VIIIw-1	58	NU
BoB	---	Broncho gravelly loam, 2 to 4 percent slopes-----	10	IVs-1	56	-----	--	---
BoC	---	Broncho gravelly loam, 4 to 10 percent slopes-----	10	VIe-2	56	VIe-1	57	RY1
BoF	---	Broncho gravelly loam, 20 to 40 percent slopes-----	10	-----	--	VIIe-0	58	RY1
BrD	---	Broncho very cobbly loam, 2 to 15 percent slopes--	10	VIe-2	56	VIIe-2	58	RY1
---	BUE	Buckskin silt loam, rolling-----	11	-----	--	IIIe-9	56	CY4
ChA	---	Chedehap sandy loam, 0 to 2 percent slopes-----	12	IIs-1	54	-----	--	---
ChB	---	Chedehap sandy loam, 2 to 4 percent slopes-----	12	IIIe-13	55	-----	--	---
ChC	---	Chedehap sandy loam, 4 to 8 percent slopes-----	12	IIIe-13	55	-----	--	---
ChE	---	Chedehap sandy loam, 12 to 20 percent slopes-----	12	-----	--	VIe-1	57	SI1
CkA	---	Chedehap sandy loam, saline-alkali, 0 to 2 percent slopes-----	12	IVs-8	56	-----	--	---
CkB	---	Chedehap sandy loam, saline-alkali, 2 to 4 percent slopes-----	12	IVs-8	56	-----	--	---
DcA	---	Declo loam, 0 to 2 percent slopes-----	13	IIC-2	54	-----	--	---
DcB	---	Declo loam, 2 to 4 percent slopes-----	13	IIE-1	54	-----	--	---
DcC	---	Declo loam, 4 to 8 percent slopes-----	13	IIIe-1	55	-----	--	---
---	DDD	Declo loam, undulating-----	13	-----	--	VIe-1	57	SI1
DeA	---	Declo loam, saline-alkali, 0 to 2 percent slopes--	13	IIC-2	54	-----	--	---
DeB	---	Declo loam, saline-alkali, 2 to 4 percent slopes--	14	IIE-1	54	-----	--	---
DeC	---	Declo loam, saline-alkali, 4 to 8 percent slopes--	14	IIIe-1	55	-----	--	---
---	DHB	Declo loam, hardpan variant, 0 to 4 percent slopes-----	15	IIs-1	54	IVw-9	57	SL8
---	DRF	Dranyon silt loam, rolling-----	15	-----	--	IIIe-9	56	MP4
EnA	---	Escalante sandy loam, 0 to 2 percent slopes-----	16	IIE-4	54	-----	--	---
EnB	---	Escalante sandy loam, 2 to 4 percent slopes-----	16	IIE-1	54	-----	--	---
EnC	---	Escalante sandy loam, 4 to 8 percent slopes-----	16	IIIe-13	55	-----	--	---
---	EOC	Escalante sandy loam, undulating-----	16	-----	--	VIe-1	57	SI1
EsA	---	Escalante sandy loam, saline-alkali, 0 to 2 percent slopes-----	16	IVs-8	56	-----	--	---
EsB	---	Escalante sandy loam, saline-alkali, 2 to 4 percent slopes-----	16	IVs-8	56	-----	--	---
FeB	---	Feltham loamy sand, 0 to 4 percent slopes-----	17	IVe-5	55	VIIe-0	58	SA1
FeC	---	Feltham loamy sand, 4 to 8 percent slopes-----	17	IVe-5	55	VIIe-0	58	SA1
---	FLF	Feltham loamy sand, undulating-----	17	-----	--	VIIe-0	58	SA1
Fr	---	Firth fine sandy loam-----	18	IIw-2	54	IVw-9	57	SB8
---	FU	Fury silt loam-----	19	-----	--	IVw-9	57	SB8
He	---	Heiseton fine sandy loam-----	19	IIw-2	54	VIw-1	58	SI1
---	HGE	Highams very gravelly loam, hilly-----	20	-----	--	VIIe-0	58	SW2
---	HGF	Highams very gravelly loam, steep-----	20	-----	--	VIIe-0	58	ST2
---	HHF	Highams extremely stony loam, steep-----	20	-----	--	VIIIs-1	58	NU
---	HHG	Highams extremely stony loam, very steep-----	20	-----	--	VIIIs-1	58	NU
---	HOF	Hondoho very cobbly loam, hilly-----	21	-----	--	VIIIs-2	58	SI2
---	HOG	Hondoho very cobbly loam, steep-----	21	-----	--	VIIIs-1	58	NU
---	HYG	Hymas extremely stony loam, steep-----	22	-----	--	VIIIs-2	58	SS3
---	KN	Knull silt loam-----	23	-----	--	VIIIs-2	58	SI2
---	KUE	Kucera silt loam, 12 to 30 percent slopes-----	23	-----	--	VIe-1	57	SI2
---	LAB	Lanoak silt loam, 0 to 4 percent slopes-----	24	-----	--	IIIc-4	57	SI3
---	LAC	Lanoak silt loam, 4 to 12 percent slopes-----	24	-----	--	IIIe-4	56	SI3
---	LAE	Lanoak silt loam, 12 to 20 percent slopes-----	24	-----	--	IIIe-4	56	SI3
---	LAF	Lanoak silt loam, hilly-----	24	-----	--	IIIe-4	56	SI3
MdA	---	McDole silt loam, 0 to 2 percent slopes-----	25	IIC-2	54	-----	--	---
---	MEB	McDole silt loam, 0 to 4 percent slopes-----	25	-----	--	IVc-45	57	SI2
---	MEC	McDole silt loam, 4 to 12 percent slopes-----	25	-----	--	IVe-45	57	SI2

