

# SOIL SURVEY

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## **Surprise Valley- Home Camp Area, California-Nevada**

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UNITED STATES DEPARTMENT OF AGRICULTURE  
Soil Conservation Service and Forest Service  
UNITED STATES DEPARTMENT OF THE INTERIOR  
Bureau of Land Management  
in cooperation with  
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION  
and  
UNIVERSITY OF NEVADA AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was completed in 1966. 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 Forest Service, the Bureau of Land Management, the University of California Agricultural Experiment Station, and the University of Nevada Agricultural Experiment Station. It is part of the technical assistance furnished to the Surprise Valley and Vya Resource Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

## 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 Surprise Valley-Home Camp 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 county in alphabetic order by map symbol and gives the capability, range, and wildlife suitability classification of each. It also shows the page where each soil is described and the page for the capability unit, range site, and wildlife suitability group in which the 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 ranchers and those who work with them* can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and range sites.

*Foresters and others* can refer to the section "Management of Woodland," where the management of soils suitable for commercial woodland is discussed.

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

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

*Community planners and others* can find information about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the engineering tables.

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

*Newcomers to the 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 section "General Nature of the Area."

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# SOIL SURVEY OF SURPRISE VALLEY-HOME CAMP AREA, CALIFORNIA-NEVADA

SOIL SURVEY OF SURPRISE VALLEY-HOME CAMP AREA, CALIFORNIA-NEVADA  
BY H. B. SUMMERFIELD, JR. AND D. G. BAGLEY

FIELDWORK BY R. MALCHOW, H. B. SUMMERFIELD, JR., L. WILLIAMS, AND G. BADURA, SOIL CONSERVATION SERVICE  
UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH THE UNIVERSITY OF CALIFORNIA AND UNIVERSITY OF NEVADA AGRICULTURAL EXPERIMENT STATION AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT

**S**URPRISE VALLEY-HOME CAMP AREA is located in northeastern California and northwestern Nevada (fig. 1). The Surprise Valley part of the survey area is mostly in Modoc County, but a small area is in northeastern Lassen County. It lies east of the crest of the Warner Mountain range and extends for a distance of 12

to 15 miles to the Nevada State line. It extends from the Oregon State line on the north toward the south for 73 miles along the Nevada State line. The Home Camp part of the survey area lies east of and adjacent to the Surprise Valley part along the Nevada-California State line, from Pilgrim Lake at the south boundary to approximately half a mile north of the Long Ranch in northern Washoe County. It extends eastward from the Nevada-California State line for approximately 11 miles at the narrowest part and 35 miles at the broadest part.

The total extent of the survey area is 1,257,366 acres; this includes 52,554 surface acres in lakes. The total land area mapped in this soil survey is 1,204,812 acres and includes the eastern part of the Modoc National Forest administered by the U.S. Forest Service; the cultivated lands of Surprise Valley, Duck Flat, and Cow Head Lake; the Indian Service-administered lands of Fort Bidwell; and the Bureau of Land Management-administered lands in Lassen and Modoc Counties, California, and Washoe County, Nevada.

## How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Surprise Valley-Home Camp Area, where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They examined road cuts and ditchbanks, dug pits, and bored 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

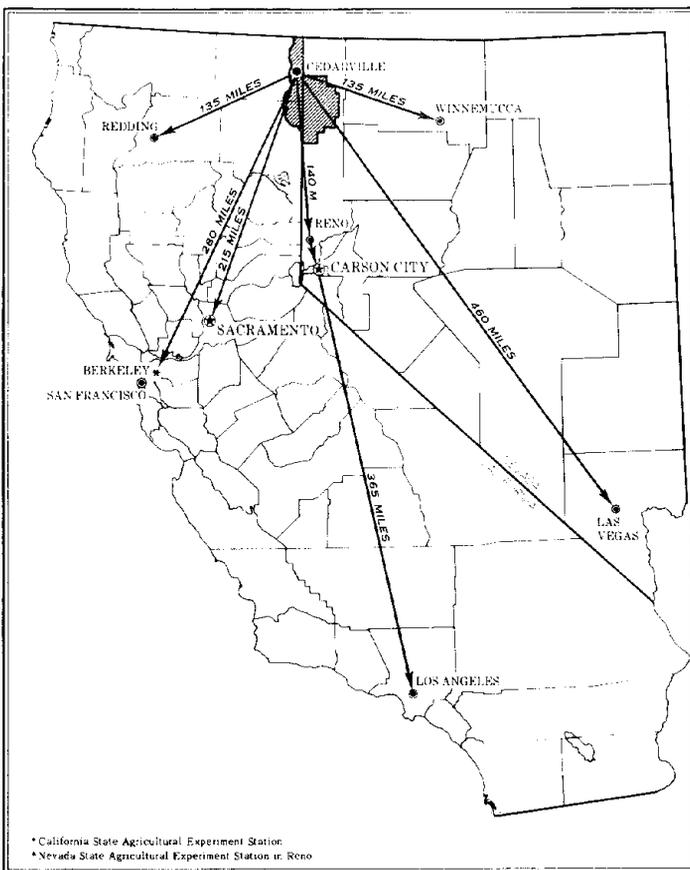


Figure 1.—Location of the Surprise Valley-Home Camp area in California and Nevada.

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. Donica and Waca, 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 soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Donica gravelly sandy loam, 2 to 5 percent slopes, is one of several phases within the Donica series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the 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 bits of soil of some other kind 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. Three such kinds of mapping units are shown on the soil map of the Surprise Valley-Home Camp Area: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled 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. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Donica-Surprise complex 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. Waca-Haggood association is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group con-

sists of the names of the dominant soils, joined by "and." Espil and Fertiline soils is an example.

In most areas surveyed there are places where the soil material is so rocky, so wet, so shallow, or so severely eroded that it cannot be 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. Marsh is a land type in this survey area.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

## General Soil Map

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

A map showing soil associations is useful to people who want a general idea of the soils in 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, a wooded tract, or a wildlife area, or in planning engineering works, 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 13 soil associations in the Surprise Valley-Home Camp Area are grouped on the basis of physiography as follows: (1) five of the associations consist of soils of the lowlands, foothills, and upland basins; (2) four of the associations consist of soils of the upland plateaus, terraces, and lower mountain slopes; and (3) four of the associations consist of moderately sloping to very steep soils and land types on uplands. The three physiographic

areas and the 13 associations are described in the following pages.

## Soils of the Lowlands, Foothills, and Upland Basins

These are somewhat excessively drained to poorly drained soils that have a surface layer of gravelly and stony loam to clay. They are on alluvial fans, terraces, flood plains, and foothills and in upland basins. They formed from alluvium derived from mixed basic rocks.

These soils are dominantly on the California side of the survey area in the vicinity of Upper, Middle Alkali, and Lower Lakes. On the Nevada side, they are in the vicinity of Boulder Flat, Antelope Flat, Duck Flat, Cottonwood Creek, and Garden Lake. Elevation ranges from 4,000 to 6,500 feet. The average annual precipitation is 6 to 14 inches, the average annual temperature is 41° to 51° F., and the frost-free season ranges from about 80 to 130 days.

Approximately 5 percent of the acreage is extensively cultivated. It is used to produce hay, grain, potatoes, and pasture plants. The rest of the acreage is used for livestock grazing and wildlife habitat.

Five associations are in this group. They make up 25 percent of the survey area.

### 1. Gorzell-Raglan-Schamp association

*Very deep, well-drained, nearly level to moderately steep soils on terraces and foothills*

Association 1 is on terraces, interterrace slopes, and foothills. It forms one continuous area along the eastern side of Surprise Valley in the northwestern part of the survey area. The elevation is 4,000 to 5,600 feet. The average annual precipitation is 6 to 10 inches, the average annual temperature is 45° to 50° F., and the frost-free season is about 100 days.

This association makes up about 5 percent of the survey area. Gorzell soils make up about 30 percent of the association; Raglan soils, 20 percent; and Schamp soils, 15 percent. The remaining 35 percent is minor soils and lands.

Gorzell soils are gently sloping to moderately steep and well drained. They have a surface layer of light brownish-gray gravelly loam about 8 inches thick. The subsoil is light-gray gravelly clay loam about 4 inches thick. Below it is about 18 inches of light-gray gravelly clay loam that is weakly cemented with silica and lime. This material is underlain by light-gray very gravelly loamy sand that extends to a depth of about 60 inches. The plant cover consists of big sagebrush, spiny hopsage, Sandberg bluegrass, squirreltail, and forbs.

Raglan soils are nearly level to moderately sloping and well drained. They have a surface layer of light brownish-gray to light-gray fine sandy loam and light sandy clay loam about 6 inches thick. The subsoil is pale-brown sandy clay loam about 7 inches thick. The underlying material is pale-brown and light brownish-gray, stratified very fine sandy loam containing silica-cemented concretions. It extends to a depth of 60 inches. The plant cover consists of greasewood, shadscale, and bud sagebrush.

Schamp soils are gently sloping to moderately steep and well drained. They have a surface layer of light brown-

ish-gray stony loam about 3 inches thick. The subsoil is light brownish-gray or brown clay about 29 inches thick. The substratum, extending to a depth of 60 inches, is stratified loam and sandy loam grading to extremely cobbly loam. The plant cover consists of big sagebrush and bluebunch wheatgrass.

Minor soils and land of this association consist of scattered, intermixed, small tracts of Couch, Nevador, Survya, Toney, and Zorravista soils and small areas of the land type Playas.

The major soils of this association are used mainly for livestock grazing and wildlife habitat. Gorzell and Schamp soils are suitable for range seeding. Areas of Gorzell soils have been used to a limited extent to grow dryland wheat. Some areas of Raglan soils are suitable for cultivation if irrigation water is available. Management practices on these soils should include proper grazing use and maintenance of a desirable plant cover.

### 2. Disabel-Weimer-Boulder Lake association

*Very deep, well-drained and poorly drained, nearly level soils on flood plains and low lake terraces and in enclosed basins*

Association 2 is in small, enclosed basins and on low terraces and broad flood plains widely scattered throughout the survey area. The elevation is 4,000 to 6,500 feet. The average annual precipitation is 8 to 14 inches, the average annual temperature is 41° to 44° F., and the frost-free season is about 80 days.

This association makes up about 3 percent of the survey area. Disabel soils make up about 50 percent of the association; Weimer soils, 20 percent; and Boulder Lake soils, 5 percent. The remaining 25 percent is minor soils.

Disabel soils are nearly level and well drained. They have a surface layer of light brownish-gray silty clay loam about 11 inches thick. The subsoil is light brownish-gray to pale-brown clay or silty clay about 30 inches thick. The underlying material is light brownish-gray silty clay that extends to a depth of 60 inches. The plant cover consists mainly of big sagebrush and basin wildrye, but small amounts of greasewood and shadscale are at lower elevations.

Weimer soils are nearly level, very deep, and poorly drained. They have a dark-gray surface layer about 48 inches thick. It is underlain by dark-gray clay that contains white lime segregations. It extends to a depth of 60 inches. The plant cover consists of sedges, rushes, dock silver sagebrush, mat muhly, and evening primrose.

Boulder Lake soils are nearly level and somewhat poorly drained. They have a surface layer of grayish-brown clay about 6 inches thick. The underlying material is light brownish-gray clay that extends to a depth of 60 inches. The plant cover consists of silver sagebrush, mat muhly, povertyweed, and evening primrose. A few sedges and rushes are present in places.

Minor soils of this association consists of scattered, intermixed tracts of Jesse Camp, Crutcher, and McConnell soils.

The major soils of this association are used for livestock grazing and wildlife habitat. They are suitable for range seeding. Plant species must be carefully selected to provide the most desirable livestock forage.

### 3. *Playas-Couch-Lolak association*

*Very deep, well-drained and poorly drained, nearly level to gently sloping soils that have been affected by salts and alkali; in flat basins and on low lake terraces*

Association 3 is in large tracts on lake terraces and low-lying alluvial fans adjacent to the intermittent lakes in Surprise Valley and in one other large, irregularly shaped tract in the southern part of the survey area. The elevation is 4,300 to 6,200 feet. The average annual precipitation is 8 to 12 inches, the average annual temperature is 41° to 49° F., and the frost-free season is about 90 days.

This association makes up about 7 percent of the survey area. The land type Playas makes up about 36 percent of the association; Couch soils, 13 percent; and Lolak soils, 8 percent. The remaining 43 percent is minor soils.

Playas are flat, undrained basins of saline-alkali affected, stratified silty clay and clay lake sediment. In spring and infrequently for short periods in other seasons they contain shallow water because of runoff from higher lying areas. They are very nearly barren.

Couch soils are smooth, nearly level and gently sloping, and well drained. They have a thin surface layer of light-gray loam about 3 inches thick. The subsoil, about 20 inches thick, is brown clay, brown heavy clay, and pale-brown clay loam. The underlying material is light-gray and very pale brown, stratified fine sandy loam and very fine sandy loam that extends to a depth of 60 inches. The plant cover consists of greasewood, spiny hopsage, big sagebrush, and inland saltgrass.

Lolak soils are smooth, nearly level, and poorly drained. They have a surface layer of light-gray to light brownish-gray silty clay and silty clay loam, about 4 inches thick, that is strongly saline-alkali affected. The underlying material is light brownish-gray to light-gray silty clay and clay that extends to a depth of 60 inches. The plant cover consists of greasewood and inland saltgrass.

Minor soils of this association consist of scattered, intermixed, small tracts of Disabel, Kirsing, Raglan, and Zorvasta soils.

The major soils of this association are used mainly for livestock grazing and wildlife habitat. Couch soils have been used to a limited extent to grow alkali-tolerant grasses and barley where irrigation water is available. Crops grow poorly on these soils.

### 4. *Hussa-Donica-Surprise-Bidwell association*

*Very deep, poorly drained, somewhat excessively drained, and well-drained, nearly level to strongly sloping soils on flood plains, terraces, and alluvial fans that have truncated side slopes*

Association 4 is in one large, continuous tract on flood plains, low terraces, and alluvial fans along the western edge of the lakes in Surprise Valley. The elevation is 4,400 to 4,800 feet. The average annual precipitation is about 12 to 16 inches, the average annual temperature is 44° to 50° F., and the frost-free season is 100 to 130 days.

This association makes up about 5 percent of the survey area. Husa soils make up about 20 percent of the association; Donica soils, 20 percent; Surprise soils, 20 percent; and Bidwell soils, 15 percent. The remaining 25 percent is minor soils.

Hussa soils are nearly level to moderately sloping and poorly drained. They have a surface layer of very dark

gray to black clay loam and loam about 20 inches thick. The underlying material is dark grayish-brown to black, stratified sandy clay loam, clay loam, and silty clay loam that extends to a depth of 60 inches. The water table is at a depth of less than 30 inches. The plant cover consists of meadow plants, mostly sedges, clover, bentgrass, redtop, and bluegrass.

Donica soils are nearly level to moderately steep and somewhat excessively drained. They have a surface layer of very dark grayish-brown to dark grayish-brown very gravelly sandy loam about 13 inches thick. The underlying material is about 16 inches of brown very gravelly sandy loam over light-gray and gray very gravelly coarse sand that extends to a depth of 60 inches. The plant cover consists of big sagebrush, bitterbrush, and bluebunch wheatgrass.

Surprise soils are nearly level to strongly sloping and well drained. They have a surface layer of grayish-brown sandy loam about 9 inches thick. The underlying material is light brownish-gray gravelly sandy loam and very gravelly sandy loam that extends to a depth of 60 inches. The plant cover consists of big sagebrush, bitterbrush, and bluebunch wheatgrass.

Bidwell soils are nearly level to moderately sloping and well drained. They have a surface layer of grayish-brown loam and clay about 10 inches thick. The subsoil is grayish-brown to brown clay loam to gravelly loam about 36 inches thick. The underlying material is pale-brown gravelly loam that extends to a depth of 60 inches or more. The plant cover consists of big sagebrush, bitterbrush, and bluebunch wheatgrass.

Minor soils of this association consist of scattered, intermixed tracts of Bicondoa, Buntingville, Four Star, Hovey, Lolak, and Simpson soils.

Most of the irrigated and cultivated acreage in the survey area is in this association. The soils are used to grow improved pasture plants, small grain, and alfalfa. The native meadows are used for pasture or hay. The soils are also used for livestock grazing and wildlife habitat.

### 5. *Old Camp-McConnel association*

*Shallow and very deep, well-drained and somewhat excessively drained, nearly level to moderately steep soils on pediments, plateaus, and offshore lake bars*

Association 5 is in one large tract and one smaller, irregularly shaped tract on gravel bars, beach terraces, embankments and basaltic pediments, and plateaus in the southern part of the survey area. The elevation is 4,200 to 5,500 feet. The average annual precipitation is 7 to 10 inches, the average annual temperature is 45° to 49° F., and the frost-free season is about 100 days.

This association makes up about 5 percent of the survey area. Old Camp soils make up about 40 percent of the association and McConnel soils, 30 percent. The remaining 30 percent is minor soils and land.

Old Camp soils are moderately sloping to moderately steep and well drained. They are underlain at a shallow depth by basalt. They have a surface layer of very pale brown gravelly loam about 2 inches thick. The subsoil is about 12 inches of pale-brown to brown stony, cobbly, and gravelly clay loam that is underlain by dark-gray basalt. The plant cover consists of big sagebrush, spiny hopsage, and Thurber needlegrass.

McConnel soils are nearly level to gently sloping and somewhat excessively drained. They have a surface layer of light brownish-gray gravelly loam about 2 inches thick. The subsoil is light brownish-gray gravelly fine sandy loam and fine sandy loam about 10 inches thick. The underlying material is light-gray to pale-brown very gravelly loamy sand or very gravelly sand that extends to a depth of 48 inches or more. The plant cover consists of big sagebrush, shadscale, spring hopsage, and Indian ricegrass.

Minor soils and land of the association consist of scattered, intermixed tracts of Couch, Disabel, Langston, Pegler, and Vylach soils and small areas of Badland.

The major soils of this association are used for livestock grazing and wildlife habitat. They are not suitable for range seeding or for crops. Management practices on these soils should include proper grazing use and maintenance of a desirable plant cover.

### Soils of the Upland Plateaus, Terraces, and Lower Mountain Slopes

These are well-drained soils that have a surface layer of loam, fine sandy loam, sandy loam, or clay and a subsoil of clay loam or clay. They are on volcanic plateaus, terraces, and mountain slopes. They formed from alluvium derived from mixed basic rocks.

These soils are dominantly on the Nevada side of the survey area in the vicinity of Boulder Lake, Hart Ranch, Denio Ranch, Grass Valley Ranch, Garden Lake, and areas north and south of Hays Canyon and north and west of Fox Mountain. On the California side, they are adjacent to the Nevada-California State line northeast and south of Cow Head Lake and in the area north and south of Tuledad Canyon. Elevation ranges from 4,300 to 6,800 feet. The average annual precipitation is about 8 to 16 inches, the average annual air temperature is between 41° and 47° F., and the frost-free season is about 60 to 90 days.

The soils of this group are used extensively for livestock grazing and wildlife habitat. Some areas are being improved by brush control and seeding to provide forage for wildlife and livestock and for watershed purposes.

Four soil associations are in this group. They make up about 39 percent of the survey area.

#### 6. *Ninemile-Karlo-Catnip association*

*Shallow and moderately deep, well-drained, nearly level to strongly sloping soils on tablelands and lava plateaus*

Association 6 is in large tracts on volcanic tablelands and plateaus in the northern, north-central, and southern parts of the survey area. The elevation is 4,300 to 6,800 feet. The average annual precipitation is 10 to 16 inches, the average annual temperature 41° to 45° F., and the frost-free season about 60 days.

This association makes up about 14 percent of the survey area. Ninemile soils make up about 30 percent of this association; Karlo soils, 20 percent; and Catnip soils, 15 percent. The remaining 35 percent is minor soils and lands.

Ninemile soils are nearly level to moderately sloping and well drained. They are underlain at shallow depth by basalt or volcanic tuff. They have a surface layer of dark-brown extremely cobbly loam about 2 inches thick. The subsoil is about 10 inches of brown clay that is underlain

by bedrock. The plant cover consists of low sagebrush and Sandberg bluegrass.

Karlo soils are nearly level to moderately sloping and well drained. They consist of dark reddish-brown to reddish-brown clay and silty clay that extends to basalt at a depth of about 32 inches. The surface is extremely stony, but few or no stones are below the surface. The plant cover consists of low gray rabbitbrush and Sandberg bluegrass.

Catnip soils are nearly level to moderately sloping and well drained. They are underlain by basalt or volcanic tuff. These soils have a surface layer of dark grayish-brown and light-gray extremely cobbly loam about 5 inches thick. The subsoil is about 30 inches of dark grayish-brown, brown, and dark-brown clay that is underlain by basalt. The plant cover consists of low sagebrush, Sandberg bluegrass, squirrel-tail, low Douglas rabbitbrush, and various forbs.

Minor soils and lands of this association consist of scattered, intermixed tracts of Home Camp, Madeline, Newlands, and Toney soils and Rubble land and Rock outcrop along plateau escarpments.

The major soils of this association are used mainly for livestock grazing and wildlife habitat. They are not suitable for range seedings or crops. Management practices on these soils should include proper grazing use and maintenance of a desirable plant cover.

#### 7. *Mascamp-Powley association*

*Shallow, well-drained, gently sloping to strongly sloping soils on terraces, rolling foothills, and dissected alluvial fans*

Association 7 is in large, irregularly shaped tracts on upland areas in the Nevada part of the survey area, extending from north to south mainly through the central part. The elevation is 5,500 to 6,500 feet. The average annual precipitation is 10 to 12 inches, the average annual temperature is 42° to 45° F., and the frost-free season is about 80 days.

This association makes up 10 percent of the survey area. Mascamp soils make up about 60 percent of the association and Powley soils, 25 percent. The remaining 15 percent consists of minor soils and land types.

Mascamp soils are well drained and stony, and they are underlain by volcanic tuff. They have a surface layer of light brownish-gray to grayish-brown extremely stony sandy loam and very cobbly and gravelly sandy loam about 7 inches thick. The subsoil is brown, very cobbly, stony, and gravelly sandy clay loam that extends to bedrock at a depth of 15 inches. The plant cover consists of big sagebrush, Thurber needlegrass, and bluebunch wheatgrass.

Powley soils are well drained. They are gravelly and are underlain by a silica-cemented hardpan. The surface layer is grayish-brown and light grayish-brown gravelly fine sandy loam and fine sandy loam about 9 inches thick. The subsoil is pale-brown to brown sandy clay loam to clay about 10 inches thick. The underlying material is a pale-brown to grayish-brown, indurated hardpan that extends to a depth of 32 inches. The plant cover consists of big sagebrush, bluebunch wheatgrass, and Thurber needlegrass.

Minor soils and land types of this association consist of scattered, intermixed tracts of Espil, Fertaline, and Hart

Camp soils and areas of Rubble land and Rock outcrop along escarpments.

The major soils of this association are used for livestock grazing and wildlife habitat. Powley soils are suitable for range seeding, but Mascamp soils, because of the extremely stony surface, are not. Powley and Mascamp soils are not suitable for crops. Management practices on these soils should include proper grazing use and maintenance of a desirable plant cover.

### 8. *Espil-Fertaline association*

*Very shallow and moderately deep, well-drained, nearly level to moderately sloping soils on valley fill, terraces, truncated alluvial fans, and tablelands*

Association 8 is in several large, irregularly shaped tracts and a few scattered small tracts on valley fill and upland terraces on the Nevada side of the survey area, mainly in the eastern part. The elevation is 5,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual temperature is 41° to 44° F., and the frost-free season is 60 to 90 days.

This association makes up about 10 percent of the survey area. Espil soils make up about 70 percent of the association and Fertaline soils, about 10 percent. The remaining 20 percent is minor soils and lands.

Espil soils are well drained. They have a surface layer of grayish-brown gravelly sandy loam and gravelly sandy clay loam about 7 inches thick. The subsoil is brown gravelly light clay about 2 inches thick. The underlying material is a variegated pale-brown and brownish-yellow, indurated hardpan that extends to a depth of 31 inches. The plant cover consists of low sagebrush, Sandberg bluegrass, Indian ricegrass, Webber ricegrass, squirreltail, buckwheat, and phlox.

Fertaline soils are well drained. They have a surface layer of light brownish-gray to light-gray gravelly fine sandy loam and fine sandy loam about 7 inches thick. The upper part of the subsoil is about 14 inches of brown clay. The lower part is about 4 inches of very pale brown sandy clay loam that has mottles of white lime. The underlying material is a very pale brown, indurated hardpan more than 9 inches thick. The plant cover consists of low sagebrush, Sandberg bluegrass, Thurber needlegrass, and squirreltail.

Minor soils and lands of this association consist of scattered, intermixed tracts of Mascamp, Hart Camp, and Powley soils and Rubble land and Rock outcrop along escarpments.

The major soils of this association are used for livestock grazing and wildlife habitat. They are not suitable for range seeding or crops. Management practices on these soils should include proper grazing use and maintenance of a desirable plant cover.

### 9. *Olson-Badland-Nevador association*

*Shallow to very deep, well-drained, nearly level to very steep soils on mountains, ridges, and dissected lacustrine terraces*

Association 9 is in one large and several smaller, irregularly shaped areas on broad alluvial fans and terraces in the eastern and southern parts of the survey area. The elevation is 4,500 to 5,500 feet. The average annual precipita-

tion is between 8 and 10 inches, the average annual temperature is 42° to 47° F., and the frost-free season is about 85 days.

This association makes up about 5 percent of the survey area. Olson soils make up about 45 percent of the association; Badland, 40 percent; and Nevador soils, 10 percent. The remaining 5 percent is minor soils.

Olson soils are well drained, and they are underlain by a silica-cemented hardpan. They have a surface layer of light brownish-gray to light-gray fine sandy loam about 4 inches thick. The subsoil is light brownish-gray to light yellowish-brown sandy clay loam and gravelly sandy clay loam about 9 inches thick. The upper part of the underlying material is a very pale brown, indurated hardpan about 8 inches thick. The lower part, to a depth of 44 inches, is light-gray gravelly loamy sand. The plant cover consists of big sagebrush, spiny hopsage, Indian ricegrass, and squirreltail.

Badland is a barren area of gullied and dissected lake terraces. It consists of stratified silt, clay, volcanic ash, and diatomaceous lake sediment. It supplies very limited amounts of forage and for the most part is of no practical value.

Nevador soils are well drained. They have a surface layer of grayish-brown to light brownish-gray fine sandy loam about 5 inches thick. The subsoil is grayish-brown to pale-brown clay loam about 13 inches thick. The underlying material is pale-brown, weakly cemented sandy loam about 18 inches thick in the upper part. The lower part is pale-brown loamy sand that is mildly alkaline and extends to a depth of 46 inches. The plant cover consists of big sagebrush, spiny hopsage, and Thurber needlegrass.

Minor soils and land of the association consist of scattered, intermixed tracts of Mascamp, Old Camp, and Powley soils and Rubble land.

The major soils of this association are used for livestock grazing and wildlife habitat. They are marginally suitable for range seeding of adapted species. They are not suitable for crops. Management practices on these soils should include proper grazing use and maintenance of a desirable plant cover.

## Soils and Land Types on Moderately Sloping to Very Steep Uplands

These are well-drained soils that have a surface layer of loam, sandy loam, stony loam, stony fine sandy loam, and very stony loam. They formed in alluvium derived from mixed basic rocks. The land types consist of exposed bedrock and of nearly barren sloping areas consisting of colluvium.

These soils are scattered throughout the survey area. On the California side, they are along the Warner Mountain front to the Red Rock and Cottonwood Mountains. On the Nevada side, they are in the vicinity of Hays Canyon, Home Camp Ranch, Indian and Nellie Springs, Bordwell Spring, Fox Mountain, and Garden Lake. The elevation ranges from 4,500 to 9,500 feet. The average annual precipitation is about 12 to 50 inches and is related to elevation. The average annual temperature is 40° to 45° F., and the frost-free season is about 60 to 80 days.

The soils of this group are used for livestock grazing, wildlife habitat, timber production, and recreation. The

land types provide limited forage for livestock, but they are of considerable importance as wildlife habitat.

Four associations are in this group. They make up about 36 percent of the survey area.

#### **10. Rubble land-Mendeboure-Rock outcrop association**

*Moderately deep, well-drained, steep and very steep soils interspersed with stones and boulders; on mountains*

Association 10 is in irregularly shaped tracts along the foothills and mountainous slopes that are extensive in the survey area. It occurs at elevations between 4,500 and 8,500 feet. The average annual precipitation is 12 to 20 inches, the average annual temperature is 41° to 44° F., and the frost-free season is about 60 days.

This association makes up about 7 percent of the survey area. Rubble land makes up about 65 percent of the association; Mendeboure soils, 20 percent; and Rock outcrop, 10 percent. The remaining 5 percent is minor soils.

Rubble land consists of nearly barren, steep and very steep mountain slopes that are strewn with colluvial stones and boulders.

Mendeboure soils are well drained and moderately steep to steep. They have a surface layer of grayish-brown very stony loam about 3 inches thick. The subsoil is dark grayish-brown to brown very stony clay loam and light clay. It is underlain by basalt at a depth of about 31 inches. The plant cover consists of big sagebrush and bluebunch wheatgrass.

Rock outcrop consists of lava-flow escarpments of volcanic dikes and sills and other exposed bedrock.

Minor soils of this association consist of scattered, intermixed tracts of Home Camp and Newlands soils.

The soils in this association provide very limited grazing. They are not suitable for range seeding because of slope, stoniness, and rock outcrops. They are better suited to wildlife habitat and as watershed.

#### **11. Waca-Lyonman association**

*Moderately deep and deep, well-drained, strongly sloping to steep soils on uplands and mountains*

Association 11 is in small, irregularly shaped tracts in wooded areas or uplands of the Warner Mountains along the western edge of the survey area. The elevation is generally 6,500 to 9,500 feet, but in places where slopes face north it is as low as 5,500 feet. The average annual precipitation is 25 to 50 inches, the average annual temperature is 40° to 44° F., and the frost-free season is about 70 days.

This association makes up about 5 percent of the survey area. Waca soils make up about 50 percent of the association and Lyonman soils, 15 percent. The remaining 35 percent is minor soils.

Waca soils are well drained. They are underlain by basalt. A layer of duff, consisting of fir and pine needles, covers the surface. The upper part of the surface layer is grayish-brown stony fine sandy loam about 3 inches thick. The lower part of the surface layer is brown gravelly sandy loam about 17 inches thick. The underlying material is 10 inches of pale-brown very gravelly coarse sandy loam over slightly weathered basalt. The plant cover consists of white fir and ponderosa pine.

Lyonman soils are well drained. A layer of duff, consisting of fir needles, covers the surface. The surface layer is

dark grayish-brown to brown sandy loam and cobbly loam about 13 inches thick. The subsoil is brown cobbly clay loam about 11 inches thick. The underlying material is light yellowish-brown, brown, and pale-brown clay loam and cobbly clay loam about 24 inches thick. The plant cover consists of white fir and ponderosa pine and an understory of grasses and browse.

Minor soils of this association consist of scattered, intermixed bodies of Campone, Longval, Snag, Tourn, and Welch soils.

The major soils of this association are used for the production of commercial timber and are important for watershed purposes. They are used for livestock grazing and wildlife habitat.

#### **12. Home Camp-Newlands association**

*Moderately deep and deep, well-drained, moderately sloping to steep soils on foothill toe slopes, mountains, and ridges*

Association 12 is in various-sized tracts on mountainous uplands widely scattered throughout the survey area. The elevation is 6,000 to 7,000 feet. The average annual precipitation is 12 to 16 inches, the average annual temperature is 41° to 45° F., and the frost-free season is 50 to 80 days.

This association makes up about 15 percent of the survey area. Home Camp soils make up about 55 percent of the association and Newlands soils, 35 percent. The remaining 10 percent is minor soils and lands.

Home Camp soils are moderately sloping to steep and well drained. They have a surface layer of grayish-brown stony loam and gravelly loam about 8 inches thick. The subsoil, about 28 inches thick, is brown and pale-brown gravelly sandy clay loam to gravelly clay. It is underlain by tuff. The plant cover consists of big sagebrush, bitterbrush, and Idaho fescue.

Newlands soils are moderately sloping to steep and well drained. About 10 percent of the surface is covered with stones. The surface layer is dark grayish-brown loam about 8 inches thick. The subsoil is about 37 inches of brown and light-brown clay loam and gravelly clay loam. It is underlain by andesite. The plant cover consists of big sagebrush, bitterbrush, and Idaho fescue.

Minor soils and lands of the association consist of scattered, intermixed tracts of Hapgood, Madeline, and Nine-mile soils and scattered areas of Rock outcrop and Rubble land.

The major soils of this association are used for livestock grazing and wildlife habitat. They are not suitable for crops. The major soils are well suited to brush control by aerial spraying. Management practices on these soils should include proper grazing use and maintenance of a desirable plant cover.

#### **13. Hapgood-Snag association**

*Deep, well-drained, moderately sloping to very steep soils on mountains and ridge crests and in small basins.*

Association 13 is in various-sized, irregularly shaped areas along the eastern slopes of the Warner Mountains throughout the length of the survey area. The elevation is 6,000 to 8,500 feet. The average annual precipitation is 12 to 25 inches, the average annual temperature is 40° to 45° F., and the frost-free season is less than 80 days.

This association makes up about 9 percent of the survey area. Hapgood soils make up about 45 percent of the association and Snag soils, 25 percent. The remaining 30 percent is minor soils and lands.

Hapgood soils are well drained and moderately sloping to very steep. They have a surface layer of dark grayish-brown and very dark grayish-brown stony and gravelly fine sandy loam about 50 inches thick. It is underlain by tuff. The plant cover consists of big sagebrush, bitterbrush, and Idaho fescue.

Snag soils are well drained and moderately sloping to steep. They have a surface layer of dark-brown stony fine sandy loam and very stony fine sandy loam about 20 inches thick. The underlying material is brown very stony fine sandy loam that extends to slightly weathered basalt bedrock at a depth of 44 inches. The plant cover consists of big sagebrush, bitterbrush, snowberry, Idaho fescue, mountain brome, and western needlegrass.

Minor soils and lands of this association consist of scattered, intermixed tracts of Bluebell, Home Camp, Madeline, and Newlands soils and Rubble land and Rock outcrop along plateau escarpments.

The major soils of the association are used for livestock grazing and wildlife habitat. The steeper sloping soils are not suitable for range seeding. They are well suited to brush control by aerial spraying. Management practices on these soils should include proper grazing use and maintenance of a desirable plant cover.

## Descriptions of the Soils

This section describes the soil series and mapping units in the Surprise Valley-Home Camp Area. The procedure is to describe first the soil series and then the mapping units in the series. To get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the series to which it belongs. An essential part of each soil series description is the description of the soil profile. A soil profile is the sequence of layers from the surface to depths beyond which the roots of most plants do not penetrate. Each soil series contains a brief nontechnical description and a detailed technical description of the soil profile. The nontechnical description gives the information most readers need. The detailed technical description is useful to soil scientists, engineers, and others who need to make thorough and precise studies of the soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil, and consistence is for a moist soil.

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

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit (or units), the range site, and the wildlife suitability group in which the mapping unit has been placed. The page for the description of each capability unit, range site, and wildlife suit-

ability group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

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 at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (9).<sup>1</sup>

Part of the Surprise Valley-Home Camp Area was mapped at high intensity and part at low intensity. The two kinds of mapping units can be distinguished in the text and on the soil map by a difference in the map symbols. The symbol for a low-intensity mapping unit is made up of capital letters and, in the case of an eroded unit, a number. The symbol for a high-intensity unit is made up of one or two capital letters and one small letter.

## Badland

Badland (BA) consists of steep and very steep gullied and dissected lake terraces, dunes of wind-deposited clay, exposures of lake sediment, and diatomaceous earth. This land type is severely eroded, and it produces a large amount of silt and debris. It is nearly barren, and brush, the only vegetation, is sparse.

Surface runoff is very rapid, and the hazard of erosion is very severe. Natural drainage, subsoil permeability, available water capacity, and effective rooting depth are variable.

This land type has no value for farming, but some areas supply a very limited amount of forage and are used for grazing by livestock and for wildlife habitat. Capability unit VIIIe-224, dryland; not placed in a range site; not placed in a wildlife suitability group.

## Bicondoa Series

The Bicondoa series consists of poorly drained soils that formed in lacustrine sediment derived from mixed basic rocks. They are on low-lying lake terraces and on flood plains. The slope range is 0 to 2 percent. Juncus, sedges, and meadow grasses are the dominant vegetation. Saltgrass and greasewood are common in the areas most affected by salts and alkali. The elevation ranges from 4,400 to 4,500 feet. The average annual precipitation is 7 to 10 inches, the average annual air temperature is 42° to 45° F., and the frost-free season is about 100 to 120 days.

In a representative profile the surface layer is gray, moderately alkaline clay about 11 inches thick. Below is light-gray clay or silty clay that extends to a depth of 62 inches or more. This layer is moderately alkaline and decreases to mildly alkaline with depth.

Bicondoa soils have slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 9 to 10 inches. Runoff is very slow, and the hazard of accelerated erosion is slight. Depth to the seasonal high water table fluctuates between 1 and 3 feet.

Representative profile of Bicondoa clay in Modoc County, California, about 1,350 feet west and 400 feet

<sup>1</sup> Italic numbers in parentheses refer to Literature Cited, page 129.

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

Soil	Area	Extent	Soil	Area	Extent
	<i>Acres</i>	<i>Percent</i>		<i>Acres</i>	<i>Percent</i>
Badland	6,483	0.54	Hussa loam, drained, 2 to 5 percent slopes <sup>1</sup>	1,572	.13
Bicondoa clay <sup>1</sup>	722	.06	Hussa loam, slightly saline-alkali, 0 to 2 percent slopes <sup>1</sup>	760	.06
Bicondoa-Kisring complex <sup>1</sup>	647	.05	Hussa loam, clay substratum, drained, 0 to 2 percent slopes <sup>1</sup>	640	.05
Bidwell loam, 0 to 2 percent slopes <sup>1</sup>	5,599	.46	Hussa clay loam, 0 to 2 percent slopes <sup>1</sup>	3,281	.27
Bidwell loam, 2 to 5 percent slopes <sup>1</sup>	2,812	.23	Hussa clay loam, clay substratum, 0 to 2 percent slopes <sup>1</sup>	5,817	.48
Bluebell-Hapgood association, moderately steep	2,821	.23	Hussa silty clay loam, seeped, 0 to 9 percent slopes <sup>1</sup>	2,573	.21
Bluebell-Hapgood association, steep	3,663	.30	Hussa silty clay loam, seeped, cold, 0 to 9 percent slopes <sup>1</sup>	759	.06
Boulder Lake clay <sup>1</sup>	2,103	.17	Hussa-Couch complex <sup>1</sup>	705	.06
Bregar rocky loam, 2 to 15 percent slopes	3,010	.25	Jesse Camp fine sandy loam, 0 to 2 percent slopes <sup>1</sup>	2,241	.19
Buntingville loam, 0 to 2 percent slopes <sup>1</sup>	3,159	.26	Jesse Camp fine sandy loam, 2 to 5 percent slopes <sup>1</sup>	304	.03
Buntingville loam, 2 to 5 percent slopes <sup>1</sup>	785	.07	Jesse Camp silt loam, overwash, 0 to 2 percent slopes <sup>1</sup>	1,029	.09
Campone gravelly loam, drained, 2 to 15 percent slopes	2,672	.22	Karlo very cobbly clay, 0 to 9 percent slopes	12,120	1.00
Campone clay loam, 0 to 5 percent slopes	581	.05	Kisring fine sandy loam <sup>1</sup>	3,782	.31
Catnip-Ninemile association	66,441	5.51	Kisring fine sandy loam, wet <sup>1</sup>	1,592	.13
Couch loam <sup>1</sup>	5,822	.48	Lolak loamy sand, overflow	208	.02
Couch loam, clay substratum <sup>1</sup>	4,870	.40	Lolak silty clay	3,969	.33
Crutcher very fine sandy loam	1,289	.11	Lolak-Zorravista association	4,676	.39
Crutcher silty clay loam	4,591	.38	Longval fine sandy loam, 2 to 15 percent slopes	5,069	.42
Cummings silty clay loam <sup>1</sup>	2,628	.22	Lyonman sandy loam, 15 to 30 percent slopes	1,416	.12
Cummings muck, clay subsoil variant <sup>1</sup>	567	.05	Lyonman sandy loam, 30 to 50 percent slopes	9,067	.75
Cummings muck, clay subsoil variant, drained	492	.04	Madeline very stony loam, 2 to 30 percent slopes	8,288	.69
Dangberg loam, cold variant, 0 to 2 percent slopes	858	.07	Madeline very stony loam, 30 to 50 percent slopes	1,836	.15
Dangberg loam, cold variant, drained, 2 to 5 percent slopes	263	.02	Marsh <sup>1</sup>	221	.02
Disabel silty clay loam	12,926	1.07	Mascamp extremely stony sandy loam, 2 to 15 percent slopes <sup>1</sup>	74,617	6.19
Disabel-Crutcher association, eroded	5,720	.47	McConnel sandy loam, 0 to 5 percent slopes	5,330	.44
Disabel-Jesse Camp association, overwash	3,439	.29	McConnel sandy loam, overwash, 0 to 2 percent slopes	2,857	.24
Disabel-McConnel association	2,657	.22	McConnel-Badland association	22,430	1.86
Disabel-Pegler association	2,645	.22	Mosquet-Home Camp association	6,751	.56
Donica gravelly sandy loam, 2 to 5 percent slopes	880	.07	Nevador loamy fine sand, 0 to 2 percent slopes <sup>1</sup>	592	.05
Donica gravelly sandy loam, 15 to 30 percent slopes <sup>1</sup>	1,860	.15	Nevador loamy fine sand, 2 to 5 percent slopes <sup>1</sup>	779	.06
Donica gravelly sandy loam, 30 to 50 percent slopes <sup>1</sup>	846	.07	Nevador fine sandy loam, 0 to 2 percent slopes <sup>1</sup>	282	.02
Donica very gravelly sandy loam, 5 to 30 percent slopes <sup>1</sup>	1,779	.15	Nevador fine sandy loam, 2 to 5 percent slopes <sup>1</sup>	6,720	.56
Donica very stony sandy loam, 2 to 15 percent slopes <sup>1</sup>	4,165	.35	Newlands-Hapgood association	53,622	4.45
Donica-Surprise complex <sup>1</sup>	2,721	.23	Ninemile-Karlo association	57,264	4.75
Espil-Badland association	2,601	.22	Old Camp association	18,441	1.53
Espil and Fertaline soils	22,996	1.91	Old Camp-Langston association	10,922	.96
Espil-Mosquet association	81,433	6.76	Olson-Badland association	47,064	3.91
Espil-Powley association	19,057	1.58	Playas	31,300	2.60
Four Star loam <sup>1</sup>	2,783	.23	Powley gravelly fine sandy loam, 2 to 15 percent slopes	7,320	.61
Four Star loam, cold <sup>1</sup>	240	.02	Powley-Espil association	19,170	1.59
Four Star loam, seeped <sup>1</sup>	588	.05	Powley-Mascamp association	12,236	1.02
Four Star loam, clay substratum <sup>1</sup>	192	.02	Raglan very fine sandy loam, 2 to 9 percent slopes	5,856	.49
Foxmount gravelly loam, 15 to 30 percent slopes	4,482	.37	Raglan very fine sandy loam, alkali, 0 to 2 percent slopes <sup>1</sup>	7,893	.65
Gorzell stony loam, 5 to 30 percent slopes	10,991	.91	Riverwash	464	.04
Gorzell gravelly loam, 2 to 15 percent slopes	9,358	.78	Rubble land-Home Camp association	4,766	.40
Hapgood fine sandy loam, 5 to 30 percent slopes	4,453	.37	Rubble land-Mendeboure association	58,671	4.86
Hapgood very stony fine sandy loam, 50 to 75 percent slopes	2,638	.22	Rubble land and Rock outcrop	34,771	2.89
Hapgood-Home Camp association	5,819	.48	Schamp stony loam, 2 to 30 percent slopes	9,069	.75
Hapgood-Snag association	10,580	.88	Simpson sandy loam, 2 to 5 percent slopes <sup>1</sup>	2,633	.22
Hapgood and Newlands soils	1,233	.10	Simpson gravelly sandy loam, 5 to 15 percent slopes	1,721	.14
Hapgood-Snag-Newlands association	5,996	.50			
Hartig-Hapgood association	8,845	.73			
Home Camp-Hapgood association	4,305	.36			
Home Camp-Newlands association, hilly	143,714	11.92			
Home Camp-Newlands association, steep	8,942	.74			
Hovey silty clay loam <sup>1</sup>	5,157	.43			
Hovey silty clay loam, cold <sup>1</sup>	494	.04			
Hussa loam, drained, 0 to 2 percent slopes <sup>1</sup>	1,563	.13			

See footnotes at end of table.

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

Soil	Area		Soil	Area	
	Acres	Percent		Acres	Percent
Simpson loam, 0 to 2 percent slopes <sup>1</sup> -----	384	.03	Waca stony fine sandy loam, 5 to 30 percent slopes-----	12,587	1.04
Snag very stony sandy loam, 30 to 50 percent slopes-----	19,448	1.61	Waca stony fine sandy loam, 30 to 50 percent slopes-----	13,220	1.10
Surprise gravelly sandy loam, 0 to 2 percent slopes <sup>1</sup> -----	809	.07	Waca stony fine sandy loam, 50 to 75 percent slopes-----	2,760	.23
Surprise gravelly sandy loam, 2 to 5 percent slopes <sup>1</sup> -----	8,187	.68	Waca-Hapgood association-----	2,966	.25
Surprise gravelly sandy loam, 5 to 15 percent slopes <sup>1</sup> -----	148	.01	Waca-Snag association-----	3,984	.33
Survya fine sandy loam, 0 to 9 percent slopes, eroded-----	6,140	.51	Waca very gravelly sandy loam, shallow variant, 15 to 50 percent slopes-----	2,018	.17
Survya-Zorravista association-----	794	.07	Weimer clay <sup>1</sup> -----	3,025	.25
Survya fine sandy loam, hardpan variant, 0 to 9 percent slopes, eroded-----	924	.08	Weimer clay, drained <sup>1</sup> -----	978	.08
Toney-Ninemile association-----	7,060	.59	Weimer clay, slightly alkali <sup>1</sup> -----	4,113	.34
Tourn stony loam, 2 to 15 percent slopes-----	1,768	.14	Welch silty clay loam, 0 to 9 percent slopes <sup>1</sup> -----	3,940	.33
Vylach-Pegler association-----	5,085	.42	Zorravista fine sand, 0 to 15 percent slopes <sup>1</sup> -----	3,995	.33
Vylach-Pegler association, overwash-----	2,665	.22	Zorravista-Couch association-----	1,372	.11
			Total <sup>2</sup> -----	1,204,812	100.00

<sup>1</sup> High intensity mapping unit.

<sup>2</sup> Exclusive of lakes and Wilderness Area.

north of the southeast corner of sec. 34, T. 39 N., R. 17 E., Mount Diablo base line and meridian:

- A11—0 to 3 inches, gray (10YR 5/1) clay, very dark brown (10YR 2/2) moist; strong, very fine, granular structure; hard, friable, very sticky, very plastic; many very fine and fine roots; many very fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.4); clear, smooth boundary. 2 to 3 inches thick.
- A12—3 to 11 inches, gray (10YR 5/1) clay, black (10YR 2/1) moist; strong, very fine, granular structure; hard, friable, very sticky, very plastic; many very fine and fine roots; many very fine and fine interstitial pores and many fine tubular pores; strongly effervescent; moderately alkaline (pH 8.4); clear, wavy boundary. 6 to 12 inches thick.
- C1—11 to 20 inches, light-gray (10YR 6/1) clay, very dark gray (10YR 3/1) moist; weak, medium, prismatic structure; hard, friable, very sticky, very plastic; common very fine and fine interstitial and tubular pores; strongly effervescent; moderately alkaline (pH 8.4); clear, wavy boundary. 6 to 13 inches thick.
- C2—20 to 27 inches, light-gray (10YR 6/1) clay, very dark gray (10YR 3/1) moist; common, coarse, faint, gray (N 5/0) organic stains; weak, medium, prismatic structure; very hard, friable, very sticky, very plastic; common very fine and few fine roots; many very fine and few fine tubular pores; moderately alkaline (pH 8.2); clear, wavy boundary. 3 to 10 inches thick.
- C3—27 to 46 inches, light-gray (10YR 6/1) clay, very dark gray (10YR 3/1) moist; common, medium, faint, gray (N 5/0) and dark-gray (N 4/0) organic stains and many, medium and coarse, distinct, light-gray (2.5Y 7/2) stains; massive; very hard, firm, very sticky, very plastic; few very fine and fine roots; many very fine tubular pores; moderately alkaline (pH 8.2); abrupt, wavy boundary. 12 to 27 inches thick.
- C4—46 to 62 inches, light-gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; common, fine, distinct, yellowish-brown (10YR 5/4) mottles of iron and common, medium and coarse, distinct, gray (N 5/0) and dark-gray (N 4/0) organic stains; massive; hard, friable, very sticky, very plastic; few very fine roots; few very fine and fine tubular pores; mildly alkaline (pH 7.6).

The A horizon ranges from 7 to 14 inches in thickness. In this horizon colors have a hue of 10YR to 2.5Y, a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 1 or 2. This horizon is massive or has moderate to strong, very fine or

fine, granular structure. Reaction is moderately alkaline to very strongly alkaline. In the C horizon colors have a hue of 10YR to 5Y, a dry value of 6 or 7, a moist value of 3 to 5, and a chroma of 1 or 2. This horizon is mottled below a depth of 36 inches, and in many places it is mottled at a depth of 12 inches. The C horizon is clay or silty clay, and it is massive or has weak, medium, prismatic structure. Reaction is mildly alkaline to strongly alkaline.

**Bicondoa clay (Bc).**—This nearly level soil occupies one irregularly shaped tract on low-lying lake terraces in the southern part of Surprise Valley. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Jesse Camp soils that make up about 5 percent of the total acreage.

Occasional flooding of short duration is caused by runoff from higher lying areas. The native vegetation consists mostly of juncus, sedges, and meadow grasses.

This soil is suitable for irrigated crops. It is used mainly for livestock grazing in summer. Meadow hay is harvested from a few areas. Capability unit IVw-67, irrigated; not placed in a range site; wildlife suitability group 2.

**Bicondoa-Kisring complex (Bd).**—This complex consists of nearly level soils on low-lying flood plains and lake terraces in the southern part of Surprise Valley. It occupies one of two small tracts that are irregular in shape. It is about 65 percent Bicondoa clay or silty clay and about 30 percent Kisring fine sandy loam. The Bicondoa soil is on the flood plains, and the Kisring soil is on the terraces. Each of the two soils has a profile similar to the one described as representative for its respective series, and each is strongly saline-alkali.

Included with this complex in mapping are areas of Jesse Camp and Cummings soils that make up about 5 percent of the total acreage.

The native vegetation consists of greasewood and salt-grass.

The soils in this complex are not suitable for crops. They are used for late-season pasture. Pasture on the Bicondoa soil responds to water spreading. Bicondoa part: Capability unit VIw-64, irrigated and VIIw-205, dryland; range

site NV 23-10; wildlife suitability group 4. Kising part: Capability unit VIIw-227, dryland; range site NV 23-10; wildlife suitability group 4.

## Bidwell Series

The Bidwell series consists of well-drained soils that formed in alluvium derived from basalt, andesite, tuff, and pyroclastics. These soils are on alluvial fans and low lake terraces. The slope range is 0 to 5 percent. Vegetation consists mainly of big sagebrush, bitterbrush, and bluebunch wheatgrass. The elevation ranges from 3,000 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 46° to 52° F., and the frost-free season is about 100 to 130 days.

In a representative profile the surface layer is grayish-brown loam or clay loam about 10 inches thick. Below this is grayish-brown clay loam and brown gravelly loam about 36 inches thick. The underlying material is pale-brown gravelly loam that contains segregated lime filaments. It extends to a depth of more than 73 inches.

Bidwell soils have moderately slow permeability. The effective rooting depth is more than 60 inches if the soils are irrigated. Available water capacity is 10 to 11 inches. Runoff is slow, and the hazard of accelerated erosion is slight to moderate. These soils are not affected by a water table or by flooding.

Representative profile of Bidwell loam, 0 to 2 percent slopes, in Modoc County, California, about 2,500 feet north and 2,600 feet west of the southeast corner of sec. 32, T. 43 N., R. 16 E., Mount Diablo base line and meridian:

- Ap1—0 to 4 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine roots; many very fine interstitial pores and few very fine and fine tubular pores; neutral (pH 6.8); clear, smooth boundary. 3 to 9 inches thick.
- Ap2—4 to 10 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure in place, but moderate, medium, subangular blocky structure if displaced; hard, friable, sticky, plastic; many very fine roots; many very fine interstitial pores and common very fine and fine tubular pores; few thin clay films in pores; neutral (pH 6.8); clear, wavy boundary. 3 to 7 inches thick.
- B2t—10 to 22 inches, grayish-brown (10YR 5/2) clay loam (10 percent gravel), brown (10YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable, sticky, plastic; many very fine roots; many very fine interstitial pores and few very fine tubular pores; few thin clay films on ped faces and many thin films in pores; neutral (pH 7.0); clear, wavy boundary. 8 to 15 inches thick.
- B31t—22 to 32 inches, grayish-brown (10YR 5/2) clay loam, brown (10YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable, sticky, plastic; common very fine roots; common very fine and fine tubular pores and many very fine interstitial pores; few thin clay films on ped faces and many thin clay films in pores; neutral (pH 7.2); clear, wavy boundary. 4 to 12 inches thick.
- B32t—32 to 46 inches, brown (10YR 5/3) gravelly loam (25 percent gravel), brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine roots; few very fine tubular pores and many very fine interstitial pores; few thin clay films on ped faces and in pores; mildly alkaline (pH 7.6); clear, wavy boundary. 0 to 14 inches thick.

Cca—46 to 73 inches, pale-brown (10YR 6/3) gravelly loam (25 percent gravel), brown (10YR 4/3) moist; common, fine, distinct, very pale brown (10YR 7/3 and 8/3) segregated lime; massive; very hard, friable, slightly sticky, slightly plastic; few very fine roots; few very fine tubular pores and common very fine interstitial pores; noneffervescent in matrix and strongly effervescent in lime segregations; moderately alkaline (pH 8.2).

In the A horizon colors have a hue of 10YR, a dry value of 4 or 5, a moist value of 3, and a chroma of 1 or 2. This horizon has granular or blocky structure. Reaction is neutral or mildly alkaline. In the B2t horizon colors have a hue of 10YR, a dry value of 5 to 6, a moist value of 3.5 to 4.5, and a chroma of 2 or 3. This horizon is clay loam or sandy clay loam and has moderate prismatic or blocky structure. Reaction is neutral to moderately alkaline. This horizon is noncalcareous. The B3t horizon has segregated lime in the lower part in places.

**Bidwell loam, 0 to 2 percent slopes (BeA).**—This soil occupies small, irregularly shaped tracts along the western edge of Surprise Valley. It is on alluvial fans between the toe slopes of the Warner Mountains and the valley floor. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Bidwell, Surprise, and Buntingville soils that make up about 10 percent of the total acreage.

The hazard of erosion is slight if the soil is irrigated. In areas that are not farmed, the native vegetation consists mainly of big sagebrush, bitterbrush, and bluebunch wheatgrass.

Most areas of this soil are irrigated and used for the production of small grain, alfalfa hay, and permanent pasture. Capability unit IIc-1, irrigated and VIc-220, dryland; range site NV 23-22; wildlife suitability group 1.

**Bidwell loam, 2 to 5 percent slopes (BeB).**—This soil occupies small, irregularly shaped tracts throughout the irrigated areas along the western edge of Surprise Valley. It is on alluvial fans between the toe slopes of the Warner Mountains and the valley floor. It has a profile similar to the one described as representative for the series, except that the slopes are slightly steeper, and it is moderately susceptible to erosion if irrigated.

Included with this soil in mapping are areas of Donica, Simpson, and Surprise soils that make up about 10 percent of the acreage mapped.

In areas that are not farmed, the native vegetation consists mainly of big sagebrush, bitterbrush, and bluebunch wheatgrass.

Most areas of this soil are irrigated or dryfarmed and are used for the production of small grain, alfalfa hay, and permanent pasture. Capability unit IIe-20, irrigated and VIc-220, dryland; range site NV 23-22; wildlife suitability group 1.

## Bluebell Series

The Bluebell series consists of well-drained soils that formed in residuum weathered from basalt, andesite, and tuff. These soils are on mountainous uplands along ridge crests of south- and east-facing slopes. The slope range is 5 to 75 percent. Vegetation consists of an overstory of curlleaf mountain mahogany and an understory of big sagebrush, serviceberry, and needlegrass. The elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is 14 to 24 inches, the average annual air tem-

perature is 39° to 42° F., and the frost-free season is less than 90 days.

In a representative profile the surface layer is very dark grayish-brown or dark-brown very stony fine sandy loam about 13 inches thick. The next layer is brown very stony clay loam 15 inches thick. Pale-brown andesite bedrock is at a depth of 28 inches.

Bluebell soils have moderately slow permeability. The effective rooting depth is 20 to 28 inches. Available water capacity is 4 to 5 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Bluebell very stony sandy loam in an area of Bluebell-Hapgood association, moderately steep, in Modoc County, California, 1,400 feet south and 500 feet east of the north quarter corner of sec. 1, T. 45 N., R. 15 E., Mount Diablo base line and meridian:

O1—1½ inches to 0, dark grayish-brown (10YR 4/2) mahogany leaf litter, very dark brown (10YR 2/2) moist; neutral (pH 6.8); abrupt, smooth boundary. 0 to 2 inches thick.

A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) very stony sandy loam, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine and fine roots; many very fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary. 2 to 5 inches thick.

A12—3 to 13 inches, dark-brown (7.5YR 3/2) very stony fine sandy loam, very dark brown (7.5YR 2/2) moist; moderate, fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine and fine roots and few medium and coarse roots; many very fine interstitial pores; medium acid (pH 6.0); clear, wavy boundary. 6 to 13 inches thick.

B2t—13 to 28 inches, brown (7.5YR 4/2) very stony clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky, plastic; common very fine and fine roots and few medium and coarse roots; common very fine tubular pores and many very fine interstitial pores; few thin clay films on ped faces and many thin and few moderately thick clay films in pores; slightly acid (pH 6.2); abrupt, slightly irregular boundary. 10 to 18 inches thick.

R—28 inches, pale-brown (10YR 6/3) andesite bedrock, grayish brown (10YR 5/2) moist; few, thin, brown (7.5YR 5/4) clay films and many, moderately thick, dark-brown (7.5YR 4/3) clay films coat the bedrock surface and are in cracks and crevices.

Less than 15 percent of the surface area of these soils is stony. In the A1 horizon colors have a hue of 10YR or 7.5YR, a dry value of 3 or 4, a moist value of 2, and a chroma of 1 to 3. This horizon is fine sandy loam or loam in texture and is more than 50 percent stones. It is massive or has weak to moderate granular or blocky structure. Reaction is medium acid to very slightly acid. In the B2t horizon colors have a hue of 5YR or 7.5YR, a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 2 or 3. It is light sandy clay or heavy clay loam in texture and is 50 to 80 percent stones. It has weak to moderate, medium to coarse, subangular blocky structure. Reaction is slightly acid. Depth to bedrock ranges from 20 to 36 inches.

**Bluebell-Hapgood association, moderately steep (BHE).**—This association consists of soils in irregularly shaped, small to large, scattered areas throughout the Warner Mountains on the western edge of the survey area. These tracts are on ridge crests and south- and east-facing slopes. This association is about 60 percent Bluebell very stony sandy loam that has 5 to 30 percent slopes and about 25 percent Hapgood very stony fine sandy loam that has 5 to 30 percent slopes. The Bluebell soil has a very stony clay loam subsoil, and the Hapgood soil has a very stony loam subsoil.

Included with this association in mapping are areas of Newlands, Home Camp, and steeper phases of Bluebell and Hapgood soils. These areas make up about 15 percent of the total acreage.

The Bluebell soil has a native vegetation that consists of an overstory of curleaf mountain mahogany and an understory of big sagebrush, serviceberry, and needlegrass. The Hapgood soil has a native vegetation that consists of big sagebrush, serviceberry, and perennial grasses.

The soils of this association are not suitable for irrigated crops. They are used mainly for livestock grazing, wildlife habitat, and watershed. Bluebell part: Capability unit VIIs-211, dryland; not placed in a range site; wildlife suitability group 10. Hapgood part: Capability unit VIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

**Bluebell-Hapgood association, steep (BHF).**—This association consists of soils in irregularly shaped, small, scattered tracts throughout the Warner Mountains along the western edge of the survey area. These tracts are on ridge crests and south- and west-facing slopes. This association is similar to Bluebell-Hapgood association, moderately steep, except that the soils are steep and very steep. It is about 60 percent Bluebell very stony sandy loam that has 30 to 50 percent slopes and about 25 percent Hapgood very stony fine sandy loam that has 30 to 50 percent slopes. The Bluebell soil has a very stony clay loam subsoil, and the Hapgood soil has a very stony loam subsoil.

Included with this association in mapping are areas of Newlands soil and more gently sloping phases of Hapgood and Bluebell soils. These areas make up about 15 percent of the total acreage.

The Bluebell soil has a native vegetation that consists of an overstory of curleaf mountain mahogany and an understory of big sagebrush, serviceberry, and needlegrass. The Hapgood soil has a native vegetation that consists of big sagebrush, serviceberry, and perennial grasses.

The soils of this association are not suitable for irrigated crops. They are used mainly for livestock grazing, wildlife habitat, and watershed. Bluebell part: Capability unit VIIs-211, dryland; not placed in a range site; wildlife suitability group 10. Hapgood part: Capability unit VIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

## Boulder Lake Series

The Boulder Lake series consists of somewhat poorly drained soils on floors of enclosed basins. They formed in lacustrine sediment derived from mixed basic rocks. The slope range is 0 to 2 percent. Vegetation consists mainly of silver sagebrush and mat muhly and, to a lesser extent, povertyweed, primrose, carex, and rumex. The elevation ranges from 5,500 to 6,000 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 60 to 80 days.

In a representative profile the surface layer is about 6 inches of grayish-brown clay that shrinks and forms wide cracks when dry. The underlying material is light brownish-gray clay that contains a few mottles of iron and manganese and extends to a depth of more than 54 inches.

Boulder Lake soils have very slow permeability. The effective rooting depth is more than 60 inches. Available

water capacity is 8 to 9 inches. The hazard of accelerated erosion is slight. In places these soils are ponded, and they are flooded for short periods each year because of runoff from higher soils.