GUIDE TO MAPPING UNITS--Continued

High intensity	Low and medium intensity	Mapping unit	Page	Capability unit		Range site		
				Irrigated	Nonirrigated			
				Symbol	Page	Symbol	Page	Symbol
---	MHF	Moohoo-Dranyon association, hilly-----	26	-----	--	-----	---	MP4
		Moohoo part-----	--	-----	--	VIe-1	57	---
		Dranyon part-----	--	-----	--	IIIe-9	56	---
---	MHG	Moohoo-Dranyon association, steep-----	26	-----	--	VIIe-0	58	NE4
---	NAF	Nagitsy gravelly loam, hilly-----	26	-----	--	VIe-1	57	SI3
---	NGF	Nagitsy very gravelly loam, 4 to 30 percent slopes-----	27	-----	--	VIe-1	57	RY3
---	NHF	Nagitsy-Nielsen extremely stony loams, hilly-----	27	-----	--	VIIIs-2	58	RY3
---	NHG	Nagitsy-Nielsen extremely stony loams, steep-----	27	-----	--	VIIIs-2	58	ST3
---	NLB	Neeley silt loam, 0 to 4 percent slopes-----	28	-----	--	IVc-45	57	SI2
---	NLC	Neeley silt loam, 4 to 12 percent slopes-----	28	-----	--	IVe-45	57	SI2
---	NLE	Neeley silt loam, 12 to 20 percent slopes-----	28	-----	--	VIe-1	57	SI2
---	NLF	Neeley silt loam, rolling-----	28	-----	--	VIe-1	57	SI2
---	NLG	Neeley silt loam, steep-----	28	-----	--	VIIe-0	58	ST2
---	NMG	Nielsen extremely stony loam, very steep-----	29	-----	--	VIIIIs-1	58	NU
---	NRF	Nielsen extremely rocky loam, steep-----	29	-----	--	VIIIs-2	58	SS3
---	NTF	Nielsen-Nagitsy extremely stony loams, steep-----	29	-----	--	VIIIs-2	58	SS3
---	PAF	Pandoah channery loam, hilly-----	30	-----	--	VIe-1	57	SI2
---	PBG	Pandoah very cobbly loam, steep-----	30	-----	--	VIIIs-2	58	SS3
PeA	---	Paniogue loam, 0 to 2 percent slopes-----	30	IIs-1	54	-----	--	---
PeB	---	Paniogue loam, 2 to 4 percent slopes-----	30	IIE-1	54	-----	--	---
PeC	---	Paniogue loam, 4 to 8 percent slopes-----	31	IIIe-1	55	-----	--	---
PeD	---	Paniogue loam, 8 to 12 percent slopes-----	31	IVe-1	55	-----	--	---
PfA	---	Paniogue loam, saline-alkali, 0 to 2 percent slopes-----	31	IVs-8	56	-----	--	---
PfB	---	Paniogue loam, saline-alkali, 2 to 4 percent slopes-----	31	IVs-8	56	-----	--	---
PfC	---	Paniogue loam, saline-alkali, 4 to 8 percent slopes-----	31	IVe-1	55	-----	--	---
PgA	---	Paniogue loam, strongly alkali, 0 to 2 percent slopes-----	31	-----	--	VIIIs-2	58	SL8
PhA	---	Paniogue gravelly loam, 0 to 2 percent slopes-----	31	IIs-1	54	-----	--	---
PhB	---	Paniogue gravelly loam, 2 to 4 percent slopes-----	31	IIE-1	54	-----	--	---
Pk	---	Parehat silt loam-----	32	IIw-2	54	IVw-9	57	SB8
Pm	---	Parehat silt loam, saline-alkali-----	32	IVs-8	56	IVw-9	57	SL8
Pn	---	Parehat silt loam, high water table-----	32	-----	--	Vw-2	57	WL8
---	PCG	Pavohroo gravelly loam, steep-----	33	-----	--	VIIe-0	58	NE4
---	PLB	Penoyer silt loam, 0 to 4 percent slopes-----	34	-----	--	VIC-1	58	SI1
PoA	---	Penoyer silt loam, 0 to 2 percent slopes-----	34	IIC-2	54	-----	--	---
PoB	---	Penoyer silt loam, 2 to 4 percent slopes-----	34	IIE-1	54	-----	--	---
PpA	---	Penoyer silt loam, saline-alkali, 0 to 2 percent slopes-----	34	IVs-8	56	-----	--	---
Pr	---	Penoyer silt loam, mottled variant-----	35	-----	--	IVw-9	57	SB8
Ps	---	Peteetneet peat-----	35	-----	--	VIIIw-1	58	NU
Pt	---	Peteetneet muck, clayey subsoil variant-----	36	-----	--	Vw-2	57	WL8
Pu	---	Philbon peat-----	36	-----	--	VIIIw-1	58	NU
PvA	---	Pocatello silt loam, 0 to 2 percent slopes-----	37	IIC-2	54	-----	--	---
PvB	---	Pocatello silt loam, 2 to 4 percent slopes-----	37	IIE-1	54	-----	--	---
PvC	---	Pocatello silt loam, 4 to 8 percent slopes-----	37	IIIe-1	55	-----	--	---
PvD	---	Pocatello silt loam, 8 to 12 percent slopes-----	37	IVe-1	55	-----	--	---
PvF	---	Pocatello silt loam, 20 to 30 percent slopes-----	37	-----	--	VIe-1	57	SI1
---	PWB	Pocatello silt loam, 0 to 4 percent slopes-----	37	-----	--	VIC-1	58	SI1
---	PWD	Pocatello silt loam, 4 to 12 percent slopes-----	37	-----	--	VIe-1	57	SI1
---	PWE	Pocatello silt loam, 12 to 20 percent slopes-----	37	-----	--	VIe-1	57	SI1
---	PWF	Pocatello silt loam, rolling-----	38	-----	--	VIe-1	57	SI1
PxA	---	Portneuf silt loam, 0 to 2 percent slopes-----	38	IIC-2	54	-----	--	---
PxB	---	Portneuf silt loam, 2 to 4 percent slopes-----	38	IIE-1	54	-----	--	---
---	PYB	Portneuf silt loam, 0 to 4 percent slopes-----	38	-----	--	VIC-1	58	SI1
---	PYC	Portneuf silt loam, undulating-----	39	-----	--	VIe-1	57	SI1
---	PYD	Portneuf silt loam, 4 to 12 percent slopes-----	39	-----	--	VIe-1	57	SI1