Representative profile of Boulder Lake clay about three-quarters of a mile west of Boulder Lake near the center of sec. 9, T. 40 N., R. 19 E., Mount Diablo base line and meridian:

- A11—0 to 2 inches grayish-brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; strong, very fine and fine, granular structure; slightly hard, friable, very sticky, very plastic; root crowns only; many very fine and fine interstitial pores; slightly acid (pH 6.4); abrupt, smooth boundary.  $\frac{1}{4}$  inch to 3 inches thick.
- A12—2 to 4 inches, grayish-brown (10YR 5/2) clay, dark grayish-brown (10YR 4/2) moist; moderate, medium, prismatic structure; slightly hard, friable, very sticky, very plastic; few very fine, fine, and medium roots; many very fine and fine interstitial pores; neutral (pH 6.6); abrupt, slightly wavy boundary. 2 to 5 inches thick.
- A13—4 to 6 inches, grayish-brown (10YR 5/2) clay, dark grayish-brown (10YR 4/2) moist; moderate, coarse, prismatic parting to strong, very fine and fine, angular blocky structure; slightly hard, friable, very sticky, very plastic; few fine and medium roots; few very fine and fine tubular pores and many fine and fine interstitial pores; few slickensides on ped faces; neutral (pH 6.6); clear, wavy boundary. 2 to 4 inches thick.
- C1—6 to 24 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; few, fine and medium, distinct, brown (7.5YR 4/4) and very dark brown (7.5YR 2/2) mottles of iron and manganese; moderate, medium, prismatic structure; very hard, firm, very sticky, very plastic; few fine and medium roots; few fine tubular pores and many very fine interstitial pores; common slickensides on ped faces and within peds; neutral (pH 6.8); gradual, smooth boundary. 12 to 30 inches thick.
- C2—24 to 54 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; common, fine, distinct, brown (7.5YR 4/4) and dark-brown (7.5YR 3/4) mottles of iron and few, fine and medium, distinct, very dark brown (10YR 2/2) mottles of manganese; weak, coarse, prismatic parting to strong, medium to very coarse, angular blocky structure; very hard, firm, very sticky, very plastic; few fine and medium roots; few fine tubular pores and many very fine interstitial pores; common slickensides on ped faces; neutral (pH 6.8).

The A1 horizon ranges from 10YR to 2.5Y in hue, has a dry value of 5 or 6, and has a moist value of 3.5 to 4. It is slightly acid or neutral in reaction. The A1 horizon is silty clay loam, silty clay, or clay. It forms a loose mulch when dry. This horizon has strong, very fine and fine, granular structure. The A12 and A13 horizons are clay or silty clay and have moderate to strong, medium to coarse, prismatic structure that parts to angular blocky in places. The C horizon ranges from 10YR to 2.5Y in hue, is 5 or 6 in dry value, 3.5 to 4 in moist value, and is mottled. This horizon has mostly moderate to strong, medium to coarse, prismatic structure but parts to angular blocky in places. Slickensides are common.

**Boulder Lake clay (Bo).**—This nearly level soil occupies scattered, small to large, circular tracts on floors of enclosed basins in the area north of Duck Lake Valley.

Included with this soil in mapping are small islands and stringers of Weimer clay that make up about 10 percent of the acreage.

This soil is used mainly for livestock grazing and wildlife habitat. Capability unit VIw-204, dryland; range site NV 23-3; wildlife suitability group 11.

## Bregar Series

The Bregar series consists of well-drained soils that formed in material weathered from basic rocks. These soils have many small outcrops of volcanic rock. They are on mountain uplands and ridges. The slope range is 2 to 15 percent. Cobblestone and rock outcrop are in about 80 percent of the surface area. Vegetation consists of low sagebrush, Sandberg bluegrass, Idaho fescue, bluebunch wheatgrass, squirreltail, and miscellaneous forbs. The elevation ranges from 6,500 to 7,500 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 60 to 80 days.

In a representative profile the surface layer is light brownish-gray very gravelly and cobbly loam about 4 inches thick. The next layer is light brownish-gray to brown gravelly and cobbly sandy clay loam to very cobbly and gravelly clay loam about 5 inches thick. Andesite bedrock is at a depth of 9 inches.

Bregar soils have moderately slow permeability. The effective rooting depth is 5 to 12 inches. Available water capacity is 0.75 to 1 inch. Runoff is medium, and the hazard of accelerated erosion is slight.

Representative profile of Bregar very gravelly loam, 2 to 15 percent slopes, in an area of Bregar rocky loam, in Washoe County, Nevada, 150 feet south and 300 feet east of the west quarter corner of sec. 7, T. 39 N., R. 19 E., Mount Diablo base line and meridian:

- A1—0 to 4 inches, light brownish-gray (10YR 6/2) very gravelly and cobbly loam (60 percent coarse fragments), dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; soft, very friable, non-sticky, nonplastic; common very fine and fine roots; common fine vesicular pores and many very fine interstitial pores; very slightly acid (pH 6.5); clear, smooth boundary. 2 to 4 inches thick.
- B21t—4 to 6 inches, light brownish-gray (10YR 6/2) gravelly and cobbly sandy clay loam (50 percent coarse fragments), dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; slightly hard, very friable, slightly sticky, plastic; many very fine and fine roots and few medium roots; many very fine and fine interstitial pores; few thin clay films on ped faces and common thin clay films in pores; few thin clay coatings on pebbles; very slightly acid (pH 6.6); clear, wavy boundary. 2 to 5 inches thick.
- B22t—6 to 9 inches, brown (10YR 5/3) very cobbly and gravelly clay loam (70 percent coarse fragments), dark brown (10YR 4/3) moist; moderate, fine, angular blocky structure; hard, friable, sticky, plastic; many very fine and fine roots; common very fine interstitial pores; common thin and few moderately thick clay films on ped faces and in pores; very slightly acid (pH 6.5); abrupt, broken boundary. 0 to 4 inches thick.
- R—9 to 16 inches, unweathered andesitic bedrock.

In the A1 horizon colors have a dry value of 5.5 to 6, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is massive or has weak, granular or subangular blocky structure. Reaction is slightly acid to very slightly acid. In the B2t horizon colors have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 3 to 5, and a chroma of 2 or 3. This horizon is clay loam or sandy clay loam in texture, and 50 percent or more of it is coarse fragments. It is massive or has weak or moderate, fine or medium, angular or subangular blocky structure. Reaction is slightly acid to very slightly acid. The solum is 5 to 12 inches thick and is underlain by bedrock.

**Bregar rocky loam, 2 to 15 percent slopes (BRC).**—This complex occupies small, scattered tracts on mountain up-

lands and ridgetops. The tracts are near Hays Canyon and Fox Mountain in Nevada and in the Warner Mountains and near Cow Head Lake in California. This complex consists of about 85 percent Bregar soils and 5 percent basalt outcrops. Gravel, cobblestones, and stones cover 80 percent of the surface of the Bregar soil.

Included with this soil in mapping are areas of Mosquet and Newlands soils and small eroded areas in the Warner Mountains. These areas make up 10 percent of the total acreage.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VII<sub>s</sub>-237, dryland; range site NV 23-8; wildlife suitability group 8.

## Buntingville Series

The Buntingville series consists of somewhat poorly drained soils on alluvial fans. They formed in alluvium derived from mixed basic volcanic rocks. The slope range is 0 to 5 percent. Vegetation consists of meadow plants, such as sedges, grasses, and native clover. The elevation ranges from 4,450 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 48° to 53° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is dark-gray loam about 4 inches thick. Below this is dark-gray to gray, mildly alkaline to moderately alkaline clay loam about 28 inches thick. The underlying material is stratified, brown to pale-brown light silty clay loam, loam, and silty clay loam about 31 inches thick.

Buntingville soils have moderately slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 11 to 12 inches. Runoff is very slow. The seasonal high water table is at a depth of 3 to 4 feet in most years.

Representative profile of Buntingville loam, 2 to 5 percent slopes, in Modoc County, California, 0.6 mile south of the intersection of State Route 299 and Surprise Valley Road, 130 feet south and 45 feet east of the center of sec. 8, T. 42 N., R. 16 E., Mount Diablo base line and meridian:

Ap—0 to 4 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; weak, very fine, granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine roots; many very fine interstitial pores; neutral (pH 6.8); clear, wavy boundary. 4 to 8 inches thick.

Blt—4 to 15 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; common, fine and medium, black (10YR 2/1) organic stains; weak, medium, prismatic structure; hard, friable, sticky, plastic; many very fine roots; few fine and common very fine tubular pores; few thin clay films bridging sand grains and in pores; mildly alkaline (pH 7.4); clear, wavy boundary. 6 to 12 inches thick.

B2t—15 to 24 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; few, medium, faint, brown (10YR 4/2) mottles of iron and dark-gray (10YR 4/1) organic stains; moderate, medium, prismatic structure; hard, friable, sticky, plastic; common very fine roots; few medium and common very fine and fine tubular pores; few thin clay films as bridges and common thin clay films in pores; mildly alkaline (pH 7.6); clear, wavy boundary. 7 to 13 inches thick.

B3tca—24 to 32 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; few, medium, faint, dark-gray (10YR 4/1) organic stains; common, fine to

coarse, faint, dark grayish-brown (10YR 4/2) and dark-brown (10YR 3/3) mottles of iron; common, fine and medium, light-gray (10YR 7/1) lime segregations; weak, coarse, subangular blocky structure; hard, friable, sticky, plastic; common very fine roots; common fine and many very fine tubular pores; few thin clay films on ped faces and common thin clay films in pores; effervescent in matrix but strongly effervescent in spots; moderately alkaline (pH 8.0); clear, wavy boundary. 7 to 14 inches thick.

Clca—32 to 46 inches, brown (10YR 5/3) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; common, fine and medium, light brownish-gray (10YR 6/2) lime segregations; massive; hard, friable, sticky, plastic; common very fine roots; common fine and many very fine tubular pores; not effervescent in matrix but strongly effervescent in spots; moderately alkaline (pH 8.0); gradual, wavy boundary. 12 to 20 inches thick.

C2—46 to 59 inches, pale-brown (10YR 6/3) loam, olive brown (2.5Y 4/3) moist; many, medium, distinct, dark-brown (7.5YR 4/4) mottles of iron; few, medium, distinct, gray (10YR 5/1) and very dark gray (10YR 3/1) organic stains; massive; hard, friable, slightly sticky, slightly plastic; few very fine roots; common fine and many very fine tubular pores; mildly alkaline (pH 7.8); gradual, wavy boundary. 8 to 15 inches thick.

C3—59 to 63 inches, pale-brown (10YR 6/3) silty clay loam, grayish brown (2.5Y 5/2) moist; common, fine, faint, dark-brown (10YR 4/4) mottles of iron; common, fine, distinct, very dark gray (N 3/0) organic stains; massive; hard, friable, sticky, plastic; few very fine roots; common very fine tubular pores; mildly alkaline (pH 7.6).

In the A horizon colors have a dry value of 3 to 5, a moist value of 2 or 3, and a chroma of 1 or 2. The Ap horizon is loam or clay loam. The Bt horizon is 20 to 30 inches thick and is 25 to 35 percent clay, by weighted average. In the B2t horizon colors have a hue of 10YR or 2.5Y, a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 1 or 2. This horizon is clay loam or silty clay loam and has weak to moderate, fine to medium, prismatic or subangular blocky structure. Reaction is mildly alkaline to moderately alkaline. Iron mottles are at a depth of 20 inches or less. These soils are effervescent in or below the B3t horizon.

**Buntingville loam, 0 to 2 percent slopes (BuA).**—This soil occupies small, irregularly shaped tracts throughout the irrigated part of Surprise Valley along its western edge. These tracts are on alluvial fans. The slopes are smooth or gently convex.

Included with this soil in mapping are areas of a soil that is similar to Buntingville soils, except that the dark colors in the upper horizons do not extend below a depth of 30 inches. These areas make up 10 percent of the total acreage.

The hazard of erosion is slight. The native vegetation consists mainly of sedges, grasses, and native clover.

This soil is used mainly for irrigated crops. It is used mainly for the production of alfalfa, small grain, and native pasture. Capability unit IIw-60, irrigated; not placed in a range site; wildlife suitability group 2.

**Buntingville loam, 2 to 5 percent slopes (BuB).**—This soil occupies small, irregularly shaped tracts in the irrigated part of Surprise Valley along its western edge. These tracts are on alluvial fans between the valley floor and the Warner Mountains. Slopes are smooth or gently convex. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of a soil that is similar to Buntingville soil, except that the dark colors of the upper horizons do not extend below a depth

of 24 inches. These areas make up 5 percent of the total acreage.

The hazard of erosion is moderate if this soil is irrigated. The native vegetation consists mainly of sedges, grasses, and native clover.

This soil is used mainly for irrigated crops. It is used mainly for the production of alfalfa, small grain, and native pasture. Capability unit IIw-62, irrigated and VIw-200 dryland; range site NV 23-13; wildlife suitability group 2.

## Campone Series

The Campone series consists of somewhat poorly drained soils on mountain meadows and swales. They formed in alluvium from basalt and tuffaceous parent material. The slope range is 0 to 15 percent. Vegetation consists mainly of meadow grasses, sedges, forbs, and open stands of aspen or lodgepole pine. The elevation ranges from 6,500 to 8,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is 38° to 40° F., and the frost-free season is 60 to 80 days.

In a representative profile the surface layer is very dark grayish-brown to dark grayish-brown, medium acid to slightly acid gravelly loam to a depth of about 12 inches and about 16 inches of dark grayish-brown, medium acid stony loam below. Between depths of 28 and 40 inches or more is light brownish gray, medium acid very gravelly sandy clay loam that contains iron mottles and stains.

Campone soils have moderate to moderately slow permeability. The effective rooting depth is more than 48 inches. Available water capacity is 6 to 8 inches. Runoff is medium, and the hazard of accelerated erosion is severe. The seasonal high water table is at a depth of 3 to 5 feet.

Representative profile of Campone gravelly loam, drained, 2 to 15 percent slopes, in Lassen County, California, about 100 feet east of Skunk Cabbage Creek, 100 feet east, and 600 feet south of the north quarter corner of sec. 22, T. 38 N., R. 16 E., Mount Diablo base line and meridian:

- A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine roots; many very fine interstitial pores; slightly acid (pH 6.4); clear, smooth boundary. 1 to 4 inches thick.
- A12—3 to 12 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots and common fine and medium roots; many very fine and fine interstitial pores; medium acid (pH 6.0); gradual, smooth boundary. 6 to 10 inches thick.
- A13—12 to 28 inches, dark grayish-brown (10YR 4/2) stony loam, very dark brown (10YR 2/2) moist, moderate, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots and few medium roots; many very fine and few fine tubular pores; medium acid (pH 6.0); clear, irregular boundary. 10 to 20 inches thick.
- C—23 to 40 inches, light brownish-gray (10YR 6/2) very gravelly sandy clay loam, dark brown (10YR 4/3) moist; few to common, fine to medium, distinct, strong-brown (7.5YR 5/6) and reddish-yellow (7.5YR 6/6) iron mottles and stains; massive; hard, friable, sticky, plastic; common very fine roots and few fine roots; many very fine and fine tubular pores; medium acid (pH 5.6).

In the A horizon colors have a dry value of 3 to 5, a moist value of 2 to 3, and a chroma of 1 to 3. This horizon is loam, sandy clay loam, clay loam, and sandy loam and is gravelly in places. It has weak to strong, granular and subangular blocky structure. In the C horizon colors have a hue of 10YR or 2.5Y, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. Mottles that indicate wetness are in the lower part.

**Campone gravelly loam, drained, 2 to 15 percent slopes (CAC).**—This soil occupies long, narrow tracts along drainageways and small swales in upland mountainous areas. Gully entrenchment has resulted in drainage of this soil in places. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Hapgood, Longval, and Newlands soils that make up about 15 percent of the total acreage.

Permeability is moderate, the available water capacity is 6 to 8 inches, and the depth to the seasonal high water table is 4 to 5 feet. The native vegetation consists mainly of balsamroot, meadow grasses, sedges, and forbs. Big sagebrush is invading areas of this soil.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIw-200, dryland; range site NV 23-13; wildlife suitability group 5.

**Campone clay loam, 0 to 5 percent slopes (CCB).**—This soil occupies small, narrow tracts along drainageways and small swales in upland mountainous areas. The profile is similar to the one described as representative for the series, except that the surface layer is clay loam and slightly thicker.

Included with this soil in mapping are areas of a soil that is similar to Welch soils. These areas make up about 10 percent of the total acreage.

Permeability is moderately slow, the available water capacity is 6 to 8 inches, and the depth to the seasonal high water table is 3 to 4 feet. The native vegetation consists mainly of meadow grasses, sedges, and forbs, but includes open stands of aspen or lodgepole pine.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing. Capability unit VIw-200, dryland; range site NV 23-13; wildlife suitability group 5.

## Catnip Series

The Catnip series consists of well-drained soils that formed in residuum from basalt, andesite, and tuff. They are on basaltic tablelands and plateaus. The slope range is 0 to 9 percent. Vegetation consists of low sagebrush, Sandberg bluegrass, squirreltail, low Douglas rabbitbrush, and miscellaneous forbs. Cobblestones cover about 85 percent of the surface area. The elevation ranges from 5,800 to 6,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 41° to 45° F., and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is dark grayish-brown to light-gray, neutral extremely cobbly loam and silt loam about 4 inches thick. The next layer is dark grayish-brown or dark-brown to brown, neutral to mildly alkaline clay about 35 inches thick. Very dark gray, decomposing andesitic bedrock is at a depth of 39 inches.

Catnip soils have very slow permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 4 to 6 inches. Runoff is medium, and the hazard of accel-

erated erosion is slight because of the extremely cobbly surface.

Representative profile of Catnip extremely cobbly loam in an area of Catnip-Ninemile association, in Washoe County, Nevada, 1.25 miles north of the southwest quarter of sec. 3, T. 39 N., R. 19 E., Mount Diablo base line and meridian:

- A1—0 to 1 inch, dark grayish-brown (10YR 4/2) extremely cobbly loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine roots; many very fine interstitial pores; neutral (pH 6.6); abrupt, smooth boundary. 0 to 3 inches thick.
- A2—1 to 3½ inches, light-gray (10YR 6/1) silt loam, dark brown (7.5YR 3/2) moist; massive; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; common fine vesicular pores; neutral (pH 6.6); abrupt, slightly wavy boundary. 1 to 4 inches thick.
- B21t—3½ to 6 inches, dark grayish-brown (10YR 4/2) clay, dark brown (7.5YR 4/2) moist; strong, medium, columnar structure that has a thin capping of bleached sand grains; very hard, very firm, very sticky, very plastic; common very fine and fine roots; few fine tubular pores; continuous pressure cutans; neutral (pH 6.8); abrupt, slightly wavy boundary. 2 to 6 inches thick.
- B22t—6 to 11 inches, dark-brown (7.5YR 4/2) clay, dry or moist; strong, medium, prismatic structure; extremely hard, extremely firm, very sticky, very plastic; few very fine and fine exped roots; very few fine tubular pores; continuous pressure cutans; neutral (pH 7.0); clear, smooth boundary. 3 to 7 inches thick.
- B23t—11 to 13 inches, dark-brown (7.5YR 4/2) clay, dry or moist; moderate, medium, prismatic structure; very hard, very firm, very sticky, very plastic; few very fine and fine exped roots; very few fine tubular pores; continuous thin clay films on ped faces and in pores; neutral (pH 7.0); clear, smooth boundary, 2 to 9 inches thick.
- B24tca—13 to 26 inches, dark-brown (7.5YR 4/2) clay, dry or moist; many, medium, distinct, white (10YR 8/1) lime mottles; weak, medium, prismatic structure; very hard, very firm, very sticky, very plastic; few very fine and fine exped roots; few fine tubular pores; common thin clay films on ped faces and in pores; mildly alkaline (pH 7.4); gradual, smooth boundary, 7 to 13 inches thick.
- B3t—26 to 39 inches, brown (7.5YR 4/4) clay, dry or moist; few, fine, distinct, white (10YR 8/1) lime mottles; weak, medium, prismatic structure; hard, firm, sticky, plastic; few very fine and fine roots; few fine tubular pores; slightly effervescent in matrix; mildly alkaline (pH 7.4); abrupt, smooth boundary. 8 to 16 inches thick.
- R—39 inches, very dark gray (N 3/0) decomposing andesitic bedrock; common thick clay films and distinct white (10YR 8/1) lime coating the rock surface.

The A1 horizon is missing in places. Where present it is as much as 4 inches thick. It has colors that have a dry value of 4 or 5, a moist value of 2 to 3.5, and a chroma of 2. The A1 horizon is extremely cobbly loam or sandy loam and is massive or has weak platy or granular structure. In the A2 horizon colors have a hue of 7.5YR to 10YR and are at least one unit higher in value or lower in chroma than those in the A1 or B21t horizon. In the B2t horizon colors have a hue of 7.5YR or 10YR, a dry value of 4 or 5, a moist value of 3 to 5, and a chroma of 2 to 4. The B2t horizon is 60 to 75 percent clay, by weighted average, and it has strong, columnar structure and bleached capping in the upper part that grades with depth from strong to weak prismatic structure. These soils have subangular blocky structure above the R horizon in places. They are noncalcareous and neutral or nearly neutral in the upper part of the solum, but in the lower part they are mildly alkaline to moderately alkaline and contain segregated lime. The solum is 20 to 36 inches thick, and bedrock is at a depth of 20 to 40 inches.

**Catnip-Ninemile association (CK).**—This association consists of soils in large, irregularly shaped, scattered tracts throughout the survey area, except on the high slopes of the Warner Mountains. It is about 40 percent Catnip extremely cobbly loam, 0 to 9 percent slopes, about 40 percent Ninemile extremely cobbly loam, 0 to 9 percent slopes, and 15 percent Karlo very cobbly clay, 0 to 9 percent slopes. The Catnip soil is 20 to 40 inches deep to bedrock and is calcareous in the lower part of the profile. The Ninemile soil is 10 to 20 inches deep to bedrock and is noncalcareous. The Karlo soil has a granular, cracked, clay surface layer and is a self-churning soil.

Included with this soil in mapping are areas of Made-line soils, a soil that is similar to Catnip soil but that is shallower to bedrock, and a few, small, scattered rock escarpments. These areas make up 5 percent of the total acreage.

The Catnip and Ninemile soils have a native vegetation that consists of low sagebrush and Sandberg bluegrass. The Karlo soil has a native vegetation that consists mainly of low gray rabbitbrush.

This association is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Catnip part: Capability unit VIIIs-239, dryland; range site NV 23-17; wildlife suitability group 8. Ninemile part: Capability unit VIIIs-237, dryland; range site NV 23-17; wildlife suitability group 8. Karlo part: Capability unit VIIIs-241, dryland; range site NV 23-1; wildlife suitability group 8.

## Couch Series

The Couch series consists of well-drained, saline-alkali soils on smooth old lake terraces. They formed in alluvium from mixed volcanic rock sources. The slope range is 0 to 2 percent. Vegetation consists mainly of greasewood, spiny hopsage, big sagebrush, and a few areas of inland saltgrass. The elevation ranges from 4,500 to 5,200 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 47° to 49° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is light-gray, strongly alkaline loam about 1 inch thick. Below this is brown clay, heavy clay loam, and clay loam, about 21 inches thick, that contains gypsum crystals and segregated lime in the lower part. The next layer is light-gray to very pale brown fine sandy loam and very fine sandy loam that extends to a depth of 60 inches.

Couch soils have slow to very slow permeability. The effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of accelerated erosion is slight. At the lower elevations, the water table is at a depth of 6 to 7 feet in winter.

Representative profile of Couch loam, in Modoc County, California, about 1,400 feet north and 300 feet east of the south quarter of sec. 4, T. 43 N., R. 16 E., Mount Diablo base line and meridian:

- A2—0 to 1 inch, light-gray (10YR 6/1) loam, dark gray (10YR 4/1) moist; weak, medium, platy structure; soft, very friable, nonsticky, nonplastic; few very fine and fine roots; many very fine and fine vesicular pores; strongly alkaline (pH 8.8); abrupt, slightly wavy boundary. 1 to 3 inches thick.
- B2t—1 to 6 inches, brown (10YR 5/3) clay, brown (10 YR 4/3) moist; strong, medium, columnar structure that has

very thin (less than  $\frac{1}{8}$  inch thick) light-gray (10YR 7/2) coatings on caps; hard, firm, very sticky, very plastic; many very fine roots; many very fine and fine tubular pores; many thin clay films on ped faces and in pores; strongly alkaline (pH 9.0); clear, wavy boundary. 4 to 9 inches thick.

B31t-6 to 13 inches, brown (10YR 6/2) heavy clay loam, brown (10YR 4/3) moist; many, medium and fine, white (10YR 8/2) lime segregations; weak, medium and coarse, subangular blocky structure; slightly hard, friable, very sticky, very plastic; few very fine and fine roots; many very fine tubular pores; many thin clay films in pores and few thin clay films on ped faces; noneffervescent in matrix but violently effervescent in lime segregations; very strongly alkaline (pH 9.4); gradual, wavy boundary. 5 to 10 inches thick.

B32tea-13 to 22 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/2) moist; many, very fine and fine, very pale-brown (10YR 7/3) and white (10YR 8/2) gypsum crystals and lime segregations; weak, medium and fine, subangular blocky and moderate, very fine, granular structure; soft, very friable, sticky, plastic; few very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.2); abrupt, wavy boundary. 6 to 12 inches thick.

C1-22 to 40 inches, light-gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; many dark-gray (10YR 4/1) and very dark gray (10YR 3/1) sand grains; massive; soft, very friable, nonsticky, nonplastic; few fine and very fine roots; many very fine and fine tubular pores; violently effervescent; very strongly alkaline (pH 9.6); gradual, smooth boundary. 12 to 30 inches thick.

C2-40 to 60 inches, very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine and fine roots; many very fine and fine tubular pores; violently effervescent; very strongly alkaline (pH 9.3).

In the A1 horizon colors have a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 1 or 2. Texture is fine sandy loam, loam, or silt loam. Reaction is moderately alkaline to very strongly alkaline. This horizon is noncalcareous to weakly calcareous. In the B2t horizon colors have a dry value of 5 or 6, moist value of 3 or 4, and a chroma of 2 or 3. This horizon is heavy clay loam or clay and has moderate to strong, fine to medium, prismatic or columnar structure. Reaction is strongly alkaline or very strongly alkaline. The B2t horizon is noncalcareous or strongly calcareous. Accumulations of lime are below the B2t horizon in the B3t or C horizon. Dense, unformable, lacustrine clay is at a depth below 40 inches in some areas.

**Couch loam (Cm).**—This nearly level soil is on lake terraces in large, long, narrow tracts around the peripheral area of the ancient lakes in Surprise Valley and Duck Flat. It has the profile described as representative for the series.

Included with this soil in mapping are narrow stringers of Lolak soils, several gullied drainageways from higher lying areas, and small, scattered areas that have a surface layer of silt loam. These areas make up 5 percent of the total acreage.

Permeability is slow. The native vegetation consists mainly of greasewood, but a few saltgrass plants are also present.

This soil is suitable for irrigated crops if reclaimed and water is available. It is used mainly for livestock grazing and wildlife habitat. Capability units IVs-64, irrigated and VIIs-221, dryland; range site NV 23-2; wildlife suitability group 4.

**Couch loam, clay substratum (Cn).**—This nearly level soil occupies large, long, narrow tracts on undulating lake terraces. The profile is similar to the one described as

representative for the series, except that it has a layer of dense, extremely hard, very firm, massive or platy, very slowly permeable, lacustrine clay at a depth of more than 40 inches.

Included with this soil in mapping are areas of Couch loam that make up about 10 percent of the total acreage.

Permeability is very slow. The native vegetation consists mainly of greasewood, but a few saltgrass plants are also present.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIs-221, dryland; range site NV 23-2; wildlife suitability group 4.

## Crutcher Series

The Crutcher series consists of well-drained soils that formed in clayey lake sediment derived from mixed basic rock sources, mainly tuffs and basalt. These salts are on flood plains and low-lying lacustrine terraces. The slope range is 0 to 2 percent. Vegetation consists mainly of greasewood, big sagebrush, and some four-wing saltbush. Flooded areas also have basin wildrye. The elevation ranges from 4,400 to 5,600 feet. The average annual precipitation is 6 to 10 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 90 to 120 days.

In a representative profile the surface layer is pale-brown very fine sandy loam about 2 inches thick. Below this is pale-brown, strongly to very strongly alkaline silt loam and silty clay loam about 34 inches thick. The next layer is pale-brown, very strongly alkaline silty clay that extends to a depth of 54 inches.

Crutcher soils have slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 9 to 11 inches. Runoff is slow, and the hazard of accelerated erosion is slight. Some areas are subject to flooding because of runoff from higher lying soils, mainly during heavy rainstorms.

Representative profile of Crutcher very fine sandy loam in Washoe County, Nevada, at the northwest corner of sec. 34, T. 36 N., R. 20 E., Mount Diablo base line and meridian:

A1-0 to 1½ inches, pale-brown (10YR 6/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, thick, platy structure; slightly hard, friable, sticky, plastic; very few very fine and fine roots; many very fine, fine, and medium vesicular pores; slightly saline; strongly effervescent; strongly alkaline (pH 8.6); abrupt, smooth boundary. 1 to 3 inches thick.

C1-1½ to 3 inches, pale-brown (10YR 6/3) heavy silt loam, dark grayish brown (10YR 4/2) moist; moderate, very fine, granular structure; slightly hard, friable, slightly sticky, plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; strongly saline; strongly effervescent; strongly alkaline (pH 8.6); clear, smooth boundary. 1 to 4 inches thick.

C2-3 to 6 inches, pale-brown (10YR 6/3) silty clay loam, dark grayish brown (10YR 4/2) moist; weak, thin, platy structure; slightly hard, friable, sticky, plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores and few fine tubular pores; strongly alkaline (pH 8.6); clear, smooth boundary. 2 to 7 inches thick.

C3-6 to 10 inches, pale-brown (10YR 6/3) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, thin, platy structure; hard, friable, sticky, plastic; many

very fine and fine roots and few medium roots; few very fine and common fine tubular pores; strongly effervescent; strongly alkaline (pH 8.8); clear, smooth boundary. 4 to 10 inches thick.

IIC4—10 to 36 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; weak, fine and medium, angular blocky structure; very hard, firm, very sticky, very plastic; common very fine and fine roots and few medium roots; common fine tubular pores; violently effervescent; very strongly alkaline (pH 9.2); clear, smooth boundary. 18 to 30 inches thick.

IIC5—36 to 54 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; massive; hard, friable, very sticky, very plastic; many very fine and fine roots and few medium roots; common fine tubular pores; violently effervescent; very strongly alkaline (pH 9.2).

In a few places pebbles of andesite, basalt, obsidium, tuff, and diatomaceous earth cover as much as 40 percent of the surface. The soil material in the upper 6 to 12 inches consists of reworked sediment ranging from fine sandy loam to silty clay loam in texture. This material is slightly saline to strongly saline, and the reaction is moderately alkaline to very strongly alkaline. Throughout the profile, hue ranges from 10YR to 2.5Y, dry value is 6 or 7, and chroma is 3 to 5. The upper part of the profile has a moist value of 3 or 4, and the lower part has a moist value of 4 or 5.

In the A horizon structure ranges in grade from weak to moderate, and it is platy or granular. The platiness is mainly the result of deposition, and the granulation is mainly caused by soluble salts.

The lower part of the C horizon ranges from silty clay loam to silty clay in texture. It is 20 to 60 percent pyroclastics where the material is silt or is coarser textured. It is massive or has weak blocky or prismatic structure, is slightly saline, and is strongly alkaline to very strongly alkaline in reaction.

**Crutcher very fine sandy loam (CR).**—This nearly level soil is on low-lying lake terraces in fairly large, irregularly shaped tracts in the southeastern part of Duck Flat in the Nevada part of the survey area. It has the profile described as representative for the series.

Included with this soil in mapping are narrow stringers of Disabel, Jesse Camp, and other Crutcher soils that make up about 10 percent of the total acreage.

This soil has been slightly affected by salt. The native vegetation consists mainly of greasewood, big sagebrush, and basin wildrye. The soil is subject to flooding by runoff from higher lying soils, mainly during heavy rainstorms.

This soil is suitable for irrigated crops if water is available. It is used mainly for livestock grazing and wildlife habitat. Capability unit IIIs-64, irrigated and VIIs-226, dryland; range site NV 23-2; wildlife suitability group 4.

**Crutcher silty clay loam (CS).**—This nearly level soil occupies fairly large, irregularly shaped areas throughout the central part of Duck Flat and the southern end of Surprise Valley. It is on low-lying lake terraces and flood plains. The profile is similar to the one described as representative for the series, except that the surface layer is silty clay loam, and it is strongly alkali affected.

Included with this soil in mapping are slightly elevated, terraced stringers of Nevador soils and local areas adjacent to shallow drainageways that are subject to flooding. They make up about 5 percent of the total acreage.

The native vegetation consists mainly of greasewood. This soil is suitable for irrigated crops if water is available. It is used mainly for livestock grazing and wildlife habitat. Capability unit IVs-64, irrigated and VIIs-221, dryland; range site NV 23-2; wildlife suitability group 4.

## Cummings Series

The Cummings series consists of poorly drained soils. They formed on smooth lake basins in lake sediment derived from volcanic ash mixed with such volcanic rocks as tuff, andesite, and basalt. The slope range is 0 to 2 percent. The elevation ranges from 5,000 to 5,500 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is gray to very dark gray, strongly alkaline silty clay loam, about 34 inches thick, that contains many very fine fresh-water snail and clam shells. The next layer is light brownish-gray, light-gray, and pale-brown, moderately alkaline silty clay loam that contains white lime and gypsum segregations and some iron mottles in the lower part. This layer extends to a depth of 60 inches.

Cummings soils have moderately slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 11 to 12 inches. The hazard of accelerated erosion is none to slight. In places these soils are ponded, and the seasonal high water table is at a depth of 1 to 2 feet. Drainage ditches and pumping have reduced ponding and controlled the level of the water table.

Representative profile of Cummings silty clay loam in Cow Head Lake Basin in Modoc County, California, 500 feet east and 1,500 feet south of the northwest corner of sec. 27, T. 47 N., R. 17 E., Mount Diablo base line and meridian:

Ap—0 to 12 inches, gray (10YR 5/1) silty clay loam, black (10YR 2/1) moist; many, very fine (less than ¼ inch in diameter), white (N 8/0) fresh-water snail and clam shells; massive; soft, very friable, slightly sticky, plastic; many very fine roots; many very fine interstitial pores and few very fine tubular pores; strongly effervescent; strongly alkaline (pH 8.6); gradual, wavy boundary. 8 to 12 inches thick.

A11—12 to 26 inches, gray (10YR 5/2) silty clay loam, black (10YR 2/1) moist; many, very fine (less than ¼ inch in diameter), white (N 8/0) fresh-water snail and clam shells and fragments; massive; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots and few fine roots; many very fine interstitial pores and few very fine tubular pores; violently effervescent; strongly alkaline (pH 8.6); clear, wavy boundary. 12 to 27 inches thick.

A12—26 to 28 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; many, very fine (less than ½ inch in diameter), white (N 8/0) fresh-water snail shells and common, fine, distinct, very dark gray (N 3/0) organic stains; massive; soft, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine interstitial pores; violently effervescent; strongly alkaline (pH 8.6); abrupt, wavy boundary. 0 to 12 inches thick.

A13b—28 to 34 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; fine and medium, distinct, black (N 2/0) organic stains; common, fine, prominent, white (N 8/0) lime segregations and very fine fresh-water snail shells; massive; slightly hard, friable, sticky, plastic; few very fine roots; few very fine tubular pores and many very fine interstitial pores; strongly effervescent; strongly alkaline (pH 8.6); abrupt, smooth boundary. 0 to 8 inches thick.

C1b—34 to 39 inches, light brownish-gray (10YR 6/2) and gray (10YR 5/1) silty clay loam, dark grayish brown 10YR 4/2) crushed and moist; common, fine and medium, distinct, white (N 8/0) lime and gypsum segregations and fresh-water snail shells; few, fine and medium, faint, brown (10YR 4/3) iron stains and

few, fine, distinct, very dark gray (10YR 3/1) organic stains; massive; very hard, firm, sticky, plastic; few very fine roots; common very fine tubular pores; not effervescent in matrix but violently effervescent in lime segregations; moderately alkaline (pH 8.2); clear, wavy boundary. 0 to 6 inches thick.

C2b—39 to 48 inches, light-gray (10YR 7/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common, fine and medium, prominent, white (N 8/0) gypsum segregations and few, fine and medium, distinct, very dark gray (10YR 3/1) organic stains; massive; very hard, friable, sticky, plastic; few very fine tubular pores; moderately alkaline (pH 8.0); gradual, wavy boundary. 4 to 12 inches thick.

C3b—48 to 60 inches, pale-brown (10YR 6/3) light silty clay loam, brown (10YR 5/3) moist; few, fine, faint, yellowish-brown (10YR 6/4) and light yellowish-brown (10YR 5/6) circular iron mottles; few, very fine, distinct, white (10YR 8/2) gypsum segregations; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; few very fine tubular pores; moderately alkaline (pH 8.0).

The A horizon ranges from 24 to 48 inches in thickness. It contains sufficient organic matter to make the horizon somewhat mucky. In this horizon hue is 10YR to 2.5Y, or is neutral, dry value is 3 to 5, and moist value is 2 or 3. In the C horizon hue is 10YR to 5Y, dry value is 6 or 7, moist value is 4 to 6, and chroma is 1 to 3. The profile has a stratified texture throughout but is dominantly silty clay loam and ranges from silt loam to clay. The soil is massive throughout or has weak, coarse, prismatic or blocky structure. Mottles, ranging in color from black to reddish yellow, are below a depth of 20 inches. The reaction ranges from moderately alkaline to strongly alkaline throughout.

**Cummings silty clay loam (Cu).**—This nearly level soil occupies a large, uniform tract on bottom land of the Cow Head Lake Basin.

Included with this soil in mapping are areas of other soils similar to Cummings soils. They make up less than 2 percent of the total acreage.

This soil is suitable for irrigated crops. Drainage ditches and protective dikes must be installed to prevent ponding and to lower the water table. It is dryfarmed and mainly produces small grain. Capability unit IVw-67, irrigated; not placed in a range site; wildlife suitability group 11.

## Cummings Series, Clay Subsoil Variant

The Cummings series, clay subsoil variant, consists of poorly drained and very poorly drained soils that formed in lacustrine sediment derived from mixed basic rocks. These soils are nearly level and slightly concave and are on lake terraces. Vegetation consists of wet meadow grasses. The elevation ranges from 4,450 to 4,700 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is gray, neutral muck about 8 inches thick. It is black when moist. The next layer is white, moderately alkaline silt loam about 7 inches thick. It is light gray when moist. Below this layer is light-gray and light brownish-gray, moderately alkaline clay about 23 inches thick. This material is underlain by pale-olive grading to olive, strongly alkaline silty clay that extends to a depth of 72 inches.

These variants from the normal Cummings soils have slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 11 to 12 inches. Runoff is very slow, and the hazard of accelerated erosion

is slight. The seasonal high water table is at the surface to a depth of 2 feet.

Representative profile of Cummings muck, clay subsoil variant, drained, in Modoc County, California, 1,400 feet north and 50 feet east of the south quarter corner of sec. 33, T. 39 N., R. 17 E., Mount Diablo base line and meridian:

Op—0 to 8 inches, gray (10YR 5/1) muck, black (10YR 2/1) moist; massive; soft, friable, nonsticky, nonplastic; many very fine and fine roots; many very fine and fine interstitial pores; neutral (pH 6.8); clear, wavy boundary. 6 to 20 inches thick.

Cl—8 to 15 inches, white (10YR 8/1) silt loam, light gray (10YR 6/1) moist; massive; slightly hard, brittle, slightly sticky, very plastic; common very fine and fine roots; common very fine and fine tubular pores; moderately alkaline (pH 8.0); abrupt, wavy boundary. 2 to 14 inches thick.

IIC2—15 to 19 inches, light-gray (10YR 6/1) clay, very dark gray (10YR 3/1) moist; strong, medium and fine, columnar structure; extremely hard, very fine, sticky, very plastic; common very fine and fine roots; few very fine tubular pores; common slickensides; moderately alkaline (pH 8.2); clear, wavy boundary. 2 to 6 inches thick.

IIC3—19 to 25 inches, light-gray (10YR 6/1) clay, dark gray (10YR 4/2) moist; moderate, medium, prismatic parting to strong, coarse, angular blocky structure; extremely hard, very firm, sticky, very plastic; few very fine impeded and common very fine exped roots; few very fine tubular pores; common slickensides; moderately alkaline (pH 8.2); gradual, wavy boundary. 5 to 10 inches thick.

IIC4—25 to 38 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, angular blocky parting to medium and fine angular blocky structure; extremely hard, firm, sticky, very plastic; common very fine and fine roots; common fine tubular pores; common slickensides; moderately alkaline (pH 8.2); gradual, irregular boundary. 6 to 14 inches thick.

IIC6g—38 to 52 inches, pale-olive (5Y 6/3 6/4) silty clay, variegated, brownish gray (2.5Y 6/2), light olive brown (2.5Y 5/3), and olive (5Y 5/6) moist; many, fine and medium, white (2.5Y 8/2) lime mottles; massive; hard, firm, sticky, very plastic; common very fine and fine roots; common very fine tubular pores; slightly effervescent; strongly alkaline (pH 8.6); gradual, wavy boundary. 8 to 15 inches thick.

IIC7g—52 to 72 inches, olive (5Y 5/3) and pale-olive (5Y 6/4) silty clay, olive to greenish (5Y 6/2-5/4), (5GY 6/1), (5G 5/2) moist; many, medium, bluish (5BG 5/1) mottles; massive; hard, slightly firm, slightly brittle, sticky, very plastic; common very fine and fine roots; few very fine tubular pores; slightly effervescent; strongly alkaline (pH 8.8).

In the O horizon hue is 10YR or 2.5Y or is neutral, dry value is 4 or 5, moist value is 2 or 3, and chroma is 1 or less. This horizon is made up of peat or muck, and it is slightly acid to neutral in reaction. Horizons made up of ash are immediately below the O horizon. They range from 10YR to 2.5Y or are neutral in hue, have a dry value of 7 or 8, a moist value of 5 or 6, and a chroma of 1 or less. They are silt or silt loam and are neutral to moderately alkaline in reaction. In the IIC horizon hue is 10YR to 5Y, dry value is 5 to 7, and moist value is 4 or 5. This horizon is mottled throughout in places, but below a depth of 48 inches mottles are always present. It is massive or has weak or moderate prismatic structure to strong angular blocky structure. It is strongly effervescent to violently effervescent in places. Reaction is mildly alkaline to very strongly alkaline.

**Cummings muck, clay subsoil variant (Cv).**—This soil occupies irregularly shaped wet areas of various sizes that are on lake terraces below natural springs at the southern end of Surprise Valley. Slopes are nearly level and slightly

concave. This soil is similar to the one described as representative for the series, except that it is not drained. Water from the spring area immediately above this soil maintains the water table at, or near, the surface.

Included with this soil in mapping are small, irregularly shaped island areas of Lolak, Couch, and Zorravista soils. They make up 10 percent of the total acreage.

The native vegetation consists mainly of coarse sedges. This soil can be improved for meadow pasture by drainage, which improves the quality of vegetation and widens the range of use. It is not cultivated. The soil is used mainly for livestock grazing and wildlife habitat. Capability unit VIw-64, irrigated; not placed in a range site; wildlife suitability group 2.

**Cummings muck, clay subsoil variant, drained (Cw).**—This soil occupies irregularly shaped, various-sized areas below natural springs on lake terraces in Surprise Valley. Slopes are nearly level and slightly concave. This soil has the profile described as representative for the series. The water table is at a depth of 1 to 2 feet.

Included with this soil in a mapping are areas of Lolak, Couch, and other soils. They make up about 2 percent of the total acreage.

The native vegetation consists mainly of wet meadow grasses and sedges. This soil is suitable for irrigated crops. It is used mainly for production of native meadow hay and pasture. Some areas are irrigated and have been seeded to improve plant species for production of better quality hay and pasture. Capability unit IVw-67, irrigated; not placed in a range site; wildlife suitability group 2.

## Dangberg Series, Cold Variant

The Dangberg series, cold variant, consists of poorly drained saline-alkali soils that formed in lake-laid sediment derived from mixed basic rock sources. These soils are on low-lying lake terraces and alluvial fans. The slope range is 0 to 5 percent. Vegetation consists of greasewood and saltgrass. The elevation ranges from 4,400 to 4,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 44° to 45° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is light brownish-gray, very strongly alkaline loam about 4 inches thick. Below this is light brownish-gray very strongly alkaline silty clay about 13 inches thick. It is underlain by a variegated light-gray and light brownish-gray, very strongly alkaline, strongly silica-cemented duripan about 3 inches thick. The underlying material is variegated, light brownish-gray, strongly alkaline loam and silty clay loam that is weakly cemented in the upper part and that extends to a depth of 54 inches.

These variants from the normal Dangberg soils have very slow permeability. The effective rooting depth is 15 to 28 inches. Available water capacity is 2.5 to 3.5 inches. The seasonal high water table is at a depth of 1½ to 3 feet.

Representative profile of Dangberg loam, cold variant, 0 to 2 percent slopes, in Modoc County, California, near the northeast corner of sec. 17, T. 43 N., R. 16 E., Mount Diablo base line and meridian:

A11—0 to 2 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate, medium, platy structure; slightly hard, friable, non-sticky, nonplastic; common very fine and fine roots;

many very fine tubular and interstitial pores; strongly effervescent; very strongly alkaline (pH 9.2); abrupt, smooth boundary. 1 to 2 inches thick.

A12—2 to 4 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; few very fine tubular pores and many very fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.3); abrupt, slightly wavy boundary. 2 to 4 inches thick.

B21t—4 to 9 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, columnar structure; very hard, firm, very sticky, very plastic, common very fine exped roots and few very fine impeded roots, common very fine tubular pores; common thin clay films in pores; many pressure cutans; strongly effervescent; very strongly alkaline (pH 9.4); clear, wavy boundary. 4 to 7 inches thick.

B22t—9 to 17 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; strong, medium, prismatic structure; very hard, firm, very sticky, very plastic; common very fine exped roots and few very fine impeded roots; many very fine tubular pores; many thin clay films in pores; many pressure cutans; strongly effervescent; many, fine to coarse, faint, light-gray and white (10YR 7/1 and 8/1) lime segregations in lower inch of horizon; very strongly alkaline (pH 9.2); abrupt, smooth boundary. 4 to 15 inches thick.

Cl3sicam—17 to 20 inches, variegated, light-gray (10YR 7/2) and light brownish-gray (10YR 6/2), strongly cemented duripan, dark grayish brown (10YR 4/2) and light brownish gray (10YR 6/2) moist; almost continuous white (10YR 8/2) lime coatings on ped faces; moderate, medium and thick, platy structure; extremely hard and extremely firm in upper part of horizon and very hard and very firm in lower part; many to common very fine roots; matted on plate surfaces; common very fine tubular pores and many very fine interstitial pores; many thin silica films lining pores and bridging sand grains; common, very thin, discontinuous laminae on plate surfaces; violently effervescent; very strongly alkaline (pH 9.1); clear, slightly wavy boundary. 1 to 5 inches thick.

C2sica—20 to 35 inches, light brownish-gray (10YR 6/2) loam that is weakly silica-cemented, dark grayish brown (10YR 4/2) moist; common, fine to coarse, white (10YR 8/1) lime coatings and mottles and few, fine, faint, brown (10YR 5/3) iron mottles; massive, many, moderate and strong, medium and fine, subangular blocky durinodes; very hard, firm, slightly sticky, slightly plastic; few very fine roots; many very fine and few fine tubular pores; many very thin and thin silica films coating pores and bridging sand grains; few, very thin, discontinuous, unoriented silica laminae; violently effervescent; very strongly alkaline (pH 9.2); gradual, wavy boundary. 8 to 20 inches thick.

C3sica—35 to 54 inches, variegated, light brownish-gray (10YR 7/2) and light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few, very fine, distinct, very dark grayish-brown (10YR 3/2) and very dark brown (10YR 2/2) manganese and iron mottles and stains and common, fine and medium, faint, white (10YR 8/2) lime mottles; massive; slightly hard, friable, sticky, plastic; few very fine roots; common very fine and fine tubular pores; common, medium and coarse, hard and firm, subangular blocky durinodes; violently effervescent; strongly alkaline (pH 9.0).

In the A1 horizon colors have a hue of 10YR or 2.5Y, a dry value of 5 to 7, a moist value of 3 or 4, and a chroma of 1 or 2. This horizon is loam to sandy loam and is massive or has weak or moderate, fine to thick, platy structure. In the B2t horizon colors have a hue of 10YR to 2.5Y, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. The B2t horizon is clay or silty clay and has moderate to strong, fine to coarse, columnar structure in the upper part and prismatic structure in the

lower part. Depth to the silica-cemented hardpan ranges from 15 to 28 inches.

**Dangberg loam, cold variant, 0 to 2 percent slopes (DcA).**—This soil occupies small to medium-sized, irregularly shaped areas scattered throughout the northern half of Surprise Valley. It is on west and east sides of the lakes on low-lying lake terraces. This soil has the profile described as representative for the series. Included areas of Hovey and Hussa soils make up about 5 percent of the acreage mapped.

The water table is at a depth of about 1½ to 2 feet. Runoff is slow, and the hazard of erosion is slight. Vegetation consists of greasewood and saltgrass.

This soil is marginally suitable for irrigated crops. In places areas have been cleared of brush, planted in salt-tolerant vegetation, irrigated, and used for pasture and the production of hay. Capability unit IVw-64, irrigated and VIIw-229, dryland; range site NV 23-10; wildlife suitability group 4.

**Dangberg loam, cold variant, drained, 2 to 5 percent slopes (DbB).**—This soil occupies small to medium-sized, irregularly shaped areas scattered throughout the northern half of Surprise Valley. It is on the west and east sides of the lakes on alluvial fans and lake terraces.

Included with this soil in mapping are areas of Hovey, Hussa, and Lolak soils that make up about 5 percent of the total acreage.

This soil has been drained by deep gullies and has a water table at a depth of about 3 feet. Runoff is medium, and the hazard of erosion is moderate. The native vegetation consists of greasewood and saltgrass.

This soil is marginally suitable for irrigated crops. It is used mainly for livestock grazing. In places, areas are cleared of brush, planted in salt-tolerant vegetation, irrigated, and used for pasture and the production of hay. Capability unit IVw-64, irrigated and VIIw-229, dryland; range site NV 23-2; wildlife suitability group 4.

## Disabel Series

The Disabel series consists of well-drained soils that formed in lake sediment derived from basalt, andesite, tuff, and volcanic ash. These soils are on lacustrine terraces and flood plains. The slope range is 0 to 2 percent. Vegetation consists of big sagebrush, basin wildrye, and some greasewood and shadscale at lower elevations. The elevation ranges from 4,500 to 5,000 feet. The average annual precipitation is 8 to 12 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is light brownish-gray, moderately alkaline silty clay loam about 11 inches thick. The next layer is about 29 inches thick and is light brownish-gray and pale-brown, moderately alkaline clay in the upper 15 inches and pale-brown silty clay in the lower 14 inches. The underlying material is light brownish-gray, moderately alkaline to strongly alkaline silty clay loam and silty clay to a depth of 60 inches.

Disabel soils have slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 10 to 12 inches. Runoff is slow, and the hazard of accelerated erosion is slight. Some areas are subject to flooding.

Representative profile of Disabel silty clay loam in Washoe County, Nevada, 200 feet north and 100 feet east of the southwest quarter of sec. 7, T. 36 N., R. 19 E., Mount Diablo base line and meridian:

- A11—0 to 2 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; strong, thick, platy structure; slightly hard, friable, sticky, very plastic; many very fine and fine roots; many fine and medium vesicular pores and common fine interstitial pores; effervescent; moderately alkaline (pH 8.4); abrupt, slightly wavy boundary. 1 to 2 inches thick.
- A12—2 to 11 inches, light brownish-gray (10YR 6/2) silty clay loam, brown (10YR 4/3) moist; strong, very thin, platy structure; slightly hard, friable, sticky, very plastic; many very fine and fine roots; few fine tubular pores; noneffervescent in matrix but effervescent in spots; moderately alkaline (pH 8.4); clear, smooth boundary. 2 to 10 inches thick.
- B1t—11 to 17 inches, light brownish-gray (10YR 6/2) clay, brown (10YR 4/3) moist; weak, medium, prismatic and strong, fine, angular blocky structure; hard, friable, very sticky, very plastic; many very fine and fine tubular pores; few thin clay films on ped faces and common thin clay films in pores; noneffervescent in matrix but effervescent in spots; moderately alkaline (pH 8.3); clear, smooth boundary. 4 to 8 inches thick.
- B21t—17 to 26 inches, pale-brown (10YR 6/3) clay, brown (10YR 4/3) moist; moderate, medium, prismatic parting to strong, fine, angular blocky structure; hard, firm, very sticky, very plastic; common very fine and fine exped roots; common very fine and fine tubular pores; many thin clay films on ped faces and continuous thin clay films in pores; not effervescent in matrix but slightly effervescent in spots; moderately alkaline (pH 8.2); clear, smooth boundary. 6 to 10 inches thick.
- B22t—26 to 40 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 4/3) moist; few, fine, distinct, white (10YR 8/1) lime filaments; moderate, medium, prismatic parting to strong, medium and fine, platy structure; hard, friable, very sticky, very plastic; common very fine and fine roots; common very fine and fine tubular pores; many thin clay films on ped faces and in pores; effervescent but violently effervescent in spots; moderately alkaline (pH 8.3); clear, slightly wavy boundary, 10 to 20 inches thick.
- C1—40 to 50 inches, light brownish-gray (10 YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; common, fine, distinct, white (10YR 8/1) lime filaments and very dark brown (10YR 2/2) manganese mottles; strong, very fine, angular blocky structure; hard, friable, sticky, plastic; few fine roots; common fine and very fine tubular pores; few thin clay films in pores; effervescent but violently effervescent in spots; moderately alkaline (pH 8.4); clear, smooth boundary. 9 to 20 inches thick.
- IIC2—50 to 60 inches, light brownish-gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; many, fine, distinct, very dark brown (10YR 2/2) manganese mottles; moderate, very fine, angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; few very fine and fine tubular pores; effervescent; strongly alkaline (pH 8.6).

In the A1 horizon colors have a hue of 10YR to 2.5Y, a dry value of 5.5 to 6.5, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is very fine sandy loam, loam, or silty clay loam. It is massive or has weak to strong, thin to thick, platy structure. The reaction is neutral to strongly alkaline. In the B2t horizon colors have a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is heavy silty clay to clay, and it has moderate to strong prismatic primary structure. The reaction is mildly alkaline to strongly alkaline. The solum ranges from 30 to 50 inches in thickness but generally is more than 30 inches thick. Weak silica cementation is at depths below 40 inches in places.

**Disabel silty clay loam (DC).**—This nearly level soil occupies large, irregularly shaped areas and long narrow stringers on lacustrine terraces and valley flood plains. These areas are adjacent to creek channels east of Surprise Valley in Boulder Flat and Antelope Flat. This soil has the profile described as representative for the series.

Included with this soil in mapping are irregularly shaped tracts of Boulder Lake and Hart Camp soils and small areas of stony Mascamp soils. They make up 10 percent of the total acreage.

Vegetation consists mainly of big sagebrush and basin wildrye. This soil is suitable for irrigated crops if adequate water is available. It is used mainly for livestock grazing and wildlife habitat. Capability unit IIs-41, irrigated and VIs-226, dryland; range site NV 23-5; wildlife suitability group 7.

**Disabel-Crutchter association, eroded (DD2).**—This association consists of nearly level soils on lake terraces. They are in large, irregularly shaped areas near Duck Flat. This association is about 70 percent saline-alkali soil similar to Disabel silty clay loam except that it is eroded and about 20 percent Crutchter silty clay loam. The Disabel soil has a clayey, strongly structured subsoil and is moderately alkaline to strongly alkaline. The Crutchter soil has a clayey subsoil that lacks a strong degree of structure. It is strongly alkaline to very strongly alkaline.

Included with this association in mapping are small gullied areas and a few small sand or clay dunes that make up about 10 percent of the total acreage.

The soils in this association have a native vegetation that consists of big sagebrush and greasewood.

Both soils are suitable for irrigated crops if water is available. The Crutchter soil has been dryfarmed but is now abandoned. The soils are used mainly for livestock grazing and wildlife habitat. Disabel part: Capability unit IIIs-64, irrigated and VIIs-221, dryland; range site NV 23-2; wildlife suitability group 4. Crutchter part: Capability unit IVs-64, irrigated and VIIs-221, dryland; range site NV 23-2; wildlife suitability group 4.

**Disabel-Jesse Camp association, overwash (DE).**—This association consists of nearly level soils on broad, shallow drainageways. It occupies large, irregularly shaped areas near Duck Flat. It is about 45 percent Disabel silty clay loam, overwash, about 25 percent Jesse Camp silt loam, overwash, 0 to 2 percent slopes, and 20 percent Crutchter soils. The Disabel soil has a clayey subsoil and strong structure. The Jesse Camp soil has a silty subsoil. The Crutchter soil has a clayey subsoil but lacks the structure of the Disabel soil. It has been partly leached of salt and alkali because of position and the effects of excess amounts of water from higher-lying soils.

Included with this association in mapping are higher lying islands of Crutchter soils and saline-alkali affected Jesse Camp soils that make up about 10 percent of the total acreage.

These soils are subject to flooding from higher areas. They have a vegetation that consists of big sagebrush, basin wildrye, and a small amount of greasewood.

These soils are all suitable for irrigated crops if water is available. They are used mainly for livestock grazing and wildlife habitat. Disabel part: Capability unit IIIw-91, irrigated and VIw-226, dryland; range site NV 23-9; wildlife suitability group 7. Jesse Camp part: Capability unit IIIw-91, irrigated and VIw-226, dryland; range site

NV 23-5; wildlife suitability group 7. Crutchter part: Capability unit IIIw-91, irrigated and VIw-226, dryland; range site NV 23-5; wildlife suitability group 7.

**Disabel-McConnel association (DM).**—This association consists of nearly level to gently sloping soils on dissected lake terraces in large, irregularly shaped areas near Duck Flat. This association is 45 percent Disabel silty clay loam, about 25 percent McConnell sandy loam, 0 to 5 percent slopes, and 20 percent Badland. The Disabel soil has a clayey and strong structured subsoil, and the McConnell soil has a very gravelly subsoil. Badland consists of nearly barren soft lake sediment.

Included with this association in mapping are small scattered sand dunes and small areas of Langston, Vylach, and Pegler soils that make up about 10 percent of the total acreage.

The Disabel soil has a native vegetation that consists of big sagebrush. The native vegetation on McConnell soils consists of big sagebrush, shadscale, and Indian ricegrass.

The McConnell soil is not suitable for irrigated crops. If irrigation water is made available, the Disabel soil is suitable for irrigated crops. The soils in this association are used mainly for livestock grazing and wildlife habitat. Disabel part: Capability unit IIs-41, irrigated and VIs-226, dryland; range site NV 23-5; wildlife suitability group 7. McConnell part: Capability unit VIIs-285, dryland; range site NV 23-12; wildlife suitability group 9. Badland part: Capability unit VIIIe-224; not placed in a range site; not placed in a wildlife suitability group.

**Disabel-Pegler association (DP).**—This association consists of nearly level to gently sloping soils on lake terraces in the west-central part of Duck Flat. Areas are large and irregular in shape. This association is about 50 percent slightly saline-alkali Disabel silty clay loam and about 40 percent Pegler fine sandy loam that has slopes of 0 to 5 percent. The Disabel soil is very deep and has a clayey, strongly structured subsoil. The Pegler soil has a clay loam subsoil and is very shallow to tuff.

Included with this association in mapping are narrow stringers and scattered areas of Disabel silty clay loam, overwash, and nonsaline-alkali phases of Pegler soils. They make up about 10 percent of the total acreage.

The Disabel soil has a native vegetation that consists of big sagebrush, greasewood, and basin wildrye. The native vegetation on the Pegler soil is mainly big sagebrush and some shadscale, spiny hopsage, Thurber needlegrass, and Indian ricegrass.

The Pegler soil is not suitable for irrigated crops. The Disabel soil is suitable for irrigated crops if water is available. Both soils are used mainly for livestock grazing and wildlife habitat. Disabel part: Capability unit IIIs-64, irrigated and VIIs-221, dryland; range site NV 23-2; wildlife suitability group 4. Pegler part: Capability unit VIIs-231, dryland; range site NV 23-12; wildlife suitability group 9.

## Donica Series

The Donica series consists of somewhat excessively drained soils that formed in gravelly alluvium from mixed basic rocks. They are on smooth to convex alluvial fans and lake terraces. The slope range is 2 to 50 percent. The native vegetation is big sagebrush, bitterbrush, and blue-bunch wheatgrass. The elevation ranges from 4,000 to

5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is about 50° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is very dark grayish-brown and dark grayish-brown very gravelly sandy loam about 13 inches thick. Below this is brown very gravelly coarse sandy loam about 16 inches thick. The next layer is light-gray and gray very gravelly coarse sand that extends to a depth of 60 inches.

Donica soils have moderately rapid permeability. The effective rooting depth is more than 60 inches. Available water capacity is 3 to 4 inches.

Representative profile of Donica very gravelly sandy loam, 5 to 30 percent slopes, in Modoc County, California, at the north end of Surprise Valley; 1,400 feet east and 100 feet north of the southwest quarter of sec. 35, T. 47 N., R. 16 E., Mount Diablo base line and meridian:

- A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) very gravelly sandy loam, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine roots; many very fine interstitial pores; slightly acid (pH 6.5); abrupt, smooth boundary. 2 to 4 inches thick.
- A12—3 to 13 inches, dark grayish-brown (10YR 4/2) very gravelly sandy loam, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine and common fine roots; many very fine interstitial and tubular pores; neutral (pH 6.6); clear, wavy boundary. 7 to 15 inches thick.
- B2—13 to 29 inches, brown (10YR 5/3) very gravelly coarse sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; common very fine and few fine roots; many very fine and fine interstitial pores; neutral (pH 6.8); abrupt, wavy boundary. 12 to 21 inches thick.
- IIC—29 to 60 inches, light-gray and gray (N 6/0, N 7/0, N 5/0) very gravelly coarse sand; occasional white (10YR 8/2) and very pale brown (10YR 7/3) gravel and sand grains; dark gray (N 4/0) and gray (N 5/0) moist; single grain; loose when dry or moist; common very fine and few fine roots decreasing with depth to almost no roots; many very fine and fine and few medium interstitial pores; slightly acid (pH 6.5).

In the A horizon colors have a dry value of 3 to 5 and a moist value of 2 to 3. The B2 horizon generally has a hue of 10YR, but hue ranges to 7.5YR in places. In this horizon dry value is 5 or 6, moist value is 3 or 4, and chroma is 2 or 3. The B2 horizon is coarse sandy loam or sandy loam and is 40 to 70 percent gravel. It is massive or has weak, fine or medium, subangular blocky structure. Reaction in this horizon is neutral to slightly acid. Depth to the C horizon ranges from 25 to 40 inches. The color of the C horizon depends on the color of parent rocks.

**Donica gravelly sandy loam, 2 to 5 percent slopes (DrB).**—This soil occupies small areas scattered along the west side of Surprise Valley on the lower end of alluvial fans. The profile is similar to the one described as representative for the series, but this soil has less gravel on the surface.

Included with this soil in mapping are areas of Surprise gravelly sandy loam, 2 to 5 percent slopes. These areas make up about 2 percent of the total acreage. Also included are areas of Riverwash.

Runoff is very slow, and the hazard of erosion is slight. The native vegetation consists of big sagebrush, bitterbrush, and bluebunch wheatgrass.

This soil is suitable for irrigated crops if water is available. It is used mainly for livestock grazing and wildlife habitat. In places areas are used for the production of dryland hay and grain. Capability unit IVE-20, irrigated and

VIIIs-243, dryland; range site NV 23-22; wildlife suitability group 1.

**Donica gravelly sandy loam, 15 to 30 percent slopes (DrE).**—This soil occupies medium-sized scattered areas on higher alluvial fans and terrace escarpments along the west side of Surprise Valley. The profile is similar to the one described as representative for the series, but the range in slope is not so wide for this soil, and this soil has less gravel on the surface.

Included with this soil in mapping are areas of less sloping Donica very gravelly sandy loam. These areas make up about 2 percent of the acreage.

Runoff is medium, and the hazard of erosion is moderate. The native vegetation consists of big sagebrush, bitterbrush, and bluebunch wheatgrass.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIe-228, dryland; range site NV 23-22; wildlife suitability group 3.

**Donica gravelly sandy loam, 30 to 50 percent slopes (DrF).**—This soil occupies small areas at the upper end of the higher alluvial fans and terrace escarpments along the west side of Surprise Valley. It has a profile similar to the one described as representative for the series, but less gravel is on the surface of this soil.

Included with this soil in mapping are areas of Surprise soils that make up about 5 percent of the acreage mapped.

Runoff is medium on this soil, and the hazard of erosion is severe.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIe-228, dryland; range site NV 23-22; wildlife suitability group 3.

**Donica very gravelly sandy loam, 5 to 30 percent slopes (DsE).**—This soil occupies medium-sized areas on old beach terraces at the north end of Surprise Valley. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Surprise soils and stony Donica soils. They make up about 10 percent of the acreage mapped.

Runoff is medium on this soil, and the hazard of erosion is moderate.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIs-243, dryland; range site NV 23-22; wildlife suitability group 3.

**Donica very stony sandy loam, 2 to 15 percent slopes (DtC).**—This soil occupies medium-sized, irregularly shaped, scattered areas between Cottonwood Creek and Emerson Creek at the upper extremities of the alluvial fans and lake terraces. Stones and cobblestones cover 3 to 15 percent of the surface.

Included with this soil in mapping are areas of Donica and Surprise gravelly sandy loams. The inclusions make up about 10 percent of the acreage mapped.

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

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIs-243, dryland; range site NV 23-22; wildlife suitability group 3.

**Donica-Surprise complex (Du).**—This complex consists of moderately sloping to strongly sloping soils on higher parts of alluvial fans along the west side of Surprise

Valley. Areas are scattered and are long and narrow. This complex is about 50 percent Donica gravelly sandy loam that has a slope range of 5 to 15 percent and about 40 percent Surprise gravelly sandy loam, 5 to 15 percent slopes. The Donica soil has a very gravelly subsoil, and the Surprise soil has only a gravelly subsoil.

Included with this complex in mapping are areas of less sloping Donica very gravelly or stony sandy loam and Surprise gravelly sandy loam. These soils make up about 10 percent of the acreage mapped.

The available water capacity of the Donica soils is 3 to 4 inches, and runoff is slow. The available water capacity of the Surprise soils is 6 to 7 inches, and runoff is very slow to slow. The hazard of erosion is slight to moderate for both Donica and Surprise soils.

The Donica soil in this complex is not suitable for irrigated crops. Both the Donica and Surprise soils are used mainly for livestock grazing and wildlife habitat. A few minor areas of Surprise soils are planted in dryland grain and pasture. Donica part: Capability unit VII<sub>s</sub>-243, dryland; range site NV 23-22; wildlife suitability group 3. Surprise part: Capability unit IV<sub>e</sub>-20, irrigated and VI<sub>c</sub>-220, dryland; range site NV 23-22; wildlife suitability group 3.

## Espil Series

The Espil Series consists of well-drained soils that formed in valley-fill material derived from mixed basic rock. They are on terraces and truncated alluvial fans. A gravel pavement of andesite, basalt, and obsidium covers 60 percent of the surface. The slope range is 0 to 15 percent. Vegetation consists of low sagebrush, Sandberg bluegrass, Indian and Webber ricegrass, squirreltail, buckwheat, and phlox. The elevation ranges from 5,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 60 to 90 days.

In a representative profile the surface layer is grayish-brown, slightly acid gravelly sandy loam and gravelly sandy clay loam about 7 inches thick. Below this is brown gravelly light clay, about 2 inches thick, that contains discontinuous lenses of reddish-brown clay. The next layer is a variegated, pale-brown and brownish-yellow hardpan. It is at a depth of 9 inches.

Espil soils have very slow permeability. The effective rooting depth is 8 to 14 inches. Available water capacity is 1 to 2 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

Representative profile of Espil gravelly sandy loam, in Washoe County, Nevada, 10 feet west of the west quarter corner of sec. 26, T. 39 N., R. 21 E., Mount Diablo base line and meridian:

A11—0 to 3½ inches, grayish-brown (10R 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; massive, slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine, and few medium roots; many very fine vesicular pores; slightly acid (pH 6.4); abrupt, slightly wavy boundary. 1 to 3½ inches thick.

A12—3½ to 7 inches, grayish-brown (10YR 5/2) gravelly sandy clay loam, dark brown (10YR 3/3) moist; strong, very fine, granular structure; slightly hard, friable, sticky, plastic; many very fine and fine roots; many very fine interstitial pores; continuous colloidal coats on

sand grains; slightly acid (pH 6.4); abrupt, slightly wavy boundary. 3 to 7 inches thick.

B2t—7 to 9 inches, brown (7.5YR 5/4) gravelly light clay, dark brown (7.5YR 3/4) moist; moderate, fine and medium, subangular blocky structure; hard, firm, very sticky, very plastic; common very fine roots and few fine roots; common fine interstitial pores and few fine tubular pores; many thin and few moderately thick clay films on ped faces; in shallow depressions in the top of the hardpan are thin (¼ to ½ inch in diameter) discontinuous lenses of reddish-brown (5YR 4/4, dry and moist) clay that has strong, fine, prismatic structure; slightly acid (pH 6.4); abrupt, wavy boundary. 2 to 5 inches thick.

C1sim—9 to 15 inches, variegated, pale-brown and brownish-yellow (10YR 6/3 and 6/5) indurated hardpan, dark yellowish brown (10YR 4/4) moist; moderate, fine and medium, platy structure; extremely hard, extremely firm; common very fine roots matted on plate surfaces; many, thin to moderately thick, white (N 8/0) opalized silica laminae; many thick clay films on tops of plates in upper 3 inches; slightly acid (pH 6.5); clear, smooth boundary. 4 to 10 inches thick.

C2sim—15 to 31 inches, very pale brown (10YR 7/3) strongly silica-cemented conglomerate, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm; few, thin, (¼ to ½ inch in diameter), continuous strata of extremely hard silica-cemented laminae; many, very thin, unoriented silica laminae; slightly acid (pH 6.5).

In the A1 horizon colors have a dry value of 5 or 6, a moist value of 2.5 to 3.5, and a chroma of 2 or 3. The horizon is gravelly sandy loam or gravelly sandy clay loam and is massive or has weak, platy structure in the upper part and weak to strong, granular or subangular blocky structure in the lower part. In the B2t horizon colors have a hue of 5YR to 10YR, a dry value of 4 to 6, a moist value of 3 to 4, and a chroma of 3 or 4. This horizon is mainly light clay or clay but ranges to heavy clay loam in places. It has moderate or strong, fine or medium, subangular blocky or prismatic structure. The upper, indurated part of the hardpan is at a depth of 8 to 14 inches and is 4 to more than 18 inches thick.

**Espil-Badland association (EB).**—This association consists of soils on high terraces and their eroded, dissected, barren breaks. The soils are in small, irregularly shaped areas. This association is about 60 percent Espil gravelly sandy loam that has 0 to 15 percent slopes and about 30 percent Badland. Espil soils are on the upper part of terraces.

The Badland is steep to very steep and is on terrace breaks.

Included with this association in mapping are areas of Olson soils that make up about 10 percent of the total acreage.

The Espil soil has a native vegetation that consists mainly of low sagebrush. The Badland is nearly barren.

Neither soil is suitable for irrigated crops. The Espil soil is used mainly for livestock grazing and wildlife habitat. Badland has no practical use at the present time. Espil part: Capability unit VII<sub>s</sub>-231, dryland; range site NV 23-21; wildlife suitability group 8. Badland part: Capability unit VIII<sub>e</sub>-224, dryland; not placed in a range site; not placed in a wildlife suitability group.

**Espil and Fertaline soils (EF).**—This undifferentiated unit consists of soils in large, irregularly shaped areas on upland terraces. The unit is made up of Espil gravelly sandy loam that has 0 to 15 percent slopes and Fertaline gravelly fine sandy loam that has 0 to 9 percent slopes. The Espil soil has a dark-colored surface layer and a hardpan at a depth of 8 to 14 inches. The Fertaline soil has a light-

colored surface layer and a hardpan at a depth of 18 to 30 inches.

Included with these soils in mapping are areas of a similar soil that is cobbly, stony, and very stony. It makes up about 10 percent of the total acreage.

Both soils have a native vegetation that consists mainly of low sagebrush.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Espil and Fertaline parts: Capability unit VIIs-231, dryland; range site NV 23-21; wildlife suitability group 8.

**Espil-Mosquet association (EM).**—This association is made up of nearly level to strongly sloping soils in large, irregularly shaped areas in the northeastern part of the survey area. The soils are on terraces adjacent to nearly level to moderately steep soils on basaltic plateaus and mountain slopes. This association is about 70 percent Espil gravelly sandy loam and about 20 percent Mosquet very stony fine sandy loam and Rock outcrop. The Mosquet soil has 5 to 30 percent slopes, and the Espil soil has 0 to 15 percent slopes. The Espil soil has a hardpan within a depth of 14 inches, and the Mosquet soil has bedrock at a depth of less than 20 inches.

Included with this association in mapping are areas of Fertaline, Hart Camp, and Powley soils that make up about 10 percent of the total acreage.

These soils have a native vegetation that consists mainly of low sagebrush and some Sandberg bluegrass and Idaho fescue.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Espil part: Capability unit VIIs-231, dryland; range site NV 23-21; wildlife suitability group 8. Mosquet part: Capability unit VIIs-239, dryland; range site NV 23-14; wildlife suitability group 8.

**Espil-Powley association (EP).**—This association consists of nearly level to strongly sloping soils on upland terraces in small, irregularly shaped areas. The association is about 65 percent Espil gravelly sandy loam that has 0 to 15 percent slopes and about 25 percent Powley gravelly fine sandy loam, 2 to 15 percent slopes. The Espil soil has a hardpan at a depth of 8 to 14 inches, and the Powley soil has a hardpan at a depth of 15 to 20 inches.

Included with this association in mapping are Fertaline and Hart Camp soils and small gullied areas. They make up about 10 percent of the total acreage.

The Espil soil has a native vegetation that consists mainly of low sagebrush. The native vegetation on Powley soils consists of big sagebrush, Thurber needlegrass, and bluebunch wheatgrass.

The soils in this association are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Espil part: Capability unit VIIs-231, dryland; range site NV 23-21; wildlife suitability group 8. Powley part: Capability unit VIIs-231, dryland; range site NV 23-20; wildlife suitability group 7.

## Fertaline Series

The Fertaline series consists of well-drained soils that formed in alluvium derived mainly from siliceous tuffs and an admixture of basalt, andesite, and volcanic ash. These soils are on valley-fill terraces and tablelands interspersed with rolling hills. Pebbles of obsidium and andesite cover

25 to 30 percent of the surface. The slope range is 0 to 9 percent. Vegetation is low sagebrush, Sandberg bluegrass, Thurber needlegrass, and squirreltail. The elevation ranges from 5,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 70 to 80 days.

In a representative profile the surface layer is light brownish-gray to light-gray, slightly acid gravelly fine sandy loam and fine sandy loam about 7 inches thick. Below this is about 14 inches of brown clay that is neutral in the upper part and moderately alkaline in the lower part. The next layer is very pale brown, strongly alkaline sandy clay loam about 4 inches thick. A very pale brown indurated hardpan is at a depth of 25 inches.

Fertaline soils have very slow permeability. The effective rooting depth is 18 to 30 inches. Available water capacity is 3 to 4 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

In this area, Fertaline soils were mapped only in an undifferentiated unit with Espil soils.

Representative profile of Fertaline gravelly fine sandy loam, in Washoe County, Nevada, 50 feet northeast of the intersection of the runways of the Grass Valley airstrip in sec. 12, T. 37 N., R. 21 E., Mount Diablo base line and meridian:

- A1—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly fine sandy loam; dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky, nonplastic; many very fine and fine roots; many fine and medium vesicular pores; slightly acid (pH 6.4); clear, wavy boundary. 1 to 4 inches thick.
- A2—3 to 7 inches, light-gray (10YR 7/2) fine sandy loam, very dark gray (10YR 3/1) moist; massive; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; few fine interstitial and tubular pores and common fine and medium vesicular pores; many clean sand grains; slightly acid (pH 6.4); abrupt, slightly wavy boundary. 2 to 5 inches thick.
- B21t—7 to 10 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; strong, fine, columnar structure; extremely hard, very firm, very sticky, very plastic; common very fine and fine and few medium exped roots; few fine tubular pores; continuous pressure cutans; neutral (pH 6.6); clear, smooth boundary. 2 to 5 inches thick.
- B22t—10 to 15 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; strong, fine, angular blocky structure; very hard, friable, very sticky, very plastic; common very fine and fine and few medium exped roots; few fine tubular pores; continuous pressure cutans; neutral (pH 6.8); clear, smooth boundary. 4 to 6 inches thick.
- B23t—15 to 21 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; strong, fine, angular blocky structure; hard, friable, sticky, plastic; few fine and fine roots; few fine tubular pores; few pressure cutans; common moderately thick clay films on ped faces and many in pores; noneffervescent in matrix but effervescent in spots; moderately alkaline (pH 8.4); clear, smooth boundary. 4 to 8 inches thick.
- B3tea—21 to 25 inches, very pale brown (10YR 7/4) sandy clay loam, brown (7.5YR 4/4) moist; common, fine, faint, white (10YR 8/1) lime mottles; moderate, fine and medium, subangular blocky structure; hard, friable, sticky, plastic; few very fine and fine roots; few fine tubular pores; common thin clay films on ped faces and in pores; strongly effervescent; strongly alkaline (pH 8.6); abrupt, wavy boundary. 2 to 8 inches thick.
- Cs1cam—25 to 34 inches, very pale brown (10YR 7/4 and 8/4) indurated hardpan, light brown (7.5YR 6/4), light yellowish brown (10YR 6/4), and very pale brown

(10YR 7/4); moist; many, very thin, white (10YR 8/1 and N 8/0) lime and opal laminae; massive; extremely hard, extremely firm; common very fine interstitial pores; gray (N 6/0) pebbles; many thin (up to  $\frac{3}{8}$  inch diameter) opal laminae; silica bridges between sand grains and as coatings in pores; violently effervescent; strongly alkaline (pH 8.8).

In the A1 horizon colors have a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is gravelly loam or fine sandy loam and is massive or has weak, platy or granular structure. The A2 horizon generally is a unit higher in value or is lower in chroma than the A1 or B2t horizons. In the B2t horizon colors have a hue of 10YR or 7.5YR, a dry value of 4 to 6, a moist value of 4 or 5, and a chroma of 3 to 5. This horizon has strong, columnar structure in the upper part and prismatic or blocky structure in the lower part. The solum is 18 to 30 inches thick. It is underlain by an indurated hardpan.

## Four Star Series

The Four Star series consists of poorly drained and very poorly drained soils on flood plains and narrow canyon bottoms in mountainous areas. They formed in stratified alluvium derived from volcanic tuff and admixtures of rhyolite, basalt, and andesite. The slope range is 0 to 5 percent. Vegetation consists of sedges, carex, clover, bentgrass, and redtop. The elevation ranges from 4,400 to 6,500 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 42° to 45° F., and the frost-free season is 70 to 120 days.

In a representative profile a very dark brown root mat, about 3 inches thick, is on the surface. The surface layer is very dark gray loam and very dark grayish-brown sandy loam about 28 inches thick. It is underlain, to a depth of 44 inches, by dark greenish-gray sandy loam that contains dark-brown and dark grayish-brown iron mottles.

Four Star soils have moderately rapid permeability, except in the areas that have an unconformable clay stratum. In these areas the permeability is slow. The effective rooting depth is more than 60 inches. Available water capacity is 5 to 6 inches. Runoff is very slow, and the hazard of accelerated erosion is slight. The seasonal high water table is at a depth of 1 to 3 feet.

Representative profile of Four Star loam, in Modoc County, California, on the Four Star Ranch 1,300 feet east and 1,300 feet south of the northwest corner of sec. 1, T. 40 N., R. 16 E., Mount Diablo base line and meridian:

- O1—2½ inches to 0, dark grayish-brown (10YR 4/2) root mat, very dark brown (10YR 2/2) moist; massive; neutral (pH 6.8); clear, smooth boundary. 0 to 3 inches thick.
- A11—0 to 6 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; common, fine, distinct, dark-brown (7.5YR 3/2) iron mottles; weak, coarse, subangular blocky parting to moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine interstitial pores; neutral (pH 6.6); clear, wavy boundary. 5 to 13 inches thick.
- A12—6 to 28 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; many, fine and medium, faint, dark-brown (7.5YR 3/3) and distinct, yellowish-brown (10YR 5/6) iron mottles; few, coarse, prominent, dark greenish-gray (5BG 4/1) iron stains in lower part of horizon; massive; slightly hard, very friable, nonsticky, nonplastic; common very fine and fine roots; many very fine and few fine tubular pores; neutral (pH 6.6); diffuse, smooth boundary. 7 to 24 inches thick.

Cg—28 to 44 inches, grayish-brown (2.5Y 5/2) sandy loam, dark greenish gray (5BG 4/1) moist; common, fine, distinct, dark-brown (7.5YR 3/2) and common, coarse, distinct, very dark grayish-brown (10YR 3/2) iron mottles in the upper part; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; common very fine tubular pores and many very fine interstitial pores; slightly acid (pH 6.5).

These soils generally are noncalcareous throughout, but in places they range from weakly to strongly calcareous in the upper 6 to 10 inches. Reaction ranges from pH 6.2 to 7.3, except where the soil material is calcareous. In those areas reaction in the surface layer is as high as pH 8.0. Faint to prominent high-chroma mottles occur in places in all horizons. As depth increases they grade to low-chroma mottles that are faint to prominent. These soils have weak to moderate, fine to coarse, subangular blocky structure or are massive.

The A horizon is 10YR or 2.5Y in hue or is neutral. It has a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 0 to 2. In places in poorly drained areas this horizon is peat, 4 to 6 inches thick. The A12 horizon is dominantly fine sandy loam or sandy loam but in places is loam. This horizon is seldom more than 15 percent gravel. A buried A1 horizon is present in these soils in places.

The C horizon, when dry, ranges from 2.5Y to 5Y in hue or is neutral. When moist, hue in this horizon ranges from 2.5Y to 5BG or is neutral. In places dense, unconformable clay is below a depth of 40 inches.

**Four Star loam (Fo).**—This nearly level soil is on flood plains and low-lying alluvial fans in small, irregularly shaped areas along the west side of Surprise Valley. It has the profile described as representative for the series.

Included with this soil in mapping are areas of other Four Star soils and Husssa soils and a few marsh areas. These areas make up 5 percent of the total acreage.

Permeability is moderately rapid. The seasonal high water table is at a depth of 2 to 3 feet. The native vegetation consists mainly of sedges and other meadow plants.

This soil is suitable for irrigated crops. It is used mainly for production of meadow hay. If limited drainage is provided, alfalfa can be grown, but it is short lived. Capability unit IIIw-60, irrigated; not placed in a range site; wildlife suitability group 2.

**Four Star loam, cold (Fr).**—This nearly level soil is on flood plains and low-lying alluvial fans in small, irregularly shaped areas near Red Rock Lake. The profile is similar to the one described as representative for the series, but the soil is at higher elevations than is normal for the series, and the frost-free season is 70 to 90 days.

Included with this soil in mapping are areas of cold phases of Hovey and Husssa soils that make up 10 percent of the total acreage.

Permeability is moderately rapid. The seasonal high water table is at a depth of 2 to 3 feet. The native vegetation consists mainly of sedges.

This soil is suitable for irrigated crops if drainage is provided. It is used mainly for livestock grazing and wildlife habitat. It is also used for the production of native meadow. Small areas are cut for hay. Capability unit IVw-120, irrigated; not placed in a range site; wildlife suitability group 2.

**Four Star loam, seeped (Fs).**—This nearly level to gently sloping soil occupies small, irregularly shaped areas adjacent to springs and seeps along the west side of Surprise Valley, mainly near the Four Star Ranch. It is on alluvial fans. The profile is similar to the one described as representative for the series, except that it has a surface layer of peat 4 to 6 inches thick.

Included with this soil in mapping are areas of other soils that are very poorly drained and marshy and that make up about 10 percent of the total acreage.

Permeability is moderately rapid. This soil is kept wet by seepage from adjacent springs. Drainage is very poor. The seasonal high water table is at a depth of 1 to 2 feet throughout the year. The native vegetation consists mainly of water-tolerant plants, mostly sedges.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit Vw-60, irrigated; not placed in a range site; wildlife suitability group 2.

**Four Star loam, clay substratum (F<sub>1</sub>).**—This nearly level soil is on flood plains and low-lying alluvial fans in small, irregularly shaped areas along the west side of Surprise Valley, generally below Four Star loam. The profile is similar to the one described as representative for the series, except that it is underlain, at a depth of 40 inches or more, with dense, slowly permeable, lacustrine clay. A perched water table is above this clay substratum.

Included with this soil in mapping are areas of Husa soils and other poorly drained or very poorly drained soils. These areas make up 5 percent of the total acreage. Permeability is slow. Available water capacity is 8 to 9 inches. The seasonal high water table is at a depth of 2 to 3 feet. The native vegetation consists mainly of water-tolerant plants, mostly sedges.

This soil is suitable for irrigated crops if drainage is provided. It is used mainly for livestock grazing and wildlife habitat. A few small areas are cut for hay. Capability unit IIIw-63, irrigated; not placed in a range site; wildlife suitability group 2.

## Foxmount Series

The Foxmount series consists of well-drained soils that formed in residuum and colluvium derived from tuff. These soils are on mountains and ridgetops. The slope range is 15 to 30 percent. Vegetation consists of moderate to dense stands of curleaf mountain mahogany. The elevation ranges from 6,700 to 8,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 41° to 43° F., and the frost-free season is 30 to 45 days.

In a representative profile an organic mulch of mahogany leaves, about 2 inches thick, is on the surface. The surface layer is dark grayish-brown to grayish-brown, slightly acid gravelly loam about 9 inches thick. Below this is light brownish-gray, slightly acid gravelly loam about 18 inches thick. The next layer is light-gray very cobbly loam about 11 inches thick. Weathered tuff bedrock is at a depth of 38 inches.

Foxmount soils have moderate permeability. The effective rooting depth is 24 to 40 inches. Available water capacity is 6 to 7 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

Representative profile of Foxmount gravelly loam, 15 to 30 percent slopes, in Washoe County, Nevada, 400 feet north and 1,100 feet east of the south quarter corner of sec. 4, T. 36 N., R. 22 E., Mount Diablo base line and meridian:

O1—2 inches to 0, very dark brown (10YR 2/2) organic mulch of mountain mahogany leaves, black (10YR 2/1)

moist; slightly acid (pH 6.2); abrupt, smooth boundary. 0 to 3 inches thick.

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak, coarse, subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; slightly acid (pH 6.3); abrupt, slightly wavy boundary. 3 to 6 inches thick.

A12—4 to 9 inches, grayish-brown (10YR 5/2) gravelly loam, very dark brown (10YR 2/2) moist; weak, coarse, subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine and few medium interstitial pores; slightly acid (pH 6.4); abrupt, slightly wavy boundary. 3 to 6 inches thick.

B2—9 to 14 inches, light brownish-gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; few, fine and medium, light yellowish-brown (10YR 6/4) iron stains; weak, coarse, subangular blocky structure; slightly hard, friable, slightly plastic; few very fine and few medium roots; many very fine and fine interstitial pores and few very fine tubular pores; very few thin clay films on ped faces and in pores; slightly acid (pH 6.4); abrupt, smooth boundary. 4 to 9 inches thick.

B3—14 to 27 inches, light brownish-gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; few, fine, distinct, brown (7.5YR 5/4) iron stains and mottles; common fine and medium and few, coarse, distinct, light-brown (7.5YR 6/4) iron stains and mottles; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; many very fine and fine interstitial pores; few very thin clay films on ped faces and in pores; slightly acid (pH 6.4); abrupt, smooth boundary. 8 to 15 inches thick.

C—27 to 38 inches, light-gray (10YR 7/2) very cobbly loam, dark grayish brown (10YR 4/2) moist; common fine, medium and coarse, distinct, light-brown (7.5YR 6/4) iron mottles and stains; massive; slightly hard, friable, nonsticky, nonplastic; few very fine roots; many very fine and fine interstitial pores; slightly acid (pH 6.3); abrupt, irregular boundary. 6 to more than 30 inches thick.

R—38 inches, weathered tuff bedrock.

The A horizon ranges from 6 to 12 inches in thickness. In this horizon colors have a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 1 or 2. The A1 horizon is loam or sandy loam and is 10 to 30 percent gravel. It has weak or moderate, subangular blocky or granular structure. Colors in all horizons below the dark-colored surface layer have a hue of 10YR to 7.5YR, a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 2 to 4. The B2 horizon is loam or sandy loam and is 20 to 60 percent gravel. It has subangular blocky structure that is of at least moderate grade in some part of the horizon. Weathered tuff is at a depth of 24 to 40 inches.

**Foxmount gravelly loam, 15 to 30 percent slopes (FXE).**—This soil occupies large, irregularly shaped areas on Fox Mountain in the southeastern part of the survey area. It is on mountains and ridgetops.

Included with this soil in mapping are areas of Home Camp, Newlands, and Hapgood soils that make up about 10 percent of the total acreage. The soil is not suitable for irrigated crops. It is used mainly for limited livestock grazing and wildlife habitat. Capability unit VIe-200, dryland; not placed in a range site; wildlife suitability group 10.

## Gorzell Series

The Gorzell series consists of well-drained soils that formed in alluvium derived from mixed basic volcanics, including tuff, andesite, and basalt. They are on smooth,

high lacustrine terraces. The slope range is 2 to 30 percent. Vegetation consists of big sagebrush, spiny hopsage, Sandberg bluegrass, and squirreltail. The elevation ranges from 4,600 to 5,100 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 45° to 48° F., and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is light brownish-gray, neutral to mildly alkaline gravelly loam about 8 inches thick. Below this is light-gray, moderately alkaline gravelly clay loam about 4 inches thick. The underlying material to a depth of about 30 inches is light-gray, strongly alkaline gravelly light clay loam that is weakly cemented with silica. Below this depth and extending to a depth of more than 40 inches, the underlying material is light-gray, strongly alkaline very gravelly loamy sand.

Gorzell soils have moderately slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 6 to 7 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Gorzell gravelly loam, 2 to 15 percent slopes, in Modoc County, California, 150 feet north and east of the center of sec. 29, T. 45 N., R. 17 E., Mount Diablo base line and meridian:

A11—0 to 3 inches, light brownish-gray (2.5Y 6/2) gravelly loam, upper ½ inch is light gray (10YR 7/2); very dark grayish brown (10YR 3/2) moist; weak, medium, platy structure; slightly hard, friable, non-sticky, slightly plastic; many very fine and fine and few coarse roots; many fine and medium vesicular pores; neutral (pH 6.6); clear, smooth boundary. 2 to 4 inches thick.

A12—3 to 8 inches, light brownish-gray (10YR 6/2) gravelly loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine and few coarse roots; many very fine tubular and interstitial pores; effervescent; mildly alkaline (pH 7.8); clear, wavy boundary. 3 to 6 inches thick.

B2t—8 to 12 inches, light-gray (10YR 7/2) gravelly clay loam, dark grayish brown (10YR 4/2) moist; few to common, medium, faint pockets of brown (10YR 5/3); massive; hard, friable, sticky, plastic; common very fine and fine and few coarse roots; many very fine tubular and interstitial pores; common thin clay films at pebblesoil mass interfaces and in pores; few thin clay bridges; strongly effervescent; moderately alkaline (pH 8.0); clear, wavy boundary. 4 to 10 inches thick.

C1sica—12 to 30 inches, light-gray (10YR 7/2) gravelly light clay loam that is weakly silica-lime cemented, dark grayish brown (10YR 4/2) moist; massive; very hard, firm, nonsticky, nonplastic; common very fine and fine roots; many very fine tubular and interstitial pores; few to common randomly oriented silica laminate and common very thin silica films lining pores and bridging sand grains; violently effervescent; strongly alkaline (pH 8.6); clear, wavy boundary. 13 to 18 inches thick.

IIC2ca—30 to 46 inches, light-gray (10YR 7/2) very gravelly loamy sand, light brownish gray (10YR 6/2) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine and fine roots; many very fine and fine and few medium interstitial pores; violently effervescent; pebbles have white (10YR 8/2) lime coats on underside; strongly alkaline (pH 8.9).

The A1 horizon ranges from 5 to 10 inches in thickness. It has a hue of 10YR and 2.5Y, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. The A1 horizon is sandy loam or loam that is gravelly or stony and generally is massive. It has weak platy structure in places. In the Bt horizon dry value is 6 or 7, moist value is 3 or 4, and chroma is 2 to 4. It is gravelly sandy clay loam or gravelly clay loam and is massive

or has weak, subangular blocky structure. Reaction is mildly alkaline to strongly alkaline. The content of coarse fragments ranges from 15 to 35 percent. In the C horizon colors have a hue of 10YR to 2.5Y, a dry value of 6 to 8, a moist value of 4 to 6, and a chroma of 1 to 3. This horizon is weakly cemented with silica and lime. Depth to the IIC horizon ranges from 22 to 38 inches.

**Gorzell stony loam, 5 to 30 percent slopes (GRE).**—This soil is on old beach terraces in large, irregularly shaped bends in the northeastern and southern part of Surprise Valley. The profile is similar to the one described as representative for the series, except that the surface layer is stony rather than gravelly.

Included with this soil in mapping are areas of soils similar to Gorzell soils, except that they are very stony and are steeper. These areas make up about 10 percent of the total acreage.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIc-236, dryland; range site NV 23-6; wildlife suitability group 7.

**Gorzell gravelly loam, 2 to 15 percent slopes (GSC).**—This soil is on old lake terraces in large, irregularly shaped bands along the eastern side of Surprise Valley and Duck Flat. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of soils that have a sandy loam surface layer. Also included are a few small sand dunes, small stony areas, and a few small eroded areas. These areas make up about 10 percent of the total acreage.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Small areas have been cleared for growing dryland wheat, but cultivation of these areas has been abandoned. Capability unit VIc-220, dryland; range site NV 23-6; wildlife suitability group 7.

## Hapgood Series

The Hapgood series consists of well-drained soils that formed in alluvium derived from andesite, basalt, tuff, and pyroclastics. These soils are on mountains, in basins, in pockets, and on ridges. Areas generally have a northern exposure. The slope range is 5 to 75 percent. Vegetation consists of big sagebrush, bitterbrush, Idaho fescue, and aspen thickets. The elevation ranges from 6,000 to 8,500 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 50 to 70 days.

In a representative profile the surface layer is dark grayish-brown, slightly acid stony and gravelly fine sandy loam about 50 inches thick. This layer is underlain by fractured tuff bedrock.

Hapgood soils have moderate permeability. The effective rooting depth is more than 60 inches. Available water capacity is 7 to 8 inches.

Representative profile of Hapgood fine sandy loam, 5 to 30 percent slopes, in an area of Hapgood-Home Camp association, in Washoe County, Nevada, 1,200 feet north and 800 feet west of the southwest corner of sec. 12, T. 39 N., R. 18 E., Mount Diablo base line and meridian:

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) stony fine sandy loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; slightly hard,

very friable, slightly sticky, slightly plastic; many very fine to fine roots; many very fine and fine interstitial pores; slightly acid (pH 6.4); clear, smooth boundary. 0 to 6 inches thick.

A12—5 to 11 inches, very dark grayish-brown (10YR 4/2) gravelly fine sandy loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; many very fine and fine interstitial pores; neutral (pH 6.6); gradual, smooth boundary. 4 to 8 inches thick.

A13—11 to 50 inches, dark grayish-brown (10YR 4/2) gravelly fine sandy loam, very dark brown (10YR 2/2) moist; massive; hard, friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots above a depth of 30 inches, common, very fine and fine and few medium roots below; many very fine interstitial pores and few fine tubular pores; neutral (pH 6.6); abrupt, irregular boundary. 25 to 45 inches thick.

R—50 inches, very pale brown (10YR 7/3) fractured tuff bedrock.

The A1 horizon ranges from 20 to 55 inches in thickness. In this horizon hue is 10YR to 7.5YR, dry value is 4 or 5, moist value is 2 or 3, and chroma is 1 to 3. This horizon is fine sandy loam or loam that is nonstony, stony, or very stony. It has moderate or weak, granular or subangular blocky structure or is massive. Reaction is slightly acid or neutral. In the C horizon, if present, hue is 10YR to 7.5YR, dry value is 6 or 7, moist value is 3 to 5, and chroma is 2 or 3. This horizon is fine sandy loam, loam, or silt loam that is gravelly or very gravelly, cobbly or very cobbly, or stony or very stony. The content of coarse fragments increases with depth. Between depths of 10 to 40 inches 35 to 50 percent of the material, by weighted average, is coarse fragments. Depth to tuffaceous or andesitic bedrock ranges from 40 to more than 60 inches.

**Hapgood fine sandy loam, 5 to 30 percent slopes (HAE).**—This soil occupies irregularly shaped areas of various sizes throughout the survey area but mostly in the southern part of the Warner Mountains. In these areas winter snows accumulate and remain until late in the growing season.

Included with this soil in mapping are areas of Hapgood stony and very stony soils and areas of soils that are similar to Hapgood soils, except that bedrock is at a depth of less than 40 inches. Also included are small areas of Newlands, Snag, and Hartig soils. These areas have a vegetation consisting mainly of big sagebrush. They make up 20 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. The native vegetation is mainly aspen groves and thickets.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIIs-236, dryland; not placed in a range site; wildlife suitability group 10.

**Hapgood very stony fine sandy loam, 50 to 75 percent slopes (HDG).**—This soil is on mountains in fairly large, irregularly shaped areas. This soil is more steeply sloping than the one described as representative for the series. The profile is similar except that the surface layer of this soil is 3 to 15 percent stony.

Included with this soil in mapping are areas of Rubble land and Rock outcrop. Also included are less stony areas of less sloping Hapgood soil and areas of soils that are similar to Hapgood soils, except that bedrock is at a depth of less than 40 inches.

Runoff is very rapid, and the hazard of erosion is severe. The native vegetation is mainly big sagebrush, bitterbrush, and Idaho fescue.

This soil is not suitable for irrigated crops. It is used mainly for limited livestock grazing and wildlife habitat.

Capability unit VIIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

**Hapgood-Home Camp association (HF).**—This association consists of moderately sloping to moderately steep soils in small, irregularly shaped areas on mountains. The association is about 55 percent Hapgood stony fine sandy loam that has 5 to 30 percent slopes and about 35 percent Home Camp stony loam that has 5 to 30 percent slopes. The Hapgood soil has a loamy subsoil, and stones cover about 10 percent of the surface. The Home Camp soil has a clayey subsoil and is 20 to 40 inches deep to bedrock.

Included with this soil in mapping are areas of Newlands soil and areas of soils similar to Hapgood soils, except that they are less than 40 inches deep to bedrock. Also included are areas of very stony Hapgood soils and a few small areas of Rock outcrop. These areas make up about 10 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. These soils have a native vegetation that consists of big sagebrush and bitterbrush.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Hapgood and Home Camp parts: Capability unit VIIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

**Hapgood-Snag association (HG).**—This association consists of moderately sloping to moderately steep soils in small, irregularly shaped areas on mountains. This association is about 50 percent Hapgood stony fine sandy loam that has 5 to 30 percent slopes and about 45 percent Snag stony fine sandy loam that has 5 to 30 percent slopes. The Hapgood soil is 35 to 50 percent coarse fragments, by weighted average, and it is slightly acid throughout. The Snag soil is 50 to 75 percent coarse fragments, by weighted average, and it is medium acid throughout.

Included with this soil in mapping are areas of nonstony Hapgood and Snag soils, and areas of soils that are similar to Hapgood and Snag soils, except that they are less than 40 inches deep to bedrock. These areas make up about 5 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. The Hapgood soil has a native vegetation that consists of big sagebrush, bitterbrush, needlegrasses, and snowbrush.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. They are also used for watershed. Hapgood part: Capability unit VIIIs-236, dryland; range site NV 23-7; wildlife suitability group 6. Snag part: Capability unit VIIIs-211, dryland; range site NV 23-19; wildlife suitability group 6.

**Hapgood and Newlands soils (HH).**—This undifferentiated unit consists of soils in small, irregularly shaped areas on mountains. The unit is made up of Hapgood very stony fine sandy loam and Newlands very stony loam. These soils have 30 to 50 percent slopes. The Hapgood soil has a loamy subsoil that is 35 to 50 percent coarse fragments. The Newlands soil has a heavy clay loam or heavy sandy clay loam subsoil that is less than 35 percent coarse fragments.

Included with this soil in mapping are areas of stony Hapgood, Newlands, and Snag soils and areas of soils that are similar to Hapgood soils, except that they have bedrock at a depth of 40 inches or less. These areas make up 15 percent of the total acreage.

Runoff is rapid, and the hazard of erosion is severe. These soils have a native vegetation that consists mainly of big sagebrush.

These soils are not suitable for irrigated crops. They are used for livestock grazing and wildlife habitat. Hapgood and Newlands parts: capability unit VII<sub>s</sub>-236, dryland; range site NV 23-7; wildlife suitability group 6.

**Hapgood-Snag-Newlands association (H).**—This association consists of moderately sloping to moderately steep soils in small, scattered, irregularly shaped areas on mountains. This association is about 50 percent Hapgood very stony sandy loam that has 5 to 30 percent slopes, about 20 percent Snag very stony sandy loam that has 5 to 30 percent slopes, and 20 percent Newlands very stony loam that has 5 to 30 percent slopes. The Hapgood soil has a loamy subsoil and is 35 to 50 percent coarse fragments, by weighted average. It is slightly acid in reaction. The Snag soil has a loamy subsoil, and it is 50 to 75 percent coarse fragments, by weighted average. This soil is medium acid in reaction. The Newlands soil has a clay loam subsoil that is less than 35 percent coarse fragments and is slightly acid in reaction.

Included with this soil in mapping are areas of very stony Newlands and Hapgood soils and shallow soils similar to Snag soils. These areas make up 10 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. These soils have a native vegetation that consists mainly of big sagebrush.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing, wildlife habitat, and watershed. Hapgood part: Capability unit VII<sub>s</sub>-236, dryland; range site NV 23-7; wildlife suitability group 6. Snag part: Capability unit VII<sub>s</sub>-211, dryland; range site NV 23-19; wildlife suitability group 6. Newlands part: Capability unit VII<sub>s</sub>-236, dryland; range site NV 23-7; wildlife suitability group 6.

## Hart Camp Series

The Hart Camp series consists of well-drained soils that formed on pediments and plateaus in residuum derived from basalt, andesite, tuff, and pyroclastics. The slope range is 2 to 15 percent. The vegetation is big sagebrush, Thurber needlegrass, bluebunch wheatgrass, basin wildrye, and squirreltail. The elevation ranges from 5,500 to 6,500 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 42° to 45° F., and the frost-free season is 50 to 80 days.

In a representative profile the surface layer is about 3 inches of brown to pale-brown gravelly fine sandy loam and fine sandy loam. The subsoil is brown light sandy clay loam in the upper 7 inches and brown gravelly sandy clay loam in the lower 3 inches. Light yellowish-brown tuff bedrock is at a depth of about 13 inches.

The Hart Camp soils have moderately slow permeability. The effective rooting depth is 10 to 20 inches. Available water capacity is 2 to 3 inches. Runoff is medium, and the hazard of accelerated erosion is slight to moderate.

Representative profile of Hart Camp gravelly fine sandy loam, 2 to 15 percent slopes, in Washoe County, Nevada, in an area of Powley-Espil association near the northwest

corner of section 27, T. 40 N., R. 19 E., Mount Diablo base line and meridian:

A11—0 to 1½ inches, brown (10YR 5/3) gravelly fine sandy loam, very dark grayish-brown (10YR 3/2) moist; massive; soft, very friable, nonsticky, nonplastic; root crowns only; many very fine and fine vesicular and interstitial pores; slightly acid (pH 6.3); abrupt, smooth, boundary. 1 to 4 inches thick.

A12—1½ to 3 inches, pale-brown (10YR 6/3) fine sandy loam, very dark grayish-brown (10YR 3/2) moist; massive; slightly hard; very fine and fine vesicular pores; slightly acid (pH 6.3); clear, smooth boundary. 0 to 2 inches thick.

B1t—3 to 10 inches, brown (10YR 5/3) light sandy clay loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure; slightly hard, friable, sticky, plastic; many very fine and fine roots; common very fine and fine interstitial and tubular pores; slightly acid (pH 6.4); abrupt, slightly wavy boundary. 3 to 8 inches thick.

B2t—10 to 13 inches, brown (10YR 5/3) gravelly sandy clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; slightly hard, friable, sticky, plastic; many very fine and fine roots; many very fine and fine interstitial and tubular pores; common thin clay films on ped faces and many thin clay films in pores; neutral (pH 6.7); abrupt, irregular boundary. 3 to 7 inches thick.

R—13 to 20 inches, light yellowish-brown (10YR 6/4) tuff bedrock.

In the A1 horizon colors have a dry value of 4 to 6, a moist value of 2 or 3, and a chroma of 2 or 3. This horizon ranges in texture from gravelly fine sandy loam to loam. It has weak or moderate platy structure, fine to medium granular structure, or is massive. Reaction in the A1 horizon is pH 6.2 to 6.6. In the B2t horizon hue is 10YR or 7.5YR, value is 4 to 6 dry and 2 to 3 moist, and chroma is 2 to 4. The B2t horizon is sandy clay loam or clay loam. It has moderate to strong, fine to coarse, angular or subangular blocky structure. Reaction ranges from pH 6.4 to 7.0. The thickness of the solum and depth to bedrock range from 10 to 20 inches.

Hart Camp soils are mapped only as a part of the Powley-Espil association (PH).

## Hartig Series

The Hartig series consists of well-drained soils that formed in alluvium and colluvium derived from basalt, andesite, tuff, and pyroclastics. These soils are on uplands. The slope range is 5 to 30 percent. Vegetation consists of big sagebrush, bluebunch wheatgrass, and Thurber needlegrass. The elevation ranges from 5,500 to 7,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 50 to 80 days.

In a representative profile the surface layer is grayish-brown gravelly loam or gravelly sandy loam about 15 inches thick. The underlying material is light brownish-gray gravelly sandy loam and pale-brown gravelly and cobbly sandy loam about 17 inches thick. Hard tuff bedrock is at a depth of 32 inches.

Hartig soils have moderate permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 6 to 7 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Hartig gravelly loam in an area of Hartig-Hapgood association in Washoe County, Nevada; 1,300 feet north and 1,300 feet east of the southwest corner of sec. 2, T. 39 N., R. 22 E., Mount Diablo base line and meridian:

A11—0 to 2 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; massive;

soft, friable, nonsticky, nonplastic; common very fine and fine roots; many very fine interstitial pores; slightly acid (pH 6.4); abrupt, smooth boundary. 2 to 4 inches thick.

- A12—2 to 7 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular parting to weak, medium, granular structure; soft, very friable, very slightly sticky, nonplastic; many very fine and fine roots; many very fine and few fine interstitial pores; slightly acid (pH 6.4); clear, smooth boundary. 4 to 6 inches thick.
- A13—7 to 15 inches, grayish-brown (10YR 5/2) gravelly sandy loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; many very fine tubular pores; few thin clay films as bridges; neutral (pH 6.); gradual, smooth boundary. 5 to 10 inches thick.
- B2—15 to 21 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure; soft, very friable, very slightly sticky, nonplastic; common very fine and fine roots; common very fine interstitial pores and few fine tubular pores; few thin clay films as bridges; neutral (pH 6.6); clear, smooth boundary. 5 to 10 inches thick.
- B3—21 to 32 inches, pale-brown (10YR 6/3) gravelly and cobbly sandy loam, dark yellowish brown (10YR 3/4) moist; weak, medium, subangular blocky structure; soft, very friable, very slightly sticky, nonplastic; common very fine and fine roots; common very fine and fine interstitial pores and few fine tubular pores; few thin clay bridges; neutral (pH 6.6); abrupt, irregular boundary. 5 to 12 inches thick.
- R—32 inches, hard tuff bedrock.

In the A horizon colors have a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 2 or 3. This horizon is loam, fine sandy loam, or sandy loam in texture and is 10 to 40 percent coarse fragments. It is gravelly, cobbly, or stony in places. This horizon is massive or has weak, subangular blocky or weak to moderate, granular structure. Reaction is slightly acid to neutral. In the B horizon colors have a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. The B2 and B3 horizons have the same range in texture as the A horizon but are 35 to 50 percent gravel and cobblestones. They are massive, or have weak, subangular blocky structure. Bedrock is at a depth of 20 to 40 inches.

Hartig soils, as mapped in this area, differ from the central concept of the series by having bedrock at a depth of 20 to 40 inches and by generally being dry in most years.

**Hartig-Hapgood association (HK).**—This association consists of moderately sloping to steep soils on uplands in large uniformly shaped areas and small scattered areas. This association is about 40 percent Hartig gravelly loam that has 15 to 30 percent slopes, about 30 percent Hapgood stony fine sandy loam that has 5 to 30 percent slopes, and 20 percent Mosquet very stony fine sandy loam that has 5 to 30 percent slopes and Rock outcrop. Rock outcrop makes up 10 percent of Mosquet soils. The Hartig soil has convex slopes that have a southerly exposure. It has a dark-colored surface layer less than 20 inches thick. The Hapgood soil has concave slopes that have a northerly exposure. This soil has a dark-colored surface layer that is more than 20 inches thick. The Mosquet soil is shallow over bedrock and is below the mountain ridgetops.

Included with this association in mapping are areas of Home Camp, Bregar, and Newlands soils and many small areas of Rock outcrop. These areas make up about 10 percent of the total acreage.

The Hartig soil has a native vegetation that consists of big sagebrush, bluebunch wheatgrass, and Thurber needlegrass. The native vegetation on the Hapgood soil consists of big sagebrush, bitterbrush, and Idaho fescue. The Mos-

quet soil has a native vegetation that consists mainly of low sagebrush, Idaho fescue, and Sandberg bluegrass.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Hartig part: Capability unit VIe-200, dryland; range site NV 23-16; wildlife suitability group 6. Hapgood part: Capability unit VIIs-236, dryland; range site NV 23-7; wildlife suitability group 6. Mosquet part: Capability unit VIIs-239, dryland; range site NV 23-14; wildlife suitability group 8.

## Home Camp Series

The Home Camp series consists of well-drained soils on mountain slopes. They formed in alluvium and residuum derived from basalt, andesite, tuff, and pyroclastics. The slope range is 5 to 50 percent. Vegetation consists of big sagebrush, bitterbrush, and Idaho fescue. The elevation ranges from 5,500 to 7,500 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 50 to 80 days.

In a representative profile the surface layer is grayish-brown, slightly acid stony loam and gravelly loam about 8 inches thick. Below this is brown, slightly acid gravelly sandy clay loam about 10 inches thick. The next layer is pale-brown, neutral gravelly clay about 9 inches thick. Below it is gravelly sandy clay loam about 9 inches thick. Very pale brown tuff bedrock is at a depth of 36 inches.

Home Camp soils have moderately slow permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 5 to 6 inches. Runoff is medium.

Representative profile of Home Camp stony loam in an area of Home Camp-Newlands association in Washoe County, Nevada, 300 feet east and 800 feet south of the west quarter corner of sec. 12, T. 38 N., R. 20 E., Mount Diablo base line and meridian:

- A11—0 to 2½ inches, grayish-brown (10YR 5/2) stony loam, very dark brown (10YR 2/2) moist; massive; soft, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine and fine vesicular pores; slightly acid (pH 6.4); abrupt, smooth boundary. 1 to 3 inches thick.
- A12—2½ to 8 inches, grayish-brown (10YR 5/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores and few very fine tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary. 4 to 8 inches thick.
- B11t—8 to 14 inches, brown (10YR 5/3) gravelly sandy clay loam, dark brown (10YR 3/3) moist; moderate, fine and medium, subangular blocky structure; hard, friable, sticky, plastic; common very fine and few fine roots; many very fine and fine interstitial pores; few thin clay films on ped faces; slightly acid (pH 6.5); abrupt smooth boundary. 0 to 6 inches thick.
- B12t—14 to 18 inches, brown (10YR 5/3) gravelly sandy clay loam, dark brown (10YR 3/3) moist; moderate, fine and medium, subangular structure; very hard, friable, sticky, plastic; few very fine and fine roots; common very fine and fine interstitial pores; common thin and very few moderately thick clay films on ped faces and continuous thin clay films in pores; slightly acid (pH 6.5); abrupt, slightly wavy boundary. 3 to 5 inches thick.
- B2t—18 to 27 inches, pale-brown (10YR 6/3) gravelly clay, brown (7.5YR 4/4) moist; very dark brown (7.5YR

4/2) and brown (10YR 5/4) clay films; weak, fine and medium, prismatic structure parting to strong, very fine and fine, angular blocky structure; very hard, firm, very sticky, very plastic; few very fine and fine roots; common very fine and fine interstitial pores; continuous moderately thick clay films on ped faces and common moderately thick and thick clay films in pores; neutral (pH 6.6); abrupt, slightly wavy boundary. 8 to 18 inches thick.

B3t—27 to 36 inches, very pale brown (10YR 7/3) gravelly sandy clay loam, very dark brown (7.5YR 4/2) and yellowish brown (10YR 5/4) moist; moderate, fine, subangular blocky structure; hard, friable, sticky, plastic; few very fine and fine roots; common very fine and fine interstitial pores; few moderately thick and common thin clay films on ped faces; neutral (pH 7.0); abrupt, smooth boundary. 0 to 24 inches thick.

R—36 to 40 inches, very pale brown (10YR 7/3) tuff bedrock, brown (10YR 5/3) moist.

The colors in the A1 horizon have a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 2 or 3. The A1 horizon is stony loam and sandy loam and is massive or has weak to moderate, granular structure. The B2t horizon ranges from 10YR to 7.5YR in hue, has a dry value of 4 to 6, a moist value of 3 or 4, and a chroma of 2 to 4. It is 30 to 50 percent gravel, cobbles, and stones, and it has moderate to strong, angular or subangular blocky structure. Reaction is slightly acid to neutral. The depth to bedrock ranges from 20 to 40 inches, but is 24 to 40 inches in most places.

**Home Camp-Hapgood association (H1).**—This association consists of moderately sloping to moderately steep soils in scattered, irregularly shaped areas in the Warner Mountains. This association is about 60 percent Home Camp stony loam that has 5 to 30 percent slopes and about 30 percent Hapgood fine sandy loam, 5 to 30 percent slopes. The Home Camp soil is on open mountainsides and has a clayey subsoil. The Hapgood soil has a loamy subsoil and is in concave pockets where the snow accumulates and remains late into the growing season.

Included with this association in mapping are areas of soils similar to Home Camp soils that are more than 40 inches deep to bedrock. Also included are areas of stony and very stony Hapgood soils and of small areas of Rock outcrop. These areas make up about 10 percent of the total acreage.

These soils have a moderate hazard of erosion. The Home Camp soil has a native vegetation that consists of big sagebrush, bitterbrush, and Idaho fescue. The native vegetation on the Hapgood soil consists mainly of aspen groves and thickets.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Home Camp part: Capability unit VIIs-236, dryland; range site NV 23-7; wildlife suitability group 6. Hapgood part: Capability unit VIIs-236, dryland; not placed in a range site; wildlife suitability group 10.

**Home Camp-Newlands association, hilly (HME).**—This association consists of moderately sloping to moderately steep soils in large, irregularly shaped areas on mountains throughout the survey area. Slopes generally face north, but at higher elevations they face other directions. This association is about 65 percent Home Camp stony loam that has 5 to 30 percent slopes and about 25 percent Newlands stony loam that has 5 to 30 percent slopes. The Home Camp soil has a gravelly clay subsoil. The Newlands soil has a heavy clay subsoil.

Included with this association in mapping are areas of Hapgood soils, Rock outcrop, and Rubble land. These areas make up about 10 percent of the total acreage.

The hazard of erosion is moderate. These soils have a native vegetation that consists of big sagebrush, bitterbrush, and Idaho fescue.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Home Camp and Newlands parts: Capability unit VIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

**Home Camp-Newlands association, steep (HMF).**—This association consists of steep soils in scattered, irregularly shaped areas on mountains. It is about 55 percent Home Camp very stony loam that has 30 to 50 percent slopes and about 25 percent Newlands very stony loam that has 30 to 50 percent slopes. The Home Camp soil has a clay subsoil. The Newlands soil has a clay loam subsoil.

Included with this association in mapping are areas of other Home Camp and Newlands soils, Madeline and Mendoube soils, Rock outcrop, and Rubble land. These areas make up about 20 percent of the total acreage.

The hazard of erosion is severe. These soils have a native vegetation that consists of big sagebrush, bitterbrush, and Idaho fescue.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing, wildlife habitat, and watershed. Home Camp and Newlands parts: Capability unit VIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

## Hovey Series

The Hovey series consists of poorly drained soils that formed in lake-laid silty alluvium derived from mixed basic rocks. These soils are on flood plains or enclosed basins. The slope range is 0 to 2 percent. Vegetation consists of sedges, wire grass, and other water-tolerant grasses and forbs. The elevation ranges from 4,300 to 6,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 70 to 120 days.

In a representative profile the surface layer is covered by an organic surface mat, about 2 inches thick, that is mostly decomposed grasses. The surface layer is gray, strongly alkaline silty clay loam about 8 inches thick. The underlying material is light-gray or light brownish-gray, strongly alkaline to moderately alkaline silty clay loam to a depth of 70 inches. These soils are nonsaline to slightly saline.

Hovey soils have slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 11 to 12 inches. Runoff is very slow, and the hazard of accelerated erosion is slight. The seasonal high water table is at a depth of 2 to 3 feet during most of the growing season, but drops below a depth of 30 inches late in summer and in fall.

Representative profile of Hovey silty clay loam, in Modoc County, California, 350 feet south and 1,200 feet west of the north quarter corner of sec. 23, T. 46 N., R. 16 E., Mount Diablo base line and meridian:

O1—2 inches to 0, organic mat, mostly of decomposed grasses.  
1 to 4 inches thick.

A11—0 to 3 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, sticky, plastic; many very fine and fine roots; common very fine and fine tubular pores; weakly effervescent; strongly alkaline (pH 8.8); clear, smooth boundary. 2 to 6 inches thick.

A12—3 to 8 inches, gray (10YR 6/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky, plastic; common very fine and fine roots; many very fine and fine tubular pores; strongly effervescent; strongly alkaline (pH 8.6); clear, smooth boundary. 3 to 17 inches thick.

C1ca—8 to 30 inches, light-gray (10YR 7/2) silty clay loam, brown (2.5YR 5/2) moist; common, medium, faint, dark grayish-brown (2.5Y 4/2) iron mottles; massive; slightly hard, friable, slightly sticky, plastic; few very fine and fine roots; many very fine and fine tubular pores; violently effervescent; strongly alkaline (pH 8.5); gradual, smooth boundary. 6 to 26 inches thick.

C2—30 to 46 inches, light brownish-gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; common, fine, distinct, gray (10YR 5/1) and light-gray (10YR 7/1) organic and iron mottles; massive; slightly hard, friable, sticky, plastic; few fine roots; many very fine and fine tubular pores; strongly effervescent; strongly alkaline (pH 8.5); clear, smooth boundary. 10 to 20 inches thick.

C3—46 to 70 inches, light brownish-gray (10YR 6/2) silty clay loam, grayish brown (2.5YR 5/2) moist; common, medium and fine, distinct, light-gray (10YR 7/1), dark-gray (10YR 4/1), dark-brown (10YR 3/3), and olive (5Y 4/3) organic and iron mottles; massive; hard, friable, sticky, plastic; few fine roots; few very fine pores; weakly effervescent, violently effervescent in lime mottles, moderately alkaline (pH 8.4).

The A horizon ranges from 7 to 25 inches in thickness. Colors range from 10YR to 2.5Y in hue and have a dry value of 5 or 6. This horizon is silt loam to silty clay loam. In the Cca horizon colors range from 10YR to 2.5Y in hue. They have a dry value of 7 or 8, a moist value of 4 to 6, and a chroma of 1 or 2. This horizon ranges from heavy silt loam to silty clay loam. The C horizon is similar to the Cca horizon, but the color is a unit lower in value, both dry and moist.

**Hovey silty clay loam (Hh).**—This nearly level soil is in fairly large, irregularly shaped areas on flood plains and in enclosed basins. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of soils that are similar to Hovey soils but have an organic surface layer 6 to 8 inches thick. These areas make up about 5 percent of the total acreage.

The native vegetation consists mainly of sedges, wire grass, and other water-tolerant grasses and forbs. The frost-free season is 100 to 120 days.

This soil is suitable for irrigated crops if drainage is provided. It is used mainly for livestock grazing and meadow hay. Capability unit IIIw-60, irrigated; not placed in a range site; wildlife suitability group 2.

**Hovey silty clay loam, cold (Ho).**—This nearly level soil is in small, irregularly shaped areas in basins. The profile of this soil is similar to the one described as representative for the series, but this soil is at an elevation of about 6,000 feet and has a 70 to 90 day frost-free season.

Included with this soil in mapping are areas of cold phases of Husa and Four Star soils that make up about 5 percent of the total acreage.

The native vegetation consists mainly of sedges, wire grass, and other water-tolerant grasses and forbs.

The soil is suitable for irrigated crops if drainage is provided. It is used for livestock grazing and native

meadow hay. Capability unit IVw-120, irrigated; not placed in a range site; wildlife suitability group 2.

## Husa Series

The Husa series consists of poorly drained and very poorly drained soils that formed in stratified loamy alluvium derived from tuff, basalt, andesite, and rhyolite. These soils are on alluvial flood plains and fans. The slope range is 0 to 9 percent. Vegetation consists of sedges, clover, bentgrass, redtop, and bluegrass. The elevation ranges from 4,500 to 6,000 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 42° to 45° F., and the frost-free season is 70 to 120 days.

In a representative profile the surface layer is stratified, very dark gray and black, strongly alkaline clay loam and loam about 23 inches thick. The underlying material is stratified, black, dark grayish-brown, and grayish-brown, moderately alkaline clay loam, sandy clay loam, and silty clay loam to a depth of 60 inches.

Husa soils generally have moderately slow permeability. They have very slow permeability where they are underlain by clay. The effective rooting depth is more than 60 inches. Available water capacity is 11 to 12 inches. The seasonal high water table is at a depth of 1 to 4 feet and depends upon the degree of artificial drainage provided.

Representative profile of Husa clay loam, 0 to 2 percent slopes, in Modoc County, California, 2,000 feet east and 250 feet north of the southwest corner of sec. 10, T. 42 N., R. 16 E., Mount Diablo base line and meridian:

A11—0 to 2 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; moderate, fine and medium, subangular blocky structure; very hard, friable, slightly sticky, plastic; many very fine and medium roots; many very fine interstitial pores; violently effervescent; strongly alkaline (pH 8.8); abrupt, smooth boundary. 2 to 6 inches thick.

IIA12—2 to 12 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; strong, medium and fine, granular structure; hard, friable, slightly plastic; slightly sticky; many fine and medium roots; many very fine interstitial pores; violently effervescent; strongly alkaline (pH 8.6); diffuse, smooth boundary. 0 to 15 inches thick.

IIA13—12 to 20 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; fine, distinct, white (10YR 8/2) lime segregations; moderate, medium and coarse, subangular blocky structure; hard, friable, sticky, plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; violently effervescent; strongly alkaline (pH 8.6); clear, smooth boundary. 6 to 10 inches thick.

IIIA14—20 to 23 inches, dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; common, fine, distinct, white (10YR 8/2) lime segregations; moderate, medium and coarse, subangular blocky structure; hard, friable, sticky, plastic; few very fine roots; many very fine and fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.0); clear, smooth boundary. 0 to 8 inches thick.

IIIC1—23 to 30 inches, light brownish-gray (2.5Y 6/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; common, coarse, distinct, black (10YR 2/1) organic stains; common, fine, distinct, white (10YR 8/2) lime segregations; massive; slightly hard, friable, sticky, plastic; few very fine roots; many very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0); clear, wavy boundary. 5 to 20 inches thick.

IVA1b—30 to 36 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; massive; hard, friable, sticky,

plastic; few very fine roots; many very fine tubular pores; effervescent; moderately alkaline (pH 8.0); diffuse, smooth boundary. 0 to 8 inches thick.