GUIDE TO MAPPING UNITS--Continued

High intensi-	Low and medium intensi-	Mapping unit	Page	Capability unit				Range site
				Irrigated		Nonirrigated		
si	ty		Symbol	Page	Symbol	Page	Symbol	
QnB	---	Quincy sand, 2 to 4 percent slopes-----	39	IVe-5	55	-----	--	---
QnC	---	Quincy sand, 4 to 8 percent slopes-----	39	IVe-5	55	-----	--	---
---	QUF	Quincy sand, undulating-----	39	-----	--	VIIe-0	58	SA1
---	QVD	Quincy very stony sand, moderately shallow, undulating-----	39	-----	--	VIIIs-2	58	SA1
---	RBB	Rexburg silt loam, 0 to 4 percent slopes-----	40	-----	--	IIIc-4	57	SI2
---	RBC	Rexburg silt loam, 4 to 12 percent slopes-----	40	-----	--	IIIe-4	56	SI2
---	RBE	Rexburg silt loam, 12 to 20 percent slopes-----	40	-----	--	IIIe-4	56	SI2
---	RBF	Rexburg silt loam, rolling-----	40	-----	--	IIIe-4	56	SI2
---	RBG	Rexburg silt loam, steep-----	41	-----	--	VIIe-0	58	ST2
---	RCF	Ricrest-Ridgecrest gravelly loams, hilly-----	41	-----	--	VIe-1	57	SI3
---	RDG	Ricrest-Ridgecrest cobbly loams, steep-----	41	-----	--	VIIe-0	58	ST3
---	REF	Ridgecrest-Hymas gravelly loams, hilly-----	42	-----	--	VIe-1	57	SI3
---	RGF	Ridgecrest-Hymas very cobbly loams, hilly-----	42	-----	--	VIIIs-2	58	RY3
---	RGG	Ridgecrest-Hymas very cobbly loams, steep-----	42	-----	--	VIIIs-2	58	ST3
---	RHG	Ridgecrest-Hymas extremely stony loams, very steep-----	43	-----	--	VIIIIs-1	58	NU
Rw	---	Riverwash-----	43	-----	--	VIIIw-1	58	NU
---	RKE	Robin silt loam, 4 to 20 percent slopes-----	43	-----	--	IIIe-9	56	MP4
---	RKF	Robin silt loam, 20 to 30 percent slopes-----	43	-----	--	IIIe-9	56	MP4
---	RKG	Robin silt loam, steep-----	43	-----	--	VIIe-0	58	NE4
---	RL	Rock land-----	44	-----	--	VIIIIs-1	58	NU
---	RNC	Rudeen loam, 4 to 12 percent slopes-----	44	-----	--	VIe-1	57	SI2
---	RNE	Rudeen loam, 12 to 20 percent slopes-----	44	-----	--	VIe-1	57	SI2
---	RNF	Rudeen loam, hilly-----	45	-----	--	VIe-1	57	SI2
---	RUE	Rudeen extremely stony loam, hilly-----	45	-----	--	VIIIs-2	58	RY2
---	RUF	Rudeen extremely stony loam, steep-----	45	-----	--	VIIIs-2	58	ST2
---	RUG	Rudeen extremely stony loam, very steep-----	45	-----	--	VIIIIs-1	58	NU
Sn	---	Snake silt loam-----	45	-----	--	IVw-9	57	SB8
Ss	---	Snake silt loam, saline-alkali-----	46	-----	--	VIw-1	58	SL8
St	---	Snake silt loam, high water table-----	46	-----	--	Vw-2	57	WL8
---	TAC	Tahquats loam, undulating-----	46	-----	--	IIIe-9	56	CY3