VC2—36 to 60 inches, pale-brown (10YR 6/3) silty clay loam, grayish brown (2.5Y 5/2) moist; few, fine, distinct, yellowish-brown (10YR 5/4) iron mottles; common, fine, distinct, dark-gray (10YR 4/1) organic stains; common, fine, distinct, white (10YR 8/2) lime segregations; massive; hard, friable, sticky, plastic; few fine roots; common very fine tubular pores; violently effervescent; moderately alkaline (pH 8.0).

A root mat, as much as 4 inches thick, is in uncultivated areas. The A1 horizon is 18 to 24 inches thick. The colors in the A1 horizon range from 10YR to 2.5Y in hue, have a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 1 or 2. This horizon has moderate to strong, granular or subangular blocky structure or is massive. The 10- to 40-inch zone is mainly clay loam, but includes strata of loam, sandy clay loam, or silty clay loam in places. In the C horizon the colors range from 10YR to 5Y in hue, have a dry value of 5 or 6, a moist value of 3 to 5, and a chroma of 1 to 3. Iron, manganese, or organic mottles are in the C horizon. These soils are calcareous throughout the upper 20 to 30 inches and are noncalcareous below this depth in places. Some areas are slightly to moderately saline.

**Hussa loam, drained, 0 to 2 percent slopes (HrA).**—This soil is in fairly large, long, narrow, irregularly shaped areas on alluvial fans. The profile is similar to the one described as representative for the series, except that the surface layer is loam. Unlike the representative soil, this soil has been partly drained by deep gullies.

Included with this soil in mapping are areas of undrained Hussa soils and of Hovey and Lolak soils. These areas make up about 2 percent of the total acreage.

The frost-free season is 100 to 120 days. Runoff is slow, and the hazard of erosion is slight. The seasonal high water table is at a depth of 3 to 4 feet. Interception and control of water on areas above this soil has lowered the water table. Additional drainage is needed in places to achieve optimum suitability for crops. The native vegetation consists mainly of sedges, clover, bentgrass, redbud, and bluegrass.

This soil is suitable for irrigated crops and is used mainly for hay, small grain, and some pasture. A few areas are also dryfarmed for hay and small grain. Capability unit IIw-60, irrigated and VIw-200, dryland; range site NV 23-13; wildlife suitability group 2.

**Hussa loam, drained, 2 to 5 percent slopes (HrB).**—This soil is in fairly large, long, narrow, irregularly shaped areas on dissected alluvial fans. The profile of this soil is similar to the one described as representative for the series, except that the surface layer is loam. Also, this soil is slightly steeper.

Included with this soil in mapping are areas of undrained Hussa soils and Hovey and Lolak soils. These areas make up about 2 percent of the total acreage.

The frost-free season is 100 to 130 days. Runoff is medium, and the hazard of erosion is moderate. The seasonal high water table is at a depth of 3 to 4 feet. Interception and control of water on areas above this soil has lowered the water table. Deep gullies have resulted in partial drainage. Additional drainage is needed to achieve optimum suitability for crops. The native vegetation consists mainly of sedges, clover, bentgrass, redbud, and bluegrass.

This soil is suitable for irrigated crops and is used mainly for irrigated hay, small grain, and pasture. A few areas are dryfarmed. Capability unit IIw-62, irrigated and VIw-200, dryland; range site NV 23-13; wildlife suitability group 2.

**Hussa loam, slightly saline-alkali, 0 to 2 percent slopes (HsA).**—This soil is in small, irregularly shaped areas on lake terraces. The profile is similar to the one described as representative for the series, except that the surface layer is loam, and the soil material is slightly saline-alkali affected.

Included with this soil in mapping are areas of Couch and Raglan soils and soils that are similar to Hussa soils, except they are slightly eroded. These areas make up about 5 percent of the total acreage.

The frost-free season is 100 to 130 days. Runoff is slow and the hazard of erosion is slight. The seasonal high water table is at a depth of 3 to 4 feet. The native vegetation consists mainly of sedges and saline- and alkali-tolerant plants.

This soil is suitable for irrigated crops if drainage is provided. It is used mainly for livestock grazing and wildlife habitat. Small areas have been planted in mixtures of tall wheatgrass and alfalfa. Capability unit IVw-61, irrigated and VIw-200, dryland; range site NV 23-10; wildlife suitability group 2.

**Hussa loam, clay substratum, drained, 0 to 2 percent slopes (HuA).**—This soil is in small, irregularly shaped areas on alluvial fans. The profile is similar to the one described as representative for the series, except that it is underlain by very slowly permeable lacustrine clay at a depth of 40 to 50 inches and has been partly drained by deep gullies. Included with this soil in mapping are areas of other Hussa soils that make up about 2 percent of the total acreage.

This soil has moderately slow permeability in the upper part and very slow permeability through the underlying clay. The frost-free season is 100 to 130 days. Runoff is slow, and the hazard of erosion is slight. The seasonal high water table is at a depth of 3 to 4 feet. The native vegetation consists of sedges, clover, bentgrass, redbud, and bluegrass.

This soil is suitable for irrigated crops if drainage is provided. It is used mainly for livestock grazing and wildlife habitat. Some areas are irrigated and used for native meadow hay. Capability unit IIw-62, irrigated and VIw-200, dryland; range site NV 23-13; wildlife suitability group 2.

**Hussa clay loam, 0 to 2 percent slopes (HvA).**—This soil is in fairly large, irregularly shaped areas on flood plains and alluvial fans. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Four Star soils and other Hussa soils. These areas make up about 5 percent of the total acreage.

The frost-free season is 100 to 130 days. Runoff is slow, and the hazard of erosion is slight. The seasonal high water table is at a depth of 2 to 3 feet. The native vegetation consists mainly of sedges, clover, bentgrass, redbud, and bluegrass.

This soil is suitable for irrigated crops if drainage is provided. It is used mainly for native hay, livestock grazing, and wildlife habitat. Improved grasses and legumes have been planted in a few isolated areas. Capability unit IIIw-60, irrigated; not placed in a range site; wildlife suitability group 2.

**Hussa clay loam, clay substratum, 0 to 2 percent slopes (HwA).**—This soil is in fairly large, irregularly shaped areas on alluvial fans. The profile is similar to the one described as representative for the series, except that

this soil is underlain by a very slowly permeable lacustrine clay at a depth of 40 to 50 inches.

Included with this soil in mapping are areas of Four Star soils, areas of Husssa silty clay loam, seeped, and areas of Marsh. These areas make up about 2 percent of the total acreage.

This soil has moderately slow permeability in the upper part and very slow permeability in the underlying clay. The frost-free season is 100 to 130 days. Runoff is slow, and the hazard of erosion is slight. The seasonal high water table is at a depth of 2 to 3 feet. The native vegetation consists mainly of sedges, clover, bentgrass, redtop, and bluegrass.

This soil is suitable for irrigated crops if drainage is provided. It is used mainly for native meadow hay. Capability unit IIIw-63, irrigated; not placed in a range site; wildlife suitability group 2.

**Husssa silty clay loam, seeped, 0 to 9 percent slopes (HxB).**—This soil is in fairly large, irregularly shaped areas on alluvial fans. The profile is similar to the one described as representative for the series, except that the surface layer is silty clay loam.

Included with this soil in mapping near seeps are areas of very wet soils that are similar to Husssa soils. These areas make up about 10 percent of the total acreage.

The frost-free season is 100 to 120 days. Drainage is very poor. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The seasonal high water table is at a depth of 1 to 2 feet, and the feasibility of artificial drainage is questionable. The native vegetation consists mainly of water-tolerant plants.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit Vw-60, irrigated; not placed in a range site; wildlife suitability group 2.

**Husssa silty clay loam, seeped, cold, 0 to 9 percent slopes (HyB).**—This soil is in small, scattered, irregularly shaped areas on alluvial fans. The profile is similar to the one described as representative for the series, except that the surface layer is silty clay loam. This soil is at higher elevations, and the growing season is 70 to 90 days.

Included with this soil in mapping are areas of cold phases of Hovey and Four Star soils. These areas make up about 5 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. The seasonal high water table is at a depth of 1 to 2 feet, and the feasibility of artificial drainage is questionable. The native vegetation consists mainly of water-tolerant plants.

This soil is not suitable for irrigated crops. It is used mainly for late-season livestock grazing and wildlife habitat. Capability unit Vw-60, irrigated; not placed in a range site; wildlife suitability group 2.

**Husssa-Couch complex (Hz).**—This complex consists of nearly level soils in small, irregularly shaped areas on low-lying lake terraces. It is about 65 percent Husssa loam, slightly saline-alkali, 0 to 2 percent slopes, and about 25 percent Couch loam. The Husssa soil has a dark-colored surface layer and lacks a subsoil. The Couch soil is on small, slightly raised terrace remnants and has a light-colored surface layer and a well-developed subsoil.

Included with this soil in mapping are areas of Kising and Lolak soils that make up about 10 percent of the total acreage.

The frost-free season is 100 to 120 days. Runoff is slow, and the hazard of erosion is slight. The Husssa soil has a seasonal high water table at a depth of 3 to 4 feet. The Couch soil is well drained. The Husssa soil has a native vegetation that consists of sedges and other saline-alkali tolerant plant species. The native vegetation on Couch soil is greasewood and small amounts of saltgrass.

The Husssa soil is suitable for irrigated crops if it is drained and reclaimed. The Couch soil is suitable for irrigated farming if it is reclaimed and irrigation water is available. Leveling is required. These soils are used mainly for livestock grazing and wildlife habitat. Small areas of the Husssa soil have been planted in mixtures of tall wheatgrass and alfalfa. Husssa part: Capability unit IVw-61, irrigated and VIw-200, dryland; range site NV 23-10; wildlife suitability group 2. Couch part: Capability unit IVs-64, irrigated and VIIs-221, dryland; range site NV 23-2; wildlife suitability group 4.

## Jesse Camp Series

The Jesse Camp series consists of well-drained soils that formed in alluvium derived from andesite, basalt, tuff, and pyroclastics. These soils are on flood plains and lake terraces. The slope range is 0 to 5 percent. Vegetation consists of big sagebrush, greasewood, and Great Basin wildrye. The elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is about 8 inches, the average annual air temperature is 43° to 44° F., and the frost-free season is 100 to 110 days.

In a representative profile the surface layer is light brownish-gray, moderately alkaline silt loam about 3 inches thick. Below this is light brownish-gray, moderately alkaline very fine sandy loam about 7 inches thick. The underlying material, to a depth of 60 inches, is pale-brown silt loam that contains some silica-cemented nodules. It is strongly alkaline in the lower part.

Jesse Camp soils have moderate permeability. The effective rooting depth is more than 60 inches. Available water capacity is 11 to 12 inches. Runoff is medium.

Representative profile of Jesse Camp silt loam, overwash, 0 to 2 percent slopes, in Washoe County, Nevada, 600 feet east and 400 feet north of the corner of sec. 22, T. 36 N., R. 19 E., Mount Diablo base line and meridian:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate, thin, platy structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and fine roots; many fine and medium vesicular and interstitial pores; moderately alkaline (pH 8.2); abrupt, smooth boundary. 1 to 4 inches thick.

B2—3 to 10 inches, light brownish-gray (10YR 6/2) very fine sandy loam; brown (10YR 4/3) moist; moderate, thin, platy structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and fine interstitial and tubular pores; effervescent; moderately alkaline (pH 8.3); clear, slightly wavy boundary. 6 to 12 inches thick.

C1si—10 to 35 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak, fine and medium, prismatic structure; hard, friable, slightly sticky, slightly plastic; common very fine and few fine and medium roots; common fine tubular pores; few (less than 10 percent) slightly brittle durinodes; strongly effervescent; moderately alkaline (pH 8.4); gradual, smooth boundary. 18 to 28 inches thick.

C2—35 to 60 inches, pale-brown (10YR 6/3) silt loam, olive brown (2.5Y 4/3) moist; few, fine, faint, light-gray (10YR 7/2) lime segregations; moderate, fine, angular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; few fine tubular pores; few (less than 10 percent) slightly brittle durinodes; violently effervescent; strongly alkaline (pH 8.6).

The thickness of the solum and depth to the silica-cemented nodules (durinodes) range from 10 to 15 inches. Color throughout the profile is 10YR or 2.5Y in hue. In the A1 horizon colors have a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. In the rest of the profile colors have a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 2 or 3. The material is somewhat stratified silt loam and very fine sandy loam throughout the profile. It ranges from weak or moderate, platy, angular, or subangular blocky in structure or is massive. These soils are strongly to violently effervescent in the lower part of the profile, but in places are noneffervescent in the upper 10 inches. As much as 20 percent brittle silica-cemented nodules are in the C horizon in places. Reaction ranges from moderately alkaline to very strongly alkaline throughout.

**Jesse Camp fine sandy loam, 0 to 2 percent slopes (JcA).**—This soil is in large, irregularly shaped areas on flood plains. The profile is similar to the one described as representative for the series, except that the surface layer is fine sandy loam.

Included with this soil in mapping are areas of soils that are similar to Jesse Camp soils but are on low rolling knolls and slope is as much as 5 percent. These areas make up about 10 percent of the total acreage.

The hazard of erosion is slight. The native vegetation consists mainly of big sagebrush and greasewood.

This soil is suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit IIc-1, irrigated and VIc-220, dryland; range site NV 23-2; wildlife suitability group 4.

**Jesse Camp fine sandy loam, 2 to 5 percent slopes (JcB).**—This soil is in small, irregularly shaped areas on lake terraces. The profile is similar to the one described as representative for the series, except that the surface layer is fine sandy loam.

Included with this soil in mapping are areas of other Jesse Camp soils that are saline-alkali affected and have a coarse-textured subsoil. These areas make up about 10 percent of the total acreage.

The hazard of erosion is moderate. The native vegetation consists mainly of big sagebrush and greasewood.

This soil is suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit IIe-20, irrigated and VIc-220, dryland; range site NV 23-2; wildlife suitability group 4.

**Jesse Camp silt loam, overwash, 0 to 2 percent slopes (JeA).**—This soil is in fairly large, irregularly shaped areas on flood plains. It has the profile described as representative for the series.

Included with this soil in mapping are small islands of Crutcher soils and stringers of Disabel soils along the edges of the flood plains. These areas make up about 10 percent of the total acreage.

The hazard of erosion is slight. This soil is subject to frequent flooding of short duration. The native vegetation consists mainly of big sagebrush, greasewood, and basin wildrye.

This soil is suitable for irrigated crops if protected from flooding. It is used mainly for livestock grazing and wildlife habitat. Capability unit IIIw-91, irrigated and VIw-

226, dryland; range site NV 23-5; wildlife suitability group 7.

## Karlo Series

The Karlo series consists of well-drained soils that formed in material derived from tuff, basalt, and andesite. These soils are on tablelands. The slope range is 0 to 9 percent. Cobblestones and small stones cover about 20 percent of the surface. Vegetation consists of low gray rabbitbrush and Sandberg bluegrass. The elevation ranges from 5,000 to 6,500 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 80 to 100 days.

In a representative profile dark reddish-brown and reddish-brown clay or silty clay extend to a depth of about 40 inches, and basalt bedrock is below.

Karlo soils have slow permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 4 to 6 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

Representative profile of Karlo very cobbly clay, 0 to 9 percent slopes, in Washoe County, Nevada, near the approximate center of sec. 1, T. 34 N., R. 18 E., Mount Diablo base line and meridian :

A11—0 to 2 inches, dark reddish-brown (5YR 3/3) clay, dark brown (7.5YR 3/2) moist; strong, very fine and fine, granular structure; hard, very friable, very sticky, very plastic; common very fine and fine roots; many very fine interstitial pores; neutral (pH 7.0); abrupt, smooth boundary. 1 to 4 inches thick.

A12—2 to 5 inches, dark reddish-brown (5YR 3/3) silty clay, dark brown (7.5YR 3/2) moist; moderate, fine, angular blocky structure; hard, friable, sticky, plastic; common very fine and fine roots; many very fine and fine interstitial pores; continuous colloidal coatings on ped faces; neutral (pH 7.2); clear, smooth boundary. 2 to 6 inches thick.

A13—5 to 10 inches, dark reddish-brown (5YR 3/3) clay, dark brown (7.5YR 3/2) moist; weak, coarse, prismatic structure; very hard, friable, sticky, very plastic; common very fine and fine roots; many very fine interstitial pores; continuous pressure cutans; mildly alkaline (pH 7.4); clear, smooth boundary. 4 to 8 inches thick.

C1—10 to 25 inches, dark reddish-brown (5YR 3/3) clay, dry or moist; weak, coarse, prismatic parting to strong, fine and medium, angular blocky structure; very hard, slightly firm, sticky, very plastic; few very fine and very few medium roots; common very fine interstitial pores; continuous pressure cutans and many slickensides; moderately alkaline (pH 8.0); clear, smooth boundary. 8 to 20 inches thick.

C2ca—25 to 40 inches, reddish-brown (5YR 4/3) silty clay, dark brown (7.5YR 3/4) moist; few, medium, white splotches of lime; strong, fine and medium, blocky structure; parallel piped peds; hard, friable, sticky, plastic; very fine tubular pores; common pressure cutans and many slickensides; moderately alkaline (pH 8.2); abrupt, smooth boundary. 5 to 25 inches thick.

R—40 inches, basalt bedrock; strong-brown (7.5YR 5/6) decomposed rock material in fractures; thin, continuous, white coats of lime on fractured faces.

In the profile colors have a hue of 5YR or 7.5YR, a value of 3 or 4 dry or moist, and a chroma of 2 to 4. The A1 horizon is 5 to 15 inches thick and is neutral to mildly alkaline. The upper part of the C horizon is neutral to mildly alkaline, and the lower part is mildly alkaline to moderately alkaline. Depth to andesitic, basaltic, or tuffaceous bedrock is 20 to 40 inches. Depth to the Cca horizon ranges from 19 to 30 inches.

**Karlo very cobbly clay, 0 to 9 percent slopes (KAB).**—This soil is in large, irregularly shaped areas on basaltic tablelands.

Included with this soil in mapping are small, stony areas and small, irregularly shaped areas of Catnip, Nine-mile, and Madeline soils. Also included are narrow areas of Home Camp and Newlands soils below rock escarpments. These areas make up about 5 percent of the total acreage.

The native vegetation consists mainly of low gray rabbitbrush and Sandberg bluegrass.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VII<sub>s</sub>-241, dryland; range site NV 23-1; wildlife suitability group 8.

## Kisring Series

The Kisring series consists of somewhat poorly drained saline-alkali soils. They formed on low-lying lake terraces in lacustrine sediment derived from andesite, basalt, tuff, and pyroclastics. The slope range is 0 to 2 percent. Vegetation consists of greasewood and saltgrass. The elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is 6 to 8 inches, the average annual air temperature is 45° to 48° F., and the frost-free season is 100 to 120 days.

In a representative profile a white salt crust, about 1/8 inch thick, covers the surface. The surface layer is light brownish-gray fine sandy loam about 3 inches thick. Below this is light brownish-gray fine sandy loam about 9 inches thick. Between depths of 12 and 28 inches is light brownish-gray to light-gray silty clay loam that contains silica-cemented nodules. Light-gray silty clay loam or loam that contains many silica-cemented nodules is at depths of 28 to 38 inches and below.

Kisring soils have slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 6 to 10 inches. Runoff is medium, and the hazard of accelerated erosion is slight. The seasonal high water table is at a depth of 3 to 5 feet, but in wet phases it is within a foot of the surface in places.

Representative profile of Kisring fine sandy loam, in Washoe County, Nevada, 50 feet east and 200 feet south of the west quarter corner of sec. 9, T. 38 N., R. 18 E., Mount Diablo base line and meridian:

A1sa—0 to 3 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark brown (10YR 3/3) moist; upper 1/8 inch is a white (10YR 8/1) salt crust; weak, thick, platy structure; slightly hard, very friable, nonsticky, nonplastic; root crowns only; many very fine vesicular pores; strongly effervescent; very strongly alkaline (pH 9.6); abrupt, smooth boundary. 1 to 4 inches thick.

C1—3 to 7 inches, light brownish-gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thick, platy structure; slightly hard, very friable, nonsticky, nonplastic; few very fine roots; many very fine vesicular pores; strongly effervescent; very strongly alkaline (pH 9.6); clear, smooth boundary. 3 to 7 inches thick.

C2—7 to 12 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky, nonplastic; many very fine and few fine and medium roots; common very fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.6); abrupt, smooth boundary. 3 to 6 inches thick.

C3—12 to 17 inches, light brownish-gray (10YR 6/2) silty clay loam, brown (10YR 4/3) moist; weak, thin, platy structure; slightly hard, very friable, sticky, plastic; common very fine roots; few fine tubular pores and many very fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.4); clear, smooth boundary. 3 to 6 inches thick.

C4sica—17 to 28 inches, light-gray (10YR 7/2) silty clay loam, brown (10YR 4/3) moist; many, coarse, faint, grayish-brown (10YR 5/2) lime mottles; moderate, thin and medium, platy structure; hard, friable, very sticky, plastic; many very fine and few fine roots; many very fine and fine tubular and interstitial pores; about 10 percent very hard, firm, brittle, fine durinodes; violently effervescent; moderately alkaline (pH 8.4); clear, wavy boundary. 6 to 14 inches thick.

C5sica—28 to 38 inches, light-gray (10YR 7/2) silty clay loam, dark grayish brown (10YR 4/2) moist; many, medium and coarse, faint, grayish-brown (10YR 5/2) lime and common, coarse, faint, dark yellowish-brown (10YR 3/4) iron mottles; weak, medium, platy and moderate, fine and medium, angular blocky structure; hard, friable, sticky, plastic; few fine roots; many very fine and fine interstitial pores; about 30 percent very hard, firm, brittle, fine, cylindrical durinodes; violently effervescent; moderately alkaline (pH 8.4); clear, wavy boundary. 6 to 15 inches thick.

C6sica—38 inches, light-gray (2.5Y 7/2) loam, dark grayish-brown (10YR 4/2) moist; many, medium and coarse, faint, brown (10YR 4/3) iron mottles; moderate, medium, subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine interstitial pores; about 70 percent very hard, firm, brittle, fine, angular blocky durinodes; violently effervescent; strongly alkaline (pH 8.6).

These soils are normally nonstony, but as much as 40 percent of the surface is covered by cobblestones and stones if the soil is immediately below steep Rubble land. The upper 6 to 16 inches is fine sandy loam, very fine sandy loam, or silt loam. In this layer colors have a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 2 or 3. This layer is massive or has weak platy or granular structure and is strongly saline-alkali affected. In the C horizon colors have a hue of 10YR or 2.5Y, a dry value of 6 or 7, a moist value of 4 or 5, and a chroma of 2 or 3. This horizon is massive or has weak or moderate, platy or angular blocky structure. The upper boundary of the Csica horizon is 12 to 24 inches below the surface.

**Kisring fine sandy loam (Kr).**—This nearly level soil is in a large, irregularly shaped area on lake terraces. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Kisring fine sandy loam, wet, near small springs and seeps, areas of very stony Kisring soils immediately below sloping Rubble land, and areas of Couch and Zorravista soils. These areas make up about 10 percent of the total acreage.

The seasonal high water table is at a depth of 3 to 5 feet. The native vegetation consists mainly of saltgrass and greasewood.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VII<sub>w</sub>-227, dryland; range site NV 23-10; wildlife suitability group 4.

**Kisring fine sandy loam, wet (Ks).**—This nearly level soil is in large, uniform areas and a few scattered, small areas on lake terraces.

Included with this soil in mapping are areas of Kisring fine sandy loam and Couch and Lolak soils. These areas make up about 10 percent of the total acreage.

Springs and seeps keep this soil wet. The seasonal high water table is at a depth of 1 to 2 feet. The vegetation consists mainly of salt-tolerant meadow grasses.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIw-227, dryland; not placed in a range site; wildlife suitability group 2.

## Langston Series

The Langston series consists of well-drained soils that formed in gravelly beach material derived from basalt, andesite, tuff, and pyroclastics. These soils are on dissected, high-lying lake terraces. The slope range is 0 to 5 percent. Vegetation consists of big sagebrush, spiny hopsage, Sandberg bluegrass, and Thurber needlegrass. The elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is 7 to 9 inches, the average annual air 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 sandy loam and light brownish-gray gravelly sandy loam about 7 inches thick. The next layer has 9 inches of brown or pale-brown sandy clay loam and gravelly sandy clay loam and 3 inches of pale-brown very gravelly sandy loam. It is underlain, at a depth of 19 inches, by light brownish-gray and light-gray very gravelly sand, which extends to a depth of 54 inches or more.

Langston soils have moderately slow permeability. The effective rooting depth is 50 to 60 inches. Available water capacity is 4 to 6 inches. Runoff is slow, and the hazard of accelerated erosion is moderate.

In this survey area Langston soils were mapped only as a component of the Old Camp-Langston association.

Representative profile of Langston sandy loam in an area of Old Camp-Langston association, in Washoe County, Nevada, near the center of sec. 2, T. 36 N., R. 19 E., Mount Diablo base line and meridian:

- A11—0 to 1½ inches, grayish-brown (10YR 5/2) sandy loam, dark brown (10YR 3/3) moist; very thin light-gray (10YR 7/2) surface crust; massive; slightly hard, very friable, nonsticky, nonplastic; root crowns only; many very fine and fine vesicular pores; neutral (pH 6.6); abrupt, smooth boundary. 0 to 3 inches thick.
- A12—1½ to 7 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure; soft, very friable; nonsticky, nonplastic; many very fine and fine roots and few medium roots; many very fine interstitial pores and few fine tubular pores; neutral (pH 6.6); clear, smooth boundary, 3 to 7 inches thick.
- B21t—7 to 11 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; massive; hard, friable, sticky, plastic; common very fine and fine roots and few medium roots; many very fine interstitial pores and few fine tubular pores; common thin clay bridges between sand grains; many thin clay films in pores; neutral (pH 6.8); clear, wavy boundary. 4 to 9 inches thick.
- B22t—11 to 16 inches, pale-brown (10YR 6/3) gravelly sandy clay loam, dark brown (10YR 4/3) moist; massive; hard, friable, sticky, plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; few thin clay bridges between sand grains; common thin clay films in pores; neutral (pH 6.8); clear, wavy boundary. 0 to 6 inches thick.
- IIB3t—16 to 19 inches, pale-brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine interstitial pores; common thin clay films in pores; few thin clay bridges between sand grains;

neutral (pH 7.0); clear, wavy boundary. 2 to 5 inches thick.

IIC1—19 to 31 inches, light brownish-gray (10YR 6/2) very gravelly sand, brown (10YR 4/3) moist; single grain; loose when dry or moist; many very fine and fine roots and few medium roots; many very fine and fine interstitial pores; effervescent in spots; few very thin, white (10YR 8/2) undercoats of lime on pebbles in places; mildly alkaline (pH 7.8); clear, wavy boundary. 10 to 17 inches thick.

IIC2ca—31 to 54 inches, light-gray (10YR 7/2) very gravelly sand, brown (10YR 4/3) moist; single grain; loose when dry or moist; many very fine and fine roots and few medium roots; many very fine and fine interstitial pores; strongly effervescent; thin white (10YR 8/2) undercoats of lime on most pebbles; moderately alkaline (pH 8.4).

The surface is gravelly or stony.

In the A1 horizon colors have a dry value of 5 to 7, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is sandy loam or loamy sand. It is massive or has weak platy or prismatic structure. The B2t horizon is 6 to 12 inches thick. Colors in this horizon have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 4 or 5, and a chroma of 2 or 3. This horizon is sandy clay loam, clay loam, or heavy loam that is as much as 35 percent gravel. It is massive or has weak subangular blocky structure. The solum is 12 to 20 inches thick. The C horizon consists of beach material that is 65 to 90 percent gravel. Depth to the Cca horizon ranges from 20 to 40 inches.

## Lolak Series

The Lolak series consists of poorly drained, strongly saline-alkali affected soils. They formed in lacustrine sediment derived from andesite, basalt, tuff, and pyroclastics on basins or low lake terraces. The slope range is 0 to 2 percent. Vegetation consists of greasewood and inland saltgrass. The elevation ranges from 4,500 to 5,600 feet. The average annual precipitation is 8 to 12 inches, the average annual air temperature is 41° to 45° F., and the frost-free season is 80 to 100 days.

In a representative profile light-gray silty clay and light brownish-gray silty clay loam about 4 inches thick are at the surface. Below this, and extending to a depth of about 60 inches, is light brownish-gray and light-gray clay and silty clay that has iron mottles in the upper part.

Lolak soils have very slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 9 to 10 inches. Runoff is very slow, and in places the soil is ponded. The hazard of accelerated erosion is slight, except on the Lolak loamy sand, overflow, where it is severe. The seasonal high water table is variable and depends upon the water level in the adjacent lakes. It is at least at a depth of 4 to 5 feet in spring, but it is at the surface in places in years of heavy precipitation.

Representative profile of Lolak silty clay, 500 feet north of the southwest corner of sec. 5, T. 38 N., R. 18 E., Mount Diablo base line and meridian:

- C1—0 to 2 inches, light-gray (10YR 7/2) silty clay, dark grayish brown (10YR 4/2) moist; weak, medium, platy structure; hard, friable, sticky, plastic; few very fine roots; few fine vesicular and tubular pores; strongly saline; strongly effervescent; very strongly alkaline (pH 9.6); abrupt, smooth boundary. 0 to 6 inches thick.
- C2—2 to 4 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish-brown (10YR 4/2) moist; weak, fine and very fine, angular blocky structure; hard, friable, sticky, plastic; few very fine roots; many very fine interstitial pores; strongly saline; strongly effervescent; very strongly alkaline (pH 9.6); abrupt, smooth boundary. 1 to 6 inches thick.

- C3—4 to 12 inches, light brownish-gray (10YR 6/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong, fine, angular blocky structure; very hard, very sticky, very plastic; common very fine and fine roots; many fine interstitial pores; strongly saline; mostly effervescent but strongly effervescent in spots; very strongly alkaline (pH 9.6); clear, smooth boundary. 4 to 12 inches thick.
- C4—12 to 18 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish-brown (10YR 4/2) moist; few, medium, very dark grayish-brown (10YR 3/2) iron mottles; strong, medium, angular blocky structure; very hard, very firm, very sticky, very plastic; common very fine roots; many fine interstitial pores; moderately saline; mostly effervescent but strongly effervescent in spots; very strongly alkaline (pH 9.6); clear, smooth boundary. 3 to 12 inches thick.
- C5—18 to 40 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; few, medium, very dark grayish-brown (10YR 3/2) mottles and common, fine, white (10YR 8/1) astrocoods; moderate, medium, angular blocky structure; pedis have conchoidal faces; very hard, very firm, very sticky, very plastic; few very fine and fine roots; few fine interstitial pores; slightly saline; mostly effervescent but strongly effervescent in spots; very strongly alkaline (pH 9.2); clear, smooth boundary. 12 to 36 inches thick.
- C6—40 to 60 inches, light-gray (10YR 7/2) clay, dark grayish brown (10YR 4/2) moist; few, fine, dark-brown (7.5YR 4/4) mottles; massive; very hard, very firm, very sticky, very plastic; moderately saline; mostly effervescent but strongly effervescent in spots; very strongly alkaline (pH 9.2).

In the upper 2 to 8 inches colors have a hue of 10YR or 2.5Y, a dry value of 6 or 7, a moist value of 3 to 5, and a chroma of 1 to 3. This material generally is silty clay loam or silty clay but in places is loamy sand. It has weak or moderate platy, granular, or blocky structure or is single grained. In the horizons below this depth, colors have a hue of 10YR, 2.5Y, or 5Y; a dry value of 6 or 7; a moist value of 3 to 5; and a chroma of 1 to 3. These horizons are mottled in places. They are massive or have weak to strong, fine or medium, blocky structure. These soils are saline-alkali affected. The horizons that have the greatest accumulation of soluble salts, sodium, and lime are in the upper 20 inches.

**Lolak loamy sand, overflow (LK).**—This nearly level soil is in very small, irregularly shaped areas on low terraces. The profile is similar to the one described as representative for the series, except that salt- and alkali-free loamy sand is between depths of 0 and 12 inches.

Included with this soil in mapping are narrow ridges of Lolak silty clay, a few sand dunes, and a few narrow stringers of Zorravista soils. These areas make up about 10 percent of the total acreage.

The hazard of erosion is severe. This soil is subject to occasional flooding by runoff from higher lying areas. The native vegetation consists mainly of a sparse stand of greasewood and saltgrass.

This soil is not suitable for irrigated crops. It is mainly used for livestock grazing and wildlife habitat. Capability unit VIIw-205, dryland; range site NV 23-2; wildlife suitability group 4.

**Lolak silty clay (Lm).**—This nearly level soil is in fairly large, irregularly shaped areas on lake terraces on the valley floor adjacent to lakes in Surprise Valley. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Raglan and Survya soils and small areas of the land type Playas on slightly elevated positions. These areas make up about 5 percent of the total acreage.

The hazard of erosion is slight. The native vegetation consists mainly of a sparse stand of greasewood and saltgrass.

The soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIw-205, dryland; range site NV 23-10; wildlife suitability group 4.

**Lolak-Zorravista association (LN).**—This association consists of nearly level soils in one fairly large, irregularly shaped area and several smaller areas where sand dunes have been deposited on lake terraces. These soils are mainly in the southern and eastern parts of Surprise Valley. This association is about 60 percent Lolak silty clay and about 30 percent Zorravista fine sand, 0 to 15 percent slopes. The Lolak soil is clayey. The Zorravista soil is sandy and consists of semistabilized sand dunes.

Included with this soil in mapping are areas of Lolak loamy sand, overflow, and Couch soils. These areas make up about 10 percent of the total acreage.

The Lolak soil has a slight hazard of erosion. The Zorravista soil has a severe hazard of soil blowing. The Lolak soil has a native vegetation that consists of a sparse stand of greasewood and saltgrass. The native vegetation on the Zorravista soil consists of big sagebrush, greasewood, and four-wing saltbush.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Lolak part: Capability unit VIIw-205, dryland; range site NV 23-10; wildlife suitability group 4. Zorravista part: Capability unit VIIs-224, dryland; range site NV 23-11; wildlife suitability group 9.

## Longval Series

The Longval series consists of well-drained soils that formed in alluvium derived from mixed basic rock. The slope range is 2 to 15 percent. Vegetation consists of lodgepole pine, big sagebrush, grasses, and forbs. The elevation ranges from 7,000 to 8,500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 39° to 41° F., and the frost-free season is less than 50 days.

In a representative profile the surface layer is grayish-brown, strongly acid to medium acid fine sandy loam about 15 inches thick. Below this is pale-brown, medium acid gravelly fine sandy loam about 19 inches thick. Weathered basaltic bedrock is at a depth of 34 inches.

Longval soils have moderately rapid permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 4 to 6 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Longval fine sandy loam, 2 to 15 percent slopes, in Lassen County, California, near the south quarter corner of sec. 21, T. 38 N., R. 16 E., Mount Diablo base line and meridian:

O1—¼ inch to 0, very dark grayish-brown (10YR 3/2) needle litter, very dark brown (10YR 2/2) moist; very strongly acid (pH 5.0); abrupt, smooth boundary. 0 to 2½ inches thick.

A11—0 to 4 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine and fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine roots; many very fine interstitial pores; strongly acid (pH 5.5); clear, smooth boundary. 3 to 6 inches thick.

- A12—4 to 15 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, fine, and medium, granular structure; soft, very friable, nonsticky, nonplastic; common very fine and fine roots and many medium and coarse roots; many very fine interstitial pores; medium acid (pH 5.7); clear, wavy boundary. 7 to 12 inches thick.
- B2—15 to 34 inches, pale-brown (10YR 6/3) gravelly fine sandy loam, dark grayish-brown (10YR 4/2) moist; massive; soft, very friable, nonsticky, nonplastic; common very fine and fine roots and few medium and coarse roots; many very fine interstitial pores; medium acid (pH 5.8); clear, irregular boundary. 9 to 21 inches thick.
- R—34 inches, light-gray (N 7/0) weathering basaltic bedrock, very dark gray (N 3/0) moist; weathered in the upper 3 to 5 inches; few thin and moderately thick clay films in rock pores and filling cracks.

Thickness of the solum and depth to bedrock range from 20 to 40 inches. Colors in the A1 horizon are 10YR or 7.5YR in hue, have a dry value of 3 to 5, a moist value of 2 or 3, and a chroma of 1 or 2. This horizon has moderate to strong, granular structure. Base saturation of the A1 horizon is less than 50 percent. Colors in the B2 horizon have a hue of 10YR and 7.5YR, a dry value of 6 or 7, a moist value of 3 to 5, and a chroma of 2 to 4. The B2 horizon is dominantly fine sandy loam or sandy loam and is as much as 35 percent gravel. It is massive or ranges to weak, fine to coarse, subangular blocky or granular structure. A C horizon is present in places in areas where bedrock is below a depth of 30 inches.

**Longval fine sandy loam, 2 to 15 percent slopes** (LOC).—This soil is on mountains in large, irregularly shaped areas and in several smaller, scattered areas along the western edge of the survey area. Slopes are concave.

Included with this soil in mapping are areas of Campone, Newlands, and Snag soils that make up about 10 percent of the total acreage.

The native vegetation consists mainly of lodgepole pine and an understory of big sagebrush, grasses, and forbs.

This soil is not suitable for irrigated crops. It is used mainly for limited livestock grazing, some woodland products, wildlife habitat, and watershed. Capability unit VIc-220, dryland; not placed in a range site; wildlife suitability group 10.

## Lyonman Series

The Lyonman series consists of well-drained soils that formed in residuum and localized alluvium derived from dominantly andesite and basalt mixed volcanic rocks. These soils are in the Warner Mountains. The slope range is 15 to 50 percent. Vegetation consists of white fir and ponderosa pine and an understory of grass and browse. The elevation generally ranges from 7,000 to 8,000 feet, but on north-facing slopes is as low as 5,600 feet. The average annual precipitation is 16 to 25 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 60 to 80 days.

In a representative profile a 1½-inch layer of white fir needles in various stages of decomposition covers the surface. The surface layer is dark grayish-brown and brown sandy loam and cobbly loam about 13 inches thick. Below this is brown and light yellowish-brown cobbly clay loam about 21 inches thick. The underlying material is brown to pale-brown clay loam to a depth of 48 inches.

Lyonman soils have moderately slow permeability. The effective rooting depth is 40 to 60 inches. Available water capacity is 7 to 8 inches.

Representative profile of Lyonman sandy loam, 15 to 30 percent slopes, in Modoc County, California, near the center of the southwest quarter of sec. 14, T. 43 N., R. 15 E., Mount Diablo base line and meridian:

- O—1½ inches to 0, white fir needles in various stages of decomposition; slightly acid (pH 6.1); abrupt, wavy boundary. 1 to 3 inches thick.
- A11—0 to 2½ inches, dark grayish-brown (10YR 4/2) sandy loam, very dark brown (7.5YR 2/2) moist; massive; soft, very friable, nonsticky, nonplastic; common fine and very fine roots; many very fine interstitial pores; slightly acid (pH 6.1); abrupt, wavy boundary. 1 to 8 inches thick.
- A12—2½ to 13 inches, brown (7.5YR 5/3) cobbly loam, dark brown (7.5YR 3/2) moist; strong, very fine, granular structure; slightly hard, very friable, nonsticky, slightly plastic; many fine, medium, and coarse roots; many very fine interstitial pores; slightly acid (pH 6.2); abrupt, wavy boundary. 2 to 12 inches thick.
- B2t—13 to 24 inches, brown (10YR 5/3) cobbly clay loam, brown (10YR 4/3) moist; moderate, fine, angular blocky structure; hard, firm, sticky, plastic; few fine and medium and many coarse roots; many very fine tubular pores and common fine interstitial pores; common thin clay films in pores and on ped faces; slightly acid (pH 6.1); clear, wavy boundary. 8 to 15 inches thick.
- C1—24 to 34 inches, light yellowish-brown (10YR 6/4) cobbly clay loam, brown (10YF 4/3) moist; common, fine, distinct, dark-gray (10YR 4/1) organic stains and few, fine, faint, brownish-yellow (10YR 6/6) iron mottles; massive; very hard, firm, sticky, plastic; many medium and few fine and very fine roots; many very fine tubular pores; few thin clay films in pores; medium acid (pH 5.8); abrupt, wavy boundary. 5 to 13 inches thick.
- C2—34 to 38 inches, brown (10YR 5/3) clay loam, brown (10YR 5/3) moist; common, fine and medium, distinct, dark-gray (10YR 4/1) organic stains and few, fine, faint light yellowish-brown (10YR 6/4) iron mottles; moderate, medium, angular block structure; very hard, firm, sticky, plastic; few very fine and fine roots; many very fine tubular pores; medium acid (pH 5.8); abrupt, wavy boundary. 2 to 6 inches thick.
- C3—38 to 48 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; common, fine, distinct, dark-gray (10YR 4/1) organic stains and brownish-yellow (10YR 6/6) iron mottles; massive; very hard, very firm, sticky, plastic; few very fine roots; few very fine pores; medium acid (pH 5.8).

Depth to bedrock ranges from 40 inches to more than 60 inches. In the A horizon colors have a hue of 10YR or 7.5YR, a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 1 to 3. This horizon has mostly moderate or strong, granular or subangular blocky structure but is massive in places in the upper part. Reaction is slightly acid to strongly acid. In the B2t horizon colors have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 3 or 4. This horizon is massive or has moderate to strong, subangular blocky structure. It is dominantly clay loam or sandy clay loam but in places is heavy loam. Reaction is slightly acid to strongly acid. In the C horizon colors have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 4 or 5, and a chroma of 2 to 4. Gravel, cobblestones, and stones make up 2 to 35 percent of the solum.

**Lyonman sandy loam, 15 to 30 percent slopes** (LYE).—This soil is in fairly large, irregularly shaped areas on mountain uplands. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Waca and Tourn soils, areas of soils that are similar to Lyonman soils except that bedrock is at a depth of less than 40 inches, and areas of steeper Lyonman soils. These areas make up about 20 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. The native vegetation consists mainly of white fir, ponderosa pine, and an understory of grass and browse.

This soil is not suitable for irrigated crops. It is used mainly for timber production, limited livestock grazing, wildlife habitat, and watershed. Capability unit VIe-200, dryland; not placed in a range site; wildlife suitability group 10.

**Lyonman sandy loam, 30 to 50 percent slopes (LYF).**—This steep soil is in fairly large, irregularly shaped areas on the sides of mountains. Included in mapping are areas of Waca and Home Camp soils, soils that are similar to Lyonman soils except that their subsoil is more than 35 percent coarse fragments, and Rock outcrop. These areas make up about 20 percent of the total acreage.

Runoff is rapid, and the hazard of erosion is severe. The native vegetation consists mainly of white fir, ponderosa pine, and an understory of grass and browse.

This soil is not suitable for irrigated crops. It is used mainly for timber production, limited livestock grazing, wildlife habitat, and watershed. Capability unit VIIe-200, dryland; not placed in a range site; wildlife suitability group 10.

## Madeline Series

The Madeline series consists of well-drained soils that formed in residuum from tuff, basalt, and andesite. They are on mountain uplands. The slope range is 2 to 50 percent. Vegetation consists of big sagebrush, bitterbrush, bluebunch wheatgrass, and Thurber needlegrass. The elevation ranges from 5,000 to 7,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is dark-brown very stony loam and sandy clay loam about 8 inches thick. Below this is dark-brown sandy clay and gravelly clay about 6 inches thick. Scoriaceous basalt bedrock is at a depth of 14 inches.

Madeline soils have slow permeability. The effective rooting depth is 10 to 20 inches. Available water capacity is 3 to 4 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Madeline very stony loam, 2 to 30 percent slopes, in Washoe County, Nevada, near the center of the northwest quarter of sec. 35, T. 38 N., R. 18 E., Mount Diablo base line and meridian:

A1—0 to 2 inches, dark-brown (7.5YR 4/2) very stony loam, dark brown (7.5YR 3/2) moist; weak, coarse, platy parting to strong, very fine, granular structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine interstitial pores; common very thin clay coatings on sand grains; neutral (pH 6.6); abrupt, smooth boundary. 2 to 4 inches thick.

B1t—2 to 8 inches, dark-brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic parting to strong, fine and medium, subangular blocky structure; slightly hard, friable, sticky, plastic; common very fine and few fine roots; many very fine and fine tubular pores; continuous very thin clay coatings on sand grains and common thin clay films as bridges; neutral (pH 6.6); clear, slightly wavy boundary. 0 to 8 inches thick.

B21t—8 to 12 inches, dark-brown (7.5YR 3/2) sandy clay, dry or moist; moderate, fine and medium, subangular

blocky structure; hard, friable, sticky, plastic; common very fine and few fine roots; many very fine and fine tubular pores; continuous very thin clay coatings on sand grains and common thin clay films on ped faces and in pores; neutral (pH 6.6); abrupt, smooth boundary. 3 to 10 inches thick.

B22t—12 to 14 inches, dark-brown (7.5YR 3/2) gravelly clay, dry or moist; strong, fine and medium, angular blocky structure; very hard, firm, sticky, plastic; many very fine and fine roots matted on top of underlying bedrock; common very fine and fine tubular pores; continuous thin and moderately thick clay films on ped faces and in pores; neutral (pH 6.6); abrupt, irregular boundary. 2 to 6 inches thick.

R—14 to 20 inches, scoriaceous basalt bedrock.

Colors throughout the profile range from 10YR to 5YR in hue, have a dry value of 4 or 5, and a moist value of 3 or 4. Chroma ranges from 2 to 4 in all horizons except the A1 and B1t, where it is 2 or 3.

The A1 horizon is loam or sandy clay loam. It has moderate to strong, very fine to fine, granular structure or is massive. Reaction is slightly acid to neutral. The B2t horizon is clay or sandy clay that is as much as 35 percent gravel or cobblestones. It has weak to strong, medium and coarse, prismatic or blocky structure. Reaction in the B2t horizon is slightly acid to neutral. Depth to bedrock ranges from 10 to 20 inches.

**Madeline very stony loam, 2 to 30 percent slopes (MAD).**—This soil is in very large, irregularly shaped areas on uplands. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Mendeboure soils, areas of steep Rubble land on slopes of colluvium, and a few areas where rocks crop out. These areas make up about 10 percent of the total acreage.

The native vegetation consists mainly of big sagebrush, bitterbrush, bluebunch wheatgrass, and Thurber needlegrass.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIs-237, dryland; range site NV 23-15; wildlife suitability group 6.

**Madeline very stony loam, 30 to 50 percent slopes (MAF).**—This soil is in fairly large, irregularly shaped areas on mountains. Included in mapping are mainly areas of Mendeboure soils, areas of Rubble land, and areas where rocks crop out. These areas make up about 20 percent of the acreage.

The native vegetation consists mainly of big sagebrush, bitterbrush, bluebunch wheatgrass, and Thurber needlegrass.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIs-237, dryland; range site NV 23-15; wildlife suitability group 6.

## Marsh

Marsh (Mh) is a miscellaneous land type that occupies many small, scattered areas near the edges of natural springs and seeps. This land type is nearly level to gently sloping. It is on flood plains, low lake terraces, and alluvial fans.

The native vegetation consists mainly of bulrush, spike-rush, cattails, and other water-tolerant plants.

Marsh is saturated most of the year. It is too wet to be used for production of hay, but in places areas are used for late-season pasture for livestock and for wildlife habi-

tat. Capability unit VIIw-200, dryland; not placed in a range site; not placed in a wildlife suitability group.

### Mascamp Series

The Mascamp series consists of well-drained soils on uplands. They formed in residuum and localized alluvium derived from andesite, basalt, tuff, and pyroclastics. The slope range is 2 to 15 percent. Vegetation consists of big sagebrush, bluebunch wheatgrass, and Thurber needlegrass. The elevation ranges from 5,500 to 6,500 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is light brownish-gray extremely stony sandy loam and grayish-brown very cobbly and gravelly sandy loam about 7 inches thick. The next layer is brown very cobbly and gravelly sandy clay loam about 8 inches thick. Light-gray tuff bedrock is at a depth of 15 inches.

Mascamp soils have moderately slow permeability. The effective rooting depth is 10 to 20 inches. Available water capacity is 1 to 2 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

Representative profile of Mascamp extremely stony sandy loam, 2 to 15 percent slopes, in Washoe County, Nevada, 400 feet south and 800 feet west of the northeast corner of sec. 3, T. 40 N., R. 19 E., Mount Diablo base line and meridian:

- A11—0 to 2 inches, light brownish-gray (10YR 6/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, nonsticky, nonplastic; root crown only; many fine and very fine vesicular pores; neutral (pH 6.6); abrupt, slightly wavy boundary. 0 to 2 inches thick.
- A12—2 to 7 inches, grayish-brown (10YR 5/2) very cobbly and gravelly sandy loam, dark brown (10YR 3/3) moist; moderate, fine, granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; neutral (pH 6.6); clear, smooth boundary. 4 to 8 inches thick.
- B2t—7 to 10 inches, brown (10YR 5/3) very cobbly and gravelly sandy clay loam, dark brown (10YR 3/3) moist; moderate, medium and fine, subangular blocky structure; hard, friable, sticky, plastic; many very fine and fine roots; many very fine interstitial pores and few fine tubular pores; common thin clay films on ped faces and many thin clay films in pores; neutral (pH 6.6); clear, smooth boundary. 3 to 6 inches thick.
- B3t—10 to 15 inches, brown (10YR 5/3) very cobbly, stony, and gravelly sandy clay loam, dark brown (10YR 3/3) moist; massive; hard, friable, sticky, plastic; common very fine and fine roots; few fine tubular pores; neutral (pH 6.8); abrupt, wavy boundary. 2 to 6 inches thick.
- R—15 to 22 inches, light-gray (5Y 7/1) tuff bedrock; white (10YR 8/2) lime coats the surface and sides of crevices.

The A1 horizon ranges from 5 to 9 inches in thickness. In this horizon colors generally have a dry value of 4 or 5, but may be as high as 6 in the upper 1 or 2 inches. They have a moist value of 2 or 3 and a chroma of 2 or 3. The A1 horizon is sandy loam or loam in texture, and it is 20 to 50 percent cobbles and stones and 10 to 25 percent gravel. It is massive or has platy, blocky, or granular structure. In the B2t horizon colors have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 3 or 4. Texture of this horizon is dominantly sandy clay loam but in places it is heavy loam and clay loam. The B2t horizon is 50 to 75 percent cobbles and stones and 10 to 25 percent gravel. It

has weak to moderate subangular blocky structure. Thickness of the solum and depth to bedrock is 10 to 20 inches.

**Mascamp extremely stony sandy loam, 2 to 15 percent slopes (M1C).**—This soil is mainly in large, irregularly shaped areas and in many small, scattered areas. It is on mountain uplands. Stones and a few cobblestones cover about 30 percent of the surface.

Included with this soil in mapping are areas of Rock outcrop, Mendeboure soils, and a few narrow areas of Home Camp and Newlands soils. These areas make up about 10 percent of the total acreage.

The native vegetation consists mainly of big sagebrush, bluebunch wheatgrass, and Thurber needlegrass.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIs-237, dryland; range site NV 23-20; wildlife suitability group 7.

### McConnel Series

The McConnel series consists of somewhat excessively drained soils. They formed in gravelly beach and bar deposits derived from andesite, basalt, tuff, and pyroclastics. The slope range is 0 to 5 percent. Vegetation consists of big sagebrush, shadscale, spiny hopsage, and Indian ricegrass. The elevation ranges from 4,500 to 5,000 feet. The average annual precipitation is 7 to 10 inches, the average annual air temperature is 46° to 49° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is light brownish-gray gravelly loam about 2 inches thick. Below this is light brownish-gray gravelly fine sandy loam and sandy loam about 10 inches thick. The underlying material is light-gray to pale-brown, stratified very gravelly loamy sand and very gravelly sand to a depth of 48 inches.

McConnel soils have moderately rapid permeability. The effective rooting depth is more than 60 inches. Available water capacity is 4 to 5 inches. Runoff is slow to medium, and the hazard of accelerated erosion is slight to moderate.

Representative profile of McConnel sandy loam, 0 to 5 percent slopes, in Washoe County, Nevada, 1,200 feet west and 300 feet north of the southwest corner of sec. 16, T. 36 N., R. 20 E., Mount Diablo base line and meridian:

- A1—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky, nonplastic; few very fine and fine roots; many very fine and fine vesicular pores; moderately alkaline (pH 8.4); clear, wavy boundary. 1 to 6 inches thick.
- B21—2 to 7 inches, light brownish-gray (10YR 6/2) sandy loam, dark brown (10YR 3/3) moist; weak, thin and medium, platy parting to moderate, very fine, granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; many very fine interstitial pores; common colloidal coatings on sand grains; moderately alkaline (pH 8.4); clear, wavy boundary. 4 to 10 inches thick.
- B22—7 to 12 inches, light brownish-gray (10YR 6/2) gravelly fine sandy loam, brown (10YR 4/3) moist; moderate, thin and medium platy structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine and few medium roots; few fine tubular pores; few thin clay films on plate tops; effervescent; moderately alkaline (pH 8.4); clear, wavy boundary, 4 to 8 inches thick.
- IIC1ca—12 to 34 inches, light-gray (10YR 7/2) very gravelly loamy sand (60 percent gravel), brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, non-

plastic; few very fine and fine roots; many fine interstitial pores; violently effervescent; strongly alkaline (pH 8.8); clear, wavy boundary. 18 to 24 inches thick. IIC2—34 to 48 inches, pale-brown (10YR 6/3) very gravelly sand (65 percent gravel), brown (10YR 4/3) moist; single grained; loose when dry or moist; common very fine and fine roots; many very fine and fine interstitial pores; violently effervescent; strongly alkaline (pH 8.8).

Colors throughout the profile have a hue of 10YR or 2.5Y. In the A1 horizon colors have a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is gravelly loam, fine sandy loam, or sandy loam and is massive or has weak or moderate, platy structure. In the B2 and C horizons colors have a dry value of 5 to 7, a moist value of 3 to 5, and a chroma of 2 or 3. The B2 horizon has weak or moderate, platy, granular, or subangular blocky structure. Reaction in this horizon is neutral to strongly alkaline. Depth to the IIC horizon ranges from 10 to 24 inches. Gravel in the IIC horizon is partly or completely lime-coated in the upper part. Reaction in this horizon is moderately alkaline to strongly alkaline.

**McConnel sandy loam, 0 to 5 percent slopes (MMB).**—This soil is in fairly large, long areas on lake bars and terraces. It has the profile described as representative for the series.

Included with this soil in mapping are narrow areas of McConnel sandy loam, overwash, and small areas of Pegler and Vylach soils. These areas make up about 10 percent of the total acreage.

The native vegetation consists mainly of big sagebrush, shadscale, and Indian ricegrass.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIs-285, dryland; range site NV 23-12; wildlife suitability group 9.

**McConnel sandy loam, overwash, 0 to 2 percent slopes (MNA).**—This soil occupies fairly uniform, large areas in broad, shallow drainageways that dissect lake bars and terraces. The profile of this soil is similar to the one described as representative for the series except for the overwash sediment from higher lying areas. Also, this soil has a finely stratified surface layer that is dominantly sandy loam but ranges from sand to loam and is as much as 20 percent gravel.

Included with this soil in mapping are narrow areas of barren Riverwash along gullies, gravelly areas, and a few higher lying islands of McConnel sandy loam that are not subject to overflow.

This soil is subject to frequent flooding of short duration. The native vegetation consists mainly of big sagebrush, basin wildrye, and Indian ricegrass.

This soil is not suitable for irrigated crops. It is used mainly for limited livestock grazing and wildlife habitat. Capability unit VIIw-222, dryland; range site NV 23-5; wildlife suitability group 7.

**McConnel-Badland association (MO).**—This association consists of nearly level to gently sloping soils on terraces and steep soils on short terrace breaks. These soils are in irregularly shaped areas. This association is about 50 percent McConnel sandy loam, 0 to 5 percent slopes, and about 45 percent Badland. The McConnel soil is on terrace tops. The Badland is soft lake sediment on terrace breaks.

Included with this soil in mapping are small, irregularly shaped areas of Langston soil. These areas make up about 5 percent of the total acreage.

The McConnel soil has a plant cover consisting of big sagebrush, shadscale, spiny hopsage, and Indian ricegrass. The Badland is nearly barren.

These soils are not suitable for irrigated crops. The McConnel soil is used mainly for livestock grazing and wildlife habitat. The Badland areas have little economic use. McConnel part: Capability unit VIIs-285, dryland; range site NV 23-12; wildlife suitability group 9. Badland part: Capability unit VIIIe-224, dryland; not placed in a range site; not placed in a wildlife suitability group.

## Mendeboure Series

The Mendeboure series consists of well-drained soils that formed in alluvium and colluvium derived from mixed basic rocks. These soils are on mountain uplands. The slope range is 30 to 50 percent. Vegetation consists mainly of big sagebrush and bluebunch wheatgrass. The elevation ranges from 4,400 to 7,500 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 90 to 100 days.

In a representative profile the surface layer is grayish-brown very stony loam about 3 inches thick. Below this is dark grayish-brown and brown very stony clay loam grading to light clay about 12 inches thick. The next layer is brown very stony clay loam about 16 inches thick. Andesite bedrock is at a depth of 31 inches.

Mendeboure soils have slow permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 2 to 3 inches. Runoff is medium, and the hazard of accelerated erosion is severe.

In this area Mendeboure soils were mapped only as a component of Rubble land-Mendeboure association.

Representative profile of Mendeboure very stony loam, in an area of Rubble land-Mendeboure association, Modoc County, California, 200 feet south and 1,400 feet west of the west quarter corner of sec. 5, T. 38 N., R. 17 E., Mount Diablo base line and meridian:

- A1—0 to 3 inches, grayish-brown (10YR 5/2) very stony loam, upper 1 inch is light brownish gray (10YR 6/2); dark brown (10YR 3/3) moist; massive; slightly hard, friable, sticky, plastic; common very fine and few fine roots; many very fine vesicular and interstitial pores; slightly acid (pH 6.3); abrupt, smooth boundary. 3 to 9 inches thick.
- B1t—3 to 8 inches, dark grayish-brown (10YR 4/2) very stony clay loam, dark brown (10YR 3/3) moist; weak, coarse and medium, subangular blocky structure; slightly hard, friable, sticky, plastic; many very fine and few fine roots; many very fine tubular and interstitial pores; very few clay films on ped faces; neutral (pH 6.9); clear, wavy boundary. 0 to 6 inches thick.
- B2t—8 to 15 inches, brown (10YR 5/3) very stony light clay, dark brown (10YR 3/3) moist; moderate, medium, angular blocky structure; hard, friable, sticky, plastic; many very fine and few fine roots; many thin clay films on ped faces and many moderately thick continuous clay films in pores; neutral (pH 6.8); clear, wavy boundary. 3 to 12 inches thick.
- B31t—15 to 25 inches, brown (10YR 5/3) very stony clay loam, brown (10YR 4/3) moist; weak, coarse and medium, subangular blocky structure; hard, friable, sticky, plastic; common very fine and few fine roots; common very fine tubular pores; common thin clay films on ped faces and many thin clay films in pores; neutral (pH 6.9); gradual, smooth boundary. 8 to 12 inches thick.
- B32t—25 to 31 inches, brown (10YR 5/3) very stony clay loam, brown (10YR 4/3) moist; massive; hard, friable,

sticky, plastic; common very fine roots in fractures; common very fine tubular pores; few thin clay films as bridges and common thin clay films in pores; neutral (pH 6.9); abrupt, irregular boundary. 6 to 12 inches thick.

R—31 inches, andesitic bedrock.

Thickness of the solum and depth to bedrock range from 20 to 40 inches.

The A1 horizon ranges from 3 to 9 inches in thickness. In this horizon colors have a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 2 or 3. This horizon is loam, sandy clay loam, or light clay loam in texture, and it is 50 to 80 percent stones, by volume. It is massive or has weak, granular or subangular blocky structure. Reaction is slightly acid to neutral. In the Bt horizon colors have a hue of 10YR to 7.5YR, a dry value of 4 to 6, a moist value of 2 to 4, and a chroma of 2 or 3. The B2t horizon is dominantly clay in texture but ranges to heavy clay loam. It is 50 to 75 percent cobbles or stones. This horizon has weak or moderate, blocky, subangular blocky, or prismatic structure.

Included with Mendeboure soils are soils that have bedrock at a depth of more than 40 inches. These inclusions do not affect the use and management of Mendeboure soils.

## Mosquet Series

The Mosquet series consists of well-drained soils on mountain uplands. They formed in residuum and localized alluvium derived from basalt, andesite, tuff, and pyroclastics. The slope range is 5 to 30 percent. Stones cover about 5 to 10 percent of the surface and cobblestones about 15 percent. Vegetation consists of low sagebrush, Idaho fescue, and Sandberg bluegrass. The elevation ranges from 5,800 to 7,200 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 50 to 80 days.

In a representative profile the surface layer is grayish-brown very stony fine sandy loam and dark grayish-brown gravelly sandy clay loam. It is about 5 inches thick. Below this is dark-brown cobbly sandy clay and gravelly clay about 9 inches thick. The gravelly clay is only in fractures of basalt. The upper boundary of the underlying bedrock is strongly fractured.

Mosquet soils have slow permeability. The effective rooting depth is 6 to 24 inches. Available water capacity is 1 to 2 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Mosquet very stony fine sandy loam, in an area of Mosquet-Home Camp association, in Washoe County, Nevada, near the center of sec. 6, T. 39 N., R. 19 E., Mount Diablo base line and meridian:

A11—0 to 2 inches, grayish-brown (10YR 5/2) very stony fine sandy loam, very dark brown (10YR 2/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; many very fine interstitial and vesicular pores; neutral (pH 6.8); abrupt, smooth boundary. 2 to 4 inches thick.

A12—2 to 5 inches, dark grayish-brown (10YR 4/2) gravelly sandy clay loam, very dark brown (10YR 2/2) moist; massive; slightly hard, friable, sticky, plastic; many very fine roots; many very fine interstitial pores; slightly acid (pH 6.4); abrupt, smooth boundary. 2 to 5 inches thick.

B1t—5 to 9 inches, dark-brown (10YR 4/3) cobbly sandy clay, dark yellowish brown (10YR 3/4) moist; strong, fine, angular blocky structure; hard, friable, sticky, very plastic; common very fine roots; many very fine interstitial pores and few fine tubular pores; many thin clay bridges between sand grains; thin clay coatings on sand grains; few thin clay films on ped faces; slightly acid (pH 6.4); abrupt, wavy boundary. 4 to 7 inches thick.

B2t—9 to 14 inches, dark-brown (10YR 4/3) gravelly clay in bedrock fractures, dark yellowish brown (10YR 3/4) moist; strong, fine, angular blocky structure; very hard, firm, very sticky, very plastic; few very fine roots; common very fine tubular pores; many thin and few moderately thick dark grayish-brown (10YR 4/2) clay films on ped faces and in pores; slightly acid (pH 6.4); abrupt, broken boundary. 0 to 9 inches thick.

R—14 to 24 inches, basalt bedrock.

In the A1 horizon colors have a dry value of 5 or 6 and a moist value of 2 or 3. This horizon is cobbly, very cobbly, stony, or very stony loam or gravelly fine sandy loam. It is massive or has platy or granular structure. Colors in the B2t horizon have a hue of 10YR or 7.5YR, depending upon parent material. Dry or moist value is 3 to 5, and chroma is 3 or 4. The B2t horizon has weak, moderate or strong, blocky or subangular blocky structure. It is clay or heavy sandy clay. Reaction in this horizon is slightly acid or neutral. Depth to the shallowest part of the bedrock ranges from 6 to 14 inches, but cracks range to a depth of about 24 inches. The cracks that contain B2t material are 2 to 6 inches wide at the top but are less than 1 inch wide within 20 inches of the surface. In places the upper part of the bedrock is detached but not displaced.

**Mosquet-Home Camp association (MS).**—This association consists of gently sloping to moderately steep soils on uplands and steep soils on mountains. These soils are in large, irregularly shaped areas.

This association is about 70 percent Mosquet very rocky fine sandy loam that has 5 to 30 percent slopes and about 20 percent Home Camp stony loam that has 5 to 30 percent slopes. The Mosquet soil is on broad open slopes. Bedrock is at a depth of less than 20 inches. Stones cover about 5 to 10 percent of the surface of the Mosquet soil and cobblestones, about 15 percent. Rock outcrop makes up about 10 percent of the area of the Mosquet soil. The Home Camp soil is in depressional and concave areas and has bedrock at a depth of 20 to 40 inches.

Included with this association in mapping are areas of Bregar and Newlands soils. These areas make up about 10 percent of the total acreage.

The Mosquet soil has a native vegetation that consists of low sagebrush, Idaho fescue, and Sandberg bluegrass. The native vegetation on Home Camp soils is big sagebrush, bitterbrush, and Idaho fescue.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Mosquet part: Capability unit VIIs-237, dryland; range site NV 23-14; wildlife suitability group 8. Home Camp part: Capability unit VIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

## Nevador Series

The Nevador series consists of well-drained soils on lake terraces and alluvial fans. They formed in alluvium derived from basalt, andesite, tuff, and pyroclastics. The slope range is 0 to 5 percent. Vegetation consists of big sagebrush, spiny hopsage, and Thurber needlegrass. The elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 45° to 47° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is grayish-brown and light brownish-gray fine sandy loam or sandy loam about 5 inches thick. Below this is grayish-brown and pale-brown clay loam about 13 inches thick. The clay loam is underlain, to a depth of 36 inches, by pale-brown,

weakly silica-cemented sandy loam. Pale-brown loamy sand is between depths of 36 and 60 inches.

Nevador soils have moderately slow permeability. The effective rooting depth is 60 inches. Available water capacity is 6 to 7 inches.

Representative profile of Nevador fine sandy loam, 2 to 5 percent slopes, in Washoe County, Nevada, at the north quarter corner of sec. 31, T. 38 N., R. 18 E., Mount Diablo base line and meridian:

- A11—0 to 3 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, very friable, nonsticky, nonplastic; common very fine and few fine roots; many very fine and fine interstitial pores; neutral (pH 6.7); abrupt, smooth boundary. 0 to 4 inches thick.
- A12—3 to 5 inches, light brownish-gray (10YR 6/2) sandy loam, brown (10YR 3/3) moist; moderate, medium, platy structure; slightly hard, very friable, nonsticky, nonplastic; common very fine and few fine roots; many very fine interstitial pores; neutral (pH 6.8); abrupt, smooth boundary. 1 to 8 inches thick.
- B2t—5 to 13 inches, grayish-brown (10YR 5/2) clay loam, brown (10YR 3/3) moist; moderate, medium, prismatic structure; hard, friable, very sticky, very plastic; common very fine and few fine and medium roots; common very fine tubular pores; many moderately thick clay films on ped faces and continuous thin clay films in pores; neutral (pH 7.0); clear, smooth boundary. 3 to 12 inches thick.
- B3t—13 to 18 inches, pale-brown (10YR 6/3) clay loam, dark yellowish brown (10YR 3/4) moist; massive in place, parting to moderate, medium, subangular blocky structure; hard, friable, sticky, plastic; common very fine and few fine roots; common very fine and few fine tubular pores; common thin clay films on ped faces and continuous thin clay films in pores; moderately alkaline (pH 8.4); abrupt, wavy boundary. 2 to 8 inches thick.
- C1si—18 to 25 inches, pale-brown (10YR 6/3) weakly cemented sandy loam, dark grayish brown (10YR 4/2) moist; few, medium, faint, lime mottles; massive; very hard, firm, brittle; few fine and very fine roots; few very fine interstitial pores; about 40 percent durinodes that are very firm moist; slightly effervescent in spots; moderately alkaline (pH 8.4); clear, wavy boundary. 3 to 9 inches thick.
- C2si—25 to 36 inches, pale-brown (10YR 6/3) weakly cemented sandy loam, very dark grayish brown (10YR 4/2) moist; few, fine, faint, white (10YR 8/1) lime mottles; massive; very hard, firm, brittle; few fine and very fine roots; many very fine and fine interstitial pores; 20 percent extremely hard and very brittle durinodes; slightly effervescent in spots; moderately alkaline (pH 8.3); clear, wavy boundary. 8 to 14 inches thick.
- C3—36 to 60 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; many very fine and fine interstitial pores; mildly alkaline (pH 7.6).

The solum ranges from 14 to 24 inches in thickness. In the A horizon colors have a hue of 10YR, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is loamy sand to sandy loam. It is structureless (massive or single grain), or has weak granular or platy structure. In the B2t horizon colors have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 to 4. This horizon is clay loam, sandy clay loam, or heavy loam, and it has moderate to strong, prismatic or subangular blocky structure. Reaction is neutral to mildly alkaline. Depth to the C1si horizon ranges from 14 to 37 inches. In this horizon colors have a dry value of 5 or 6, a moist value of 3 to 5, and a chroma of 2 or 3. The C1si horizon is 20 to 70 percent durinodes.

**Nevador loamy fine sand, 0 to 2 percent slopes (NdA).**—This soil is in small, irregularly shaped areas on lake terraces and alluvial fans. The profile is similar to

the one described as representative for the series, except that the surface layer is loamy fine sand that is 4 to 11 inches thick.

Included with this soil in mapping are areas of Nevador soils that have a sandy loam surface layer and small areas of soils that are similar to those of the Zorravista series. These areas make up about 10 percent of the total acreage.

Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is severe if this soil is not protected. The native vegetation consists mainly of big sagebrush, spiny hopsage, and Thurber needlegrass.

This soil is suitable for irrigated crops if water is available. It is used mainly for livestock grazing and to a lesser extent as wildlife habitat. In places areas are used for pasture and the production of alfalfa. Capability unit IIs-43, irrigated and VIIs-229, dryland; range site NV 23-6; wildlife suitability group 7.

**Nevador loamy fine sand, 2 to 5 percent slopes (NdB).**—This soil is in small, irregularly shaped areas on lake terraces and alluvial fans. The profile is similar to the one described as representative for the series, except that the surface layer is loamy fine sand that is 5 to 9 inches thick.

Included with this soil in mapping are areas of slightly steeper Nevador soils. These areas make up about 5 percent of the total acreage.

Runoff is slow. The hazard of water erosion is moderate, and the hazard of soil blowing is severe if this soil is not protected. The native vegetation consists mainly of big sagebrush, spiny hopsage, and Thurber needlegrass.

This soil is suitable for irrigated crops if water is available. It is used mainly for livestock grazing and to a lesser extent as wildlife habitat. In places areas are irrigated and used for pasture or the production of alfalfa. Capability unit IIs-43, irrigated and VIIs-229, dryland; range site NV 23-6; wildlife suitability group 7.

**Nevador fine sandy loam, 0 to 2 percent slopes (NeA).**—This soil is in very small, irregularly shaped areas on lake terraces and alluvial fans.

Included with this soil in mapping are areas of Nevador loamy fine sand that make up about 2 percent of the total acreage.

Runoff is slow, and the hazard of erosion is slight. The native vegetation consists mainly of big sagebrush, spiny hopsage, and Thurber needlegrass.

This soil is suitable for irrigated crops if water is available. It is used mainly for livestock grazing and to a lesser extent as wildlife habitat. Small areas are irrigated and are used for pasture and the production of small grains. Capability unit IIc-1, irrigated and VIc-220, dryland; range site NV 23-6; wildlife suitability group 7.

**Nevador fine sandy loam, 2 to 5 percent slopes (NeB).**—This soil occupies large, irregularly shaped areas on lake terraces and alluvial fans. It has the profile described as representative for the series.

Included with this soil in mapping are mainly small areas of stony and cobbly drainageways and small areas of an unnamed shallow stony soil on low ridges. These areas make up about 5 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. The native vegetation consists mainly of big sagebrush, spiny hopsage, and Thurber needlegrass.

This soil is suitable for irrigated crops if water is available. It is used mainly for livestock grazing and wildlife

habitat. In places areas are used for pasture and the production of alfalfa. Capability unit IIe-20, irrigated and VIc-220, dryland; range site NV 23-6; wildlife suitability group 7.

## Newlands Series

The Newlands series consists of well-drained soils on mountainous uplands. They formed in residuum and localized alluvium derived from mixed basic rocks. The slope range is 5 to 50 percent. Vegetation consists of big sagebrush, bitterbrush, and Idaho fescue. The elevation ranges from 5,500 to 7,000 feet. The average annual precipitation is 12 to 16 inches, the average air temperature is 41° to 45° F., and the frost-free season is 80 to 90 days.

In a representative profile the surface layer is dark grayish-brown loam about 8 inches thick. The next layer is brown and light-brown clay loam in the upper 30 inches and light-brown gravelly clay loam in the lower 7 inches. Andesitic bedrock is at a depth of 45 inches.

Newlands soils have moderately slow permeability. The effective rooting depth is 28 to 60 inches. Available water capacity is 5 to 9 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Newlands stony loam in an area of Newlands-Hapgood association in Lassen County, California, 200 feet west of the south quarter corner of sec. 4, T. 36 N., R. 17 E., Mount Diablo base line and meridian:

- A11—0 to 3½ inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine interstitial pores; slightly acid (pH 6.2); clear, smooth boundary. 3 to 5 inches thick.
- A12—3½ to 8 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots and few medium and coarse roots; many very fine interstitial pores; slightly acid (pH 6.4); clear, smooth boundary. 5 to 15 inches thick.
- B1t—8 to 16 inches, brown (10YR 4/3) light clay loam, dark brown (7.5YR 3/3) moist; moderate, fine and medium, granular structure; slightly hard, friable, sticky, plastic; common very fine and fine roots and few medium roots; many very fine interstitial pores; few thin clay films on ped faces and common thin bridges between sand grains; slightly acid (pH 6.4); clear, wavy boundary. 5 to 8 inches thick.
- B2t—16 to 27 inches, brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 3/4) moist; moderate, medium and coarse, subangular blocky structure; hard, friable, sticky, very plastic; common very fine roots; many very fine tubular pores; many thin, strong-brown (7.5YR 4/4) clay films on ped faces and continuous, thin, strong-brown (7.5YR 4/4) clay films in pores; slightly acid (pH 6.4); clear, wavy boundary. 7 to 18 inches thick.
- B31t—27 to 38 inches, light-brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/4) moist; moderate, coarse and medium, subangular blocky structure; hard, firm, sticky, plastic; common very fine roots; many very fine and fine tubular pores; common, moderately thick, dark-brown (7.5YR 4/4) clay films on ped faces and continuous, moderately thick, dark-brown (7.5YR 4/4) clay films in pores; slightly acid (pH 6.4); clear, wavy boundary. 9 to 16 inches thick.
- B32t—38 to 45 inches, light-brown (7.5YR 6/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; massive; very hard, very firm, sticky, plastic; few very fine roots; common very fine tubular pores; few, moderately thick, dark-brown (7.5YR 4/4) clay bridges between

sand grains and many, moderately thick, dark-brown (7.5YR 4/4) clay films in pores; slightly acid (pH 6.4); gradual, wavy boundary. 0 to 14 inches thick.

R—45 to 50 inches, andesitic bedrock.

Colors in the A1 horizon have a hue of 10YR or 7.5YR, a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 1 to 3. This horizon is loam or sandy loam and has moderate to strong, granular or subangular blocky structure or is massive. In the B2t horizon colors have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 3 to 5, and a chroma of 3 or 4. This horizon is generally heavy clay loam or clay loam but ranges to sandy clay loam and contains about 25 percent gravel or cobblestones. It has moderate to strong, angular or subangular blocky structure. Reaction is slightly acid to neutral. Thickness of the solum and the depth to bedrock range from 28 to 60 inches, but they are 28 to 48 inches in most places. Bedrock is tuff, andesite, or basalt.

**Newlands-Hapgood association (NH).**—This association consists of moderately sloping to moderately steep soils in very large, irregularly shaped areas on uplands. The association is about 45 percent Newlands stony loam that has 5 to 30 percent slopes and about 40 percent Hapgood stony fine sandy loam that has 5 to 30 percent slopes. The Newlands soil has a subsoil of clay loam, and stones cover 10 percent of its surface. The Hapgood soil has a subsoil of loam.

Included with this association in mapping are very stony areas of Newlands, Hapgood, Home Camp, and Bluebell soils. These areas make up about 15 percent of the total acreage.

These soils have a native vegetation that consists of big sagebrush, bitterbrush, and Idaho fescue.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Newlands and Hapgood parts: Capability unit VIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

## Ninemile Series

The Ninemile series consists of well-drained soils. They formed in residuum and localized alluvium from basalt, andesite, and tuff. The slope range is 0 to 9 percent. Vegetation consists of low sagebrush and Sandberg bluegrass. The elevation ranges from 5,500 to 7,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 42° to 44° F., and the frost-free season is 50 to 80 days.

In a representative profile the surface layer is dark-brown extremely cobbly loam about 2 inches thick. Below this is brown clay about 12 inches thick. Basaltic bedrock is at a depth of 14 inches.

Ninemile soils have very slow permeability. The effective rooting depth is 10 to 20 inches. Available water capacity is 2 to 3 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

Representative profile of Ninemile extremely cobbly loam in an area of Ninemile-Karlo association, in Washoe County, Nevada; 300 feet south and 800 feet east of the north quarter corner of sec. 32, T. 35 N., R. 18 E., Mount Diablo base line and meridian:

- A1—0 to 2 inches, dark-brown (10YR 4/3) extremely cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, platy structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine interstitial pores; neutral (pH 6.8); abrupt, broken boundary. 0 to 5 inches thick.

B21t—2 to 4 inches, brown (7.5YR 4/3) clay, dark brown (7.5YR 3/3) moist; moderate, very fine, subangular blocky structure; hard, friable, very sticky, very plastic; common very fine and fine roots and few medium roots; many very fine interstitial pores; continuous very thin clay films on ped faces; neutral (pH 6.7); abrupt, broken boundary. This horizon is discontinuous and is only around the under edges of surface cobblestones and stones, 0 to 2 inches thick.

B22t—4 to 8 inches, brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate, fine, prismatic parting to strong, fine, angular blocky structure; extremely hard, very firm, very sticky, very plastic; common very fine and fine roots; many very fine interstitial pores; continuous pressure cutans; neutral (pH 6.7); abrupt, smooth boundary. 3 to 9 inches thick.

B23t—8 to 14 inches, brown (7.5YR 4/3) clay, dark brown (7.5YR 3/4) moist; strong, fine and medium, subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few very fine and fine roots; very few fine tubular pores; continuous pressure cutans; neutral (pH 6.7); abrupt, irregular boundary. 4 to 7 inches thick.

R—14 to 19 inches, basaltic bedrock.

In the A1 horizon colors have a dry value of 3 to 5, a moist value of 2 or 3, and a chroma of 2 or 3. In places in barren or sparsely vegetated areas the upper 1 to 2 inches has colors that have a dry value of 6 and a chroma of 1. The A1 horizon is massive or has weak or moderate, platy or granular structure. Colors in the B2t horizon have a hue of 5YR to 10YR, a dry value of 3 to 5, a moist value of 3 or 4, and a chroma of 3 or 4. The B2t horizon is 50 to 60 percent clay and 5 to 30 percent gravel and cobblestones. This horizon has moderate or strong, blocky or prismatic structure. Thickness of the solum and the depth to bedrock are 10 to 20 inches.

**Ninemile-Karlo association (NK).**—This association consists of nearly level to moderately steep soils in very large, irregularly shaped areas on tablelands. It is about 50 percent Ninemile extremely cobbly loam that has 0 to 9 percent slopes; about 20 percent Karlo very cobbly clay, 0 to 9 percent slopes; and 20 percent Madeline very stony loam, 2 to 30 percent slopes. The Ninemile soil has an abrupt textural change between the surface layer and subsoil. Embedded cobblestones cover 80 percent of the surface of this soil. The Karlo soil has clay profiles that crack at the surface. The Madeline soil has a gradual textural change between the surface layer and subsoil.

Included with this association in mapping are areas of Home Camp and Newlands soils, a few areas of Rock outcrop, and areas of Rubble land. These areas make up about 10 percent of the total acreage.

The Ninemile soil has a vegetation that consists of low sagebrush and Sandberg bluegrass. The vegetation on the Karlo soil consists of low gray rabbitbrush. The Madeline soil has a vegetation that consists mainly of big sagebrush and bitterbrush.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Ninemile part: Capability unit VII<sub>s</sub>-237, dryland; range site NV 23-17; wildlife suitability group 8. Karlo part: Capability unit VII<sub>s</sub>-241, dryland; range site NV 23-1; wildlife suitability group 8. Madeline part: Capability unit VII<sub>s</sub>-237, dryland; range site NV 23-15; wildlife suitability group 6.

## Old Camp Series

The Old Camp series consists of well-drained soils. They formed in dark-colored residuum derived from basalt and alluvium from tuff, andesite, and volcanic ash. About 50

percent of the surface is covered by gravel. The slope range is 5 to 30 percent. Vegetation consists of big sagebrush, Thurber needlegrass, and spiny hopsage. The elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 45° to 47° F., and the frost-free season is 80 to 100 days.

In a representative profile the surface layer is very pale brown gravelly loam about 2 inches thick. The next layer is pale-brown and brown clay loam about 12 inches thick. In the lower part it is 75 to 85 percent detached bedrock fragments, 3 to 18 inches in size. Lime-coated basalt bedrock is at a depth of 14 inches.

Old Camp soils have moderately slow permeability. The effective rooting depth is 10 to 20 inches. Available water capacity is 2 to 3 inches.

Representative profile of Old Camp gravelly loam in an area of Old Camp-Langston association in Washoe County, Nevada; 500 feet west and 300 feet north of the east quarter corner of sec. 7, T. 36 N., R. 20 E., Mount Diablo base line and meridian:

A1—0 to 2 inches, very pale brown (10YR 7/3) gravelly loam, brown (10YR 4/3) moist; weak, medium, platy structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common very fine and fine vesicular pores; neutral (pH 7.0); clear, wavy boundary. 1 to 2 inches thick.

B1t—2 to 6 inches, pale-brown (10YR 6/3) clay loam, dark brown (10YR 3/3) moist; strong, very fine, granular structure; soft, very friable, sticky, plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; few thin clay films on ped faces; neutral (pH 6.8); abrupt, wavy boundary. 3 to 5 inches thick.

B2t—6 to 14 inches, brown (10YR 5/3) stony, cobbly, and gravelly clay loam, dark yellowish brown (10YR 3/4) moist; moderate, medium and fine, subangular blocky structure; hard, friable, sticky, plastic; common very fine and fine roots and few medium roots; many very fine interstitial pores; common thin and few moderately thick clay films on ped faces; continuous thin clay coatings on fine gravel; 75 to 80 percent dark-gray (10YR 4/1) to black (10YR 2/1) detached bedrock fragments 3 to 18 inches in size; many, fine to coarse, faint, yellow (10YR 7/6 and 7/8), brownish-yellow (10YR 6/6), and yellowish-brown (10YR 5/4) iron stains; many, coarse, distinct, white (10YR 8/2) lime coatings on the underside of coarse fragments; matrix is noneffervescent; mildly alkaline (pH 7.6); abrupt, irregular boundary. 6 to 13 inches thick.

R—14 to 20 inches, dark-gray (10YR 4/1) basalt; white (10YR 8/2) and very pale brown (10YR 7/3) lime coatings on the surface and filling some cracks.

Thickness of the solum and the depth to bedrock range from 10 to 20 inches.

In the A1 horizon colors have a dry value of 5 to 7, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is loam or sandy loam that is gravelly, extremely stony, or rocky. It has weak or moderate platy primary structure or is massive. In the B2t horizon colors have a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 to 4. This horizon is dominantly clay loam but in places is sandy clay loam and 50 to 90 percent gravel, cobblestones, and stones. It has weak or moderate subangular blocky structure.

**Old Camp association (OC).**—This association consists of moderately sloping to steep soils in large, irregularly shaped areas on rolling hills east of Duck Lake Valley. It is about 40 percent Old Camp very rocky loam that has 5 to 30 percent slopes and about 40 percent Old Camp extremely stony loam that has 5 to 15 percent slopes. The Old Camp soils are differentiated within mapped areas by the

amount of Rock outcrop present and the amount of coarse fragments on the surface. Large rocks crop out on about 10 percent of the surface of Old Camp very rocky loam. Stones, 10 to 24 inches in diameter, are on 25 to 50 percent of the surface of Old Camp extremely stony loam.

Included with this association in mapping are areas of Langston soils and less stony Old Camp soils. These areas make up about 20 percent of the total acreage.

Runoff is medium, and the hazard of erosion is slight. These soils have a native vegetation that consists of big sagebrush, Thurber needlegrass, and spiny hopsage.

These soils are not used for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Capability unit VIIs-237, dryland; range site NV 23-6; wildlife suitability group 7.

**Old Camp-Langston association (OG).**—This association consists of rolling soils in large, irregularly shaped areas on rock pediments and low hills along the eastern side of Duck Lake Valley. It is about 55 percent Old Camp gravelly loam that has 5 to 15 percent slopes and about 35 percent Langston sandy loam that has 0 to 5 percent slopes. The Old Camp soil is less than 20 inches deep to bedrock and gravel covers about 50 percent of the surface. The Langston soil is more than 60 inches deep and has a gravelly subsoil.

Included with this association in mapping are areas of Vylach soils, Badland, and Rock outcrop. These areas make up about 10 percent of the total acreage.

Runoff is slow, and the hazard of erosion is moderate. These soils have a native vegetation that consists of big sagebrush, Thurber needlegrass, and spiny hopsage.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Old Camp part: Capability unit VIIs-231, dryland; range site NV 23-6; wildlife suitability group 7. Langston part: Capability unit VIc-220, dryland; range site NV 23-6; wildlife suitability group 7.

## Olson Series

The Olson series consists of well-drained soils. They formed in lacustrine valley fill derived from mixed basic rocks. The slope range is 0 to 15 percent. About 50 percent of the surface is covered by gravel. Vegetation consists of big sagebrush, spiny hopsage, squirreltail, and Sandberg bluegrass. The elevation ranges from 4,900 to 5,500 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 42° to 45° F., and the frost-free season is 60 to 90 days.

In a representative profile the surface layer is light-gray and light brownish-gray fine sandy loam about 4 inches thick. The next layer is light brownish-gray sandy clay loam in the upper 5 inches and light yellowish-brown gravelly sandy clay loam in the lower 4 inches. It is underlain by a very pale brown indurated hardpan about 2 inches thick. Below this is a pale brown and very pale brown, strongly cemented hardpan about 6 inches thick, which is underlain by light-gray gravelly loamy sand to a depth of about 44 inches.

Olson soils have moderately slow permeability above the hardpan and very slow permeability within the hardpan. The effective rooting depth is 10 to 20 inches. Available water capacity is 1 to 2 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Olson fine sandy loam in an area of Olson-Badland association in Washoe County, Nevada, 600 feet northwest of the southeast corner of sec. 29, T. 39 N., R. 22 E., Mount Diablo base line and meridian:

A11—0 to 1 inch, light brownish-gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; upper ¼ inch is light-gray (10YR 7/2); massive; slightly hard, friable, nonsticky, slightly plastic; few root crowns; many very fine and fine vesicular pores; neutral (pH 6.6); abrupt, slightly wavy boundary. ½ to 2 inches thick.

A12—1 to 4 inches, light-gray (10YR 7/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thin, platy structure; slightly hard, very friable, nonsticky, nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; few thin clay films on ped surfaces and few colloidal coatings; neutral (pH 6.6); clear, wavy boundary. 1 to 4 inches thick.

B1t—4 to 9 inches, light brownish-gray (10YR 6/2) light sandy clay loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable; slightly sticky, plastic; many very fine and fine roots; many very fine interstitial pores; common colloidal coatings and few thin clay films as bridges; neutral (pH 6.7); clear, wavy boundary. 1 to 6 inches thick.

B2t—9 to 13 inches, light yellowish-brown (10YR 6/4) gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate, fine, subangular blocky structure; hard, friable, sticky, plastic; common very fine and fine roots and few medium roots; few fine tubular pores; many thin clay films in pores and common thin clay films on ped faces; neutral (pH 6.8); abrupt, wavy boundary. 4 to 8 inches thick.

C1sim—13 to 15 inches, very pale brown (10YR 7/3) indurated hardpan, dark yellowish brown (10YR 4/4) moist; many, yellowish-brown (10YR 5/4), opalescent coatings on continuous laminar caps; strong, thin to thick, platy structure; extremely hard, extremely firm; few very fine and fine roots along plate tops and in fractures; many very fine interstitial pores; many thin and moderately thick silica bridges between sand grains; neutral (pH 7.0); abrupt, wavy boundary. 2 to 9 inches thick.

C2sicam—15 to 21 inches, variegated, pale-brown (10YR 6/3) and very pale brown (10YR 7/3), strongly cemented duripan, dark brown (10YR 4/3) and yellowish brown (10YR 5/6) moist; common, fine and medium, white (10YR 8/1) lime coatings; few, fine and medium, yellowish-brown (10YR 5/4) opalescent coatings; massive; hard and very hard, firm and very firm; few very fine and fine roots; many very fine and fine interstitial pores; many thin and few moderately thick silica bridges between sand grains; effervescent in matrix, violently effervescent lime coatings; strongly alkaline (pH 8.8); clear, smooth boundary. 5 to 12 inches thick.

IIC3ca—21 to 44 inches, light-gray (10YR 7/2) gravelly loamy sand, grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) moist; very pale brown (10YR 7/3) and white (10YR 8/1) vertical lime seams, ¼ to ½ inch thick, on 4- to 6-inch centers from horizon above; massive; hard, very friable, nonsticky, nonplastic; many very fine and fine interstitial pores; violently effervescent; strongly alkaline (pH 8.8).

In the A1 horizon colors have a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is fine sandy loam or loam, and it is massive or has weak, platy structure. In the B2t horizon colors have a dry value of 6 or 7, a moist value of 4 or 5, and a chroma of 2 to 4. This horizon is sandy clay loam to light clay loam or heavy loam in texture and is as much as 35 percent gravel. It is massive or has weak prismatic or weak to moderate, angular or subangular blocky structure. Depth to the hardpan ranges from 10 to 20 inches. The hardpan ranges in thickness from 6 to 26 inches. The indurated part is 2 to 9 inches in thickness. Colors in the hardpan have a dry value of 6 to 8, a moist value of 4 or 5, and a chroma of 2 to 4. Reaction in the hardpan ranges from neutral

to moderately alkaline in the upper, noncalcareous part and from moderately alkaline to strongly alkaline in the lower, calcareous part.

**Olson-Badland association (OS).**—This association consists of soils in large, uniformly shaped areas on old lacustrine terraces near Denio Camp. It is about 65 percent Olson fine sandy loam that has 0 to 15 percent slopes and about 25 percent Badland. The Olson soil has a silica-cemented hardpan at a depth of 10 to 20 inches. Gravel covers 50 percent of the surface. Badland consists of barren or nearly barren exposures of unconsolidated or weakly consolidated sediment.

Included with this association in mapping are areas of Espil, Fertaline, and Mascamp soils that make up about 10 percent of the total acreage.

The Olson soil has a native vegetation that consists of big sagebrush, spiny hopsage, squirreltail, and Sandberg bluegrass. Badland has little or no plant cover.

These soils are not suitable for irrigated crops. The Olson soil is used mainly for livestock grazing and wildlife habitat. Badland is of little or no value, except for esthetic purposes. Olson part: Capability unit VII<sub>s</sub>-231, dryland; range site NV 23-6; wildlife suitability group 7. Badland part: Capability unit VIII<sub>e</sub>-224, dryland; not placed in a range site; not placed in a wildlife suitability group.

## Pegler Series

The Pegler series consists of well-drained soils. They formed in residuum weathered from tuff bedrock and from alluvium derived from mixed basic rocks. The slope range is 0 to 5 percent. Vegetation consists of shadscale, spiny hopsage, and Indian ricegrass. The elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is 6 to 9 inches, the average annual air temperature is 45° to 47° F., and the frost-free season is 70 to 100 days.

In a representative profile the surface layer is light-gray fine sandy loam about 2 inches thick. Below it is pale-brown clay loam and very pale brown gravelly clay loam about 7 inches thick. Highly fractured tuffs are at a depth of 9 inches.

Pegler soils have moderately slow permeability. The effective rooting depth is 8 to 14 inches. Available water capacity is 1 to 2 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

In this survey area, Pegler soils were mapped only as components of Disabel-Pegler association, Vylach-Pegler association, and Vylach-Pegler association, overwash.

Representative profile of Pegler fine sandy loam in an area of Vylach-Pegler association, Washoe County, Nevada; 100 feet south and 200 feet east of the center of sec. 10, T. 36 N., R. 19 E., Mount Diablo base line and meridian:

A1—0 to 2 inches, light-gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; light brownish gray (10YR 6/2) in the upper ½ inch; weak, thick, platy structure; slightly hard, very friable, slightly sticky, slightly plastic; very few very fine roots; many very fine interstitial pores; violently effervescent; strongly alkaline (pH 8.8); abrupt, smooth boundary. 1 to 3 inches thick.

IIB2—2 to 5 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak, medium, prismatic parting to strong, very fine, subangular blocky structure; soft, very friable, sticky, plastic; few very fine and fine roots; many very fine interstitial pores and few fine tubular pores; common, thin, colloidal clay coat-

ings on sand grains; violently effervescent; strongly alkaline (pH 8.6); abrupt, wavy boundary. 3 to 7 inches thick.

IIB3—5 to 9 inches, very pale brown (10YR 7/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; very pale brown (10YR 7/3) angular tuff gravel; moderate, medium, subangular blocky structure; slightly hard, friable, sticky, plastic; common very fine roots and few fine roots; many very fine interstitial pores and few fine tubular pores; common, thin, colloidal clay coatings on sand grains and gravel; violently effervescent; strongly alkaline (pH 8.8); clear, broken boundary. 4 to 6 inches thick.

IIC—9 to 30 inches, highly fractured tuffs as a result of local faulting action; pale yellow (5Y 8/3); common, fine, distinct, black (10YR 2/1) manganese mottles; fragments are in form of slightly curved sticks 1 to 2 inches long and ⅓ to ¼ inch in diameter; mass is readily excavatable by hand shovel to a depth of several feet.

Thickness of the solum and the depth to bedrock range from 8 to 14 inches.

In the A1 horizon colors have a hue of 10YR or 2.5Y, a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is massive or has weak to moderate, platy structure. Reaction is moderately alkaline to strongly alkaline. Colors in the IIB horizon have a dry value of 6 or 7, a moist value of 4 or 5, and a chroma of 2 to 4. This horizon is heavy loam, clay loam, or sandy clay loam. It has weak to moderate, prismatic or subangular blocky structure or is massive. Reaction is strongly alkaline to very strongly alkaline.

## Playas

Playas (PA) is a miscellaneous land type that consists of level, barren saline silt and clay in basins that have no external drainage. Prominent areas of Playas are adjacent to the intermittent lakes in Surprise Valley and Long Valley.

This land type has very slow infiltration and permeability. Rainfall and runoff flow into Playas, pond for a short period, and then evaporate.

This land type is of little or no value, except for minerals and for esthetic and recreational uses. Capability unit VIII<sub>w</sub>-207, dryland; not placed in a range site; not placed in a wildlife suitability group.

## Powley Series

The Powley series consists of well-drained soils. They formed in alluvium derived from andesite, basalt, tuff, and pyroclastics. The slope range is 2 to 15 percent. Vegetation consists of big sagebrush, Thurber needlegrass, and blue-bunch wheatgrass. About 40 percent of the surface is covered by gravel. The elevation ranges from 5,500 to 6,000 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 43° to 45° F., and the frost-free season is 60 to 90 days.

In a representative profile the surface layer is grayish-brown gravelly fine sandy loam and light brownish-gray and grayish-brown fine sandy loam. It is about 9 inches thick. Below this is pale-brown sandy clay loam and brown clay about 10 inches thick. The underlying material, to a depth of 32 inches, is a pale-brown and grayish-brown, indurated, silica-cemented hardpan.

Powley soils have very slow permeability. The effective rooting depth is 15 to 20 inches. Available water capacity is 2 to 3 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Powley gravelly fine sandy loam, 2 to 15 percent slopes, in an area of Espil-Powley association, in Washoe County, Nevada; 2,400 feet east of the southwest corner of sec. 16, T. 40 N., R. 21 E., Mount Diablo base line and meridian:

- A11—0 to 1 inch, grayish-brown (10YR 5/2) gravelly fine sandy loam, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky, nonplastic; root crowns only; many very fine interstitial pores; slightly acid (pH 6.4); abrupt, broken boundary. 0 to 2 inches thick.
- A12—1 to 3 inches, light brownish-gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, nonsticky, nonplastic; few very fine and fine roots; many very fine and fine vesicular pores; neutral (pH 6.6); clear, wavy boundary. 1 to 3 inches thick.
- A13—3 to 9 inches, grayish-brown (10YR 5/2) heavy fine sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; neutral (pH 6.6); clear, smooth boundary. 4 to 8 inches thick.
- B&A—9 to 11 inches, pale-brown (10YR 6/3) sandy clay loam, dark brown (10YR 3/3) moist; few to common fine and medium pockets of very pale brown (10YR 7/3); moderate, fine and medium, subangular blocky structure; slightly hard, very friable, sticky, plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores and few fine tubular pores; few thin clay films in pores and on ped faces; common clean sand grains, especially in light-colored pockets; neutral (pH 6.8); clear, smooth boundary. 1 to 4 inches thick.
- B21t—11 to 15 inches, brown (10YR 5/3) clay, dark brown (7.5YR 4/3) if moist and crushed; weak, medium, prismatic and moderate, medium, subangular blocky structure; hard, friable, very sticky, very plastic; many very fine and fine roots and few medium roots; common very fine and fine tubular pores; many thin and common moderately thick dark-brown (7.5YR 4/3) clay films on ped faces and continuous thin clay films in pores; neutral (pH 6.8). 4 to 6 inches thick.
- B22t—15 to 19 inches, brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; weak prismatic and moderate, medium, subangular blocky structure; hard, friable, very sticky, very plastic; common very fine and fine exped roots; few very fine and fine tubular pores; many thin and common, moderately thick, light yellowish-brown (10YR 6/4) clay films on ped faces and in pores; about 10 percent subangular blocky durinodes that are very hard, firm, and brittle; neutral (pH 6.8); abrupt, smooth boundary. 3 to 6 inches thick.
- C1sim—19 to 27 inches, pale-brown (10YR 6/3) indurated duripan, very dark grayish brown (10YR 3/2) moist; strong, medium and thick, platy structure; thin light yellowish-brown (10YR 6/4) and very pale brown (10YR 7/4) silica laminae coating plate surfaces; common very fine and fine roots matted on plate surfaces; extremely hard, extremely firm; few very fine, discontinuous tubular pores; neutral (pH 6.8); gradual, smooth boundary. 6 to 10 inches thick.
- C2sicam—27 to 32 inches, grayish-brown (10YR 5/2) indurated duripan, dark brown (10YR 4/3) moist; massive; extremely hard, extremely firm; few very fine tubular pores; yellowish-brown (10YR 6/4) and very pale brown (10YR 7/4) silica laminae and few, coarse, dark-brown (10YR 3/3) organic coatings; matrix generally is noneffervescent but is violently effervescent where common, coarse, distinct, very pale brown (10YR 8/3) lime coatings are present; neutral (pH 6.8) in matrix and moderately alkaline (pH 8.4) in coatings.

The colors in the A1 horizon have a hue of 10YR, a dry value of 4 or 5 (in places is 6 in upper 3 inches), a moist value of 2 or 3, and a chroma of 2 or 3. If the material in the upper 7

inches of this horizon is mixed, the value is less than 5.5 when dry. The A1 horizon is massive or has weak or moderate platy structure. An A2, A&B, or B&A horizon is present in places. Colors in the B2t horizon have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 3 to 5, and a chroma of 3 or 4. The colors in the hardpan have a hue of 10YR, a dry value of 5 to 7, a moist value of 3 to 5, and a chroma of 2 or 3. Thickness of the solum ranges from 15 to 20 inches.

**Powley gravelly fine sandy loam, 2 to 15 percent slopes (PGC).**—This soil is in large, uniformly shaped areas on old dissected alluvial fans and terraces. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Espil and Mascamp soils and Rock outcrop. These areas make up about 10 percent of the total acreage.

The vegetation consists mainly of big sagebrush, Thurber needlegrass, and bluebunch wheatgrass.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIIs-231, dryland; range site NV 23-20; wildlife suitability group 7.

**Powley-Espil association (PH).**—This association consists of soils in irregularly shaped areas on higher lying terraces and plateaus. It is about 50 percent Powley gravelly fine sandy loam, 2 to 15 percent slopes; about 30 percent Espil gravelly sandy loam that has 0 to 15 percent slopes; and about 15 percent Hart Camp gravelly fine sandy loam that has 2 to 15 percent slopes. The Powley soil is underlain by a silica-cemented hardpan at a depth of 15 to 20 inches. The Espil soil is underlain by a silica-cemented hardpan at a depth of 8 to 14 inches. Hart Camp soils are underlain by andesite bedrock at a depth of 10 to 20 inches.

Included with this soil in mapping are areas of Fertaline and Mascamp soils that make up about 5 percent of the total acreage.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Powley part: Capability unit VIIIs-231, dryland; range site NV 23-20; wildlife suitability group 7. Espil part: Capability unit VIIIs-231, dryland; range site NV 23-21; wildlife suitability group 8. Hart Camp part: Capability unit VIIIs-231, dryland; range site NV 23-20; wildlife suitability group 7.

**Powley-Mascamp association (PM).**—This association consists of soils in broad, irregularly shaped areas on pediments and low-lying terraces. It is about 60 percent Powley gravelly fine sandy loam, 2 to 15 percent slopes, and about 30 percent Mascamp extremely stony sandy loam, 2 to 15 percent slopes. The Powley soil is nonstony. It is underlain by a silica-cemented hardpan at a depth of 15 to 20 inches. The Mascamp soil is stony and is underlain by tuff bedrock at a depth of 10 to 20 inches.

Included with this association in mapping are areas of Espil and Fertaline soils and Rock outcrop. These areas make up about 10 percent of the total acreage.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Powley part: Capability unit VIIIs-231, dryland; range site NV 23-20; wildlife suitability group 7. Mascamp part: Capability unit VIIIs-237, dryland; range site NV 23-20; wildlife suitability group 7.

## Raglan Series

The Raglan series consists of well-drained soils that formed in alluvium derived from mixed basic rocks. Moderate amounts of exchangeable sodium and salts are in these soils. The slope range is 0 to 9 percent. Vegetation consists of greasewood, shadscale, and bud sagebrush. The elevation ranges from 4,500 to 4,800 feet. The average annual precipitation is 6 to 9 inches, the average annual air temperature is 45° to 50° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray very fine sandy loam and very pale brown light sandy clay loam. It is about 6 inches thick. Below this is pale-brown light sandy clay loam about 7 inches thick. The next layer is about 4 inches of pale-brown very fine sandy loam. Silica-cemented nodules are common in this layer. The underlying material is light brownish-gray very fine sandy loam to a depth of 61 inches.

Raglan soils have moderately slow permeability. The effective rooting depth is 60 inches. Available water capacity is 8 to 10 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

Representative profile of Raglan very fine sandy loam, 2 to 9 percent slopes, in Washoe County, Nevada, 225 feet east of the California State line marker on the Long Ranch road in sec. 12, T. 42 N., R. 17 E., Mount Diablo base line and meridian:

- A11—0 to 2 inches, light brownish-gray (2.5Y 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, platy structure; soft, very friable, nonsticky, nonplastic; many very fine and fine vesicular pores; strongly alkaline (pH 9.0); strongly effervescent; abrupt, smooth boundary. 0 to 2 inches thick.
- A12—2 to 6 inches, very pale brown (10YR 7/3) light sandy clay loam, dark brown (10YR 4/3) moist; weak, fine, platy structure; soft, very friable, slightly sticky, slightly plastic; few very fine roots; many very fine and fine vesicular pores; strongly effervescent; very strongly alkaline (pH 9.2); abrupt, smooth boundary. 2 to 6 inches thick.
- B2—6 to 13 inches, pale-brown (10YR 6/3) light sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate, fine, subangular blocky structure; slightly hard, friable, sticky, plastic; common very fine and fine roots; common very fine and fine vesicular and interstitial pores; weakly to strongly effervescent; very strongly alkaline (pH 9.4); abrupt, smooth boundary. 4 to 12 inches thick.
- C1sica—13 to 17 inches, pale-brown (10YR 6/3) very fine sandy loam, dark grayish-brown (10YR 4/2) moist; white (10YR 8/2) lime mottles; massive; hard, brittle, nonsticky, nonplastic; common durinodes; few fine and very fine roots; few very fine tubular pores and common very fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.4); clear, wavy boundary. 3 to 8 inches thick.
- C2—17 to 61 inches, light brownish-gray (2.5Y 6/2) very fine sandy loam, dark brown (10YR 4/3) moist; many fine white (10YR 8/2) lime mottles; massive; soft, very friable, nonsticky, nonplastic; common durinodes; many very fine and fine roots; many very fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.4); abrupt, smooth boundary.

Colors in the profile have a hue of 10YR or 2.5Y, a dry value of 6 or 7, a moist value of 4 or 5, and a chroma of 2 or 3. Reaction ranges from strongly alkaline to very strongly alkaline throughout.

The A1 horizon is massive or has weak or moderate, platy structure. The B2 horizon is massive or has weak, prismatic or subangular blocky structure. The C horizon is stratified

loam, silt loam, very fine sandy loam, light clay loam, and silty clay loam. It is 18 to 25 percent clay, by weighted average. The Csica horizon is massive and is 20 to 80 percent silica-cemented nodules, by volume.

**Raglan very fine sandy loam, 2 to 9 percent slopes (RAB).**—This soil is in large, uniformly shaped areas along the eastern side of Surprise Valley. It is on lake terraces and alluvial fans. This soil has the profile described as representative for the series. It is slightly to moderately saline and alkaline.

Included with this soil in mapping are areas of soils that are similar to Raglan soils, except that they are cobbly and are about 20 inches deep to bedrock. These areas make up about 10 percent of the total acreage.

The native vegetation consists mainly of shadscale, greasewood, and bud sagebrush.

Reclaimed areas of this soil are suitable for irrigated crops. This soil is used mainly for livestock grazing, but it is used to a limited extent for wildlife habitat. Capability unit VIIs-261, dryland; range site NV 23-4; wildlife suitability group 9.

**Raglan very fine sandy loam, alkali, 0 to 2 percent slopes (RgA).**—This soil is in irregularly shaped areas on old lake terraces along the eastern side of Surprise Valley. The profile is similar to the one described as representative for the series, except that in places the substratum has horizons of finer textured lacustrine sediment. This soil is moderately to strongly saline and alkaline.

Included with this soil in mapping are areas of steeper Raglan soils that make up about 10 percent of the total acreage.

Permeability in underlying lake sediment is moderately slow and slow in this soil. The native vegetation consists mainly of greasewood and shadscale.

If this soil is reclaimed, it is suitable for irrigated crops. It is used mainly for grazing by livestock and, to a limited extent, for grazing by wildlife. Capability unit IIc-1, irrigated and VIIs-261, dryland; range site NV 23-4; wildlife suitability group 9.

## Riverwash

Riverwash (Rr) is a land type that is along stream channels and flood plains on the western edges of Surprise Valley and Duck Lake Valley. It is subject to frequent flash floods. Riverwash consists of highly variable accumulations of sand, gravel, cobblestones, and stones that are found in streambeds and at mouths of canyons.

Riverwash cannot produce significant amounts of native or domesticated vegetation. It is used mainly as a source of sand and gravel. Capability unit VIIIw-233, dryland; not placed in a range site; not placed in a wildlife suitability group.

## Rock Outcrop

Rock outcrop consists of surface exposures of bedrock that occur throughout the uplands of the survey area. A variety of different kinds of rock are in this land type, but andesite, basalt, rhyolite, tuff, and agglomerate are dominant.

Runoff is very rapid, and the hazard of erosion is slight. The only vegetation is in a few pockets of intervening soils.

Areas of Rock outcrop are of value mainly for watershed and recreational and esthetic uses.

Rock outcrop is mapped only as a component of the undifferentiated group Rubble land and Rock outcrop.

## Rubble Land

This land type consists of barren, steep and very steep areas on mountain slopes and escarpments that are strewn with boulders and stones. It occurs throughout the mountainous uplands and volcanic plateaus in the survey area.

Runoff is very rapid, depending mainly on the characteristics of the underlying material. The hazard of erosion is slight. Vegetation is only on scattered areas of soils.

Rubble land is valuable mainly as watershed and for recreational and esthetic uses.

**Rubble land-Home Camp association (RM).**—This association consists of moderately sloping to moderately steep soils in uniformly shaped areas on mountain slopes. It is about 50 percent Rubble land and about 35 percent Home Camp very bouldery loam that has 5 to 30 percent slopes. Rubble land consists of rock slides that occur as scattered areas across this association. The Home Camp soil is in the intervening areas.

Included with this association in mapping are areas of Mendeboure soils and areas of shallow soils. These areas make up about 15 percent of the total acreage.

Rubble land lacks a native plant cover. The vegetation on Home Camp soils consists of juniper and big sagebrush.

These soils are not suitable for irrigated crops. Rubble land has limited use as watershed and for recreational and esthetic purposes. The Home Camp soil is used for livestock grazing and wildlife habitat. Rubble land part: Capability unit VIIIIs-236, dryland; not placed in a range site; not placed in a wildlife suitability group. Home Camp part: Capability unit VIIIs-236, dryland; range site NV 23-24; wildlife suitability group 10.

**Rubble land-Mendeboure association (RN).**—This association consists of steep and very steep soils throughout the survey area. It is on mountain slopes at elevations ranging from 5,000 to 8,000 feet. It is about 60 percent Rubble land and about 25 percent Mendeboure very stony loam, 30 to 50 percent slopes. Rubble land consists of nearly barren exposures of stones and boulders that occupy irregularly shaped, scattered areas across the faces of slopes. The Mendeboure soil has a clayey subsoil.

Included with this association in mapping are areas of Home Camp and Madeline soils and Rock outcrop. The included areas make up about 15 percent of the total acreage.

These soils are not suitable for irrigated crops. The Mendeboure soil is used mainly for limited livestock grazing and wildlife habitat. Rubble land is used for watershed, recreational, and esthetic uses. Rubble land part: Capability unit VIIIIs-236, dryland; not placed in a range site; not placed in a wildlife suitability group; Mendeboure part: Capability unit VIIIs-239, dryland; range site NV 23-18; wildlife suitability group 6.

**Rubble land and Rock outcrop (RR).**—This unit is in scattered areas throughout the mountainous parts of the survey area. Rubble land consists of stone and boulder-strewn slopes. Rock outcrop consists of surface exposures of bedrock.

Included with this unit in mapping are Mendeboure soils and other unnamed soils. These areas make up about 5 percent of the total acreage.

These land types are essentially barren of vegetation. They are used mainly for watershed, recreational, and esthetic purposes. Capability unit VIIIIs-236, dryland; not placed in a range site; not placed in a wildlife suitability group.

## Schamp Series

The Schamp series consists of well-drained soils that formed in localized alluvium and residuum derived from mixed basic rocks. The slope range is 2 to 30 percent. Vegetation consists of big sagebrush and bluebunch wheatgrass. Stones cover about 10 percent of the surface. The elevation ranges from 5,000 to 5,600 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 47° or 48° F., and the frost-free season is 70 to 100 days.

In a representative profile the surface layer is light brownish-gray stony loam about 3 inches thick. The next layer is light brownish-gray clay loam in the upper 5 inches, brown clay in the middle 12 inches, and pale-brown heavy clay loam in the lower 12 inches. The underlying material is pale-brown sandy loam, sandy clay loam, and extremely cobbly and gravelly loam to a depth of 61 inches.

Schamp soils have moderately slow permeability. The effective rooting depth is 40 to 60 inches. Available water capacity is 9 to 10 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Schamp stony loam, 2 to 30 percent slopes, in Modoc County, California, 200 feet west and 500 feet south of the center of sec. 8, T. 44 N., R. 17 E., Mount Diablo base line and meridian:

- A1—0 to 3 inches, light brownish-gray (10YR 6/2) stony loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine interstitial pores and common fine vesicular pores; neutral (pH 7.0); clear, smooth boundary. 3 to 5 inches thick.
- B1t—3 to 8 inches, light brownish-gray (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; weak, medium, prismatic and moderate, fine, subangular blocky structure; slightly hard, friable, sticky, plastic; common very fine roots and few fine and medium roots; many very fine tubular and interstitial pores; few thin clay films on ped faces in pores; neutral (pH 7.2); abrupt, wavy boundary. 3 to 5 inches thick.
- B21t—8 to 15 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate, fine, prismatic and moderate, medium, subangular blocky structure; hard, friable, very sticky, very plastic; common very fine and fine roots and few medium roots; many very fine tubular and interstitial pores; continuous thin clay films on ped faces and common thin and moderately thick clay films in pores; neutral (pH 7.2); clear, wavy boundary. 6 to 10 inches thick.
- B22t—15 to 20 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; weak, fine, prismatic and moderate, medium, subangular blocky structure; hard, friable, very sticky, very plastic; common very fine and fine roots and few medium roots; many very fine interstitial pores and common very fine tubular pores; common thin clay films on ped faces and many thin clay films in pores; mildly alkaline (pH 7.7); clear, wavy boundary. 3 to 6 inches thick.
- B3t—20 to 32 inches, pale-brown (10YR 6/3) heavy clay loam, brown (10YR 4/3) moist; massive; hard, friable, sticky, very plastic; common very fine and fine roots;

common very fine tubular pores; few thin clay films in pores and as bridges between sand grains; matrix is noneffervescent but is strongly effervescent where few fine, faint, light-gray (10YR 7/2) lime segregations are present and where few pebbles are thinly lime-coated on the underside; moderately alkaline (pH 8.2); clear, wavy boundary. 7 to 14 inches thick.

C1—32 to 43 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; massive; slightly hard, friable, sticky, plastic; common very fine and fine roots; common very fine tubular pores; effervescent grading to strongly effervescent in matrix and violently effervescent where many medium, faint, light-gray (10YR 7/2) lime segregations are present; strongly alkaline (pH 9.0); clear, wavy boundary. 7 to 14 inches thick.

C2—43 to 58 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; common very fine tubular pores; violently effervescent; many, medium and coarse, distinct, light-gray (10YR 7/2) lime segregations and coatings on gravel; strongly alkaline (pH 8.9); clear, irregular boundary. 10 to 21 inches thick.

IIC3—58 to 61 inches, pale brown (10YR 6/3) extremely cobbly and gravelly loam, brown (10YR 4/3) moist; slightly plastic; few very fine roots; common very fine tubular and interstitial pores; 60 percent basaltic cobblestones and gravel; violently effervescent; many medium and coarse, faint, light-gray (10YR 7/2) lime segregations and coatings on coarse fragments; strongly alkaline (pH 8.9).

Thickness of the solum ranges from 27 to 36 inches. In the A1 horizon colors have a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. Colors have a value of more than 5.5 dry and 3.5 moist if the upper 7 inches of material is mixed. The A1 horizon is sandy loam, fine sandy loam, or loam. In places this horizon is gravelly or stony. It is massive or has weak to moderate, platy structure. Reaction in the A1 horizon is slightly acid to neutral. In the B2t horizon colors have a hue of 10YR or 7.5YR, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is clay or heavy clay loam that has weak to moderate, prismatic primary structure and moderate or strong, fine to coarse, subangular or angular blocky secondary structure. Reaction is neutral or mildly alkaline. Thickness of the Bt horizon ranges from 24 to 32 inches. In places secondary lime is in the B3t horizon, if this horizon is present. Colors in the C horizon have a dry value of 5 to 7, a moist value of 4 or 5, and a chroma of 2 or 3. The amount of coarse fragments increases with depth and ranges from 15 to 80 percent. Cobblestones and stones are generally dominant and are lime coated on the underside.

#### Schamp stony loam, 2 to 30 percent slopes (SCE).—

This soil occupies broad areas on uplands along the eastern side of Surprise Valley and the area near Bob's Reservoir. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Gorzell and Nevador soils that make up about 10 percent of the total acreage.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIIs-236, dryland; range site NV 23-20; wildlife suitability group 7.

### Simpson Series

The Simpson series consists of well-drained soils. They formed in alluvium superimposed over gravelly lacustrine material derived from basalt, andesite, and tuff. The slope range is 0 to 15 percent. Vegetation consists of big sagebrush and bitterbrush. The elevation ranges from 4,200 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 46° to 52° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface layer is about 4 inches of dark grayish-brown gravelly sandy loam and light brownish-gray heavy sandy loam. Below this is dark grayish-brown heavy sandy clay loam about 3 inches thick; brown light clay about 10 inches thick; and brown sandy clay loam about 6 inches thick. The underlying material, to a depth of 48 inches, is brown sandy loam, pale-brown gravelly loamy sand, and very dark gray gravelly sand.

Simpson soils have slow permeability. The effective rooting depth is 40 to 60 inches. Available water capacity is 5 to 6 inches.

Representative profile of Simpson gravelly sandy loam, 5 to 15 percent slopes, in Modoc County, California, 1,300 feet south and 160 feet west of the north quarter corner of sec. 32, T. 43 N., R. 16 E., Mount Diablo base line and meridian:

A1—0 to 1½ inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine roots; many very fine interstitial pores; slightly acid (pH 6.4); abrupt, smooth boundary. 1 to 5 inches thick.

A2—1½ to 3½ inches, light brownish-gray (10YR 6/2) heavy sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, platy structure; soft, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine interstitial and tubular pores; common clean sand grains; neutral (pH 6.6); abrupt, wavy boundary. 0 to 2 inches thick.

B1t—3½ inches to 7 inches, dark grayish-brown (10YR 4/3) heavy sandy clay loam, dark brown (10YR 3/3) moist; moderate, coarse, prismatic structure; hard, friable, sticky, plastic; common very fine and fine roots; common very fine tubular pores; many thin clay films on ped faces; neutral (pH 6.8); clear, wavy boundary. 3 to 8 inches thick.

B21t—7 to 12 inches, brown (10YR 4/3) light clay, dark brown (10YR 3/3) moist; strong, medium and coarse, prismatic structure; very hard, firm, very sticky, very plastic; many very fine exped roots and few very fine inped roots; common very fine tubular pores; many thin and few moderately thick, dark-brown (10YR 3/3) clay films on ped faces and in pores; neutral (pH 6.8); gradual, smooth boundary. 4 to 9 inches thick.

B22t—12 to 17 inches, brown (10YR 4/3) light clay, dark brown (10YR 3/3) moist; moderate, coarse, prismatic structure; very hard, firm, very sticky, very plastic; many very fine exped roots and few very fine and medium inped roots; common very fine tubular pores; many thin and few moderately thick, dark-brown (10YR 3/3) clay films on ped faces and in pores; neutral (pH 7.0); clear, wavy boundary. 4 to 10 inches thick.

B3t—17 to 23 inches, brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate, medium and coarse, prismatic structure; hard, friable, sticky, plastic; few very fine, fine, and medium roots; few very fine interstitial pores and common very fine tubular pores; common thin, dark-brown (10YR 3/3) clay films on ped faces and in pores; neutral (pH 7.0); clear, wavy boundary. 3 to 14 inches thick.

C1—23 to 31 inches, brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; common very fine and few fine tubular pores; neutral (pH 7.0); clear, wavy boundary. 5 to 15 inches thick.

C2—31 to 37 inches, pale-brown (10YR 6/3) gravelly loamy sand, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; few very fine tubular pores and many very fine interstitial pores; mildly alkaline (pH 7.4); clear, wavy boundary. 5 to 10 inches thick.

IIC3—37 to 48 inches, very dark gray (10YR 3/1) and dark-gray (10YR 4/1) gravelly sand both dry and moist; few gray (10YR 5/1) pockets of very gravelly sand; single grain; loose when dry and moist; common very fine and fine roots; many very fine and fine and few medium interstitial pores; matrix is noneffervescent, but in places pebbles have white (10YR 8/2) lime coatings on the underside; moderately alkaline (pH 8.0).

Colors in the A1 horizon have a hue of 10YR, a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 2 or 3. This horizon is sandy loam or clay loam and is gravelly in places. It is massive or has weak or moderate, platy structure. Reaction in the A1 horizon is very slightly acid or neutral. The A2 horizon, if present, is as much as 2 inches thick. Colors in this horizon have a dry value of 6 or 7, a moist value of 3 or 4, a dry chroma of 1 or 2, and a moist chroma of 2. The B2t horizon is 35 to 40 percent clay, by weighted average. In the B2t horizon colors have a hue of 10YR or 7.5YR, a dry value of 4 to 6, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is sandy clay or clay and has strong, prismatic structure in the upper part. Reaction is neutral or mildly alkaline. The B3t horizon, if present, is massive and is calcareous in places. The substratum is sandy loam, sand, or gravel and is at a depth of 24 to 38 inches. Colors of the substratum depend on the color of individual sand grains and gravel.

**Simpson sandy loam, 2 to 5 percent slopes (SdB).**—This soil is in small, uniformly shaped areas along the western side of Surprise Valley on alluvial fans and lake terraces. The profile is similar to the one described as representative for the series except that in this soil the sandy loam surface layer is free of gravel.

Included with this soil in mapping are areas of Simpson loam, 0 to 2 percent slopes, and soils that are similar to Simpson soils, except that they have a clay loam subsoil. These areas make up less than 2 percent of the total acreage.

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

This soil is used mainly for irrigated production of small grains and perennial grass for pasture. A small part of the acreage is used for livestock grazing and wildlife habitat. Capability unit IIe-21, irrigated and VIs-226, dryland; range site NV 23-22; wildlife suitability group 1.

**Simpson gravelly sandy loam, 5 to 15 percent slopes (SGC).**—This soil is in small, uniformly shaped areas along the western side of Surprise Valley near the northeastern end. It is on alluvial fans and lake terraces. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of very gravelly or stony similar soils and isolated areas of Nevada soils. These areas make up about 5 percent of the total acreage.

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

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit IVe-20, irrigated and VIs-226, dryland; range site NV 23-22; wildlife suitability group 3.

**Simpson loam, 0 to 2 percent slopes (SmA).**—This soil is in small, uniformly shaped areas on alluvial fans and lake terraces along the western side of Surprise Valley. The profile is similar to the one described as representative for the series, except that it has a loam surface layer.

Included with this soil in mapping are areas of Donica and Surprise soils that make up about 2 percent of the total acreage.

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

This soil is used mainly for irrigated crops. It has limited use for dryland grains and perennial grass for pas-

ture. A small area is irrigated and used for the production of alfalfa. Capability unit IIe-41, irrigated and VIs-226, dryland; range site NV 23-22; wildlife suitability group 1.

## Snag Series

The Snag series consists of well-drained soils. They formed in alluvium and colluvium derived from mixed basic rocks. The slope range is 5 to 50 percent. Vegetation consists of big sagebrush, needlegrass, and bitterbrush. The elevation ranges from 6,000 to 7,500 feet. The average annual precipitation is 16 to 25 inches, the average annual air temperature is 40° to 44° F., and the frost-free season is 50 to 80 days.

In a representative profile the surface layer is dark-brown stony and very stony fine sandy loam about 20 inches thick. The next layer is brown very stony fine sandy loam about 24 inches thick. Very slightly weathered basaltic bedrock is at a depth of 44 inches.

Snag soils have moderately rapid permeability. The effective rooting depth is 40 to 60 inches. Available water capacity is 6 to 7 inches. Runoff is slow to rapid, depending on the slope. The hazard of accelerated erosion is slight to moderate.

Representative profile of Snag stony fine sandy loam in an area of Hapgood-Snag association in Lassen County, California, 1,000 feet west and 800 feet south of the northeast corner of sec. 20, T. 36 N., R. 17 E., Mount Diablo base line and meridian:

- O1— $\frac{1}{2}$  inch to 0, dark-brown (7.5YR 3/2) litter of snowberry leaves, very dark brown (7.5YR 2/2) moist; medium acid (pH 5.7). 0 to 1 inch thick.
- A11—0 to 10 inches, dark-brown (7.5YR 3/2) stony fine sandy loam, very dark brown (7.5YR 2/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine, common medium and coarse, and few fine roots; many very fine interstitial pores; medium acid (pH 5.6); gradual, wavy boundary. 6 to 11 inches thick.
- A12—10 to 20 inches, dark-brown (7.5YR 3/2) very stony fine sandy loam (55 percent coarse fragments), very dark brown (7.5YR 2/2) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine, common medium and coarse, and few fine roots; common very fine interstitial pores; few thin clay bridges between sand grains; medium acid (pH 6.0); gradual, irregular boundary. 9 to 18 inches thick.
- C—20 to 44 inches, brown (7.5YR 4/4) very stony fine sandy loam, (65 percent coarse fragments), dark brown (7.5YR 3/3) moist; massive; soft, very friable, nonsticky, nonplastic; common very fine, fine, and medium and few coarse roots; medium acid (pH 5.7); abrupt, slightly wavy boundary. 0 to 36 inches thick.
- R—44 inches, very slightly weathered basaltic bedrock.