---	TBC	Tahquats very stony loam, rolling-----	46	-----	--	VIIIs-2	58	CY3
---	TCD	Tahquats stony loam, heavy variant, rolling-----	47	-----	--	VIe-1	57	CY3
TdA	---	Tickason loam, 0 to 2 percent slopes-----	48	IIc-2	54	-----	--	---
---	TEB	Tickason loam, 0 to 4 percent slopes-----	48	-----	--	VIc-1	58	SI2
---	TGD	Tickason gravelly loam, 4 to 12 percent slopes-----	48	-----	--	VIe-1	57	SI1
---	ThA	Tindahay loamy coarse sand, 0 to 2 percent slopes--	49	IVe-5	55	VIIe-0	58	SA1
---	ThB	Tindahay loamy coarse sand, 2 to 4 percent slopes--	49	IVe-5	55	VIIe-0	58	SA1
---	ThC	Tindahay loamy coarse sand, 4 to 8 percent slopes--	49	IVe-5	55	VIIe-0	58	SA1
---	ThE	Tindahay loamy coarse sand, 12 to 20 percent slopes-----	49	VIe-2	56	VIIe-0	58	SA1
---	TNF	Tindahay loamy sand, undulating-----	49	-----	--	VIIe-0	58	SA1
---	WAF	Wahtigup gravelly loam, hilly-----	50	-----	--	VIe-1	57	RY2
---	WBF	Wahtigup very cobbly loam, hilly-----	50	-----	--	VIIIs-2	58	RY2
---	WBG	Wahtigup very cobbly loam, steep-----	50	-----	--	VIIIs-2	58	SW2
WcD	---	Waycup gravelly loam, 8 to 12 percent slopes-----	51	VIe-2	56	-----	--	---
---	WDF	Waycup cobbly loam, hilly-----	51	-----	--	VIe-1	57	SI1
---	WEF	Waycup extremely stony loam, hilly-----	51	-----	--	VIIIs-2	58	RY1
---	WEG	Waycup extremely stony loam, steep-----	51	-----	--	VIIIIs-1	58	NU
WhD	---	Wheeler silt loam, 8 to 12 percent slopes-----	52	IVe-1	55	VIe-1	57	SI1
WhF	---	Wheeler silt loam, 30 to 55 percent slopes-----	52	-----	--	VIIe-0	58	SI1
---	WLE	Wheeler silt loam, 12 to 30 percent slopes-----	52	-----	--	VIe-1	57	SI1
---	WLF	Wheeler silt loam, steep-----	52	-----	--	VIIe-0	58	SI1
---	WLG	Wheeler silt loam, very steep-----	52	-----	--	VIIIe-1	58	NU
---	ZN	Zunhall silt loam-----	52	-----	--	VIw-1	58	SL8
---	ZU	Zunhall silt loam, high water table-----	53	-----	--	Vw-2	57	WL8

U. S. DEPARTMENT OF AGRICULTURE

Washington, D. C. 20250

Soil Survey of Fort Hall Area, Idaho, Parts of Bannock, Bingham,  
Caribou and Power Counties

E R R A T U M

The General Soil Map in the soil survey of Fort Hall Area, Idaho, has the wrong color (yellow) in Soil Association No. 11 located in Range R. 33 E. and Townships T. 6 S., T. 7 S. and T. 8 S. The correct color for Soil Association No. 11 is green. The association number and description are correct as printed.

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