Thickness of the dark-colored surface layer ranges from 20 to 39 inches. Colors in the A1 horizon have a hue of 7.5YR to 10YR, a dry value of 3 or 4, a moist value of 2 or 3, and a chroma of 1 or 2. This horizon has weak or moderate, granular or subangular blocky structure and in places is massive in the lower part. The A12 and C horizons are fine sandy loam, sandy loam, or loam in texture and are as much as 50 to 80 percent stones, cobblestones, and gravel. Colors in the C horizon have a hue of 7.5YR to 10YR, a dry value of 4 to 6, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon has weak, granular or subangular blocky structure. The depth to bedrock ranges from 40 to 60 inches.

**Snag very stony sandy loam, 30 to 50 percent slopes (SNF).**—This steep soil is in large, irregularly shaped areas throughout the Modoc National Forest on uplands. The

profile is similar to the one described as representative for the series, except that this soil is about 40 inches deep to bedrock, and the subsoil is about 40 to 50 percent coarse fragments.

Included with this soil in mapping are areas of Rubble land and Rock outcrop that make up about 10 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. The native vegetation consists mainly of big sagebrush, needlegrass, and bitterbrush.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing, wildlife habitat, and watershed. Capability unit VII<sub>s</sub>-211, dryland; range site NV 23-19; wildlife suitability group 6.

## Surprise Series

The Surprise series consists of well-drained soils that formed in gravelly alluvium derived from mixed basic rocks. The slope range is 0 to 15 percent. Vegetation consists of big sagebrush, bluebunch wheatgrass, and bitterbrush. The elevation ranges from 4,400 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is about 50° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is grayish-brown gravelly sandy loam about 9 inches thick. The next layer is light brownish-gray gravelly sandy loam about 19 inches thick. The underlying material is gravelly sandy loam over very gravelly sandy loam to a depth of 67 inches.

Surprise soils have moderately rapid permeability. The effective rooting depth is 40 to 60 inches. Available water capacity is 6 to 7 inches. Runoff is very slow or slow, and the hazard of accelerated erosion is slight or moderate.

Representative profile of Surprise gravelly sandy loam, 5 to 15 percent slopes, in Modoc County, California, 250 feet south and 900 feet east of the northwest quarter corner of sec. 14, T. 40 N., R. 16 E., Mount Diablo base line and meridian:

A11—0 to 3 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular structure; soft, very friable, nonsticky, nonplastic; many very fine roots; many very fine interstitial pores; neutral (pH 6.8); clear, smooth boundary. 3 to 6 inches thick.

A12—3 to 9 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine roots; many very fine interstitial pores; neutral (pH 6.8); gradual, smooth boundary. 5 to 8 inches thick.

B2—9 to 28 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky, nonplastic; many very fine and few fine roots; many fine interstitial pores; neutral (pH 6.8); gradual, smooth boundary. 15 to 30 inches thick.

C1—28 to 45 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, nonsticky, nonplastic; common very fine and few fine and medium roots; many fine interstitial pores; neutral (pH 6.8); gradual, wavy boundary, 8 to 17 inches thick.

IIC2—45 to 67 inches, light brownish-gray (10YR 6/2) very gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine and common medium roots; many fine interstitial pores; neutral (pH 6.8).

The solum ranges from 23 to 38 inches in thickness. In the A1 horizon colors have a hue of 10YR, a dry value of 4 or 5, a moist value of 3, and a chroma of 2 or 3. This horizon is gravelly sandy loam or gravelly loam and is massive or has weak to moderate, fine to medium, granular or subangular blocky structure. Reaction in the A1 horizon is neutral to mildly alkaline. In the B2 and C horizons colors have a hue of 10YR, a dry value of 5 or 6, a moist value of 4 or 5, and a chroma of 2 or 3. They are gravelly sandy loam or gravelly loam in texture and 15 to 35 percent gravel. They are massive or have weak, medium or coarse, subangular blocky structure. Reaction is neutral to mildly alkaline.

**Surprise gravelly sandy loam, 0 to 2 percent slopes (SrA).**—This soil is in small, irregularly shaped areas along the western side of Surprise Valley on alluvial fans. It is similar, except for slope, to the soil described as representative for the series.

Included with this soil in mapping are areas of Bidwell soils and soils that have a surface layer of loam or very gravelly sandy loam. These areas make up about 5 percent of the total acreage.

Runoff is very slow, and the hazard of erosion is slight. The native vegetation in uncultivated areas consists mainly of big sagebrush and bitterbrush.

This soil is suitable for irrigated crops. It is used mainly for dryland production of small grains and perennial pasture grasses. Capability unit IIC-1, irrigated and VIC-220, dryland; range site NV 23-22; wildlife suitability group 1.

**Surprise gravelly sandy loam, 2 to 5 percent slopes (SrB).**—This soil is in large, irregularly shaped areas along the western side of Surprise Valley on broad alluvial fans. It is similar, except for slope, to the soil described as representative for the series.

Included with this soil in mapping are areas of Bidwell, Donica, and other Surprise soils that make up about 10 percent of the total acreage.

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

This soil is suitable for irrigated crops. It is used mainly for production of dryland small grains and perennial pasture grasses. Capability unit IIC-20, irrigated and VIC-220, dryland; range site NV 23-22; wildlife suitability group 1.

**Surprise gravelly sandy loam, 5 to 15 percent slopes (SrC).**—This soil is in small, irregularly shaped areas along the western side of Surprise Valley on higher parts of alluvial fans. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Donica, Simpson, and other Surprise soils that make up about 5 percent of the total acreage.

Runoff is slow, and the hazard of erosion is moderate. The native vegetation consists mainly of big sagebrush and bitterbrush.

This soil is suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit IIC-20, irrigated and VIC-220, dryland; range site NV 23-22; wildlife suitability group 3.

## Survya Series

The Survya series consists of well-drained soils that formed in loamy alluvium derived from basalt and tuff superimposed over gravelly lacustrine material. The slope range is 0 to 9 percent. Vegetation consists of shadscale. The elevation ranges from 4,500 to 5,000 feet. The average annual precipitation is 5 to 7 inches, the average annual air

temperature is 47° to 51° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is light-gray fine sandy loam about 1 inch thick. Below this is light-gray and pale-brown clay over light brownish-gray very gravelly sandy clay loam about 10 inches thick. The underlying material is pale-brown and grayish-brown, stratified very gravelly and gravelly sand that extends to a depth of 34 inches.

Survya soils have slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 3 to 4½ inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Survya fine sandy loam, 0 to 9 percent slopes, eroded, in Modoc County, California; 200 feet west and 300 feet north of the southeast corner of sec. 15, T. 40 N., R. 17 E., Mount Diablo base line and meridian:

A2—0 to 1 inch, light-gray (2.5Y 7/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, nonsticky, nonplastic; few very fine roots; many fine vesicular pores; violently effervescent; very strongly alkaline (pH 9.2); abrupt, smooth boundary. 1 to 3 inches thick.

B2t—1 to 3 inches, light-gray (10YR 7/2) clay, brown (10YR 5/3) moist; weak, medium, columnar breaking to moderate, medium, angular blocky structure; hard, friable, very sticky, very plastic; few very fine and fine roots; many very fine tubular pores; many thin clay films on ped faces and continuous moderately thick clay films in pores; violently effervescent; very strongly alkaline (pH 9.6); abrupt, smooth boundary. 2 to 4 inches thick.

B22tca—3 to 7 inches, variegated, light-gray (10YR 7/2) and pale-brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak, medium, prismatic breaking to moderate, medium, angular blocky structure; hard, friable, very sticky, very plastic; common very fine roots; many very fine tubular and interstitial pores; many moderately thick clay films in pores; violently effervescent; common, fine and medium, faint, white (10YR 8/2) lime segregations; very strongly alkaline (pH 9.6); clear, wavy boundary. 2 to 6 inches thick.

IIB3tca—7 to 11 inches, light brownish-gray (10YR 6/2) very gravelly sandy clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, sticky, plastic; common very fine roots; many very fine and fine interstitial pores; common thin clay films in pores and common thin clay bridges between sand grains and gravel; violently effervescent; common, medium, distinct, white (10YR 8/2) lime segregations and coatings, mainly on the underside of pebbles; strongly alkaline (pH 9.6); clear, wavy boundary. 3 to 7 inches thick.

IIC1ca—11 to 17 inches, pale-brown (10YR 6/3) very gravelly sand, dark grayish brown (10YR 4/2) moist; single grain; loose when dry and moist; few very fine roots; many very fine and fine and few medium interstitial pores; strong effervescence; white (10YR 8/2) lime coatings, mostly on the underside of pebbles; very strongly alkaline (pH 9.2); clear, wavy boundary. 5 to 12 inches thick.

IIC2—17 to 34 inches, grayish-brown (10YR 5/2) stratified fine gravelly coarse sand and very gravelly sand, dark grayish brown (10YR 4/2) moist; single grain; loose when dry and moist; few very fine roots, mainly in the upper part; many very fine and fine and few medium interstitial pores; gray (10YR 5/1), pale-brown (10YR 6/3), very pale brown (10YR 7/3) sand grains and gravel; thin (2 to 3 inches thick) massive strata that are slightly hard and friable, noneffervescent; strongly alkaline (pH 8.8).

The thickness of the solum and the depth to the very gravelly sandy IIC material ranges from 10 to 16 inches. An over-

blown A1 horizon of loamy fine sand or fine sand is present in places. It is as much as 14 inches thick but is mostly 1 to 4 inches thick. Colors in the A1 horizon, if it is present, have a dry value of 6 or 7, a moist value of 4 or 5, and a chroma of 2 or 3. Colors in the A2 horizon have a hue of 10YR or 2.5Y, a dry value of 6 or 7, a moist value of 3 or 4, and a dry chroma of 1 or 2. This horizon is massive or has weak to moderate, platy structure. Colors in the B2t horizon have a hue of 10YR or 2.5Y, a dry value of 6 or 7, a moist value of 4 or 5, and a chroma of 2 or 3. This horizon has weak to strong, prismatic or columnar structure. It is dominantly clay but ranges to heavy clay loam. Colors in the C horizon are variable and depend on the color of the individual sand grains and gravel. Except for the overblown A1 horizon, these soils are slightly saline and strongly alkali affected.

**Survya fine sandy loam, 0 to 9 percent slopes, eroded (SUB2).**—This soil is in large areas along the eastern side of Surprise Valley near the Long Ranch. It is on beach terraces. Numerous narrow gullies, 1 foot to 5 feet deep, dissect this soil because of runoff from higher lying soils. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Zorravista and Raglan soils and actively eroding sand dunes. These areas make up about 20 percent of the total acreage.

The vegetation consists mainly of shadscale.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and, to a limited extent, for wildlife habitat. Capability unit VIIIs-261, dryland; range site NV 23-4; wildlife suitability group 9.

**Survya-Zorravista association (SV).**—This association consists of soils in large, irregularly shaped areas north and south of the Hays Canyon Road. It is on broad lake terraces and on semistabilized sand dunes. Many narrow gullies, 1 foot to 5 feet deep, dissect the Survya soil because of runoff from higher lying soils.

The association is about 55 percent Survya fine sandy loam, 0 to 9 percent slopes, eroded, and about 40 percent Zorravista fine sand, 0 to 15 percent slopes. The Survya soil is on broader undulating terraces and has a clay subsoil. The Zorravista soil is on semistabilized sand dunes and has fine sand or sand texture throughout.

Included with this association in mapping are areas of sandy Survya soils, steeper Zorravista soils, and actively eroding small sand dunes. These areas make up about 5 percent of the total acreage.

The Survya soil has a native vegetation of shadscale. The vegetation on the Zorravista soil consists of greasewood, horsebrush, big sagebrush, and spiny hopsage.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and, to a limited extent, for wildlife habitat. Survya part: Capability unit VIIIs-261, dryland; range site NV 23-4; wildlife suitability group 9. Zorravista part: Capability unit VIIIs-224, dryland; range site NV 23-11; wildlife suitability group 9.

## Survya Series, Hardpan Variant

The Survya series, hardpan variant, consists of well-drained soils on lake terraces. They formed in alluvium derived from mixed basic rocks. The slope range is 0 to 9 percent. They contain moderate amounts of salt and alkali. Vegetation consists mainly of greasewood. The elevation ranges from 4,600 to 4,800 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 47° to 51° F., and the frost-free season is 100 to 130 days.

In a representative profile the surface layer is white fine sandy loam about 1 inch thick. Below this is about 10 inches of light brownish-gray and pale-brown sandy clay loam grading to gravelly sandy clay loam. The next layer is a light brownish-gray, silica-cemented hardpan about 14 inches thick. It is underlain by stratified light-gray and light brownish-gray silt loam and loamy fine sand to a depth of 44 inches.

Survya soils, hardpan variant, have moderately slow permeability to the hardpan and very slow permeability in the hardpan. The effective rooting depth is 10 to 18 inches. Available water capacity is 2 to 3 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Survya fine sandy loam, hardpan variant, 0 to 9 percent slopes, eroded, in Modoc County, California, 2,600 feet north and 1,300 feet east of the south quarter corner of sec. 34, T. 40 N., R. 17 E., Mount Diablo base line and meridian :

- A1—0 to 1 inch, white (10YR 8/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak, medium, platy structure; hard, friable, slightly sticky, slightly plastic; very few fine roots; many very fine and fine vesicular pores; violently effervescent; very strongly alkaline (pH 9.6); abrupt, wavy boundary. 0 to 2 inches thick.
- B2t—1 to 3 inches, light brownish-gray (10YR 6/2) light sandy clay loam, brown (10YR 5/3) moist; common, medium mottles of light gray (10YR 7/2); weak, fine, prismatic breaking to very fine, angular, blocky structure; hard, firm, sticky, slightly plastic; many very fine roots; many very fine tubular and interstitial pores; many thin clay films on ped faces; violently effervescent; very strongly alkaline (pH 9.5); abrupt, wavy boundary. 2 to 5 inches thick.
- B3t—3 to 7 inches, pale-brown (10YR 6/3) light sandy clay loam, brown (10YR 5/3) moist; weak, medium, prismatic parting to moderate, fine, subangular blocky structure; hard, friable, sticky, slightly plastic; common very fine roots; common thin clay films on ped faces and as bridges; strongly effervescent; very strongly alkaline (pH 9.5); clear, wavy boundary. 3 to 6 inches thick.
- C1—7 to 11 inches, light brownish-gray (10YR 6/2) fine gravelly light sandy clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common fine and very fine roots that mat at base of horizon; strongly effervescent; very strongly alkaline (pH 9.5); clear; smooth boundary. 0 to 6 inches thick.
- C2sim—11 to 25 inches, light brownish-gray (10YR 6/2) duripan, grayish-brown (10YR 5/2) moist; common, medium, faint, pale-brown (10YR 6/3) mottles and thin lenses of light-gray (10YR 6/1) sand; strong, medium, platy structure; extremely hard, extremely firm; very few fine roots in the upper 2 inches; common fine astrocoods; silica coatings on sand grains; strongly effervescent; very strongly alkaline (pH 9.6); gradual, smooth boundary. 8 to 20 inches thick.
- C3—25 to 29 inches, light brownish-gray (10YR 6/2) silt loam, grayish-brown (10YR 5/2) moist; common, fine, faint, light-gray (10YR 7/2) mottles; massive; hard, very firm, slightly sticky, slightly plastic; strongly effervescent; very strongly alkaline (pH 9.3); clear, wavy boundary. 1 to 10 inches thick.
- IIC4—29 to 44 inches, light-gray (10YR 7/2) loamy fine sand, grayish-brown (10YR 5/2) moist; common thin lenses of light-gray (10YR 6/1) sand; massive; slightly hard, very friable, nonsticky, nonplastic; many very fine interstitial pores; strongly effervescent; strongly alkaline (pH 9.0).

The thickness of the solum ranges from 5 to 12 inches, and the depth to the silica-cemented hardpan ranges from 10 to 18 inches.

In the A1 horizon colors have a hue of 10YR or 2.5Y, a dry value of 7 or 8, and a moist value of 4 or 5. This horizon is massive or has weak or moderate, platy structure. Reaction is

alkaline to very strongly alkaline in the A1 horizon. This horizon is strongly to violently effervescent. In the B2t horizon colors have a dry value of 5 or 6, a moist value of 4 or 5, and a chroma of 3 or 4. This horizon is sandy clay or clay loam and has weak to moderate, prismatic primary structure. Reaction in the B2t horizon is strongly alkaline to very strongly alkaline.

**Survya fine sandy loam, hardpan variant, 0 to 9 percent slopes, eroded (SYB2).**—This soil is in irregularly shaped areas along the eastern side of Surprise Valley on lake terraces. It is moderately to strongly alkaline and is moderately saline.

Included with this soil in mapping are areas of Raglan and other Survya soils. These areas make up about 10 percent of the total acreage.

The vegetation consists mainly of greasewood. This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIIs-231, dryland; range site NV 23-2; wildlife suitability group 9.

## Toney Series

The Toney series consists of well-drained soils that formed in residuum derived mainly from tuff. The slope range is 0 to 9 percent. Vegetation consists of low sagebrush, Sandberg bluegrass, and some areas of black sagebrush. About 65 percent of the surface is covered by cobblestones. The elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is 12 to 14 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 60 to 90 days.

In a representative profile the surface layer is about 4 inches of grayish-brown extremely cobbly loam grading to light brownish-gray silt loam. The next layer is brown clay and silty clay. Tuff bedrock is at a depth of 23 inches.

Toney soils have very slow permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 6 inches. Runoff is medium, and the hazard of accelerated erosion is slight.

Representative profile of Toney extremely cobbly loam in an area of Toney-Ninemile association in Washoe County, Nevada, 200 feet east and 400 feet south of the center of sec. 31, T. 40 N., R. 18 E., Mount Diablo base line and meridian :

- A1—0 to 1 inch, grayish-brown (10YR 5/2) extremely cobbly loam, very dark grayish brown (10YR 3/2) moist; weak, fine, platy structure; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; many very fine interstitial and tubular pores; neutral (pH 6.6); abrupt, smooth boundary. 1 to 3 inches thick.
- A2—1 to 4 inches, light brownish-gray (10YR 6/2) silt loam, light gray (10YR 6/1) in places, dark brown (10YR 3/3) moist; moderately thin platy structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; many very fine interstitial and tubular pores; many bleached sand grains; neutral (pH 6.6); abrupt, slightly wavy boundary. 2 to 4 inches thick.
- B2t—4 to 10 inches, brown (10YR 4/3) clay, brown (10YR 4/3) moist; strong, medium, columnar structure; tops of columns capped with light gray (10YR 7/1) bleached sand grains; extremely hard, firm, very sticky, very plastic; few fine and common very fine expd roots; common very fine tubular pores; many pressure cutans; many thin clay films in pores; neutral (pH 6.6); gradual, smooth boundary. 5 to 9 inches thick.

- B22t**—10 to 16 inches, brown (10YR 5/3) clay, dry or moist; moderate, medium, prismatic structure; very hard, firm, very sticky, very plastic; few fine and common very fine roots; many very fine interstitial pores and common very fine tubular pores; many pressure cutans; many thin clay films in pores; neutral (pH 7.2); abrupt, smooth boundary. 5 to 12 inches thick.
- B3tca**—16 to 23 inches, brown (10YR 5/3) grading to very pale brown (10YR 7/4) silty clay, dark yellowish brown (10YR 3/4) and yellowish brown (10YR 5/6) moist, yellowish brown (10YR 5/4) crushed; moderate, fine, subangular blocky structure; hard, firm, very sticky, very plastic; few very fine roots; many very fine interstitial and tubular pores; common moderately thick clay films in pores and few thin and moderately thick clay films on ped faces; strongly effervescent and many, fine, white (10YR 8/2) lime veins and filaments; moderately alkaline (pH 8.2); abrupt, irregular boundary. 7 to 12 inches thick.
- R**—23 to 30 inches, very pale brown (10YR 8/3) pumiceous tuff, brown (10YR 5/3) moist; many white (10YR 8/1) flecks; very hard; few very fine roots, many thin brown (10YR 5/3) clay films and many black (10YR 2/1) manganese coatings on faces of fracture; matrix is noneffervescent and has few, fine, lime veins and filaments along planes of fractures; mildly alkaline (pH 7.8).

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. In the A1 horizon colors have a hue of 10YR or 7.5YR, a moist value of 2 or 3, and a chroma of 1 or 2. This horizon is stony or extremely cobbly loam or sandy loam and is massive or has weak, platy or granular structure. In the A2 horizon colors have a hue of 10YR or 7.5YR, a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 1 or 2. This horizon is massive or has weak to moderate, platy structure. Colors in the B2t horizon have a hue of 10YR or 7.5YR, a dry value of 4 to 6, a moist value of 4 or 5, and a chroma of 2 to 4. Exchangeable sodium percentage is greater than 15 percent in places in the Bt horizon.

**Toney-Ninemile association (TN).**—This association consists of nearly level to moderately sloping soils in large, irregularly shaped areas on pediments near Boulder Lake and in Tuledad Valley. The association is about 65 percent Toney extremely cobbly loam that has 0 to 9 percent slopes and about 25 percent Ninemile extremely cobbly loam that has 0 to 9 percent slopes. The Toney soil has a light-colored surface layer, is 20 to 40 inches deep to bedrock, and cobblestones over about 65 percent of the surface. The Ninemile soil has a dark-colored surface layer and is 10 to 20 inches deep to bedrock.

Included with this association in mapping are areas of Home Camp, Newlands, and Madeline soils and, in places, areas of Rock outcrop and Rubble land. These areas make up about 10 percent of the total acreage.

The Toney soil has a native vegetation that consists of low sagebrush, Sandberg bluegrass, and, in places, black sagebrush. The vegetation on the Ninemile soil consists of low sagebrush and Sandberg bluegrass.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Toney part: Capability unit VIIs-239, dryland; range site NV 23-17; wildlife suitability group 8. Ninemile part: Capability unit VIIs-237, dryland; range site NV 23-17; wildlife suitability group 8.

## Tourn Series

The Tourn series consists of well-drained soils in the Modoc National Forest. They formed in residuum and alluvium derived from tuff. The slope range is 2 to 15 percent. Vegetation consists mainly of ponderosa pine. The

elevation ranges from 7,000 to 8,000 feet. The average annual precipitation is 16 to 25 inches, the average annual air temperature is about 41° F., and the frost-free season is 50 to 80 days.

In a representative profile a thin layer of litter from pine needles covers the surface. The surface layer is about 8 inches of dark-brown stony loam over dark-brown fine sandy loam and sandy clay loam. Tuff bedrock is at a depth of 26 inches.

Tourn soils have moderate permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 4 to 6 inches. Runoff is slow, and the hazard of accelerated erosion is slight to moderate.

Representative profile of Tourn stony loam, 2 to 15 percent slopes, in Lassen County, California, in the center of the southwest quarter of the northeast quarter of sec. 23, T. 39 N., R. 15 E., Mount Diablo base line and meridian:

- O1—¼ inch to 0, fresh and partly decomposed litter consisting of pine needles.
- A11—0 to 8 inches, dark-brown (7.5YR 4/2) stony loam, dark brown (7.5YR 3/2) moist; moderate, very fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine and few fine roots; many very fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary. 3 to 10 inches thick.
- A12—8 to 15 inches, dark-brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, coarse, subangular blocky breaking to moderate, very fine, granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine roots and few fine, medium, and coarse roots; many very fine interstitial pores and common fine tubular pores; few thin clay films as bridges; slightly acid (pH 6.4); clear, smooth boundary. 5 to 12 inches thick.
- A13—15 to 26 inches, dark-brown (7.5YR 4/2) light sandy clay loam, dark reddish brown (5YR 3/3) moist; weak, coarse, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and few fine and medium roots; many very fine interstitial pores and common very fine tubular pores; few thin clay films as bridges and in pores; thin, ¼- to ½-inch, discontinuous lenses of reddish-brown (5YR 5/3) clay loam; moist color is weak red (2.5YR 4/3) at the lower boundary; slightly acid (pH 6.2); abrupt, wavy boundary. 8 to 18 inches thick.
- C—26 inches, gray (N 6/0) weathering tuffaceous rock having evident rock structure.

In the A horizon colors have a hue of 7.5YR or 5YR, a dry value of 3 to 5, and a moist value of 2 or 3. This horizon, immediately above the bedrock, increases slightly in clay content as depth increases, but it is dominantly loam or sandy clay loam in texture and is as much as 25 percent coarse fragments. If present, the C horizon has colors that have a hue of 5YR or 7.5YR, a dry value of 5 or 6, a moist value of 3 or 4, and a chroma of 2 to 4. It is very cobbly, gravelly, or stony. The amount of coarse fragments increases with depth. The depth to weathered bedrock ranges from 20 to 40 inches.

**Tourn stony loam, 2 to 15 percent slopes (TOC).**—This soil is in large, irregularly shaped areas on mountainous uplands in the Modoc National Forest.

Included with this soil in mapping are areas of soils similar to Tourn soils, except that bedrock is at a depth of less than 20 inches. These areas make up about 15 percent of the total acreage.

The vegetation consists mainly of ponderosa pine. This soil is not suitable for irrigated crops. It is used mainly for timber production and, to a limited extent, for livestock grazing, wildlife habitat, watershed, and recreation. Capability unit VIIs-211, dryland; not placed in a range site; wildlife suitability group 10.

## Vylach Series

The Vylach series consists of well-drained soils on lake terraces. They formed in material weathered from lake-deposited tuffs and alluvium from mixed basic rocks. The slope range is 0 to 5 percent. Vegetation consists of shadscale, except in overflow areas where big sagebrush is dominant. The elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is 6 to 8 inches, the average annual air temperature is 45° to 48° F., and the frost-free season is 100 to 120 days.

In a representative profile the surface is light-gray fine sandy loam about 3 inches thick. Below this is pale-brown sandy clay loam and very pale brown clay loam about 7 inches thick. The next layer is a very pale brown, strongly cemented hardpan. It is underlain by fractured tuff bedrock at a depth of 20 inches.

Vylach soils have very slow permeability. The effective rooting depth is 10 to 20 inches. Available water capacity is 1 to 2 inches. Runoff is slow, and the hazard of accelerated erosion is slight.

Representative profile of Vylach fine sandy loam in an area of Vylach-Pegler association in Washoe County, Nevada, near the north quarter corner of sec. 3, T. 36 N., R. 19 E., Mount Diablo base line and meridian:

- A1—0 to 3 inches, light-gray (2.5YR 7/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, platy structure; soft, very friable, nonsticky, slightly plastic; few very fine roots; many fine and few medium vesicular pores; moderately alkaline (pH 8.4); clear, smooth boundary. 1 to 5 inches thick.
- B1t—3 to 7 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; moderate, fine, granular structure; soft, friable, sticky, plastic; common very fine and few fine and medium roots; many very fine interstitial pores and few fine tubular pores; moderately alkaline (pH 8.2); clear, smooth boundary. 2 to 6 inches thick.
- B2t—7 to 10 inches, very pale brown (10YR 7/3) clay loam, brown (10YR 4/3) moist; moderate, fine and medium, platy structure; slightly hard, friable, sticky, plastic; common very fine and few fine and medium roots; few very fine vesicular pores and common very fine tubular pores; few thin clay films on ped faces and common thin clay films in pores; moderately alkaline (pH 8.2); abrupt, smooth boundary. 3 to 9 inches thick.
- Csicam—10 to 20 inches, very pale brown (10YR 8/3) strongly silica-cemented hardpan, brown (10YR 4/3) moist; massive; very hard, extremely hard in spots; very firm and extremely firm; few very fine roots matted on silica laminae; very thin, light yellowish-brown (10YR 6/4), unoriented silica laminae and bridges between sand grains; violently effervescent; many, coarse, white (10YR 8/1) lime coatings on silica laminae having matrix color; very strongly alkaline (pH 9.6); gradual, wavy boundary. 6 to 18 inches thick.
- R—20 to 36 inches, light yellowish-brown (2.5Y 6/4) fractured tuff bedrock, olive brown (2.5Y 4/4) moist; continuous white (2.5YR 8/2) lime coats along cleavages.

The thickness of the solum and the depth to hardpan range from 10 to 20 inches.

Colors in the A1 and B2t horizons have a hue of 2.5Y or 10YR, a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 2 or 3. The A1 horizon is loamy sand or sandy loam that is massive, single grained, or has platy structure. Reaction is neutral to moderately alkaline. The B2t horizon is sandy clay loam or light clay loam. It is massive or has platy or sub-angular blocky structure. Reaction is moderately alkaline. The Csicam horizon is strongly to very strongly alkaline. Depth to fractured tuff ranges from 20 to 30 inches.

**Vylach-Pegler association (VP).**—This association consists of nearly level to gently sloping soils in irregularly shaped areas on lake terraces along the eastern edge of Duck Lake Valley. The association is about 50 percent Vylach fine sandy loam that has 0 to 5 percent slopes and about 35 percent Pegler fine sandy loam that has 0 to 5 percent slopes. The Vylach soil has a silica-cemented hardpan at a depth of 10 to 20 inches. The Pegler soil is underlain by tuff bedrock at a depth of 10 to 20 inches. Both soils are slightly salt and alkali affected.

Included with this soil in mapping are areas of McConnell and Old Camp soils that make up about 15 percent of the total acreage.

These soils have a native vegetation that consists mainly of shadscale.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Vylach and Pegler parts: Capability unit VIIIs-231, dryland; range site NV 23-12; wildlife suitability group 9.

**Vylach-Pegler association, overwash (VY).**—This association consists of soils in long, irregularly shaped areas on low-lying lake terraces along the eastern side of Duck Lake Valley. It is about 50 percent Vylach fine sandy loam, overflowed, that has 0 to 5 percent slopes and about 35 percent Pegler fine sandy loam, overflowed, that has 0 to 5 percent slopes. In the Vylach soil a silica-cemented hardpan is at a depth of 10 to 20 inches. In the Pegler soil tuff bedrock is at a depth of 10 to 20 inches. Both soils are salt free because of the overflow.

Included with this soil in mapping are areas of McConnell soils, sand dunes, and cobbly and stony Riverwash in drainageways. These areas make up about 15 percent of the total acreage.

These soils are subject to frequent flooding. They have a native vegetation that consists of big sagebrush.

These soils are not suitable for irrigated crops. They are used mainly for livestock grazing and wildlife habitat. Vylach and Pegler parts: Capability unit VIIIs-231, dryland; range site NV 23-6; wildlife suitability group 7.

## Waca Series

The Waca series consists of well-drained soils in the Warner Mountains. They formed in alluvium derived from mixed basic rocks. The slope range is 5 to 75 percent. Vegetation consists of white fir and ponderosa pine. The elevation ranges from 5,500 (on northerly slopes) to 8,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is about 40° F., and the frost-free season is 60 to 80 days.

In a representative profile a layer, about 4 inches thick, of partly decomposed and decomposed leaf litter covers the surface. The upper part of the surface layer is grayish-brown stony fine sandy loam and brown gravelly sandy loam about 8 inches thick. Below this is brown gravelly sandy loam about 12 inches thick. The next layer is pale-brown very gravelly coarse sandy loam about 10 inches thick. Basalt bedrock is at a depth of 30 inches.

Waca soils have moderately rapid permeability. The effective rooting depth is 20 to 40 inches. Available water capacity is 3 to 4 inches.

Representative profile of Waca stony fine sandy loam, 5 to 30 percent slopes, in Lassen County, California, near

the center of the northwest quarter of sec. 4, T. 38 N., R. 16 E., Mount Diablo base line and meridian:

- O1—4 inches to 3, leaf litter; strongly acid (pH 5.4); abrupt, wavy boundary. 0 to 2 inches thick.
- O2—3 inches to 0, decomposed leaf litter, strongly acid (pH 5.4); abrupt, smooth boundary. 1 to 6 inches thick.
- A11—0 to 3 inches, grayish-brown (10YR 5/2) stony fine sandy loam, very dark grayish-brown (10YR 3/2) moist; moderate, medium granular structure; soft, very friable, nonsticky, nonplastic; many very fine and fine roots, common medium roots, and few coarse roots; many fine interstitial pores; medium acid (pH 5.6); clear, smooth boundary. 1 to 4 inches thick.
- A12—3 to 8 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; moderate, medium, granular structure; soft, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots; many very fine interstitial pores; medium acid (pH 5.6); clear, smooth boundary. 2 to 6 inches thick.
- A13—8 to 20 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine, fine, medium, and coarse roots; many fine interstitial pores; medium acid (pH 5.9); abrupt, wavy boundary. 7 to 13 inches thick.
- C—20 to 30 inches, pale-brown (10YR 6/3) very gravelly coarse sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky, nonplastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores; medium acid (pH 5.9); abrupt, wavy boundary. 5 to 24 inches thick.
- R—30 inches, slightly weathered spots of basalt bedrock at the immediate surface.

Colors throughout the profile have a hue of 10YR or 7.5YR. In the A horizon colors have a dry value of 3 to 5, a moist value of 2 or 3, and a chroma of 2 or 3. Reaction ranges from slightly acid to medium acid in the upper part and strongly acid to very strongly acid in the lower part. The A horizon is sandy loam or coarse sandy loam in texture, and it is 30 to 50 percent cobbles or stones. In the C horizon colors have a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 3 or 4. The C horizon is similar in texture to the A1 horizon, but it is 50 to 70 percent gravel, cobbles, and stones. The depth to bedrock ranges from 20 to more than 40 inches.

**Waca stony fine sandy loam, 5 to 30 percent slopes (WAE).**—This soil is in large, irregularly shaped areas that are almost all within the boundaries of the Modoc National Forest. It is in the Warner Mountains. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Snag, Tourn, Longval, Hapgood, and Lyonman soils. These areas make up about 15 percent of the total acreage.

Runoff is medium, and the hazard of erosion is moderate. The native vegetation consists mainly of white fir and ponderosa pine.

This soil is not suitable for irrigated crops. It is used mainly for timber production and, to a limited extent, for livestock grazing, wildlife habitat, watershed, and recreation. Capability unit VIIIs-211, dryland; not placed in a range site; wildlife suitability group 10.

**Waca stony fine sandy loam, 30 to 50 percent slopes (WAF).**—This steep soil occupies long, narrow areas on the side slopes of narrow canyons in the Warner Mountains.

Included with these soils in mapping are areas of Lyonman, Snag, and other Waca soils. These areas make up about 15 percent of the total acreage.

Runoff is rapid, and the hazard of erosion is severe. The native vegetation consists mainly of white fir.

This soil is not suitable for irrigated crops. It is used mainly for timber production, wildlife habitat, watershed,

and recreation. Capability unit VIIIs-211, dryland; not placed in a range site; wildlife suitability group 10.

**Waca stony fine sandy loam, 50 to 75 percent slopes (WAG).**—This soil is in large, irregularly shaped areas in the Warner Mountains.

Included with this soil in mapping are areas of Snag, other Waca soils, and Rock outcrop. These areas make up about 20 percent of the total acreage.

Runoff is rapid, and the hazard of erosion is severe. The native vegetation consists mainly of white fir and ponderosa pine.

This soil is not suitable for irrigated crops. It is used mainly for timber production, wildlife habitat, watershed, and recreation. Capability unit VIIIs-211, dryland; not placed in a range site; wildlife suitability group 10.

**Waca-Hapgood association (WD).**—This association consists of moderately sloping to moderately steep soils in irregularly shaped areas in the Warner Mountains. The association is about 50 percent Waca stony fine sandy loam that has 5 to 30 percent slopes and about 40 percent Hapgood stony fine sandy loam that has 5 to 30 percent slopes. The Waca soil is 20 to 40 inches deep to bedrock, and it is medium acid in reaction. The Hapgood soil is more than 40 inches deep to bedrock, and it is slightly acid in reaction.

Included with this association in mapping are areas of Longval soils and steeper Waca and Hapgood soils. These areas make up about 10 percent of the total acreage.

The Waca soil has a native vegetation that consists of white fir and ponderosa pine. The native vegetation on the Hapgood soil consists of big sagebrush, bitterbrush, and Idaho fescue.

These soils are not suitable for irrigated crops. The Waca soil is used mainly for timber production, watershed, recreation, and, to a limited extent, for livestock grazing and wildlife habitat. The Hapgood soil is used for livestock grazing and wildlife habitat. Waca part: Capability unit VIIIs-211, dryland; not placed in a range site; wildlife suitability group 10. Hapgood part: Capability unit VIIIs-236, dryland; range site NV 23-7; wildlife suitability group 6.

**Waca-Snag association (WE).**—This association consists of steep soils in large, irregularly shaped areas on mountains. The association is about 50 percent Waca stony fine sandy loam that has 30 to 50 percent slopes and about 40 percent Snag very stony sandy loam that has 30 to 50 percent slopes. The Waca soil is 20 to 40 inches deep to bedrock, and it has a cover of timber. The Snag soil is 40 to 60 inches deep to bedrock, and it has a cover of shrub and grass.

Included with this association in mapping are areas of steeper Waca and Snag soils and Rock outcrop. These areas make up about 10 percent of the total acreage.

Runoff is rapid, and the hazard of erosion is severe. The Waca soil has a native vegetation of white fir. The native vegetation on Snag soils consists of big sagebrush, bitterbrush, and needlegrass.

These soils are not suitable for irrigated crops. The Waca soil is used mainly for timber production, watershed, recreation, and wildlife habitat. The Snag soil is used for livestock grazing and wildlife habitat. Waca part: Capability unit VIIIs-211, dryland; not placed in a range site; wildlife suitability group 10. Snag part: Capability unit VIIIs-211, dryland; range site NV 23-19; wildlife suitability group 6.

## Waca Series, Shallow Variant

The Waca series, shallow variant, consists of well-drained soils in the Warner Mountains. They formed in residuum and colluvium from mixed basic rocks. The slope range is 15 to 50 percent. Vegetation consists of white fir and ponderosa pine. The elevation ranges from 7,000 to 8,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 40° F., and the frost-free season is 60 to 80 days.

In a representative profile a very thin layer of leaf litter covers the surface. The surface layer is grayish-brown very gravelly sandy loam about 9 inches thick. The next layer is pale-brown very gravelly sandy loam. It is underlain by hard fractured andesite at a depth of 19 inches.

Waca soils, shallow variant, have rapid permeability. The effective rooting depth is 10 to 20 inches. Available water capacity is 1 to 2 inches. Runoff is medium, and the hazard of accelerated erosion is moderate.

Representative profile of Waca very gravelly sandy loam, shallow variant, 15 to 50 percent slopes, in Modoc County, California, 100 feet east and 100 feet south of the north quarter corner of sec. 4, T. 44 N., R. 15 E., Mount Diablo base line and meridian:

- O1— $\frac{1}{4}$  inch to 0, litter consisting primarily of manzanita leaves; medium acid (pH 5.6). 0 to 4 inches thick.
- A11—0 to 3 inches, grayish-brown (10YR 5/2) very gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; soft, very friable, nonstocky, nonplastic; many very fine and fine roots; many very fine and fine interstitial pores; strongly acid (pH 5.1); clear, smooth boundary, 2 to 7 inches thick.
- A12—3 to 9 inches, grayish-brown (10YR 5/2) very gravelly sandy loam, very dark brown (10YR 3/2) moist; moderate, very fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine, fine, and medium roots and common coarse roots; many very fine interstitial pores; medium acid (pH 5.8); clear, wavy boundary, 1 to 10 inches thick.
- C—9 to 19 inches, pale-brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, nonplastic; many very fine, medium, and coarse roots; many very fine and fine interstitial pores; medium acid (pH 5.8); abrupt, irregular boundary. 6 to 15 inches thick.
- R—19 inches, hard fractured andesitic bedrock that has many deep fractures.

In the A horizon colors have a hue of 10YR or 2.5Y, a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 1 or 2. This horizon is fine sandy loam, sandy loam, or loam and is gravelly or very gravelly. Reaction in the A horizon ranges from slightly acid to strongly acid. In the C horizon colors have a hue of 10YR or 2.5Y, a dry value of 6 or 7, a moist value of 3 or 4, and a chroma of 2 or 3. This horizon is gravelly, very gravelly, and stony sandy loam, fine sandy loam, or loam. Reaction ranges from medium acid to very strongly acid. The depth to hard fractured bedrock ranges from 10 to 20 inches.

**Waca very gravelly sandy loam, shallow variant, 15 to 50 percent slopes (WFF).**—This soil is in isolated areas in the Warner Mountains. It has the profile described as representative for the series.

Included with this soil in mapping are areas of stony and very stony Waca soils and Rock outcrop. These areas make up about 10 percent of the total acreage.

The native vegetation consists mainly of white fir and ponderosa pine.

This soil is not suitable for irrigated crops. It is used mainly for timber production, watershed, recreation, and

wildlife habitat. Capability unit VIIs-211, dryland; not placed in a range site; wildlife suitability group 10.

## Weimer Series

The Weimer series consists of poorly drained soils on flats of enclosed basins that lack external drainage. They formed in clayey alluvium derived from mixed basic rocks. The slope range is 0 to 2 percent. Vegetation consists of water-tolerant plants such as rushes, sedges, dock, silver sagebrush, and mat muhly. The elevation ranges from 5,250 to 6,500 feet. The average annual precipitation is 12 to 14 inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 60 to 90 days.

In a representative profile dark-gray, neutral to strongly alkaline clay extends from the surface to a depth of 62 inches.

Weimer soils have very slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 8 to 10 inches. The hazard of accelerated erosion is slight or none. The seasonal high water table is at the surface in winter and early in spring, and ponding occurs at those times. The water table drops to depths of more than 36 inches late in summer and in fall.

Representative profile of Weimer clay in Washoe County, Nevada, in Garden Lake Flat, 600 feet east and south of the northwest corner of sec. 12, T. 35 N., R. 18 E., Mount Diablo base line and meridian:

- A11—0 to 3 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3.5/1) moist; strong, very fine, granular structure; very hard, friable, sticky, very plastic; common very fine and fine roots; many fine interstitial pores; neutral (pH 7.2); clear, smooth boundary. 3 to 6 inches thick.
- A12—3 to 7 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong, fine and medium, sub-angular blocky structure; very hard, very firm, very sticky, very plastic; many very fine and fine roots; many very fine interstitial pores and few fine tubular pores; common pressure cutans; mildly alkaline (pH 7.4); clear, smooth boundary. 2 to 6 inches thick.
- A13—7 to 26 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few, fine, distinct, yellowish-brown (10YR 5/4) iron mottles; strong, medium and coarse; angular blocky structure; peds have parallel-piped faces; very hard, very firm, very sticky, very plastic; many very fine and fine roots; many very fine interstitial pores and few fine tubular pores; many slickensides; mildly alkaline (pH 7.4); gradual, wavy boundary. 12 to 24 inches thick.
- A14—26 to 48 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few, fine, distinct, yellowish-brown (10YR 5/4) iron mottles; strong, medium and coarse, angular blocky structure; peds have parallel-piped faces; very hard, very firm, very sticky, very plastic; few very fine and fine roots; common very fine interstitial pores and few fine tubular pores; many slickensides; effervescent; moderately alkaline (pH 8.4); clear, smooth boundary. 17 to 26 inches thick.
- A15ca—48 to 62 inches, dark-gray (10YR 4/1) clay, very dark grayish brown (10YR 3/2) moist; massive; very hard, very firm, very sticky, very plastic; few very fine roots; few very fine and fine tubular pores; strongly effervescent; common medium and fine, distinct, white (10YR 3/1) lime segregations; strongly alkaline (pH 8.6).

A thin crust (less than  $\frac{1}{4}$  inch thick) forms but does not last on the surface of this soil when it dries after a period of inundation. The upper 6 to 8 inches, except for the crust, has moderate or strong, very fine or fine, granular or subangular structure. The material forms a loose mulch when dry. At a depth of more than 10 inches are few to common high-chroma

mottles. Colors throughout these soils generally have a hue of 10YR or 2.5Y or are neutral, have a dry value of 4 or 5, a moist value of 2 or 3, and a chroma of 0 or 1. The exception is the ca horizon, which has a chroma of 2 in places. This horizon is only at a depth of more than 40 inches. It is dominantly clay but ranges to silty clay in places.

**Weimer clay (Wm).**—This nearly level soil is in large circular areas on floors of enclosed basins. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Weimer clay, drained, and Boulder Lake clay around the margins of the basins. These areas make up about 5 percent of the total acreage.

This soil is ponded and is subject to annual flooding. In years of unusually heavy snowpack it is flooded in places most of the summer. The vegetation consists mainly of sedges, rushes, mat muhly, and dock.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIw-204, dryland; range site NV 23-23; wildlife suitability group 11.

**Weimer clay, drained (Wp).**—This nearly level soil is in long, narrow basins. It is similar to the one described as representative for the series, except that in places a system of channels drains off excess surface water and thus prevents prolonged ponding. These areas are not inundated or are inundated only for short periods early in spring.

Included with this soil in mapping are areas of other Weimer soils and small areas of Couch soils. These areas make up about 10 percent of the total acreage.

The soil has very slow permeability. Runoff is very slow. The soil is subject to occasional flooding. The native vegetation consists mainly of silver sagebrush.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIw-204, dryland; range site NV 23-3; wildlife suitability group 11.

**Weimer clay, slightly alkali (Ws).**—This nearly level soil is only on Duck Lake, a large enclosed basin. The profile is similar to the one described as representative for the series, except that in this soil are varying amounts of soluble salts that accumulated as water evaporated within the basin.

Included with this soil in mapping are areas of strongly saline-alkali soils similar to those of the Weimer series, saline-alkali soils of the Crutcher, Couch, and Disabel series, and Boulder Lake clay. These areas make up about 5 percent of the total acreage.

The effective rooting depth is 40 to 60 inches. This soil is ponded, and it is subject to some degree of flooding almost annually. The native vegetation consists mainly of sedges, rushes, and povertyweed.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIw-204, dryland; range site NV 23-23; wildlife suitability group 11.

## Welch Series

The Welch series consists of poorly drained soils on narrow flood plains in upland valleys. They formed in alluvium derived from basalt, andesite, and tuff. The slope range is 0 to 9 percent. Vegetation consists of meadow grasses, sedges, and forbs. The elevation ranges from 5,000 to 6,500 feet. The average annual precipitation is 12 to 16

inches, the average annual air temperature is 41° to 44° F., and the frost-free season is 60 to 90 days.

In a representative profile the surface layer is very dark gray silty clay loam and heavy loam about 8 inches thick and gray silty clay loam about 27 inches thick. The underlying material is gray, mottled silty clay loam to a depth of 60 inches.

Welch soils have moderately slow permeability. The effective rooting depth is more than 60 inches. Available water capacity is 10 to 12 inches. Runoff is very slow, and the hazard of accelerated erosion is slight. The seasonal high water table is at a depth of 18 to 36 inches.

Representative profile of Welch silty clay loam, 0 to 9 percent slopes, in Washoe County, Nevada, in the Home Camp meadow near the center of sec. 27, R. 40 N., R. 19 E., Mount Diablo base line and meridian:

A11—0 to 3 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak, fine, granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and very fine roots; many very fine interstitial pores; slightly acid (pH 6.4); abrupt, smooth boundary. 2 to 6 inches thick.

A12—3 to 8 inches, very dark gray (10YR 3/1) heavy loam, black (10YR 2/1) moist; weak, medium, subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; few fine and many very fine roots; many very fine interstitial pores and common fine tubular pores; slightly acid (pH 6.4); clear, smooth boundary. 4 to 12 inches thick.

A13g—8 to 23 inches, gray (N 5/0) silty clay loam, very dark gray (N 3/0) moist; massive; slightly hard, friable, slightly sticky, plastic; few fine and many very fine roots; common very fine and fine and few medium tubular pores; neutral (pH 6.6); clear, smooth boundary. 10 to 18 inches thick.

A14—23 to 35 inches, gray (N 5/0) silty clay loam, very dark gray (N 3/0) moist; weak, medium, prismatic structure; slightly hard, friable, sticky, plastic; common very fine and fine roots; common very fine and fine tubular pores; neutral (pH 6.6); clear, smooth boundary. 10 to 18 inches thick.

C1g—35 to 42 inches, gray (N 6/0) silty clay loam, very dark gray (N 3/0) moist; many, fine, distinct, black (10YR 2/1) manganese mottles and common, fine, distinct, dark-brown (7.5YR 4/4) iron mottles; massive; slightly hard, friable, sticky, plastic; common very fine and fine roots; common very fine and fine tubular pores; neutral (pH 6.6); clear, smooth boundary. 6 to 12 inches thick.

C2g—42 to 60 inches, gray (N 6/0) silty clay loam, very dark gray (N 3/0) moist; common, fine, distinct, dark-brown (7.5YR 4/4) iron mottles; slightly hard, friable, sticky, plastic; few very fine and fine roots; few very fine and fine tubular pores; neutral (pH 6.6).

The A1 horizon ranges from 30 to more than 60 inches in thickness. Colors in this horizon have a hue of 10YR, 5Y, or N; a dry value of 3 to 5; a moist value of 2 to 3; and a chroma of 1 or less. The A1 horizon has weak or moderate, platy, blocky, prismatic, or granular structure, but it is massive in the lower part in places. In the Cg horizon colors have a hue of 5Y to 5B or neutral, a dry value of 5 to 8, a moist value of 3 or 4, and a chroma of 1 or less. Iron or manganese mottles are at depths below 12 inches in places. The profile consists of somewhat stratified sandy clay loam, clay loam, and silty clay loam. Reaction is relatively uniform and ranges from neutral to slightly acid throughout.

**Welch silty clay loam, 0 to 9 percent slopes (WvB).**—This soil is in long, narrow mountain meadows adjacent to streams throughout the survey area.

Included with this soil in mapping are areas of other highly stratified Welch-like soils that make up about 10 percent of the total acreage.

The soil is subject to frequent flooding early in spring. The native vegetation consists mainly of meadow grasses and sedges.

This soil is suitable for limited irrigated crops if drained and protected from flooding. It is used mainly for livestock grazing and wildlife habitat. Some areas are used for meadow hayland. Capability unit Vw-200, dryland; range site NV 23-13; wildlife suitability group 5.

### Zorravista Series

The Zorravista series consists of excessively drained soils. They formed in sandy eolian material derived from tuff, andesite, basalt, and lake-laid volcanic ash and pumice. The slope range is 0 to 15 percent. Vegetation is variable from place to place and includes big sagebrush, greasewood, four-wing saltbush, spiny hopsage, and Indian ricegrass. The elevation ranges from 4,500 to 5,000 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 46° to 48° F., and the frost-free season is 100 to 130 days.

In a representative profile light brownish-gray, moderately alkaline fine sand extends to a depth of 60 inches.

Zorravista soils have very rapid permeability. The effective rooting depth is more than 60 inches. Available water capacity is 4 to 5 inches. Runoff is very slow, and the hazard of accelerated soil blowing is severe.

Representative profile of Zorravista fine sand, 0 to 15 percent slopes, in Washoe County, Nevada, 200 feet north and 200 feet west of the southeast corner of sec. 17, T. 37 N., R. 19 E., Mount Diablo base line and meridian:

A1—0 to 4 inches, light brownish-gray (2.5Y 6/2) fine sand, very dark grayish brown (2.5Y 3/2) moist; single grain; loose when dry or moist; few very fine roots; many very fine and fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.2); clear, smooth boundary. 3 to 8 inches thick.

C—4 to 60 inches, light brownish-gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose when dry and moist; many very fine roots, few very fine roots at a depth of about 29 inches, and few fine roots; many very fine and fine interstitial pores; effervescent; moderately alkaline (pH 8.0).

The profile is generally uniform. Colors range from 2.5Y to 10YR in hue, are 6 or 7 in dry value, 3 or 4 in moist value, and 2 or 3 in chroma. The profile is fine sand or sand. Reaction ranges from mildly alkaline to moderately alkaline.

**Zorravista fine sand, 0 to 15 percent slopes (Z<sub>0</sub>C).**—This soil is in areas of stabilized sand dunes along the eastern edges of Surprise Valley and Duck Lake Valley. These dunes have been superimposed upon lake terraces. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Vylach, Pegler, Lolak, Gorzell, and Couch soils. These areas make up about 5 percent of the total acreage.

Runoff is very slow. The native vegetation is variable from place to place and consists of big sagebrush, greasewood, four-wing saltbush, spiny hopsage, and Indian ricegrass.

This soil is not suitable for irrigated crops. It is used mainly for livestock grazing and wildlife habitat. Capability unit VIIIs-224, dryland; range site NV 23-11; wildlife suitability group 9.

**Zorravista-Couch association (ZR).**—This association consists of soils in irregularly shaped areas along the

southeastern side of Surprise Valley. The soils are on semi-stabilized, scattered sand dunes on low-lying lake terraces. This association is about 60 percent Zorravista fine sand, 0 to 15 percent slopes, and about 30 percent Couch loam. The Zorravista soil is fine sand throughout and is in the duned areas. The Couch soil has a clay subsoil, is saline and alkali affected, and is in the interdune terrace areas.

Included with this association in mapping are areas of Lolak, Survya, and Raglan soils that make up about 10 percent of the total acreage.

The Zorravista soil has a native vegetation that consists of big sagebrush, greasewood, four-wing saltbush, spiny hopsage, and Indian ricegrass. The native vegetation on Couch soils consists mainly of greasewood.

The Zorravista soil is not suitable for irrigated crops. The Couch soil is suitable for limited irrigated farming if reclaimed. Both soils are used mainly for livestock grazing and wildlife habitat. Zorravista part: Capability unit VIIIs-224, dryland; range site NV 23-11; wildlife suitability group 9. Couch part: Capability unit IVs-64, irrigated, VIIIs-221, dryland; range site NV 23-2; wildlife suitability group 4.

### Use and Management of the Soils

This section discusses the use and management of the soils in the Area. It explains the system of capability grouping used by the Soil Conservation Service, describes the groups in which the soils of the Area have been placed, and gives estimated average yields of the principal crops grown on the arable soils under two levels of management. Management of range, wildlife habitat, and woodland is discussed, and engineering interpretations are given.

### Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive land-forming 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 rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in the Surprise Valley-Home Camp Area.)

- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.
- 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 habitat.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, II*e*. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, 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, II*e*-20 or III*w*-60. 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

The soils of this area were grouped into capability units on the basis of permanent or continuing limitations and hazards. Because of deficient precipitation, irrigation is needed for production of high-yielding crops and pasture.

Therefore, soils suitable for crops are placed in both irrigated and dryland units.

In the following pages the capability units are described and suggestions for use and management of the soils are given. Descriptions for each unit include characteristics of the soils in the unit, the suitability of these soils for crops, and the management suitable for the soils. The capability unit designation of each soil is given in the "Guide to Mapping Units."

### CAPABILITY UNIT II*e*-20, IRRIGATED

This unit consists of well-drained soils of the Bidwell, Jesse Camp, Nevador, and Surprise series. These soils have a surface layer of loam, fine sandy loam, or gravelly sandy loam. The slope range is 2 to 5 percent. They receive 6 to 18 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately rapid to moderately slow, runoff is slow to medium, and the hazard of accelerated erosion is moderate. The available water capacity for the profile under irrigation is 6 to 12 inches. The effective rooting depth is more than 60 inches. The hazard of erosion is a moderate limitation.

The soils in this capability unit are used partly for irrigated and dryland crops and partly for livestock grazing and wildlife habitat. They are suitable for irrigated crops, principally small grain, alfalfa, and permanent grass pasture.

Among practices that help offset or minimize the limitations of these soils is land smoothing or leveling. Cross-slope cultivation, contour farming, and proper management of irrigation water are needed to control erosion and conserve moisture. Fertilization is needed to maintain adequate fertility. The use of green manure, crop residues, and other organic matter helps in maintaining soil structure, tilth, and the infiltration rate of water, and in supplying plant nutrients.

### CAPABILITY UNIT II*e*-21, IRRIGATED

The only soil in this unit is Simpson sandy loam. It is a well-drained soil that has a slope range of 2 to 5 percent. It receives 12 to 16 inches of precipitation a year. The frost-free season is 100 to 120 days.

Permeability and runoff are slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 5 to 6 inches, and the effective rooting depth is over 60 inches. The erosion hazard is a moderate limitation.

This soil is used mainly for irrigated crops and a minor acreage is used for livestock grazing. It is suitable for irrigated crops, principally wheat, barley, alfalfa, and grass pasture.

Among practices that help offset or minimize the limitations of this soil are land smoothing and leveling. Cross-slope cultivation, contour farming, and proper management of irrigation water are needed to control erosion and to conserve moisture. The use of green manure, crop residues, and other organic matter helps in maintaining soil structure, tilth, and the infiltration rate of water, and in supplying plant nutrients.

### CAPABILITY UNIT II*w*-60, IRRIGATED

This capability unit consists of somewhat poorly drained soils of the Buntingville and Hussa series. These

soils have a surface layer of loam. The slope range is 0 to 2 percent. They receive 10 to 16 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately slow, runoff is slow to very slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 11 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 3 to 4 feet. Wetness is a moderate limitation.

The soils in this capability unit are used mainly for irrigated crops and to some extent for dryland crops. They are suitable for irrigated crops, principally alfalfa, small grain, meadow hay, and grass pasture.

Among practices that help offset or minimize the limitations of these soils are improvement of drainage to remove excess water and land smoothing or leveling to prepare the soils for irrigation. Proper management of irrigation water is needed to conserve moisture and to hold the water table at an acceptable level. Excessive tillage should be avoided because it breaks down the structure of the soils, causes deterioration in tilth, and reduces infiltration of water.

#### CAPABILITY UNIT IIw-62, IRRIGATED

This capability unit consists of somewhat poorly drained soils of the Buntingville and Husa series. These soils have a surface layer of loam. The slope range is mostly 2 to 5 percent. They receive 10 to 16 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately slow, runoff is slow to very slow, and the hazard of accelerated erosion is moderate. The available water capacity for the profile under irrigation is 11 to 12 inches, and the effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 3 to 4 feet in most years. These soils have limitations caused by wetness and slopes. Husa loam, clay substratum, drained, differs from the other soils in the unit in that it is nearly level, has very slow permeability, and has a slightly shorter frost-free season.

The soils in this capability unit are used mainly for irrigated crops and to a small extent for dryland crops. They are suitable for irrigated crops, principally alfalfa, small grain, meadow hay, and grass pasture.

Among practices that help offset or minimize the limitations of these soils are improvement of drainage to remove excess water; cross-slope cultivation and contour farming to control erosion; land smoothing or leveling to prepare the soils for irrigation. Proper management of irrigation water is needed to conserve moisture and to hold the water table at an acceptable level. Excessive tillage should be avoided because it breaks down the structure of the soils, causes deterioration in tilth, and reduces infiltration of water.

#### CAPABILITY UNIT II<sub>s</sub>-41, IRRIGATED

This capability unit consists of well-drained soils of the Disabel and Simpson series. These soils have a surface layer of silty clay loam and loam. The slope range is 0 to 2 percent. They receive 8 to 16 inches of precipitation a year. The frost-free season is 80 to 120 days.

Permeability and runoff are slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 5 to 11 inches. The effective

rooting depth is more than 60 inches. The slow permeability is a moderate limitation.

The soils in this capability unit are used mainly for dryland crops and livestock grazing. They are suitable for irrigated crops, principally alfalfa, wheat, barley, cereal rye, and grass pasture.

Among practices that help offset or minimize the limitations of these soils is leveling to prepare the soils for irrigation. Proper management of irrigation water is needed to conserve moisture. Fertilization is needed to maintain adequate fertility. The use of green manure, crop residues, and other organic matter helps in maintaining soil structure, tilth, and the infiltration rate of water, and in supplying plant nutrients.

#### CAPABILITY UNIT II<sub>s</sub>-43, IRRIGATED

This capability unit consists of well-drained soils of the Nevador series. These soils have a surface layer of loamy fine sand. The slope range is 0 to 5 percent. They receive 8 to 10 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately slow, runoff is slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 6 to 7 inches. The effective rooting depth is more than 60 inches. The coarse surface texture and slope are moderate limitations. Soil blowing is a hazard unless a cover crop is maintained.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for irrigated crops, principally alfalfa, wheat, barley, and grass pasture.

Among practices that help offset or minimize the limitations of this soil is land smoothing or leveling to prepare the soils for irrigation. Proper management of irrigation water is needed to control erosion and to conserve moisture. Cross-slope cultivation and contour farming help reduce the hazard of erosion. The use of green manure, crop residues, and other organic matter helps in maintaining soil structure, tilth, and the infiltration rate of water, and in supplying plant nutrients.

#### CAPABILITY UNIT II<sub>c</sub>-1, IRRIGATED

This capability unit consists of well-drained soils of the Bidwell, Jesse Camp, Nevador, Raglan, and Surprise series. These soils have a surface layer of loam, fine sandy loam, very fine sandy loam, and gravelly sandy loam. The slope range is 0 to 2 percent. They receive 6 to 18 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately rapid to moderately slow, runoff is very slow to medium, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 6 to 12 inches. The effective rooting depth is more than 60 inches. Unfavorable climate is a moderate limitation. Raglan very fine sandy loam, alkali, differs from the other soils in the unit in that it is slightly alkali affected, a condition that can easily be corrected under irrigation.

The soils in this capability unit are used mainly for livestock grazing and to some extent for irrigated and dryland crops. They are suitable for irrigated crops, principally small grain, alfalfa, alfalfa-grass mixtures, and grass pasture.

Among practices that help offset or minimize the limitations of these soils is land smoothing or leveling before planting. Border and sprinkler irrigation systems are adaptable to these soils. Proper management of irrigation water is needed to conserve moisture. The use of green manure, crop residues, and other organic matter helps in maintaining soil structure, tilth, the infiltration rate of water, and in supplying plant nutrients.

#### CAPABILITY UNIT IIIw-60, IRRIGATED

This capability unit consists of poorly drained soils of the Four Star, Hovey, and Husa series. These soils have a surface layer of loam, silty clay loam, and clay loam. The slope range is 0 to 2 percent. They receive 10 to 16 inches of precipitation a year. The frost-free season is 90 to 130 days.

Permeability is moderate to slow, runoff is slow to very slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 5 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 2 to 3 feet. Wetness is a severe limitation.

The soils in this capability unit are used mainly for livestock grazing on the native meadows. They are suitable for irrigated crops, principally alfalfa, small grain, and grass pasture or improved meadow plants.

Among practices that help offset or minimize the limitations of these soils are improvement of drainage and proper management of irrigation water. A system of drains is needed to remove excess water and hold the water table at an acceptable level. Proper management of irrigation water is needed to conserve moisture and to hold the water table at an acceptable level. Land leveling or smoothing is needed to prepare these soils for surface irrigation or water spreading.

#### CAPABILITY UNIT IIIw-63, IRRIGATED

This capability unit consists of poorly drained soils of the Four Star and Husa series. These soils have a surface layer of loam and clay loam. The slope range is 0 to 2 percent. They receive 10 to 16 inches of precipitation a year. The frost-free season is 90 to 130 days.

Permeability and runoff are slow to very slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 5 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 2 to 3 feet. Wetness and slow or very slow permeability are severe limitations.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat, and to some extent for native meadow hay. They are suitable for irrigated crops, principally alfalfa, small grain, and grass pasture or improved meadow plants if drainage is provided.

Among practices that help offset or minimize the limitations of these soils is improvement of drainage to remove excess water. Very slowly permeable lacustrine clay at a depth of 40 inches or more complicates the design of any proposed drainage system. Proper management of irrigation water is needed to conserve moisture and to hold the water table at an acceptable level. Land leveling or smoothing is needed to prepare the soils for surface irrigation or water spreading. Crops on these soils respond well to fertilization.

#### CAPABILITY UNIT IIIw-91, IRRIGATED

This capability unit consists of well-drained soils of the Crutcher, Disabel and Jesse Camp series. These soils have a surface layer of silt loam and silty clay loam. The slope range is 0 to 2 percent. They receive 6 to 10 inches of precipitation a year. The frost-free season is 80 to 130 days.

Permeability is moderately slow to slow, runoff is slow to very slow, and the hazard of accelerated erosion is slight to severe. The available water capacity for the profile under irrigation is 9 to 12 inches. The effective rooting depth is 50 to 60 inches. Flooding for short durations, caused by runoff from higher lying areas every year, is a severe limitation. In places it damages irrigation systems and structures.

The soils in this capability unit are used mainly for livestock grazing. If irrigation water is made available, these soils are suitable for alfalfa or grass pastures.

Among practices that help offset or minimize the limitations of these soils are flood control and proper management of irrigation water to conserve moisture and control erosion. Land smoothing or leveling is needed to prepare the soils for irrigation. Leaching and drainage are important in maintaining a favorable salt balance.

#### CAPABILITY UNIT IIIs-64, IRRIGATED

This capability unit consists of well-drained soils of the Crutcher and Disabel series. These soils have a surface layer of very fine sandy loam and silty clay loam. They are slightly affected by salt or by salt and alkali. The slope range is 0 to 2 percent. They receive 6 to 12 inches of precipitation a year. The frost-free season is 80 to 130 days.

Permeability and runoff are slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 9 to 11 inches. The effective rooting depth is more than 60 inches. Slow permeability and the effect of salts and alkali are limitations where these soils are used for crops.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for irrigated crops, principally alfalfa, small grain, and grass pasture or hay.

Among practices that help offset or minimize the limitations of these soils is land smoothing or leveling to prepare the soils for irrigation. Proper management of irrigation water is needed to conserve moisture. The use of green manure, crop residues, and other organic matter helps in maintaining soil structure, tilth, and infiltration of water, and in supplying plant nutrients. The addition of gypsum and periodic deep leaching are needed to reduce the content of salt and alkali. Improvement will be gradual because of slow infiltration and slow permeability.

#### CAPABILITY UNIT IVe-20, IRRIGATED

This capability unit consists of sloping to strongly sloping, well-drained soils of the Donica, Simpson, and Surprise series. These soils have a surface layer of gravelly sandy loam. The slope range is 2 to 15 percent. They receive 12 to 18 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately rapid to slow, runoff is slow, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile under irrigation is 5 to 7 inches. The effective rooting depth is more than 60 inches. The moderately coarse texture of these soils

and the hazard of erosion because of slope are limitations where these soils are used for crops. Donica gravelly sandy loam, 2 to 5 percent slopes, differs from the other soils in the unit in that it has a very gravelly, coarse-textured subsoil and substratum, has a lower available water capacity, and is gently sloping.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for irrigated crops, principally permanent pasture of legume-grass mixtures.

Among practices that help offset or minimize the limitations of these soils is proper management of irrigation water to conserve moisture. Contour or cross-slope farming is needed to reduce the hazard of erosion. The use of green manure, crop residues, or other organic matter helps to improve soil structure, tilth, stability, and the infiltration rate of water.

#### CAPABILITY UNIT IVw-61, IRRIGATED

The only soil in this unit is Hussa loam, slightly saline-alkali. It is a poorly drained soil that is slightly affected by salt and alkali. The slope range is 0 to 2 percent. It receives 10 to 16 inches of precipitation a year. The frost-free season is 110 to 130 days.

Permeability is moderately slow, runoff is slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 11 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 3 to 4 feet. Wetness and the effect of salts and alkali are limitations on this soil where it is used for crops.

The soil in this capability unit is used mainly for livestock grazing, but small areas have been planted to tall wheatgrass and alfalfa. They are suitable for irrigated crops, principally improved pasture and legume-grass mixtures used for hay production.

Among practices that help offset or minimize the limitations on this soil are proper management of irrigation water and improvement of drainage to conserve moisture and to lower the water table to an acceptable level. Leaching and drainage help to improve the salt and alkali condition.

#### CAPABILITY UNIT IVw-64, IRRIGATED

Soils in this unit are in the Dangberg series, cold variant. These soils are moderately deep and poorly drained. They have a surface layer of loam that is underlain by a silica-cemented hardpan. The slope range is 0 to 5 percent. They receive 9 to 12 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is very slow, runoff is slow to very slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 2.5 to 3.5 inches. The effective rooting depth is 15 to 28 inches. The seasonal high water table is at a depth of 1½ to 3 feet. These soils are moderately to strongly affected by salts and alkali. The effect of salts and alkali, wetness, and the limited rooting depth because of the silica-cemented hardpan are limitations on this soil where it is used for irrigated crops.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for marginal irrigated crops, such as wet meadow hay or permanent grass pasture.

Among practices that help offset or minimize the limitations of this soil are improvement of drainage and reclamation, but both are difficult to achieve because of the low-lying position of this soil.

#### CAPABILITY UNIT IVw-67, IRRIGATED

This capability unit consists of poorly drained soils of the Bicondoa and Cummings series. These soils have a surface layer of clay, silty clay loam, and muck. The slope range is 0 to 2 percent. They receive 7 to 16 inches of precipitation a year. The frost-free season is 80 to 130 days.

Permeability is moderately slow to slow, runoff is very slow to ponded, and the hazard of accelerated erosion is none to slight. The available water capacity for the profile under irrigation is 9 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 1 to 3 feet. In places these soils are flooded by runoff from higher lying areas. Wetness, slow permeability, and the fine surface texture of these soils are limitations where these soils are used for irrigated crops.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for marginal irrigated crops, mainly wet meadow hay and permanent grass pasture.

Among practices that help offset or minimize the limitations of these soils are improvement of drainage and proper management of irrigation water. Proper drainage can lower the water table to some extent, but it is difficult to achieve because of the low-lying position of these soils. Management of irrigation water is needed to hold the water table at an acceptable level.

#### CAPABILITY UNIT IVw-120, IRRIGATED

This capability unit consists of poorly drained soils of the Four Star and Hovey series. These soils have a surface layer of loam and silty clay loam. The slope range is 0 to 2 percent. They receive 10 to 16 inches of precipitation a year. The frost-free season is 70 to 90 days.

Permeability is moderately rapid to slow, runoff is slow to very slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 5 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 2 to 3 feet. Wetness and a short growing season are very severe limitations. The high water table and flooding because of runoff in spring are also limitations where these soils are used for irrigated crops.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for irrigated crops, principally improved meadow hay and grass pasture.

Among practices that help offset or minimize the limitations on these soils is the use of floodways to protect the soils from excessive flooding caused by runoff. Drainage is needed to lower the water table to an acceptable level. Proper management of irrigation water is needed to conserve moisture without affecting the water table. Natural fertility is high, and these soils respond well to fertilization.

#### CAPABILITY UNIT IVs-64, IRRIGATED

This capability unit consists of well-drained soils of the Couch and Crutcher series. These soils have a surface layer

of loam and silty clay loam. They are strongly affected by salt and alkali. The slope range is 0 to 2 percent. They receive 6 to 10 inches of precipitation a year. The frost-free season is 90 to 130 days.

Permeability and runoff are slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 9 to 11 inches. The effective rooting depth is more than 60 inches. Slow permeability and the effect of salts and alkali are limitations where these soils are used for crops. In places flooding, caused by runoff from higher lying areas, is a limitation.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for irrigated crops, principally alfalfa, small grain, legume-grass mixtures, and hay.

Among practices that help offset or minimize the limitations of these soils are improvement of drainage and reclamation to leach and remove toxic salts from these soils. Proper management of irrigation water is needed to conserve moisture. The use of green manure, crop residues, or other organic matter helps in maintaining soil structure, tilth, and infiltration of water. The use of soil amendments as a part of the reclamation process of leaching and draining are beneficial to these soils. Land leveling or smoothing is needed when preparing these soils for irrigation.

#### CAPABILITY UNIT Vw-60, IRRIGATED

This capability unit consists of very poorly drained soils of the Four Star and Hussa series. These soils have a surface layer of loam and clay loam. The slope range is 0 to 9 percent. They receive 10 to 16 inches of precipitation a year. The frost-free season is 70 to 120 days.

Permeability is moderately rapid to moderately slow, runoff is slow to medium, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile under irrigation is 5 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 1 to 2 feet. Wetness, caused by adjacent springs, is a limitation where these soils are used for crops.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are too wet to be cultivated and can produce only water-tolerant plants. Most of the acreage is used for native pasture which produces fair amounts of herbage.

Management possibilities are very limited. Drainage is difficult because of the position of the soils. Some excess water can be removed through small surface drains. Proper management of the water table helps improve the kind and amount of forage produced. Fertilization helps maintain productivity.

#### CAPABILITY UNIT VIw-64, IRRIGATED

This capability unit consists of very poorly drained or poorly drained soils of the Bicondoa series and Cummings muck, clay subsoil variant. These soils have a surface layer of clay and muck. The slope range is 0 to 2 percent. They receive 7 to 12 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is slow, runoff is very slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile under irrigation is 9 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal

high water table is at a depth of 1 to 3 feet. Wetness throughout most of the year, slow permeability, and the content of salts and alkali are limitations where these soils are used for crops.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are not suitable for irrigated crops. Most of the acreage is used for native pasture.

Management possibilities are very limited. Drainage is difficult because of the low position of the soils. Some excess water can be removed through small surface drains. Proper management of irrigation water helps reduce the content of salts and alkali in the surface layers, but complete removal is not feasible. Seeding a mixture of plants that are tolerant of excess water, salts, and alkali helps increase the growth of pasture plants.

#### CAPABILITY UNIT Vw-200, DRYLAND

The only soil in this capability unit is Welch silty clay loam, 0 to 9 percent slopes. It is poorly drained. It receives 12 to 16 inches of precipitation a year. The frost-free season is 60 to 90 days. Permeability is moderately slow, runoff is very slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 10 to 12 inches. The effective rooting depth for native plants is more than 60 inches. The seasonal high water table is at a depth of 18 to 36 inches. This soil is subject to flooding.

The soil in this capability unit is used mainly for the production of meadow hay and for grazing by livestock and wildlife. It is suitable for limited irrigated farming if it is drained and protected from flooding.

Among practices that help offset or minimize the limitations of this soil are erosion-control measures to prevent gullyng and to maintain the level of the water table.

#### CAPABILITY UNIT VIe-200, DRYLAND

This capability unit consists of well-drained soils of the Foxmount, Hartig, and Lyonman series. These soils have a surface layer of gravelly loam and sandy loam. The slope range is 15 to 30 percent. They receive 14 to 25 inches of precipitation a year. The frost-free season is 30 to 80 days.

Permeability is moderate, runoff is slow to medium, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 6 to 8 inches. The effective rooting depth is more than 20 inches. Slope is a limitation.

The soils in this capability unit are used mainly as part of a watershed, for the production of timber, and as wildlife habitat. They are suitable for woodland or range seeding.

Among practices that help offset or minimize the limitations of these soils is the maintenance of adequate plant cover.

#### CAPABILITY UNIT VIw-200, DRYLAND

This capability unit consists of poorly drained soils of the Buntingville, Campone, and Hussa series. These soils have a surface layer of gravelly loam, loam, and clay loam. The slope range is 0 to 15 percent. They receive 10 to 30 inches of precipitation a year. The frost-free season is 60 to 120 days. Permeability is moderate to moderately slow, runoff is medium to very slow, and the hazard of accelerated erosion is slight to severe. The available water ca-

capacity for the profile is 6 to 12 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 3 to 5 feet. These soils are subject to flooding. Husa loam, clay substratum, drained, 0 to 2 percent slopes, differs from other soils in the unit in that it has very slowly permeable lacustrine clays at a depth of 40 to 60 inches. It has been partly drained because of gullies.

The soils in this capability unit are used mainly for livestock grazing, but to a limited extent for wildlife habitat. They are suitable for irrigated crops.

Among practices that help offset or minimize the limitations of these soils is proper range management that maintains an adequate plant cover to minimize the hazards of erosion and that maintains the level of the water table.

#### CAPABILITY UNIT VIW-204, DRYLAND

This capability unit consists of poorly drained soils of the Weimer and Boulder Lake series. These soils have a surface layer of clay. The slope range is 0 to 2 percent. They receive 10 to 14 inches of precipitation a year. The frost-free season is 60 to 90 days.

Permeability is very slow, runoff is very slow to slow or is ponded, and the hazard of accelerated erosion is none to slight. The available water capacity for the profile is 8 to 10 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at the surface where these soils are ponded, but it drops to a depth of more than 36 inches late in fall. Very slow permeability, the fine texture in the surface layer, wetness, and flooding are limitations where these soils are used for grazing. Weimer clay, slightly alkali, differs from other soils in this unit in that it contains significant amounts of salts that accumulated from evaporating waters.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat.

Among practices that help offset or minimize the limitations of these soils is the elimination of grazing while these soils are saturated to prevent trampling of the plant cover. These soils are suitable for range seeding on their perimeters and in areas that are slightly elevated.

#### CAPABILITY UNIT VIW-226, DRYLAND

This capability unit consists of well-drained soils of the Crutcher, Disabel, and Jesse Camp series. These soils have a surface layer of silt loam and silty clay loam. The slope range is 0 to 2 percent. They receive 6 to 12 inches of precipitation a year. The frost-free season is 80 to 120 days.

Permeability is moderate to slow, runoff is medium to slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 9 to 12 inches. The effective rooting depth is more than 60 inches. Annual flooding, caused by runoff from surrounding higher lying areas, is a limitation.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for irrigated crops if adequate irrigation water is made available.

Among practices that help offset or minimize limitations of these soils is the installation of properly designed water spreading structures to make more efficient use of the runoff water from the higher lying areas. These soils are suitable for range seeding if proper soil preparation and plant selection are used.

#### CAPABILITY UNIT VI-226, DRYLAND

This capability unit consists of well-drained soils of the Crutcher, Disabel, and Simpson series. These soils have a surface layer of gravelly sandy loam, very fine sandy loam, sandy loam, loam, and silty clay loam. The slope range is 0 to 15 percent. They receive 8 to 16 inches of precipitation a year. The frost-free season is 80 to 120 days.

Permeability and runoff are slow, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 5 to 12 inches. The effective rooting depth is 40 to 60 inches. Slow permeability of the subsoils is a limitation. Crutcher very fine sandy loam differs from other soils in this unit in that it is slightly affected by salts.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat.

Among practices that help offset or minimize the limitations of these soils is good management to maintain or improve the present stands of vegetation. These soils are suitable for rangeland seedings if the soils are properly prepared. Plant varieties for seeding should be selected which are able to withstand droughty conditions.

#### CAPABILITY UNIT VI-220, DRYLAND

This capability unit consists of well-drained soils of the Bidwell, Jesse Camp, Gorzell, Langston, Longval, Nevada, and Surprise series. These soils have a surface layer of gravelly loam, loam, fine sandy loam, gravelly sandy loam, and sandy loam. The slope range is 0 to 15 percent. They receive 8 to 16 inches of precipitation a year. The frost-free season is 80 to 130 days.

Permeability is moderately rapid to moderately slow, runoff is very slow to medium, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 6 to 11 inches. The effective rooting depth is more than 60 inches. Inadequate precipitation in summer is a limitation. Longval fine sandy loam, 2 to 15 percent slopes, differs from other soils in the unit in that it has bedrock at a depth of 34 inches and is at higher elevations with greater amounts of precipitation.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat.

Among practices that help offset or minimize the limitations of these soils is good management to maintain or improve the present stand of vegetation. These soils are suitable for range seeding if proper soil preparation and plant selection are used.

#### CAPABILITY UNIT VII-209, DRYLAND

The only soil in this capability unit is Lyonman sandy loam, 30 to 50 percent slopes, a well-drained soil that has a surface layer of sandy loam. It receives 16 to 25 inches of precipitation a year. The frost-free season is 60 to 80 days.

Permeability is moderately slow, runoff is rapid, and the hazard of accelerated erosion is severe. The available water capacity for the profile is 7 to 8 inches. The effective rooting depth is more than 60 inches. The hazard of erosion because of slope is a limitation where this soil is used for the production of timber.

The soil in this capability unit is used mainly for timber production, but to a limited extent for livestock grazing and wildlife habitat. It is not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of this soil is the proper construction of roads and trails.

**CAPABILITY UNIT VIIe-228, DRYLAND**

This capability unit consists of somewhat excessively drained soils of the Donica series. These soils have a surface layer of gravelly sandy loam. The slope range is 15 to 50 percent. They receive 12 to 16 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately rapid, runoff is rapid, and the hazard of accelerated erosion is severe. The available water capacity for the profile is 7 to 8 inches. The effective rooting depth is more than 60 inches. The hazard of erosion because of slope and low available water capacity are limitations where this soil is used for grazing.

These soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are not suitable for irrigated crops.

Among practices that help offset or minimize the limitations is maintaining adequate plant cover to help control erosion.

**CAPABILITY UNIT VIIw-200, DRYLAND**

This capability unit consists of Marsh, a nearly level to gently sloping land type that is on flood plains, low lake terraces, and alluvial fans around natural springs and seeps. The water table is at or near the surface throughout the year. Wetness is a limitation.

The native vegetation is mainly water-tolerant plants, such as bulrush, spikerush, and cattails.

This land type is used for limited late-season grazing by livestock and as a habitat for migratory wildlife. They are too wet to be used for cultivated crops or hay.

Management possibilities are very limited. This land type cannot be safely crossed with heavy equipment and it is very difficult to drain because of its location adjacent to springs and seeps.

**CAPABILITY UNIT VIIw-205, DRYLAND**

This capability unit consists of poorly drained soils of the Bicondoa and Lolak series. These soils have a surface layer of clay, silty clay, and loamy sand. They are salt and alkali affected. The slope range is 0 to 2 percent. They receive 7 to 12 inches of precipitation a year. The frost-free season is 80 to 120 days.

Permeability is slow to very slow, runoff is very slow or ponded, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 9 to 10 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 1 to 5 feet. Slow or very slow permeability, fine texture in the surface layer, the salt and alkali condition, and wetness are limitations. Lolak loamy sand, overflow, differs from other soils in the unit in that the surface horizon has 4 to 6 inches of loamy sand that is free of salts and alkali.

The soils in this capability unit are used mainly for livestock grazing but to a limited extent for wildlife habitat. They are not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of these soils is proper management to maintain the present plant community.

**CAPABILITY UNIT VIIw-222, DRYLAND**

The only soil in this capability unit is McConnel sandy loam, overwash, 0 to 2 percent slopes. It is a somewhat

excessively drained soil. It is subject to periodic flooding. It receives 7 to 10 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately rapid, runoff is slow to medium, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 4 to 5 inches. The effective rooting depth is more than 60 inches. The low available water capacity and flooding are limitations.

The soil in this capability unit is used mainly for livestock grazing and wildlife habitat. It is not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of this soil is the use of water spreading structures to better distribute the flood waters.

**CAPABILITY UNIT VIIw-227, DRYLAND**

This capability unit consists of very poorly drained to somewhat poorly drained soils of the Kirsing series. These soils have a surface layer of fine sandy loam. They are salt and alkali affected. The slope range is 0 to 2 percent. They receive 6 to 8 inches of precipitation a year. The frost-free season is 100 to 120 days.

Permeability is slow, runoff is medium, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 6 to 10 inches. The effective rooting depth is more than 60 inches. The seasonal high water table is at a depth of 1 to 5 feet. Slow permeability, the salt and alkali condition, and wetness are limitations.

The soils in this capability unit are used mainly for livestock grazing but to a limited extent for wildlife habitat. They are not suitable for irrigated crops.

Among practices that help minimize the limitations of these soils is good management to maintain or improve the plant cover.

**CAPABILITY UNIT VIIw-229, DRYLAND**

This capability unit consists of poorly drained soils of the Dangberg series. These soils have a surface layer of loam that is underlain by a strongly cemented hardpan. The slope range is 0 to 5 percent. They receive 8 to 12 inches of precipitation a year. The frost-free season is 100 to 130 days. Permeability is slow, runoff is slow to medium, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 2 to 4 inches. The effective rooting depth is 15 to 28 inches. The seasonal high water table is at a depth of 1½ to 3 feet. Depth, the salt and alkali condition, and wetness are limitations.

The soils in this capability unit are used mainly for livestock grazing, but to a limited extent for wildlife habitat. They are marginally suitable for irrigated crops.

Among practices that help minimize the limitations of these soils is good management to maintain or improve plant cover.

**CAPABILITY UNIT VIIs-211, DRYLAND**

This capability unit consists of well-drained soils of the Bluebell, Snag, Tourn, and Waca series. These soils have a surface layer of very stony sandy loam, stony fine sandy loam, stony loam, and very gravelly sandy loam. The surface layer is underlain by bedrock. The slope range is 5 to 75 percent. They receive 14 to 30 inches of precipitation a year. The frost-free season is 50 to 90 days.

Permeability is rapid to moderately rapid, runoff is slow to rapid, and the hazard of accelerated erosion is slight to severe. The available water capacity for the profile is 1 to 6 inches. The effective rooting depth is more than 60 inches. The very gravelly, stony, or very stony surface layers and the slope are limitations.

The soils in this capability unit are used mainly for timber production, livestock grazing, and wildlife habitat.

Among practices that help offset or minimize the limitations of these soils are proper construction of roads and trails and the maintenance of adequate plant cover to minimize the hazard of erosion.

#### CAPABILITY UNIT VII<sub>s</sub>-221, DRYLAND

This capability unit consists of well-drained soils of the Couch, Crutcher, and Disabel series. These soils have a surface layer of loam and silty clay loam. They are salt and alkali affected. The slope range is 0 to 5 percent. They receive 6 to 12 inches of precipitation a year. The frost-free season is 80 to 130 days.

Permeability and runoff are slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 9 to 12 inches. The effective rooting depth is more than 60 inches. Slow permeability and the salt and alkali condition are limitations.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat.

Among practices that help offset or minimize the limitations of these soils is good management to maintain the native vegetation.

#### CAPABILITY UNIT VII<sub>s</sub>-224, DRYLAND

The only soil in this capability unit is Zorravista fine sand, 0 to 15 percent slopes. It is an excessively drained soil. It receives 8 to 10 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is very rapid, runoff is very slow, and the hazard of accelerated soil blowing is severe. The available water capacity for the profile is 4 to 5 inches. The effective rooting depth is more than 60 inches. The coarse texture and low available water capacity are limitations.

The soil in this capability unit is used mainly for livestock grazing and wildlife habitat. It is not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of the soil is good range management to maintain adequate plant cover that helps control the hazard of soil blowing.

#### CAPABILITY UNIT VII<sub>s</sub>-229, DRYLAND

This capability unit consists of well-drained soils of the Nevador series that have a surface layer of loamy fine sand. The slope range is 0 to 5 percent. They receive 8 to 10 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately slow, runoff is slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 6 to 7 inches. The effective rooting depth is more than 60 inches. Slow permeability and the coarse texture of the surface layer are limitations.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for irrigated crops if adequate irrigation water is made available.

Among practices that help to offset or minimize the limitations of these soils is good range management to maintain adequate plant cover that helps reduce the hazard of erosion.

#### CAPABILITY UNIT VII<sub>s</sub>-231, DRYLAND

This capability unit consists of well-drained soils of the Espil, Fertaline, Powley, Hart Camp, Old Camp, Olson, Pegler, Suryya, and Vylach series. These soils have a surface layer of gravelly fine sandy loam, gravelly loam, gravelly sandy loam, and fine sandy loam. The surface layer is underlain by hardpan or bedrock. The slope range is 0 to 15 percent. They receive 6 to 14 inches of precipitation a year. The frost-free season is 50 to 120 days.

Permeability is very slow to moderately slow, runoff is medium to slow, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 1 to 3 inches. The effective rooting depth is 8 to 30 inches. The shallow depth to hardpan or bedrock is a limitation.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of these soils is good range management to maintain adequate plant cover.

#### CAPABILITY UNIT VII<sub>s</sub>-236, DRYLAND

This capability unit consists of well-drained soils of the Gorzell, Hapgood, Home Camp, Newlands, and Schamp series. These soils have a surface layer of loam and fine sandy loam that is stony, very stony, and bouldery in places. It is underlain by bedrock. The slope range is 5 to 75 percent. These soils receive 8 to 16 inches of precipitation a year. The frost-free season is 50 to 100 days.

Permeability is moderately slow to moderate, runoff is very rapid to medium, and the hazard of accelerated erosion is moderate to severe. The available water capacity for the profile is 5 to 9 inches. The rooting depth is 20 to more than 60 inches. The stony, bouldery, or very stony nature of the surface layer is a limitation.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of these soils is good management to maintain adequate plant cover. These soils are well suited to brush control by aerial spraying, which increases their capability of producing large amounts of forage for livestock and wildlife.

#### CAPABILITY UNIT VII<sub>s</sub>-237, DRYLAND

This capability unit consists of well-drained soils of the Bregar, Madeline, Mascamp, Ninemile, Mosquet, and Old Camp series. These soils have a surface layer of loam and sandy loam that is very rocky, rocky, very stony, extremely stony, or extremely cobbly in places. It is underlain by bedrock. The slope range is 0 to 30 percent. These soils receive 8 to 16 inches of precipitation a year. The frost-free season is 50 to 100 days.

Permeability is moderately slow to slow, runoff is medium to slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 0.75 to 3 inches. The effective rooting depth is 10 to 20 inches. The shallow depth of these soils and the very rocky, rocky,

extremely stony, very stony, or extremely cobbly nature of the surface layer is a limitation.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of these soils is good management to maintain and improve the plant cover.

#### **CAPABILITY UNIT VII<sub>s</sub>-239, DRYLAND**

This capability unit consists of well-drained soils of the Catnip, Mendeboure, Mosquet, and Toney series. These soils have a surface layer of very stony or extremely cobbly loam. It is underlain by bedrock. The slope range is 0 to 50 percent. They receive 12 to 16 inches of precipitation a year. The frost-free season is 50 to 100 days.

Permeability is slow, runoff is medium, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 3 to 6 inches. The effective rooting depth is 20 to 40 inches. Slow permeability, coarse fragments on the surface, and, in places, slope are limitations.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of these soils is good management to maintain or improve the plant cover.

#### **CAPABILITY UNIT VII<sub>s</sub>-241, DRYLAND**

The only soil in this capability unit is Karlo very cobbly clay, 0 to 9 percent slopes, a well-drained soil. The very cobbly clay surface layer is underlain by bedrock. This soil receives 10 to 16 inches of precipitation a year. The frost-free season is 80 to 100 days.

Permeability and runoff are slow, and the hazard of accelerated erosion is slight. The available water capacity for the profile is 4 to 6 inches. The effective rooting depth is 20 to 40 inches. The fine texture of the surface layer, slow permeability, and the very cobbly nature of this soil are limitations.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are not suitable for irrigated crops.

Among practices that help offset or minimize the limitations of this soil is good management to maintain or improve plant cover.

#### **CAPABILITY UNIT VII<sub>s</sub>-243, DRYLAND**

This capability unit consists of somewhat excessively drained soils of the Donica series. These soils have a surface layer of gravelly, very gravelly, and very stony sandy loam. The slope range is 2 to 30 percent. They receive 12 to 16 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately rapid, runoff is very slow to medium, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 3 to 4 inches. The effective rooting depth is more than 60 inches. The low available water capacity, slope, and the very gravelly or stony nature of the surface layer are limitations. Donica gravelly sandy loam, 2 to 5 percent slopes, and Donica gravelly sandy loam, 5 to 15 percent slopes,

differ from other soils in the unit in that they lack the very gravelly or stony surface horizons.

The soils in this capability unit are used mainly for livestock grazing and wildlife habitat. They are suitable for irrigated crops on the lesser slopes.

Among practices that help offset or minimize the limitations of these soils is brush control by aerial spraying to increase the production of antelope bitterbrush and desirable grasses and forbs. Improvement of the plant cover also helps control the hazard of erosion.

#### **CAPABILITY UNIT VII<sub>s</sub>-261, DRYLAND**

This capability unit consists of well-drained soils of the Raglan and Survya series. These soils have a surface layer of very fine sandy loam and fine sandy loam. They are salt and alkali affected. The slope range is 0 to 9 percent. They receive 5 to 9 inches of precipitation a year. The frost-free season is 100 to 130 days.

Permeability is moderately slow to slow, runoff is medium to slow, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 3 to 10 inches. The effective rooting depth is more than 60 inches. The salt and alkali condition is a limitation.

The soils in this capability unit are used mainly for livestock grazing but to a limited extent for wildlife habitat. They are suitable for irrigated crops if good reclamation practices are used.

Among practices that help offset or minimize the limitations of these soils is good management to maintain or improve the plant cover.

#### **CAPABILITY UNIT VII<sub>s</sub>-285, DRYLAND**

The only soil in this capability unit is McConnel sandy loam, 0 to 5 percent slopes. It is a somewhat excessively drained soil. This soil receives 7 to 10 inches of precipitation a year. The frost-free season is 80 to 130 days.

Permeability is moderately rapid, runoff is slow to medium, and the hazard of accelerated erosion is slight to moderate. The available water capacity for the profile is 4 to 6 inches. The effective rooting depth is more than 60 inches. The low available water capacity and low precipitation are limitations.

The soil in this capability unit is used mainly for livestock grazing and wildlife habitat. It is not suitable for irrigated crops.

Among practices that help to offset or minimize the limitation of this soil is good management to maintain or improve the plant cover. Brush control by aerial spraying is beneficial in areas that have adequate remnant grasses remaining in the stand.

#### **CAPABILITY UNIT VIII<sub>e</sub>-224, DRYLAND**

This capability unit consists of Badland, a land type that is a barren or nearly barren, highly variable soil-like material occurring as lake terraces, wind-deposited clay dunes, and diatomaceous earth that has been eroded. The slope range is steep to very steep. Surface runoff is very rapid, and hazard of erosion is very severe. Drainage, permeability, available water capacity, and effective rooting depth are highly variable.

Badland is not suitable for irrigated crops. It is used along with surrounding soils for very limited livestock grazing and for wildlife habitat.

**CAPABILITY UNIT VIII<sub>w</sub>-207, DRYLAND**

This capability unit consists of Playas, areas of barren, saline silts and clays in flat basins which do not have external drainage. Permeability is slow. These areas are ponded for varying periods early in spring. They have little or no value.

**CAPABILITY UNIT VIII<sub>w</sub>-233, DRYLAND**

This capability unit consists of Riverwash, a highly variable accumulation of sand, gravel, cobblestones, and stones in areas along stream channels and flood plains. These areas are incapable of sustaining significant amounts of vegetation because of frequent flooding. They are used as a source of sand and gravel.

**CAPABILITY UNIT VIII<sub>s</sub>-236, DRYLAND**

This capability unit consists of Rubble land and Rock outcrop, land types that are on barren colluvial slopes strewn with boulders and stones. The slope is steep or very steep. Runoff is variable, and the hazard of erosion is slight. These land types are used only as part of a watershed and for recreational and esthetic purposes.

**Estimated Yields**

Table 2 lists the average annual acre yields of the principal crops on important cultivated soils in Surprise Valley-Home Camp Area under the highest level of management that is feasible.

Several important limitations should be kept in mind when using table 2. First, the figures are estimates, or predictions, rather than proven facts, but they are reliable enough to be valuable. Second, the estimates are of average yields that may be expected over a period of many years. Yields may be above or below the average in any particular year. Third, there are variations in yields among areas of the same soil. Fourth, past management of a soil affects its immediate response to new management practices. Fifth, new crop varieties and improved farming practices

are likely to increase yields in the future. Sixth, the availability of competent management on the farm has an influence on yields.

Yields in table 2 are those that can be expected when the practices suggested for each capability unit are followed. They also—

1. Use a planned conservation cropping system in which crops are grown in combination with needed cultural and management measures.
2. Apply fertilizer in accordance with current recommendations resulting from research and field trials.
3. Utilize plant residues left in cultivated fields to prevent erosion and improve the soil.
4. Utilize a planned irrigation system where all the necessary water-control structures and facilities have been installed for efficient application and distribution of irrigation water.
5. Utilize a planned drainage system which has been installed to control excessive wetness or high water table and reduce or redistribute harmful concentrations of salts in the soil.
6. Control weeds and insect pests.

**Range Management**

Soils used for range have been grouped into range sites. A range site is a distinctive kind of range that has a certain potential for producing range plants. Different range sites are recognized because of differences in the kinds of vegetation or in the amounts of herbage produced.

Twenty-four sites are recognized in the Surprise Valley-Home Camp Area. These are described in the following pages:

The range site classification of an individual soil is given at the end of the mapping unit description in the section "Descriptions of the Soils" and in the "Guide to Mapping Units." Soils and land types not used for range have not been placed in range sites.

TABLE 2.—*Estimated average yield per acre of principal crops on important cultivated soils*

[Yields for irrigated crops, unless otherwise indicated, are those obtained at the highest level of management considered feasible. Absence of a figure indicates crop is not commonly grown on the soil or crop is not economically suited to that soil. Information is based on data obtained at Cedarville, Calif.]

Soil	Alfalfa (hay)	Barley (grain)	Wheat (grain)	Oats (hay)	Alfalfa- grass (hay)	Meadow (hay)	Pasture
	Tons	Tons	Tons	Tons	Tons	Tons	Animal units <sup>1</sup>
Bidwell loam, 0 to 2 percent slopes	6.5	1.5	1.8	2.2	3.5		
Bidwell loam, 2 to 5 percent slopes	6.0		<sup>2</sup> 0.5		3.5		
Buntingville loam, 0 to 2 percent slopes	5.5	2.1	1.5	2.5	5.0		3.0
Buntingville loam, 2 to 5 percent slopes	5.5	2.0	1.5	2.5	5.0	2.5	3.0
Cummings muck, clay subsoil variant				1.3			
Four Star loam	3.0				3.0	3.0	4.0
Hovey silty clay loam	2.5				3.0	3.0	4.0
Hussa loam, drained, 0 to 2 percent slopes	5.5	2.0	1.5	2.5	5.0	2.5	3.0
Hussa clay loam, 0 to 2 percent slopes	2.5				3.0	3.0	4.0
Nevador fine sandy loam, 0 to 2 percent slopes	6.0	1.5	1.8		3.0		
Nevador fine sandy loam, 2 to 5 percent slopes	6.0	1.5	1.8		3.0		
Surprise gravelly sandy loam, 0 to 2 percent slopes	6.5	1.5	1.8	2.2	3.5		
Surprise gravelly sandy loam, 2 to 5 percent slopes	6.0	1.0	1.6	2.2	3.5		

<sup>1</sup> The number of mature animals (cows or horses) that can graze 1 acre during the irrigation season without causing damage to the pasture.

<sup>2</sup> Dryland.

## RANGE SITE NV 23-1

The soils in this site typically have a surface layer of dark reddish-brown, extremely cobbly clay that is subject to extreme swelling and shrinking. This soil movement damages the root systems of many of the desirable plants and prevents their reestablishment.

Soils of this range site are on basaltic tablelands at elevations of 5,000 to 6,500 feet. They are nearly level to moderately sloping. The average annual precipitation ranges from 10 to 16 inches.

The fully developed plant community on this site consists mainly of rabbitbrush, Sandberg bluegrass, Canby bluegrass, mountain brome, and Thurber needlegrass. Skullcap, Indian paintbrush, larkspur, lomatium, and other plants are in lesser amounts. When the soils of this range site are producing at their potential, rabbitbrush is the dominant plant.

The total annual yield of air-dry herbage ranges from 850 pounds per acre in favorable years to 500 pounds per acre in less favorable years.

Management should be designed to increase the production of the more desirable plants, such as Canby bluegrass, mountain brome, and Thurber needlegrass. The economic feasibility of brush control by aerial or mechanical means is questionable. These practices do, however, readily improve the range by reducing the volume of the broadleaf plants, allowing grasses to increase.

This site provides food for livestock, mainly early in spring. It is inhabited by antelope throughout the growing season.

## RANGE SITE NV 23-2

The soils in this site are typically affected by salts and alkali, slowly permeable, and moderately well drained to poorly drained. Most of them have a thin, light-colored surface layer of fine sandy loam to silty clay loam, but some have a surface layer of loamy sand and are subject to periodic flooding. The slow permeability and the effect of the salts and alkali limit the variety of plants that can grow on this site.

Soils of this range site are on broad flood plains, nearly level terraces, and wide alluvial fans at elevations of 4,500 to 5,600 feet. The topography generally is smooth, but there are small hummocks in places. The slope range is 0 to 9 percent. The average annual precipitation ranges from 5 to 12 inches.

The fully developed plant community on this site consists mainly of black greasewood, basin wildrye, Nevada bluegrass, saltgrass, alkali sacaton, and four-wing saltbush. Shadscale, bud sagebrush, big sagebrush, and rabbitbrush are in lesser amounts. When the soils of this range site are producing at their potential, black greasewood and basin wildrye are the dominant plants.

The total annual yield of air-dry herbage ranges from 1,000 pounds per acre in favorable years to 500 pounds per acre in less favorable years.

Management should be designed to increase the production of basin wildrye, Nevada bluegrass, alkali sacaton, and four-wing saltbush. The saline-alkali condition restricts the type of plants suitable for seeding. Tall wheatgrass or alta fescue might be introduced if seeded by deep furrow drilling in a favorable year. Brush control by aerial or mechanical means improves the condition of the plant community if there are adequate remnants of the desirable species.

Cottontail rabbits are the major wildlife users of this site.

## RANGE SITE NV 23-3

The soils in this site typically have a surface layer of dark-gray to grayish-brown clay that is subject to extreme shrinking and swelling. They are subject to flooding in winter and early in spring. When the soils are dry they have many wide cracks. When they get wet, the cracks close and low hummocks heave up as swelling continues. This soil movement damages the root systems of many plants and limits natural reproduction.

Soils of this range site are on floors of enclosed basins at elevations of 5,500 to 6,500 feet. Slope is less than 2 percent, but the surface is rather hummocky in most areas.

The fully developed plant community on this site consists mainly of silver sagebrush, basin wildrye, Nevada bluegrass, mat muhly, and various sedges and rushes. When the soils of this range site are producing at their potential, silver sagebrush is the dominant plant.

The total annual yield of air-dry herbage ranges from 800 pounds per acre in favorable years to 600 pounds per acre in less favorable years.

Management should be designed to increase the production of basin wildrye and Nevada bluegrass. Brush control by aerial or mechanical means is desirable if adequate numbers of remnant grass species are in the plant community. This site is well adapted to seeding. Seedbed preparation and seeding should be done in fall.

## RANGE SITE NV 23-4

The soils in this site typically have a surface layer of light brownish-gray and light-gray fine sandy loam and very fine sandy loam that is affected by salts and alkali. Because of the salts and alkali, effective moisture for plant growth is less than normally would be expected. This severely limits the plant community to those plants that are able to withstand desert-like dryness and moderate salinity.

Soils of this range site are on alluvial fans and lake terraces at elevations of 4,500 to 5,000 feet. The average annual precipitation ranges from 5 to 9 inches. The slope range is 0 to 9 percent.

The fully developed plant community on this site consists mainly of shadscale, Indian ricegrass, Sandberg bluegrass, winterfat, bud sagebrush, and spiny hopsage. When the soils of this range site are producing at their potential, shadscale is the dominant plant.

The total annual yield of air-dry herbage ranges from 450 pounds per acre in favorable years to 250 pounds per acre in less favorable years.

Management should be designed to increase the production of Indian ricegrass, Sandberg bluegrass, and winterfat. Brush control by aerial and mechanical means and the seeding of exotic plants are not economically feasible.

Antelope that roam through the Area make limited use of this site.

## RANGE SITE NV 23-5

The soils in this site typically have a surface layer of light brownish-gray silty clay loam but include soils that have a surface layer of overwashed sandy loam. Permeability is slow to moderately rapid, and runoff is slow to medium. They are subject to baking by the sun, which intensifies the surface runoff.

Soils of this range site are on flood plains along intermittent drainageways at elevations of 4,500 to 5,600 feet. The average annual precipitation ranges from 7 to 10 inches, and the slope range is 0 to 2 percent. These soils have occasional to frequent flooding of short duration.

The fully developed plant community on this site consists mainly of basin wildrye, Nevada bluegrass, western bluegrass, and big sagebrush. When the soils of this range site are producing at their potential, basin wildrye is the dominant plant.

The total annual yield of air-dry herbage ranges from 900 pounds per acre in favorable years to 400 pounds per acre in less favorable years.

Management should be designed to increase the production of basin wildrye, Nevada bluegrass, and western wheatgrass. Brush control by aerial or mechanical means is feasible in areas that have remnant stands of grass. This site is well suited to seeding. A suitable seedbed can be prepared by plowing deep enough to destroy the vesicular surface layer so that adequate surface moisture and air are available for young seedlings. Good equipment for seeding is a deep furrow drill, which creates soil conditions favorable for the efficient use of water that falls as rain or snow.

This site provides cover for sage grouse. Antelope traverse this site fairly frequently and feed here to a limited extent.

#### RANGE SITE NV 23-6

The soils in this site typically have a vesicular surface layer of light-colored loam to sandy loam, but some soils have a loamy fine sand surface layer that is not vesicular. Permeability is moderately slow to slow, and runoff is medium.

Soils of this range site are on terraces and fans at elevations of 4,500 to 5,500 feet. The average annual precipitation ranges from 8 to 10 inches. The slope range is 0 to 15 percent.

The fully developed plant community on this site consists mainly of Indian ricegrass, Webber ricegrass, squirreltail, Thurber needlegrass, big sagebrush, spiny hopsage, and a few annual and perennial forbs. When the soils of this range site are producing at their potential, big sagebrush is the dominant plant.

The total annual yield of air-dry herbage ranges from 500 pounds per acre in favorable years to 300 pounds per acre in less favorable years.

Management should be designed to increase the production of Indian ricegrass, Webber ricegrass, and Thurber needlegrass. Brush control by aerial or mechanical means can be used if sufficient grass remains to provide ground cover. This site is suited to seeding. For seedbed preparation plowing should be deep enough to destroy the vesicular surface layer so that adequate moisture and air will be available for young seedlings. Good equipment for seeding is a deep furrow drill, which creates conditions favorable for the efficient use of water that falls as rain or snow.

#### RANGE SITE NV 23-7

The soils in this site typically have a thick surface layer of dark-colored fine sandy loam and loam that contains stones and have rooting zones more than 28 inches deep. Although typically somewhat stony on the surface and throughout the profile, these soils have good available water capacity and give up water readily to growing

plants. Erosion is not a hazard if adequate plant cover is maintained.

Soils of this range site are on mountains at elevations of more than 5,500 feet. They are sloping to moderately steep. The average annual precipitation ranges from 12 to 16 inches.

The fully developed plant community on this site consists mainly of Idaho fescue, bluebunch wheatgrass, bitterbrush, Thurber needlegrass, basin wildrye, Sandberg bluegrass, squirreltail, big sagebrush, and many annual and perennial forbs. When the soils of this range site are producing at their potential, open stands of big sagebrush are in places. Idaho fescue, bluebunch wheatgrass, and Thurber needlegrass are the most productive plants.

The total annual yield of air-dry herbage ranges from 1,400 pounds per acre in favorable years to 900 pounds per acre in less favorable years.

Management should be designed to increase the production of the better forage plants, such as Idaho fescue, bluebunch wheatgrass, bitterbrush, and Thurber needlegrass. Brush control by aerial spraying and proper management helps improve deteriorated range. Mechanical brush control or seeding is not practical because of the stony surface layer and the steep slope.

This site provides food and cover for many kinds of wildlife. It is one of the more important producers of forage and cover for deer in this survey area.

#### RANGE SITE NV 23-8

The soils in this site typically have a thin surface layer of light-brownish-gray gravelly or cobbly loam and a clayey subsoil over bedrock. Because of the shallow depth and the gravel and cobblestone content, these soils have a low available water capacity.

Soils of this range site are on high, exposed, windswept mountain ridges and plateaus at elevations of 6,500 to 9,000 feet. Because the ridges are exposed and subject to persistent winds these soils are droughty. The average annual precipitation ranges from 12 to 16 inches. The slope range is 2 to 15 percent.

The fully developed plant community on this site consists mainly of low sagebrush, Idaho fescue, bluebunch wheatgrass, Thurber needlegrass, Canby bluegrass, Sandberg bluegrass, and miscellaneous annual and perennial forbs. When the soils of this site are producing at their potential, open stands of low sagebrush are in place. Idaho fescue, bluebunch wheatgrass, Thurber needlegrass, and Canby bluegrass are the most productive plants.

The total annual yield of air-dry herbage ranges from 250 pounds per acre in favorable years to 125 pounds per acre in less favorable years.

Management of this site should be designed to increase the production of Idaho fescue, bluebunch wheatgrass, Thurber needlegrass, and other grasses. Brush control by aerial spraying and proper management helps improve deteriorated range. Mechanical brush control or seeding is not practical because of the gravel and cobblestone content of the surface layer.

This site provides food for sage grouse and antelope.

#### RANGE SITE NV 23-9

The soils in this site typically have a surface layer of light brownish gray and are slowly permeable. They have a high available water capacity and are subject to flooding.

Soils of this range site are on smooth flood plains along intermittent drainageways at elevations of 4,500 to 5,000 feet. The slope range is 0 to 2 percent. The average annual precipitation ranges from 8 to 12 inches. Additional moisture is received from surrounding areas in most years, causing short-term flooding early in spring.

The fully developed plant community on this site consists mainly of basin wildrye, Nevada bluegrass, and creeping wildrye, and lesser amounts of big sagebrush and Douglas rabbitbrush. When the soils of this range site are producing at their potential, basin wildrye is the dominant plant.

The total annual yield of air-dry herbage ranges from 3,000 pounds per acre in favorable years to 1,300 pounds in less favorable years.

Management should be designed to increase the production of basin wildrye, Nevada bluegrass, and creeping wildrye. Brush control by aerial or mechanical means is desirable in areas that have adequate remnant stands of grass. This site is well suited to seeding. Seedbed preparation should be done by plowing. Deep furrow drilling is considered the best method of seeding.

This site is inhabited by sage grouse and antelope.

#### RANGE SITE NV 23-10

The soils in this site typically have a surface layer of light-colored and dark-colored fine sandy loam to clay. They are affected by salts and alkali and are somewhat poorly drained and poorly drained. The salts and alkali limit the kinds of vegetation that the soils are capable of producing.

Soils of this range site are on flood plains and low stream terraces at elevations of 4,500 to 5,000 feet. The average annual precipitation ranges from 6 to 16 inches. The slope range generally is 0 to 2 percent but mostly is less than 1 percent.

The fully developed plant community on this site consists mainly of black greasewood, inland saltgrass, basin wildrye, alkali sacaton, Nevada bluegrass, Nuttall alkali-grass, Douglas rabbitbrush, creeping wildrye, and cudweed sage. When the soils of this range site are producing at their potential, basin wildrye is the dominant plant.

The total annual yield of air-dry herbage ranges from 1,700 pounds per acre in favorable years to 1,000 pounds per acre in less favorable years.

Management should be designed to increase the production of basin wildrye, alkali sacaton, Nevada bluegrass, and creeping wildrye. Brush control is not economically feasible.

Cottontail rabbits are the principal wildlife using this site.

#### RANGE SITE NV 23-11

The soils in this site are windblown fine sands that occur as partially stabilized sand dunes. They are excessively drained and free of salts and alkali. In some areas, underground water and saline-alkali layers are within the rooting depth of plants, such as greasewood. Intake of water is rapid, and the available water capacity is low. Runoff is very slow. The unstable, loose surface layer and low fertility are not favorable to uniform stands of desirable plants. These soils are susceptible to soil blowing, especially where the plant cover is disturbed.

Soils of this range site are at elevations of 4,500 to 5,000 feet. The average annual precipitation is 8 to 10 inches.

The slope range is 0 to 15 percent, but it is mainly between 4 to 15 percent.

The fully developed plant community on this site consists mainly of Indian ricegrass, needle-and-thread, western wheatgrass, four-wing saltbush, big sagebrush, greasewood, and rubber rabbitbrush. When the soils of this range site are producing at their potential, the type of plant that dominates varies considerably, but four-wing saltbush is typically the dominant plant.

The total annual yield of air-dry herbage ranges from 500 pounds per acre in favorable years to 250 pounds per acre in less favorable years.

Management should be designed to increase the production of Indian ricegrass, needle-and-thread, and western wheatgrass, which protect the soil surface from soil blowing.

Blacktailed jackrabbits are the principal wildlife using this site.

#### RANGE SITE NV 23-12

The soils in this site typically have a surface layer of light-gray and light brownish-gray fine sandy loam and sandy loam that is underlain at depths of 8 to 20 inches by bedrock, hardpan, or loose beach gravel.

Soils of this range site are on lake terraces or alluvial fans at elevations of 4,500 to 5,500 feet. The average annual precipitation ranges from 6 to 10 inches. The slope range is 0 to 5 percent.

The fully developed plant community on this site consists mainly of Indian ricegrass, Webber ricegrass, Sandberg bluegrass, spiny hopsage, shadscale, big sagebrush, and bud sagebrush. When the soils of this range site are producing at their potential, big sagebrush is the dominant plant.

The total annual yield of air-dry herbage ranges from 450 pounds per acre in favorable years to 250 pounds per acre in less favorable years.

Management should be designed to increase the production of Indian ricegrass, Webber ricegrass, and Sandberg bluegrass. Brush control by aerial and mechanical means is not economically feasible.

Blacktailed jackrabbits are the principal wildlife using this site.

#### RANGE SITE NV 23-13

The soils in this site typically have a surface layer of dark-colored loam to silty clay loam that is gravelly in places. These soils are more than 48 inches deep and are poorly drained. Most of these soils have a root mat at the surface. They have a high water table early in spring and are not affected by salt.

Soils of this range site are on flood plains at elevations of 4,000 to 6,500 feet. The average annual precipitation ranges from 12 to 30 inches, but this is supplemented by ground water. The slope range is 0 to 9 percent.

The fully developed plant community on this site consists mainly of Nevada bluegrass, redtop, slender wheatgrass, timothy, Kentucky bluegrass, Dutch clover, and various sedges and rushes. When the soils of this range site are producing at their potential, grass is the dominant plant.

The total annual yield of air-day herbage ranges from 3,000 pounds per acre in favorable years to 1,500 pounds per acre in less favorable years.

Management should be designed to increase the production of Nevada bluegrass, redtop, slender wheatgrass, and

timothy. In deteriorated areas gully plugging is needed to maintain a water table. This, coupled with brush control where needed, provides for quick responses.

This site provides food and cover for sage grouse. Deer commonly inhabit the area in the latter part of each day.

#### RANGE SITE NV 23-14

The soils in this site typically have a surface layer of grayish-brown very stony fine sandy loam and a clayey subsoil over bedrock at a depth of 6 to 24 inches. They are well drained. The available water capacity is low, permeability is slow, and runoff is medium.

Soils of this range site are on mountains at elevations of 6,000 to 9,000 feet. They are gently sloping to steep. The average annual precipitation ranges from 12 to 16 inches.

The fully developed plant community on this site consists mainly of Idaho fescue, bluebunch wheatgrass, Thurber needlegrass, Canby bluegrass, and low sagebrush. When the soils of this range site are producing at their potential, low sagebrush is the dominant plant.

The total annual yield of air-dry herbage ranges from 350 pounds per acre in favorable years to 250 pounds in less favorable years.

Management should be designed to increase the production of Idaho fescue, bluebunch wheatgrass, Thurber needlegrass, and Canby bluegrass. Brush control by aerial spraying and proper management helps improve deteriorated range. Mechanical brush control or seeding is not practical because of the cobblestones and stone content and the slope of these soils.

This site provides food for sage grouse and for antelope.

#### RANGE SITE NV 23-15

The soils of this site typically have a dark-brown very stony surface layer and a clayey subsoil over bedrock at a depth of 10 to 20 inches. The subsoil hinders rooting to some degree. The available water capacity is low. Permeability is slow, and the hazard of erosion is moderate.

Soils of this range site are on basaltic tablelands and plateaus at elevations of 5,000 to 7,000 feet. The average annual precipitation ranges from 12 to 14 inches. The slope range is 2 to 50 percent.

The fully developed plant community on this site consists mainly of big sagebrush, bitterbrush, Idaho fescue, bluebunch wheatgrass, Canby bluegrass, and Thurber needlegrass. When the soils of this range site are producing at their potential, open stands of big sagebrush and bitterbrush are in places. Idaho fescue, bluebunch wheatgrass, Canby bluegrass, and Thurber needlegrass are the most productive plants.

The total annual yield of air-dry herbage ranges from 1,000 pounds per acre in favorable years to 650 pounds in less favorable years.

Management should be designed to increase the production of Idaho fescue, bluebunch wheatgrass, Thurber needlegrass, and bitterbrush. Brush control by aerial spraying and proper management accelerate the improvement of deteriorated range. Mechanical brush control or seeding is not practical because of stoniness.

This site provides food and cover for many kinds of wildlife. It is ideal habitat for deer.

#### RANGE SITE NV 23-16

The soils in this site typically have a surface layer of grayish-brown gravelly loam over bedrock at a depth of 20 to 40 inches. They are gravelly throughout. Permeability, available water capacity, and the hazard of erosion are moderate.

Soils of this range site are on mountains having southerly exposures, at elevations of 5,500 to 7,000 feet. The average annual precipitation ranges from 10 to 14 inches. The slope range is 15 to 30 percent. This site is ready for grazing much earlier than those that have other exposures.

The fully developed plant community on this site consists mainly of big sagebrush, bluebunch wheatgrass, Thurber needlegrass, and Sandberg bluegrass. When the soils of this range site are producing at their potential, open stands of big sagebrush are in place. Bluebunch wheatgrass and Thurber needlegrass are the most productive plants.

The total annual yield of air-dry herbage ranges from 1,000 pounds per acre in favorable years to 750 pounds per acre in less favorable years.

Management should be designed to increase the production of bluebunch wheatgrass and Thurber needlegrass. Brush control by aerial spraying and proper management help improve deteriorated range. Mechanical brush control or seeding is practical.

This site provides food and cover for wildlife. Chukar, sage grouse, deer, and, to some extent, antelope utilize this area.

#### RANGE SITE NV 23-17

The soils in this site typically have a surface layer of dark-colored extremely cobbly loam underlain by dense clay. The dense clay restricts the root development of many climatically suited plants. Bedrock is at a depth of 10 to 40 inches.

Soils of this range site are on basaltic tablelands at elevations of 5,500 to 7,000 feet. The average annual precipitation ranges from 12 to 16 inches. The slope range is 0 to 9 percent.

The fully developed plant community on this site consists mainly of low sagebrush, Sandberg bluegrass, Canby bluegrass, Thurber needlegrass, bluebunch wheatgrass, and Idaho fescue, and lesser amounts of annual and perennial forbs. When the soils of this range site are producing at their potential, low sagebrush is the dominant plant.

The total annual yield of air-dry herbage ranges from 500 pounds per acre in favorable years to 300 pounds per acre in less favorable years.

Management should be designed to increase the production of bluebunch wheatgrass, Canby bluegrass, and Thurber needlegrass. Brush control by aerial and mechanical means is not economically feasible. It does, however, readily improve the range by increasing the relative amounts of grasses.

This site provides food and cover for sage grouse. Antelope prefer this site to areas where big sagebrush is dominant. Also on this site are open stands of juniper trees where deer is the dominant wildlife.

#### RANGE SITE NV 23-18

The soils in this site typically have a surface layer of grayish-brown very stony loam over a subsoil of very

stony clay. Bedrock is at a depth of 20 to 40 inches. Permeability is slow, and the available water capacity is moderate to low. Erosion is not a hazard if a good plant cover is maintained.

Soils of this range site are on mountains having southerly exposures, at elevations of 4,400 to 7,500 feet. The average annual precipitation ranges from 12 to 16 inches. The slope range is 50 to 75 percent.

The fully developed plant community on this site consists mainly of big sagebrush, bluebunch wheatgrass, Thurber needlegrass, basin wildrye, and Canby bluegrass, and minor amounts of bitterbrush. When the soils of this range site are producing at their potential, open stands of big sagebrush are in places. Bluebunch wheatgrass, Thurber needlegrass, and basin wildrye are the most productive plants.

The total annual yield of air-dry herbage ranges from 900 pounds per acre in favorable years to 650 pounds per acre in less favorable years.

Management should be designed to increase the production of bluebunch wheatgrass, Thurber needlegrass, basin wildrye, and Canby bluegrass. Brush control by aerial spraying and proper management helps improve deteriorated range if adequate numbers of desirable native plants are remaining. Mechanical brush control or seeding is not practical because of the stoniness of the surface layer and the very steep slopes.

This site provides food and cover for many kinds of wildlife. Deer and chukar make good use of this area.

#### RANGE SITE NV 23-19

This is a productive site in a precipitation zone of 16 to 25 inches. Typically the soils in this site have a surface layer of thick dark-brown stony fine sandy loam and very stony sandy loam and are 40 to 60 inches deep over bedrock. These soils have a moderate available water capacity and readily give up water for plant use. Erosion is not a hazard if adequate plant cover is maintained.

Soils of this range site are on mountain uplands at elevations of more than 6,000 feet. The slope range is 5 to 50 percent.

The fully developed plant community on this site consists mainly of mountain brome, Columbia needlegrass, western needlegrass, Canby bluegrass, big sagebrush, and serviceberry. When the soils of this range site are producing at their potential, open stands of big sagebrush and snowberry are in places. Columbia needlegrass, western needlegrass, and Canby bluegrass are the most productive plants.

The total annual yield of air-dry herbage ranges from 1,500 pounds per acre in favorable years to 1,000 pounds per acre in less favorable years.

Management should be designed to increase the production of Columbia needlegrass, western needlegrass, and Canby bluegrass. Brush control by aerial spraying and proper management accelerate the improvement of deteriorated range. Mechanical brush control or seeding is not practical because of the stoniness of the surface layer and the steepness of slope.

This site provides food and cover for many kinds of wildlife. It is excellent habitat for deer.

#### RANGE SITE NV 23-20

The soils in this site typically have a surface layer of dark-colored, gravelly, stony and extremely stony sandy loam, fine sandy loam, and loam. They are shallow to very deep over bedrock. They have low to high available water capacity and give up water readily for plant use.

Soils of this range site are on uplands, terraces, and alluvial fans at elevations of 5,000 to 6,500 feet. The average annual precipitation ranges from 8 to 12 inches. The slope range is 0 to 30 percent.

The fully developed plant community on this site consists mainly of bluebunch wheatgrass, Thurber needlegrass, basin wildrye, big sagebrush, and many annual and perennial forbs. When the soils of this range site are producing at their potential, open stands of big sagebrush are in places. Bluebunch wheatgrass and Thurber needlegrass are the most productive plants.

The total annual yield of air-dry herbage ranges from 1,100 pounds per acre in favorable years to 600 pounds per acre in less favorable years.

Management should be designed to increase the production of bluebunch wheatgrass and Thurber needlegrass. Brush can be controlled by aerial or mechanical means in areas that have adequate remnant grasses.

#### RANGE SITE NV 23-21

The soils of this site typically have a surface layer of grayish-brown and light brownish-gray gravelly sandy loam and fine sandy loam and a subsoil of gravelly clay and clay over a hardpan at a depth of 8 to 30 inches.

Soils of this range site are on tablelands or plateaus at elevations of 5,500 to 6,500 feet. The average annual precipitation ranges from 10 to 14 inches. The slope range is 0 to 15 percent.

The fully developed plant community on this site consists mainly of low sagebrush, Sandberg bluegrass, bluebunch wheatgrass, Webber ricegrass, and Thurber needlegrass, and lesser amounts of annual and perennial forbs. When the soils of this range site are producing at their potential, low sagebrush is the dominant plant.

The total annual yield of air-dry herbage ranges from 400 pounds per acre in favorable years to 200 pounds per acre in less favorable years.

Management should be designed to increase the production of the more desirable plants, such as bluebunch wheatgrass, Canby bluegrass, Webber ricegrass, and Thurber needlegrass. Brush control by aerial and mechanical means is not economically feasible. This practice does, however, readily improve the range by making it possible to produce more kinds of grass.

This site provides food and cover for sage grouse. Antelope prefer this site to the big sagebrush areas.

#### RANGE SITE NV 23-22

The soils of this site are well drained and somewhat excessively drained and are over 60 inches deep. Typically they have a surface layer of grayish-brown to very dark grayish-brown loam, sandy loam and gravelly sandy loam and a loamy or clayey subsoil which is gravelly in places. In places gravel strata are interspersed throughout the profile.

Soils of this range site are on alluvial fans and terraces at elevations of 4,200 to 5,000 feet. The average annual

precipitation ranges from 12 to 16 inches. The slope range is 0 to 50 percent. Many of these soils are cultivated.

The fully developed plant community on this site consists mainly of bluebunch wheatgrass, Thurber needlegrass, Canby bluegrass, bitterbrush, big sagebrush, and lesser amounts of annual and perennial forbs. When the soils of this range site are producing at their potential, big sagebrush and bitterbrush are dominant plants.

The total annual yield of air-dry herbage ranges from 1,250 pounds per acre in favorable years to 750 pounds per acre in less favorable years.

Management should be designed to increase the production of bluebunch wheatgrass, Thurber needlegrass, Canby bluegrass, and bitterbrush. Brush control by aerial spraying and proper management helps improve deteriorated range that has adequate remnants of desirable forage plants. Mechanical brush control is not desirable since this method destroys the bitterbrush.

This site provides food and cover for pheasant, quail, and Hungarian partridge, and it probably is one of the more important producers of forage and cover for deer.

#### RANGE SITE NV 23-23

The soils in this site are poorly drained and typically have a surface layer of dark-gray clay. They are subject to extreme shrinking, when wet, and swelling, when dry, causing damage to the root system of many plants.

Soils of this range site are on floors of enclosed basins at elevations of 5,250 to 6,500 feet. The slope range is less than 2 percent. The average annual precipitation ranges from 12 to 14 inches, but this is offset by floodwaters from adjacent areas. Floods are of sufficient duration to prohibit the establishment of perennial shrubby plants.

The fully developed plant community on this site includes spikerush, Baltic rush, mat muhly, Nevada bluegrass, and various sedges. When the soils of this range site are producing at their potential, spikerush is the dominant plant.

The total annual yield of air-dry herbage ranges from 900 pounds per acre in favorable years to 400 pounds per acre in less favorable years, depending upon length of flooding.

Management should be designed to increase the production of spikerush and Baltic rush. This site is well suited to seeding, but plants selected should be able to withstand long periods of flooding and the high shrink-swell potentials of the soil. Seeding should be done in the fall.

Antelope utilize this area to a great extent, but they obtain their forage from evening primrose around the perimeters. Sage grouse also feed around the perimeter of this area.

#### RANGE SITE NV 23-24

The soils in this site typically have a surface layer of grayish-brown very bouldery loam and have varying amounts of stones and cobblestones throughout the profile. The location of these soils and the protection afforded by the large amounts of boulders and stones have prevented range fires on this site and as a result an open stand of old juniper trees exists.

Soils of this range site are on mountains at elevations of 5,500 to 7,500 feet. They are moderately sloping to steep. The average annual precipitation ranges from 12 to 16 inches on all exposures.

The fully developed plant community on this site consists mainly of juniper, bluebunch wheatgrass, basin wildrye, big sagebrush, Canby bluegrass, Thurber needlegrass, and many annual and perennial forbs. When the soils of this range site are producing at their potential, vegetation includes juniper, but the understory plants are the dominant plants.

The total annual yield of air-dry herbage ranges from 1,000 pounds per acre in favorable years to 600 pounds per acre in less favorable years.

Management should be designed to increase the production of the better forage plants, such as bluebunch wheatgrass, basin wildrye, and Canby bluegrass. The desirability of removing the juniper trees should be evaluated as to its significance as shelter and cover for livestock and wildlife.

## Management for Wildlife

Hunting and fishing are important activities in the economy of the survey area. As population increases, recreational enterprises can be expected to increase and can assume a more important role in the economy.

The soils in the survey area have been placed in 11 wildlife suitability groups. A wildlife suitability group is a group of soils that have similar potential for producing food and cover for certain kinds of wildlife. Badland, Marsh, Playas, Rubble land, and Rock outcrop are not in wildlife suitability groups.

The important wildlife species in the area are mule deer, antelope, coyotes, bobcats, cottontail rabbits, blacktailed jackrabbits, ducks, geese, pheasant, quail, dove, and sage grouse. Trout are plentiful in the reservoirs and in many creeks.

The wildlife suitability groups are described on the following pages.

#### WILDLIFE SUITABILITY GROUP 1

The soils of this group are on alluvial fans and terraces at elevations of 4,450 to 5,000 feet. They are moderately deep to deep soils that have a loamy surface layer and a loamy or clayey, gravelly subsoil. They are easy to work. Fertility is moderate to high, and the available water capacity is moderate. The slope range is 0 to 5 percent.

The soils in this group are irrigated, and they have slight or no limitations for the production of plants that provide food and cover for pheasants, quail, doves, and cottontail rabbits. Desirable plants are cereal grains, legumes, and shrubs. Ducks and geese feed on grain and alfalfa stubble, and deer inhabit such areas early in the morning and in the evening. The soils of this group are not suitable for the development of open-water impoundments.

#### WILDLIFE SUITABILITY GROUP 2

The soils of this group are on low-lying lake terraces, alluvial fans, and flood plains at elevations of 4,450 to 5,000 feet. They are somewhat poorly drained to poorly drained, moderately deep to very deep soils that have a clayey surface layer. They are difficult to work. Fertility is moderate to high, and the available water capacity is high. The slope range is 0 to 5 percent.

The soils in this group are irrigated, and they have moderate to severe limitations for the production of plants that

provide food and cover for ducks, geese, cranes, and various shore birds. Desirable plants are saltmarsh (alkali), bulrush, spikerush, and sedges, all of which tolerate wet conditions. Also desirable are plants such as sago pondweed, which tolerates flooded conditions in areas near open water. Pheasants inhabit such areas in the fall. The soils of this group are well suited to the development and construction of open-water impoundments for waterfowl or fish.

#### WILDLIFE SUITABILITY GROUP 3

The soils of this group are on alluvial fans and lake terraces at elevations of 4,450 to 5,000 feet. They are moderately deep to very deep, well-drained soils that have a loamy surface layer and a loamy or clayey, gravelly subsoil. They are easy to work. Fertility is moderately high to high, and the available water capacity is moderate. The slope range is 5 to 30 percent.

The soils in this group are irrigated, and they have slight to moderate limitations for the production of plants that provide food and cover for pheasants, quail, doves, and cottontail rabbits. Special practices are needed to prevent soil deterioration and reduction of fertility through erosion because of steepness of slope. Desirable plants are cereal grains, legumes, and shrubs. Ducks and geese feed on the grain and alfalfa stubble, and deer inhabit such areas early in the morning and in the evening. The soils of this group are not suitable for the development of open-water impoundments.

#### WILDLIFE SUITABILITY GROUP 4

The soils of this group are on low-lying alluvial fans and flood plains at elevations of 4,450 to 5,000 feet. They are moderately deep to very deep soils that have a clayey surface layer. They are difficult to work. They are well drained, somewhat poorly drained, and poorly drained and are slightly to severely affected by salts and alkali. Fertility is low, and the available water capacity is high. The slope range is 0 to 5 percent.

The soils in this group have severe limitations for the production of dryland plants that provide food and cover for wildlife. Desirable plants are those that are able to withstand slight to moderate degrees of salinity and alkali and varying conditions of drought and wetness. Principal wildlife are cottontail rabbits, blacktailed jackrabbits, coyotes, and bobcats. The soils of this group also provide areas of open water for waterfowl in peak years of precipitation. They are well suited to the development and construction of open-water impoundments.

#### WILDLIFE SUITABILITY GROUP 5

The soils of this group are on upland meadows at elevations of 5,000 to 7,500 feet. They are very deep, moderately well drained, somewhat poorly drained, or poorly drained soils that are clayey throughout. They are difficult to work. Fertility is moderate to high, and the available water capacity is high. The slope range is 0 to 9 percent.

The soils in this group have slight to moderate limitations for the production of plants that provide food and cover for sage grouse and deer. Principal plants are sedges, rushes, bluegrass, wildrye, timothy, redtop, and lovegrass. Few waterfowl use these areas. The soils of this group are well suited to the development and construction of open-water impoundments.

#### WILDLIFE SUITABILITY GROUP 6

The soils of this group are shallow to very deep. They have a dark-colored loamy surface layer and a clayey subsoil. In places the surface layer contains gravel, cobblestones, or stones. They are inherently fertile. The available water capacity is moderate to high. The slope range is 2 to 50 percent.

The soils in this group are on range, and they have no limitation or slight limitation for the production of native plants that provide food and cover for deer, quail, and cottontail rabbits. Typical plants are big sagebrush, bitterbrush, Idaho fescue, bluebunch wheatgrass, and many miscellaneous annual and perennial forbs. This suitability group is one of the more important producers of food and cover for deer.

#### WILDLIFE SUITABILITY GROUP 7

The soils of this group are on terraces and flood plains at elevations of 4,200 to 6,000 feet. They are level to strongly sloping, shallow to very deep soils that have a loamy surface layer and a clayey subsoil. In places the surface contains gravel, cobblestones, or stones. Fertility is moderate, and the available water capacity is moderate to high. They are easy to work, except for areas that contain cobblestones and stones.

The soils in this group are not irrigated, and they have slight to moderate limitations for the production of native plants that provide food and cover for sage grouse, cottontail and pygmy rabbits, and antelope. Typical plants are big sagebrush, spiny hopsage, basin wildrye, bluebunch wheatgrass, Thurber needlegrass, and various miscellaneous annual and perennial forbs. The soils of this group are well suited to the development and construction of small water holes for wildlife. They are also suited to the seeding of exotic plants, except in the more cobbly or stony areas.

#### WILDLIFE SUITABILITY GROUP 8

The soils of this group are on mountains. They are shallow to very deep soils that have a dense clay subsoil that restricts the rooting depth of most native plants. The slope range is 0 to 31 percent. Karlo soils are in this suitability group because they have high shrink-swell potential. Karlo soils are typified by a stunted gray rabbitbrush community.

The soils in this group have slight to moderate limitations for the production of native plants that provide food and cover for sage grouse and antelope. The major plants are low sagebrush, Sandberg bluegrass, Idaho fescue, Thurber needlegrass, and rabbitbrush. The soils of this group are not suited to the seeding of exotic plants because of cobblestones or stones in the surface layer or because of slope.

#### WILDLIFE SUITABILITY GROUP 9

The soils of this group are on alluvial fans, low lake terraces, and broad flood plains at elevations of 4,500 to 5,200 feet. Most of them have a light-colored, loamy surface layer and a clayey subsoil that is underlain by tuff, a duripan, or loose, clean beach gravel. One soil is sandy throughout. The slope range is 0 to 9 percent. Precipitation is 4 to 7 inches.

The soils in this group have severe limitations for the production of plants that provide food and cover for wildlife. They are climactically droughty and are affected by salts and alkali. Plants are shadscale, greasewood, big sagebrush, squirreltail, Sandberg bluegrass, and minor

amounts of annual and perennial forbs. The main wildlife in this group are blacktailed jackrabbits and a few antelope.

#### WILDLIFE SUITABILITY GROUP 10

The soils of this group are on mountainous uplands at elevations of 5,000 to 9,000 feet. They are moderately steep to very steep, moderately deep to very deep soils that have a gravelly, cobbly, or stony dark-colored loamy surface layer and a clayey subsoil. The slope range is 2 to 76 per cent. Precipitation is 12 to 20 inches.

The soils in this group are under woodland vegetation that provides food and cover for deer and a few blue grouse. The woods consist of ponderosa pine, lodgepole pine, white fir, aspen, and curleaf cercocarpus (mountain-mahogany).

#### WILDLIFE SUITABILITY GROUP 11

The soils of this group are on range in enclosed basins at elevations of more than 5,500 feet. They are nearly level, very deep, and dark colored.

These soils are flooded for periods ranging from 1 to 3 months late in winter and early in spring. This limits the variety of plants that can be grown. Upon drying, these soils tend to have cracks up to 4 inches in width. This soil movement causes damage to the root systems of many of the climatically suited plants, and it also limits the establishment of more desirable plants.

The main wildlife are sage grouse and antelope. Antelope regularly feed on the annual forbs that grow on the soils of this group. The soils are well suited to the development and construction of open-water impoundments for waterfowl.

## Management of Woodland <sup>2</sup>

Soils of the Longval, Lyonman, Tourn, Waca, and Waca, shallow variant, series have the potential for the production of commercial timber. The important timber species are ponderosa pine and white fir, with minor amounts of lodgepole pine, western white pine, Jeffrey pine, and Washoe pine.

Each of the soils suitable for woodland has been rated in relation to six factors that are important in the management of woodland. These factors are site index, erosion hazard, equipment limitations, soil-related insect and disease hazards, windthrow hazard, and seedling mortality. For all factors except site index, the ratings are slight, moderate, or severe.

*Site index.*—The site index is the average height of the dominant and codominant trees on a given soil at a stated age. If the site index is known, it is possible, through the use of standard reference material (6), to estimate the timber from a stand of a given age.

For ponderosa pine, the average height at 100 years is the site index. Table 3 shows the yields that can be expected from stands of different site indexes at different ages. These data can also be applied to Washoe pine, lodgepole pine, Jeffrey pine, and white fir.

Average yields that can be expected per acre from fully stocked, even-aged unmanaged stands of ponderosa pine on soils of various site indexes (6) are shown in fig. 2. In this figure the yields in board feet are for trees 11.6 inches

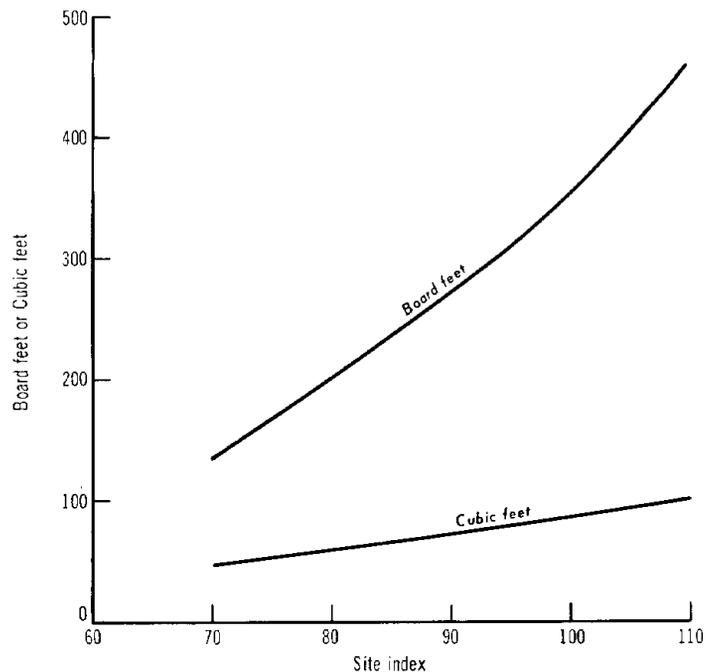


Figure 2.—Average annual acre yield for even-aged, fully stocked, unmanaged stands of ponderosa pine at 100 years of age.

in diameter and larger; yields in cubic feet are for trees 0.6 inch in diameter and larger.

*Erosion hazard.*—The erosion hazard is rated according to the susceptibility of the soil to erosion when the cover is disturbed or removed by logging, fire, or other agents. Slope, permeability, and differences in soil stability associated with aggregate size and detachability were the major factors considered in determining the ratings. If soils are kept under a protective cover of forest litter and duff, they generally do not erode.

*Equipment limitations.*—Equipment limitations are rated on soil characteristics, such as slope, wetness, rock outcrops, and texture, which hamper the operation of mechanical harvesting equipment, such as tractors and trucks. Except for snow, a rating of slight indicates that equipment use is not restricted as to kind of equipment or time of the year. A rating of moderate indicates equipment use is moderately restricted as to time and type of equipment. A rating of severe indicates that special kinds of equipment are needed and use is severely restricted because of steep slopes and other limitations.

An example of a soil that has seasonal limitations is Tourn stony loam, 2 to 15 percent slopes. This soil has few equipment limitations, except when it is wet. When this soil is wet, which could be for several months of the year, heavy equipment mires down. Tree-planting machines can be used on this soil only at carefully selected times.

In general, the sandy and gravelly soils have the fewest equipment limitations. Slopes up to 50 percent generally can be harvested with crawler tractors. Cable logging generally is required on slopes above 50 percent to reduce soil disturbance. Gentle slopes have fewer limitations than steep slopes. Less corrective action, such as frequency of cross drains, is needed to reduce the loss of soil following harvesting operations. At high elevations, deep snow pro-

<sup>2</sup> BOB DELLBERG, woodland specialist, Soil Conservation Service, helped to prepare this section.

TABLE 3.—Yields from even-aged stands of ponderosa pine

[Board-foot volume per acre (to a 6-inch diameter top, inside the bark and exclusive of a 2-foot stump, measured to nearest 100 board feet), International rule ( $\frac{1}{4}$ -inch kerf), based on trees 6.6 inches and more in diameter]

Age (years)	Volume per acre, by site index—												
	40	50	60	70	80	90	100	110	120	130	140	150	160
20	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.
30				400	1,100	2,800	5,400	8,200	12,500	17,400	23,200	28,800	36,200
40			500	1,900	3,700	7,100	11,900	17,000	23,900	31,400	39,000	46,400	55,200
50		500	1,800	4,500	7,700	12,700	19,300	26,400	35,200	44,400	53,400	62,500	72,500
60	100	1,500	3,700	7,600	12,600	19,000	27,000	35,300	45,400	56,000	66,400	77,000	88,300
70	400	3,000	6,100	11,200	17,900	25,400	34,000	43,200	54,300	66,300	78,100	90,200	102,900
80	1,000	4,900	8,800	15,000	23,100	31,100	40,200	50,100	62,200	75,400	88,700	102,300	116,400
90	1,900	7,000	11,700	18,600	27,500	36,100	45,600	56,300	69,300	83,500	98,300	113,300	128,800
100	3,200	9,200	14,600	22,000	31,200	40,300	50,300	61,800	75,600	90,800	107,000	123,300	140,200
110	4,600	11,300	17,400	25,000	34,400	43,900	54,500	66,600	81,300	97,500			
120	6,200	13,300	20,000	27,700	37,300	47,200	58,200	71,000	86,400	103,600			
130	7,800	15,200	22,300	30,200	40,000	50,200	61,600	75,000	91,000	108,900			
140	9,300	17,000	24,400	32,500	42,500	53,000	64,800	78,700	95,200	113,800			
150	10,700	18,700	26,400	34,600	44,800	55,600	67,800	82,200	99,100	118,200			
160	12,000	20,300	28,300	36,600	46,900	58,100	70,600	85,500	102,800	122,200			
170	13,200	21,800	30,000	38,500	48,900	60,500	73,300	88,500	106,300	126,000			
180	14,400	23,200	31,600	40,300	50,900	62,800	75,900	91,300	109,600	129,600			
190	15,600	24,600	33,100	42,000	52,800	65,000	78,400	94,000	112,700	133,000			
200	16,700	26,000	34,600	43,700	54,700	67,100	80,800	96,700	115,600	136,300			

hibits the use of any equipment for long periods in the winter.

*Insect and disease hazards.*—These hazards generally are associated with droughtiness, rockiness, or shallowness. Texture and natural fertility are also important factors. Observations indicate that on shallow, rocky soils, pests and disease make the greatest inroads. A rating of slight indicates no problems are recognized, a rating of moderate, that some losses of wood crops can be expected, and a rating of severe, that considerable losses can be expected.

*Windthrow hazard.*—The windthrow hazard is generally most severe on shallow and sandy soils and is only slight on deep loams. A rating of moderate would be intermediate between these two extremes.

*Seedling mortality.*—In general, seedling survival appears to be good on each of the soils where timber grows naturally. A slight rating indicates that the average seedling mortality ranges between 0 to 25 percent. A moderate rating indicates an average mortality of 25 to 50 percent, and a severe rating indicates seedling losses in excess of 50 percent. In planting, the most productive sites and the most favorable aspects and slopes should receive priority. Natural regeneration is aided by scarification prior to a good seedfall. If white pine is to be planted or favored in management, proper ribes control is essential because of white pine blister rust.

### Ratings of woodland soils

Ratings of the soils that have significant potential for timber production in relation to each of the six factors affecting management are given in the following paragraphs. Three other soils that have some value as woodland are not rated. These are Hapgood fine sandy loam, 5 to 30 percent slopes; Foxmount gravelly loam, 15 to 30

percent slopes; and the Bluebell soils, which are part of the Bluebell-Hapgood associations. The Bluebell and Foxmount soils produce curleaf mountainmahogany, which has some value as firewood and barbecue chips. Hapgood soils produce aspen; this has some commercial value, but rates of growth within the survey area vary so much that no estimates of yields have been obtained.

*Lyonman sandy loam, 15 to 30 percent slopes.*—This soil is on mountains in the Modoc National Forest at elevations of 5,400 to 7,000 feet. It typically occupies positions below the steeper Lyonman soil and the Waca soils and the lower positions in major drainageways. It is used for timber production and as part of a watershed.

The principal vegetation consists of white fir and ponderosa pine. The site index ranges from about 70 to 80. The hazard of erosion is moderate. Equipment limitations are severe, mainly because of the need for specialized harvesting equipment. Properly constructed roads are fairly stable. The hazards of insects and disease are moderate. Seedling mortality and the hazard of windthrow are slight.

*Lyonman sandy loam, 30 to 50 percent slopes.*—This soil is on mountains in the Modoc National Forest at elevations of 5,400 to 7,000 feet. It is used for timber production and as part of a watershed.

The principal vegetation consists of white fir and ponderosa pine that are either in fairly pure stands or growing together in an association. The site index ranges from about 70 to 80. The hazard of erosion is severe. Equipment limitations are very severe because of the need for specialized harvesting equipment. Properly constructed and protected roads, however, are fairly stable. The hazards of insects and disease are moderate. Seedling mortality and the hazard of windthrow are slight.

*Longval fine sandy loam, 2 to 15 percent slopes.*—This soil is on mountains in the Modoc National Forest, adja-

cent to Mount Bidwell and Hat Mountain, at elevations of 7,000 to 8,500 feet. It is used for limited livestock grazing and timber production for use as firewood and fence posts. It is also used as part of a watershed.

The vegetation consists principally of lodgepole pine and minor amounts of western white pine and an understory of big sagebrush, perennial grasses, and forbs.

The site index for lodgepole pine is low, ranging from about 40 to 60. For western white pine the site index is also low, ranging from about 30 to 40. Seedling mortality and the hazards of windthrow and erosion are slight. Equipment limitations and the hazards of insects and disease are moderate.

*Tourn stony loam, 2 to 15 percent slopes.*—This soil is on mountains in the Modoc National Forest in the vicinity of Long Valley, Patterson Meadow, and Homestead Flat at elevations of 6,000 to 8,000 feet. It is used for timber production and as part of a watershed.

The principal vegetation consists of ponderosa pine. Site quality is low. The site index ranges from about 50 to 80, with a mean of 70. Seedling mortality and the hazards of windthrow and erosion are slight. Equipment limitations and the hazards of insects and disease are moderate.

*Waca stony fine sandy loam, 5 to 30 percent slopes.*—This soil is in broad upland areas at elevations of 7,000 to 8,200 feet in the vicinity of Long Valley, Corporation Meadows, and on the east face of Mount Bidwell. It is used for timber production and as part of a watershed.

The vegetation consists of white fir and ponderosa pine. The site index for white fir and ponderosa pine ranges from about 70 to 90, depending mainly on soil depth and aspect. This range indicates low productivity. Windthrow, seedling mortality, and the hazard of erosion are slight. Equipment limitations and the hazards of insects and disease are moderate.

*Waca stony fine sandy loam, 30 to 50 percent slopes.*—This soil is on side slopes along narrow canyons in the vicinity of Granger and Soldier Creeks, Mount Vida, and the southern Warner Mountains at elevations of 6,500 to 8,000 feet. It is used for timber production and as part of a watershed.

The vegetation consists principally of white fir and some ponderosa pine. The site index for white fir and ponderosa pine ranges from about 70 to 90, depending on soil depth and aspect. The hazard of erosion is slight to moderate, depending on slope. Equipment limitations are severe because of the need for specialized harvesting equipment. The hazards of insects and disease are moderate. Seedling mortality and the hazard of windthrow are slight.

*Waca stony fine sandy loam, 50 to 75 percent slopes.*—This soil is on mountains in the vicinity of Homestead Flat, between Granger Creek and Klondike Mine, at elevations of 6,500 to 8,000 feet. It is used for timber production and as part of a watershed.

The vegetation consists of white fir and ponderosa pine. The site index for ponderosa pine and white fir ranges from about 70 to 90, depending on soil depth and aspect. The hazard of erosion is moderate to severe depending on slope. Equipment limitations are very severe because of slope. Properly constructed and maintained roads are reasonably stable. The hazards of disease and insects are moderate. Seedling mortality and the hazard of windthrow generally are slight. Scarification to aid natural

regeneration can be limited to small areas on gentler slopes.

*Waca very gravelly sandy loam, shallow variant, 15 to 50 percent slopes.*—This soil is in areas near the crest of the Warner Mountains in the vicinity of Goose Creek, Boyd Creek, Klondike Mine, and Hat Mountain at elevations of 6,000 to 8,000 feet. It is used mainly as part of a watershed and for timber production to a limited extent.

The vegetation consists of white fir and ponderosa pine. The site index is low, ranging from about 60 to 70 for white fir and ponderosa pine. The hazard of erosion is moderate to severe, depending upon slope. Equipment limitations are severe because of the need for specialized equipment. The hazards of insects and disease are severe, mainly because of droughtiness. The hazard of windthrow is moderate, and seedling mortality is slight.

## Engineering Uses of the Soils

This section provides information of special interest to engineers, contractors, farmers, and others who deal with soils as structural material or as foundation material upon which structures are built. Information contained in this section is available to planning commissions, professional planners, town and city managers, sanitarians, land developers, architects, and realtors. Among the soil properties and qualities most important in engineering are permeability, shear strength, density, shrink-swell potential, water capacity, grain-size distribution, plasticity, reaction, and salinity. These properties affect construction and maintenance of roads and airports, pipelines, building foundations, water-storage facilities, erosion-control structures, draining systems, and sewage disposal systems.

Estimates of soil properties significant to engineering are given in table 4, interpretations relating to various engineering uses of soils are given in table 5, and engineering test data on selected soils are given in table 6. The data and interpretations in these tables can be used to—

1. Select potential residential, industrial, commercial, and recreational areas. Among the factors to be considered in selecting locations are depth to bedrock, seasonal high water table, frequency of flooding, and permeability of the soil.
2. Select potential locations for roads, highways, airports, pipelines, fences, and underground cables. Among the factors to be considered are depth to bedrock, depth to water table, soil permeability, flooding frequency, and susceptibility to sliding.
3. Locate probable sources of sand, gravel, or road-fill that is suitable for use as construction material. Among the factors to be considered are depth to water table, presence of stones and boulders, thickness of the deposits, shrink-swell potential, and susceptibility to frost action.
4. Plan and design agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil. Among the factors to be considered are permeability and seepage rate, depth to water table, slope, water capacity, depth to layers that influence the rate of water movement, such as hardpans, claypans, bedrock and sand, and flooding or stream overflow.

TABLE 4.—Estimated soil properties

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The soils in for referring to other series that appear in the first column of the table; absence of information in a column

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Hardpan or bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
Badland: BA. Properties variable.	<i>Ft.</i>	<i>Ft.</i>	<i>m.</i>			
*Bicondoa: Bc.....	>5	1-3	0-60	Clay.....	CH	A-7
Bd..... For Kising part of Bd, see Kising series.	>5	1-3	0-60	Clay.....	CH	A-7
Bidwell: BeA, BeB.....	>5	(1)	0-4 4-32 32-76	Loam..... Clay loam..... Gravelly loam.....	SC or CL CL SC or GC	A-4 or A-6 A-6 A-6
*Bluebell: BHE, BHF..... For Hapgood part of these units, see Hapgood series.	1.7-3.0	(1)	0-13 13-28 28	Very stony fine sandy loam..... Very stony clay loam..... Andesite.	SM CL	A-4 or A-2 A-6
Boulder Lake: Bo.....	>5	(2)	0-54	Clay.....	CH	A-7
Bregar: BRC.....	0.5-1.0	(1)	0-4 4-9 9	Very gravelly and cobbly loam..... Very gravelly and cobbly sandy clay loam..... Andesite.	GM GC	A-2 A-2
Buntingville: BuA, BuB.....	>5	3-4	0-4 4-46	Loam..... Clay loam and silty clay loam.....	ML or CL CL	A-6 A-6 or A-7
Campone: CAC, CCB.....	>5	3-5	0-12 12-28 28-40	Gravelly loam..... Stony loam..... Very gravelly sandy clay loam.....	SC SC GC	A-2 or A-4 A-2 or A-4 A-1
*Catnip: CK..... For Ninemile part of this unit, see Ninemile series.	1.7-3.3	(1)	0-3 3-39 39	Silt loam..... Clay..... Andesite.	CL CH	A-6 A-7
Couch: Cm.....	>5	6-7	0-1 1-6 6-22	Loam..... Clay..... Clay loam.....	ML CH CL or CH	A-4 A-7 A-6 or A-7
Cn.....	>5	6-7	0-1 1-6 6-22 22-40 40-60	Fine sandy loam..... Very fine sandy loam..... Loam..... Clay..... Clay loam..... Fine sandy loam.....	SM or ML ML ML CH CL or CH SM or ML	A-4 A-4 A-4 A-7 A-6 or A-7 A-4 or A-5
			40-60	Clay.....	CH	A-7

See footnotes at end of table.

*significant to engineering*

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions indicates determination was not made or that it would not be applicable; >=more than; <=less than]

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-heave potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
<i>Pct.</i>					<i>In./hr.</i>	<i>In./in. of soil</i>	<i>pH</i>			
0	100	100	90-100	75-95	0.06-0.2	0.15-0.17	7.6-8.4	Moderate-----	High-----	Moderate.
0	100	100	90-100	75-95	0.06-0.2	0.15-0.17	8.5-9.6	High to very high.	High-----	Moderate.
0	90-100	80-90	70-85	45-65	0.60-2.0	0.16-0.17	6.8-7.0	None-----	Moderate-----	High.
0	95-100	80-90	70-90	55-70	0.20-0.6	0.17-0.18	6.8-7.2	None-----	Moderate-----	High.
0-5	60-80	50-70	40-60	30-50	2.0-6.3	0.09-0.11	7.6-8.2	None-----	Low-----	High.
60-75	90-100	80-90	55-75	30-50	2.0-6.3	0.13-0.15	6.0-6.5	None-----	Low-----	High.
60-75	90-100	80-90	70-90	55-70	0.2-0.6	0.17-0.18	6.0-6.5	None-----	Moderate-----	High.
0	100	100	90-100	75-95	<0.06	0.14-0.15	6.4-6.8	None-----	High-----	Moderate.
20-30	50-60	40-50	35-45	25-35	2.0-6.3	0.06-0.08	6.5-7.0	None-----	Low-----	High.
10-20	50-60	40-50	30-45	15-25	0.2-0.6	0.10-0.11	6.5-7.0	None-----	Moderate-----	High.
0	100	90-100	75-95	55-75	0.6-2.0	0.16-0.17	6.6-7.0	None-----	Moderate-----	High.
0	100	90-100	80-90	60-80	0.2-0.6	0.18-0.19	7.4-8.0	None-----	Moderate-----	High.
0-10	60-70	50-60	40-50	30-40	0.6-2.0	0.15-0.16	6.0-6.5	None-----	Moderate-----	High.
5-15	60-70	50-60	40-50	30-40	0.6-2.0	0.15-0.16	6.0-0.5	None-----	Moderate-----	High.
5-15	40-50	30-40	25-35	15-25	0.6-2.0	0.07-0.08	5.5-6.0	None-----	Low-----	Low.
75-90	100	90-95	80-95	60-85	0.6-2.0	0.16-0.17	6.5-7.0	None-----	Moderate-----	High.
0-10	90-100	90-95	80-95	70-90	<0.06	0.17-0.18	6.8-7.5	None-----	High-----	Moderate.
0	100	100	85-95	60-75	0.6-2.0	0.15-0.16	8.5-9.0	Moderate to high.	Low-----	High.
0	100	100	90-100	75-95	0.06-0.2	0.15-0.16	8.8-9.0	Moderate to high.	High-----	Moderate.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.2-9.4	High-----	Moderate to high.	High.
0	100	100	70-85	40-55	0.6-2.0	0.13-0.15	9.0-9.6	High-----	Low-----	High.
0	100	100	85-95	50-65	0.6-2.0	0.15-0.17	9.0-9.6	High-----	Low-----	High.
0	100	100	85-95	60-75	0.6-2.0	0.15-0.16	8.5-9.0	Moderate to high.	Low-----	High.
0	100	100	90-100	75-95	0.06-0.2	0.15-0.16	8.8-9.0	Moderate to high.	High-----	Moderate.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.2-9.4	High-----	Moderate to high.	High.
0	100	100	70-85	40-55	0.6-2.0	0.13-0.15	9.0-9.6	High-----	Low-----	High.
0	100	100	90-100	75-85	<0.06	0.15-0.16	9.0-9.6	High-----	High-----	Moderate.

TABLE 4.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Hardpan or bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
Crutcher: CR, CS.....	<i>Ft.</i> >5	<i>Ft.</i> (1)	<i>In.</i> 0-3 3-36	Silt loam..... Silty clay loam.....	CL or ML CL	A-6 A-6 or A-7
Cummings: Cu.....	>5	<sup>2</sup> 1-2	36-54 0-60	Silty clay..... Silty clay loam.....	CH CL or CH	A-7
Cummings, clay subsoil variant: Cv, Cw.....	>5	<sup>3</sup> 1-2	0-8 8-15 15-72	Muck..... Silt loam..... Clay or silty clay.....	Pt CL CH	A-8 A-6 A-7
Dangberg, cold variant: DaA, DbB.....	1. 3-2. 3	1. 5-3	0-4 4-17 17-20 20-35 35-54	Loam..... Silty clay..... Strongly cemented silica hardpan. Loam..... Silty clay loam.....	ML or CL CH ML or CL CL	A-4 or A-6 A-7 A-4 or A-6 A-6
*Disabel: DC, DD2, DE, DM, DP..... For Crutcher part of DD2, see Crutcher series. For Jesse Camp part of DE, see Jesse Camp Series. For McConnell part of DM, see McConnell series. For Pegler part of DP, see Pegler series.	>5	(1)	0-11 11-60	Silty clay loam..... Clay or silty clay.....	CL or CH CH	A-7 A-7
*Donica: DrB, DrE, DrF, DsE, DtC, Du... For Surprise part of Du, see Surprise series.	>5	(1)	0-29 29-60	Very gravelly sandy loam..... Very gravelly coarse sand.....	GP-GM or GM GP	A-1 A-1
*Espil: EB, EF, EM, EP..... Badland part of EB too variable to rate. For Fertaline part of EF; see Fertaline series. For Mosquet part of EM, see Mosquet series. For Powley part of EP, see Powley series.	0. 7-1. 2	(1)	0-7 7-9 9-15 15	Gravelly sandy loam and sandy clay loam. Gravelly clay..... Indurated silica-cemented hardpan. Conglomerate.	SM or SC SC or CH	A-2 or A-4 A-7
Fertaline..... Mapped only in undifferentiated group with Espil soils.	1. 5-2. 5	(1)	0-7 7-21 21-25 25	Fine sandy loam..... Clay..... Sandy clay loam..... Indurated silica-cemented hardpan.	SM CH SC	A-2 or A-4 A-7 A-6
Four Star: Fo, Fr.....	>5	2-3	0-6 6-44	Loam..... Sandy loam.....	MI, or CL SM	A-4 or A-6 A-2 or A-4
Fs.....	>5	1-2	0-6 6-44	Loam..... Sandy loam.....	ML or CL SM	A-4 or A-6 A-2 or A-4
Ft.....	>5	2-3	0-6 6-44 44-60	Loam..... Sandy loam..... Clay.....	ML or CL SM CH	A-4 or A-6 A-2 or A-4 A-7
Foxmount: FXE.....	2-3. 3	(1)	0-27 27-38 38	Gravelly loam..... Very cobbly loam..... Tuff.	SM or SC SM or SC	A-2 or A-4 A-2 or A-4

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-heave potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Pct.					<i>In./hr.</i>	<i>In./in. of soil</i>	<i>pH</i>			
0	100	100	90-100	70-90	0.6-2.0	0.16-0.17	8.3-8.8	Moderate	Moderate	High.
0	100	100	95-100	85-95	0.2-0.6	0.17-0.18	8.6-9.2	Moderate to high.	Moderate	High.
0	100	100	95-100	90-95	0.06-0.2	0.15-0.16	9.0-9.2	High	High	Moderate.
0	100	100	95-100	85-95	0.2-0.6	0.17-0.18	8.0-8.6	None	Moderate	High.
0						0.20-0.22	6.5-7.0	None	Moderate	High.
0	100	100	90-100	70-90	0.6-2.0	0.17-0.18	8.0-8.3	None	Moderate	High.
0	100	100	90-100	75-95	0.06-0.2	0.16-0.17	8.0-8.8	Low to none	High	Moderate.
0	100	100	85-95	60-75	0.6-2.0	0.16-0.17	9.0-9.6	Moderate to high.	Moderate	High.
0	100	100	95-100	90-95	<0.06	0.15-0.17	9.0-9.6	Moderate to high.	High	Moderate.
					<0.06		9.0-9.6			
0	100	100	85-95	60-75	0.06-0.2	0.16-0.17	9.0-9.6	Moderate	Moderate	High.
0	100	100	95-100	85-95	0.06-0.2	0.17-0.18	9.0-9.6	Moderate	Moderate	High.
0	100	100	95-100	85-95	0.2-0.6	0.17-0.18	8.3-8.5	None to moderate.	Moderate	High.
0	100	100	90-100	75-95	0.06-0.2	0.15-0.17	8.3-8.8	Low to moderate.	High	Moderate.
0-25	30-50	30-40	20-30	5-15	2.0-6.3	0.05-0.07	6.5-7.0	None	Low	Low.
0-10	30-50	30-40	15-25	0-5	6.3-20.0	0.04-0.05	6.5-7.0	None	Low	Low.
0-5	60-70	50-60	30-50	20-40	0.6-2.0	0.13-0.14	6.0-7.0	None	Low to moderate.	High.
0	70-80	60-70	55-70	45-65	<0.06	0.13-0.14	6.0-7.0	None	High	Moderate.
					<0.06					
0-5	70-80	60-70	40-60	25-40	0.6-2.0	0.13-0.15	6.0-6.5	None	Low	High.
0	80-90	70-80	60-80	50-75	<0.06	0.15-0.16	6.5-8.4	None	High	Moderate.
0	80-90	70-80	55-70	25-45	0.2-0.6	0.15-0.16	8.3-8.8	None	Moderate	High.
					<0.06					
0	100	100	85-95	60-75	0.6-2.0	0.16-0.18	6.5-7.0	None	Moderate	High.
0	100	100	60-70	30-40	2.0-6.3	0.11-0.13	6.5-7.0	None	Low	High.
0	100	100	85-95	60-75	0.6-2.0	0.16-0.18	6.5-7.0	None	Moderate	High.
0	100	100	60-70	30-40	2.0-6.3	0.11-0.13	6.5-7.0	None	Low	High.
0	100	100	85-95	60-75	0.6-2.0	0.16-0.18	6.5-7.0	None	Moderate	High.
0	100	100	60-70	30-40	2.0-6.3	0.11-0.13	6.5-7.0	None	Low	High.
0	100	100	90-100	75-95	0.06-0.2	0.15-0.16	7.0-7.5	None	High	Moderate.
0-5	70-80	60-70	50-65	35-50	0.6-2.0	0.15-0.16	6.0-6.5	None	Moderate	High.
30-40	70-80	60-70	50-65	35-50	0.6-2.0	0.14-0.15	6.0-6.5	None	Low	Low.

TABLE 4.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Hardpan or bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
Gorzell: GRE, GSC-----	<i>Ft.</i> >5	<i>Ft.</i> (1)	<i>In.</i> 0-8 8-30 30-46	Gravelly loam----- Gravelly clay loam----- Very gravelly loamy sand-----	SM or SC SC GP-GM or GM	A-2 or A-4 A-2 or A-6 A-1 or A-2
*Hapgood: HAE, HDG, HF, HG, HH, H1. For Home Camp part of HF, see Home Camp series. For Snag part of HG and H1, see Snag series. For Newlands part of HH and H1, see Newlands series.	>3.3	(1)	0-5 5-50 50	Stony fine sandy loam----- Gravelly fine sandy loam----- Fractured tuff.	SM or SC SM or SC	A-2 A-2
Hart Camp----- Mapped only as a part of the Powley-Espil association.	0.8-1.7	(1)	0-3 3-13 13	Fine sandy loam----- Sandy clay loam and gravelly sandy clay loam. Tuff bedrock.	SM SC	A-2 or A-4 A-2 or A-6
*Hartig: HK----- For Hapgood part of this unit, see Hapgood series.	1.7-3.3	(1)	0-7 7-21 21-32 32	Gravelly loam----- Gravelly sandy loam----- Gravelly and cobbly sandy loam. Hard tuff.	GM SM SM	A-2 or A-4 A-2 A-2
Home Camp: HL, HME, HMF----- For Hapgood part of HL, see Hapgood series. For Newlands part of HME and HMF, see Newlands series.	1.7-3.3	(1)	0-8 8-18 18-27 27-36 36	Stony and gravelly loam----- Gravelly sandy clay loam----- Gravelly clay----- Gravelly sandy clay loam----- Tuff.	GM GC SC or CL SC	A-2 or A-4 A-4 or A-6 A-6 A-2 or A-4
Hovey: Hn, Ho-----	>5	2-3	0-60	Silty clay loam-----	CL or MH	A-7
*Hussa: HrA, HrB, HvA-----	>5	2-4	0-12 12-23 23-30 30-60	Loam or clay loam----- Clay loam----- Sandy clay loam----- Clay loam and silty clay-----	CL or ML CL SC or CL CL	A-4 or A-6 A-6 or A-7 A-6 A-6 or A-7
HsA, Hz----- For Couch part of Hz, see Couch series.	>5	2-4	0-12 12-23 23-30 30-60	Loam or clay loam----- Clay loam----- Sandy clay loam----- Clay loam and silty clay loam-----	CL or ML CL SC or CL CL	A-4 or A-6 A-6 or A-7 A-6 A-6 or A-7
HuA, HwA-----	>5	2-4	0-12 12-23 23-42 42-60	Loam or clay loam----- Clay loam----- Sandy clay loam----- Clay-----	CL or ML CL SC or CL CH	A-4 or A-6 A-6 or A-7 A-6 A-7
HxB, HyB-----	>5	1-2	0-12 12-23 23-30 30-60	Loam or clay loam----- Clay loam----- Sandy clay loam----- Clay loam-----	CL or ML CL SC or CL CL	A-4 or A-6 A-6 or A-7 A-6 A-6 or A-7

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-heave potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Pct.					In./hr.	In./in. of soil	pH			
0-20	60-70	50-60	40-55	30-40	0.6-2.0	0.15-0.16	6.5-8.0	None	Moderate	High.
0-10	60-70	50-60	40-55	30-40	0.2-0.6	0.15-0.16	8.0-8.8	None to low	Moderate	High.
0-20	40-60	30-50	15-30	5-15	6.3-20.0	0.04-0.05	8.5-9.0	None to low	Low	Low.
0-30	60-70	50-60	35-50	20-30	0.6-2.0	0.14-0.16	6.0-6.5	None	Moderate	High.
0-10	60-70	50-60	35-50	20-30	0.6-2.0	0.14-0.16	6.5-7.0	None	Moderate	High.
0	80-90	70-80	50-70	30-45	0.60-2.0	0.14-0.16	6.0-6.5	None	Low	High.
0	70-80	60-70	50-60	20-40	0.20-0.6	0.15-0.17	6.0-7.0	None	Moderate	High.
0-5	60-70	55-65	45-60	30-50	0.6-2.0	0.15-0.16	6.0-6.5	None	Low	High.
0-5	60-70	55-65	30-45	15-25	0.6-2.0	0.14-0.16	6.5-7.0	None	Low	Moderate.
0-15	60-70	55-65	30-45	15-25	0.6-2.0	0.14-0.16	6.5-7.0	None	Low	Moderate.
15-25	60-70	55-65	45-60	30-50	0.6-2.0	0.15-0.16	6.0-6.5	None	Moderate	High.
0-10	60-70	55-65	50-65	40-50	0.2-0.6	0.16-0.17	6.5-7.0	None	Moderate	High.
0-10	70-80	60-70	55-70	40-65	0.2-0.6	0.14-0.16	6.5-7.0	None	High	Moderate.
0-10	70-80	60-70	50-60	20-40	0.2-0.6	0.14-0.16	6.5-7.0	None	Moderate	High.
0	100	100	95-100	75-85	0.06-0.2	0.17-0.18	8.3-8.8	None to moderate.	Moderate	High.
0	100	100	85-95	60-75	0.6-2.0	0.17-0.18	8.5-8.8	Low to none	Moderate	High.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.0-8.6	None	Moderate	High.
0	100	100	80-90	35-55	0.2-0.6	0.17-0.18	8.0-8.3	None	Moderate	High.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.0-8.3	None	Moderate	High.
0	100	100	85-95	60-75	0.6-2.0	0.17-0.18	8.5-8.8	Low to moderate.	Moderate	High.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.0-8.6	Low to moderate.	Moderate	High.
0	100	100	80-90	35-55	0.2-0.6	0.17-0.18	8.0-8.3	Low	Moderate	High.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.0-8.3	Low	Moderate	High.
0	100	100	85-95	60-75	0.6-2.0	0.17-0.18	8.5-8.8	Low to none	Moderate	High.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.0-8.6	None	Moderate	High.
0	100	100	80-90	35-55	0.2-0.6	0.17-0.18	8.0-8.3	None	Moderate	High.
0	100	100	90-100	75-95	<0.06	0.14-0.15	8.0-8.3	None	High	Moderate.
0	100	100	85-95	60-75	0.6-2.0	0.17-0.18	8.5-8.8	None	Moderate	High.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.0-8.6	None	Moderate	High.
0	100	100	80-90	35-55	0.2-0.6	0.17-0.18	8.0-8.3	None	Moderate	High.
0	100	100	90-100	70-80	0.2-0.6	0.17-0.18	8.0-8.3	None	Moderate	High.

TABLE 4.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Hardpan or bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
Jesse Camp: JcA, JcB, JeA	Fl. >5	Fl. (1)	0-3	Silt loam	ML or CL	A-4 or A-6
			3-10	Very fine sandy loam	ML or CL	A-4 or A-6
			10-60	Silt loam	ML or CL	A-4 or A-6
Karlo: KAB	1. 7-3. 3	(1)	0-40 40	Clay Basalt.	CH	A-7
Kising: Kr	>5	3-5	0-12	Fine sandy loam	SM or ML	A-4
			12-38	Silty clay loam	CL or CH	A-6 or A-7
			38	Loam	ML or CL	A-4 or A-6
Ks	>5	1-2	0-12	Fine sandy loam	SM or ML	A-4
			12-38	Silty clay loam	CL or CH	A-6 or A-7
			38	Loam	ML or CL	A-4 or A-6
Langston Mapped only in association with Old Camp soils.	>4	(1)	0-7	Gravelly sandy loam	SM	A-1 or A-2
			7-16	Sandy clay loam and gravelly sandy clay loam.	SC	A-2 or A-6
			16-54	Very gravelly sand	SW-SM or SP-SM	A-1
*Lolak: LK, Lm, LN For Zorravista part of LN, see Zorravista series.	>5	4 4-5	0-4	Silty clay and silty clay loam	CH	A-7
			4-60	Silty clay and clay	CH	A-7
Longval: LOC	1. 7-3. 3	(1)	0-15	Fine sandy loam	SM	A-2 or A-4
			15-34	Gravelly fine sandy loam	SM	A-2 or A-4
			34	Weathered basalt.		
Lyonman: LYE, LYF	>3. 3	(1)	0-13	Cobbly loam	ML	A-4
			13-34	Cobbly clay loam	CL	A-6
			34-48	Clay loam	CL	A-6
Madeline: MAD, MAF	0. 8-1. 7	(1)	0-2	Very stony loam	ML or CL	A-4 or A-6
			2-8	Sandy clay loam	SC	A-2 or A-6
			8-14	Sandy clay and gravelly clay	SC	A-2 or A-6
			14	Basalt.		
Marsh: Mh Properties variable.	>5	(2)				
Mascamp: MLC	0. 8-1. 7	(1)	0-7	Very cobbly and gravelly sandy loam.	SM or SC	A-2 or A-6
			7-15	Very cobbly and gravelly sandy clay loam.	SC	A-2 or A-6
			15	Tuff.		

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-heave potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Pct. 0	100	100	90-100	70-90	In./hr. 0.6-2.0	In./in. of soil 0.17-0.18	pH 8.0-8.3	Low to moderate.	Moderate-----	High.
0	100	100	85-95	50-65	0.6-2.0	0.16-0.17	8.3-8.5	Low to moderate.	Moderate-----	High.
0	100	100	90-100	70-90	0.6-2.0	0.17-0.18	8.5-8.8	Low to moderate.	Moderate-----	High.
5-20	100	100	90-100	75-95	0.06-0.20	0.14-0.16	7.0-8.3	None-----	High-----	Moderate.
0	100	100	70-85	40-55	0.6-2.0	0.14-0.16	9.0-9.6	Moderate to high.	Low-----	High.
0	100	100	95-100	75-85	0.06-0.2	0.17-0.18	8.4-9.6	Moderate to high.	Moderate-----	High.
0	90-100	90-100	75-95	55-75	0.2-0.6	0.16-0.17	8.3-9.0	Low to moderate.	Moderate-----	High.
0	100	100	70-85	40-55	0.6-2.0	0.14-0.16	9.0-9.6	Moderate to high.	Low-----	High.
0	100	100	95-100	75-85	0.06-0.2	0.17-0.18	8.4-9.6	Moderate to high.	Moderate-----	High.
0	90-100	90-100	75-95	55-75	0.2-0.6	0.16-0.17	8.3-9.0	Low to moderate.	Moderate-----	High.
0-10	80-90	70-80	40-55	20-30	2.0-6.3	0.12-0.13	6.5-7.0	None-----	Low-----	Moderate.
0-5	80-90	70-80	50-70	30-50	0.2-0.6	0.17-0.18	6.5-7.0	None-----	Moderate-----	High.
0-10	60-70	50-60	25-40	5-10	>20.0	0.05-0.06	7.0-8.5	Low to none--	Low-----	Low.
0	100	100	95-100	85-95	<0.06	0.16-0.17	9.0-9.6	Moderate to very high.	High-----	Moderate.
0	100	100	90-100	80-95	<0.06	0.15-0.16	9.0-9.6	Moderate to very high.	High-----	Moderate.
0-5	90-100	80-90	55-75	30-50	2.0-6.3	0.14-0.15	5.0-6.0	None-----	Low-----	High.
0-15	70-80	60-70	40-60	25-40	2.0-6.3	0.13-0.14	5.0-6.0	None-----	Low-----	High.
15-40	100	90-100	75-95	55-75	0.6-2.0	0.16-0.18	6.0-6.5	None-----	Low-----	High.
25-40	100	90-100	80-100	60-80	0.2-0.6	0.16-0.17	5.5-6.2	None-----	Moderate-----	High.
5-15	100	90-100	80-100	60-80	0.2-0.6	0.16-0.17	5.5-6.0	None-----	Moderate-----	High.
15-25	90-100	80-90	70-85	50-70	0.6-2.0	0.16-0.17	6.5-7.0	None-----	Moderate-----	High.
5-10	90-100	80-90	65-80	30-50	0.2-0.6	0.16-0.17	6.5-7.0	None-----	Moderate-----	High.
5-10	80-90	70-80	60-75	30-50	0.06-0.2	0.16-0.17	6.5-7.0	None-----	High-----	Moderate.
25-40	90-100	80-90	50-60	25-40	2.0-6.3	0.08-0.11	6.5-7.0	None-----	Low-----	High.
25-40	70-80	60-70	50-60	20-40	0.2-0.6	0.08-0.11	6.5-7.0	None-----	Moderate-----	High.

TABLE 4.—Estimated soil properties

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Hardpan or bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
*McConnel: MMB, MNA, MO Badland part of MO too variable to rate.	<i>Ft.</i> >5	<i>Ft.</i> (1)	<i>In.</i> 0-12 12-34 34-48	Sandy loam and gravelly fine sandy loam. Very gravelly loamy sand. Very gravelly sand.	SM or SC GP-GM or GM GW or GP	A-2 or A-4 A-1 A-1
Mendeboure Mapped only in association with Rubble land.	1. 7-3. 3	(1)	0-3 3-31 31	Very stony loam. Very stony clay and light clay. Andesite.	SC SC or CL	A-4 or A-6 A-6
*Mosquet: MS For Home Camp part of this unit, see Home Camp series.	0. 5-2	(1)	0-2 2-9 9-14 14	Very stony fine sandy loam. Cobbly and gravelly clay loam and clay. Basalt with clay in fractures. Basalt.	SM or SC SC or CL	A-2 or A-4
Nevador: NdA, NdB, NeA, NeB	>5	(1)	0-5 5-18 18-36 36-60	Fine sandy loam. Clay loam. Sandy loam. Loamy sand.	SM or ML CL SM or ML SM	A-4 A-6 A-4 or A-2 A-2
*Newlands: NH For Hapgood part of this unit, see Hapgood series.	2. 3-5. 0	(1)	0-8 8-45 45	Loam. Clay loam. Andesite.	SC or CL CL	A-4 or A-6 A-6
*Ninemile: NK For Karlo part of this unit, see Karlo series.	0. 8-1. 7	(1)	0-2 2-14 14	Extremely cobbly loam. Clay. Basalt.	SC or CL CL or CH	A-4 or A-6 A-6 or A-7
*Old Camp: OC, OG For Langston part of OG, see Langston series.	0. 8-1. 7	(1)	0-2 2-14 14	Gravelly loam. Stony, cobbly and gravelly clay loam. Basalt.	SC or CL GC	A-4 or A-6 A-2
*Olson: OS Badland part of this unit too variable to rate.	0. 8-1. 7	(1)	0-4 4-13 13-21 21-44	Fine sandy loam. Gravelly sandy clay loam. Indurated silica-cemented hardpan. Gravelly loamy sand.	SM SC or GC	A-2 or A-4 A-6
Pegler Mapped only in association with Disabel and Vylach soils.	0. 7-1. 1	(1)	0-2 2-9 9	Fine sandy loam. Gravelly clay loam. Fractured tuff.	SM or SC SC or CL	A-2 or A-4 A-6
Playas: PA Properties variable.	>5	(6)				
*Powley: PGC, PH, PM For Espil part of PH, see Espil series. For Mascamp part of PM, see Mascamp series.	1. 4-1. 7	(1)	0-9 9-11 11-19 19-32	Fine sandy loam. Sandy clay loam. Clay. Indurated silica-cemented hardpan.	SC or SM SC CH	A-2 or A-6 A-6 or A-2 A-7

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-heave potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Pct. 0	80-90	70-80	50-70	30-45	In./hr. 2.0-6.3	In./in. of soil 0.15-0.17	pH 8.0-8.5	None-----	Moderate-----	High.
0-5	40-50	30-40	15-30	5-15	6.3-20.0	0.05-0.06	8.5-9.0	None-----	Low-----	Low.
0-5	40-50	30-40	15-30	0-5	>20.0	0.04-0.05	8.5-9.0	Low to moderate.	Low-----	Low.
30-50 20-40	70-80 70-80	60-70 60-70	50-65 55-70	35-50 40-55	0.6-2.0 0.06-0.2	0.15-0.16 0.16-0.17	6.0-6.5 6.5-7.0	None----- None-----	Moderate----- Moderate to high.	High. High.
15-20 3-5	80-90 70-80	70-80 60-70	50-70 55-70	30-45 45-65	0.6-2.0 0.06-0.2	0.14-0.15 0.15-0.16	6.5-7.0 6.0-6.5	None----- None-----	Moderate----- Moderate to high.	High. High.
0	100	95-100	65-85	35-55	2.0-6.3	0.14-0.15	6.5-7.0	None-----	Low-----	High.
0	100	95-100	85-100	65-80	0.2-0.6	0.18-0.20	7.0-8.5	None-----	Moderate-----	High.
0	100	95-100	55-70	30-55	0.6-2.0	0.14-0.15	8.0-8.5	None-----	Low-----	High.
0	100	95-100	50-75	15-30	2.0-6.3	0.07-0.08	7.0-8.0	Low-----	Low-----	Moderate.
0-10 0-1	90-100 90-100	75-90 75-90	65-85 70-90	45-70 50-70	0.6-2.0 0.2-0.6	0.16-0.17 0.17-0.18	6.0-6.5 6.0-6.5	None----- None-----	Moderate----- Moderate-----	High. High.
40-60 0-10	85-95 80-95	70-80 70-80	60-75 60-80	40-60 50-75	0.6-2.0 <0.06	0.12-0.14 0.16-0.17	6.5-7.0 6.5-7.0	None----- None-----	Moderate----- High-----	High. Moderate.
5-10 15-35	80-100 30-50	70-90 30-40	60-85 25-40	40-70 20-30	0.6-2.0 0.2-0.6	0.12-0.14 0.08-0.13	7.0-8.3 6.5-8.0	None----- None-----	Moderate----- Moderate-----	High. Moderate.
0 0	70-80 60-80	60-70 50-60	40-60 45-60	25-40 35-50	2.0-6.3 0.2-0.6 <0.06	0.12-0.13 0.13-0.15	6.5-7.0 6.5-7.0	None----- None-----	Low----- Moderate-----	High. Moderate.
0	60-80	60-70	30-50	10-20	6.0-20.0	0.05-0.07	7.0-7.5	None-----	Low-----	Low.
0 0	90-100 70-80	80-90 65-75	55-75 60-75	30-50 45-60	2.0-6.3 0.2-0.6	0.13-0.15 0.17-0.18	8.5-9.0 8.5-9.0	Low----- Moderate-----	Moderate----- Moderate-----	High. High.
0 0 0	70-80 90-100 90-100	60-75 85-95 85-90	40-65 70-85 75-90	25-40 30-50 65-90	2.0-6.3 0.6-2.0 <0.06 <0.06	0.13-0.14 0.14-0.16 0.14-0.16	6.3-7.0 6.5-7.0 6.5-7.0	Low----- Low----- Low-----	Moderate----- Moderate----- High-----	High. High. Moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Hardpan or bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
Raglan: RAB, RgA-----	<i>Ft.</i> >5	<i>Ft.</i> (1)	<i>In.</i> 0-6 6-13 13-61	Very fine sandy loam and sandy clay loam. Sandy clay loam----- Very fine sandy loam-----	SC or CL SC or CL ML	A-4 or A-6 A-6 A-4
Riverwash: RH----- Properties variable.	>5	(7)				
Rock outcrop. Mapped only in undifferentiated group with Rubble land. Properties variable.						
*Rubble land: RM, RN, RR. Properties variable. For Home Camp part of RM, see Home Camp series. For Mendeboure part of RN, see Mendeboure series. Rock outcrop part of RR too variable to rate.						
Schamp: SCE-----	3.3-5.0	(1)	0-8 8-32 32-43 43-61	Clay loam----- Clay----- Sandy clay loam----- Extremely cobbly and stony sandy loam.	CL CH SC SC	A-6 A-7 A-2 or A-6 A-2
Simpson: SdB, SGC, SmA-----	>5	(1)	0-3 3-23 23-31 31-48	Sandy loam----- Sandy clay loam or clay----- Sandy loam----- Loamy sand and very gravelly sand.	SM SC or CL SM GW-GM	A-2 A-2 or A-6 A-2 A-1
Snag: SNF-----	3.3-5.0	(1)	0-10 10-44 44	Stony fine sandy loam----- Very stony fine sandy loam----- Basalt.	SM SM	A-2 or A-4 A-2 or A-4
Surprise: SrA, SrB, SrC-----	>5	(1)	0-45 45-67	Gravelly sandy loam----- Very gravelly sandy loam-----	SM GM	A-2 A-1 or A-2
*Survyva: SUB2, SV----- For Zorravista part of SV, see Zorravista series.	>5	(1)	0-1 1-7 7-11 11-34	Fine sandy loam----- Clay----- Very gravelly sandy clay loam----- Very gravelly sand-----	SM or ML CH GC GP-GM	A-4 A-7 A-2 A-1
Survyva, hardpan variant: SYB2-----	0.8-1.5	(1)	0-1 1-11 11-25 25-29 29-44	Fine sandy loam----- Sandy clay loam----- Silica-cemented hardpan----- Silt loam----- Loamy sand-----	SM or ML SC or CL ML or CL SM	A-4 A-2 or A-6 A-4 or A-6 A-2 or A-1

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-heave potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Pct. 0	100	100	70-80	40-55	In./hr. 2.0-6.3	In./in. of soil 0.14-0.16	pH 9.0-9.5	Low-----	Moderate-----	High.
0	100	100	80-90	35-55	0.2-0.6	0.14-0.16	9.0-9.5	High-----	Moderate-----	High.
0	100	100	85-95	50-65	0.2-0.6	0.15-0.17	9.0-9.5	Very high-----	Low-----	High.
5-10	90-100	85-95	75-95	60-75	0.2-0.6	0.18-0.20	7.0-7.5	None-----	Moderate-----	High.
5-10	90-100	85-95	75-95	65-90	0.2-0.6	0.14-0.16	7.0-8.3	None-----	High-----	Moderate.
10-15	80-90	75-85	60-75	25-50	0.2-0.6	0.14-0.16	8.8-9.3	Low-----	Moderate-----	High.
15-60	60-70	50-60	30-40	15-25	0.6-2.0	0.06-0.07	8.8-9.3	Low-----	Moderate-----	Low.
0	80-100	75-85	45-60	20-35	2.0-6.3	0.11-0.13	6.0-6.8	None-----	Moderate-----	High.
0	90-100	85-95	70-90	40-60	0.06-0.2	0.14-0.16	6.7-7.2	None-----	Moderate-----	High.
0	80-90	75-85	45-60	20-35	2.0-6.3	0.11-0.13	6.8-7.2	None-----	Low-----	High.
0-5	40-50	30-40	15-30	5-10	6.3-20.0	0.04-0.05	7.0-8.3	None-----	Low-----	Low.
10-25	80-90	75-85	50-70	30-50	2.0-6.3	0.14-0.15	5.5-6.0	None-----	Low-----	High.
25-40	80-90	75-85	50-70	30-50	2.0-6.3	0.12-0.14	5.5-6.0	None-----	Low-----	High.
0	60-70	55-65	30-45	15-25	2.0-6.3	0.11-0.13	6.5-7.0	None-----	Low-----	Moderate.
0-5	40-60	35-45	20-30	10-20	6.3-20.0	0.04-0.06	6.5-7.0	None-----	Low-----	Low.
0	90-100	90-100	60-85	35-55	2.0-6.3	0.14-0.15	9.0-9.5	Moderate-----	Low-----	High.
0	90-100	90-100	80-100	70-95	0.06-0.2	0.14-0.16	9.0-9.6	Moderate-----	High-----	Moderate.
0	40-50	35-45	30-40	10-25	0.2-0.6	0.07-0.08	9.0-9.6	Moderate-----	Moderate-----	Moderate.
0	40-50	30-40	15-30	5-10	>20.0	0.04-0.05	8.6-9.4	Moderate-----	Low-----	Low.
0	90-100	90-100	60-85	35-55	2.0-6.3	0.14-0.15	9.0-9.6	High-----	Low-----	High.
0	90-100	90-100	70-90	30-55	0.2-0.6	0.15-0.16	9.0-9.6	High-----	Moderate-----	High.
					<0.06					
0	100	100	90-100	70-90	0.6-2.0	0.17-0.18	9.0-9.5	High-----	Moderate-----	High.
0	90-100	90-100	45-75	15-25	6.3-20.0	0.06-0.08	9.0-9.5	High-----	Low-----	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification		
	Hardpan or bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
*Toney: TN----- For Ninemile part of this unit, see Ninemile series.	<i>Fl.</i> 1. 7-3. 3	<i>Fl.</i> ( <sup>1</sup> )	<i>m.</i> 0-4 4-23 23	Extremely cobbly silt loam----- Clay----- Pumiceous tuff.	ML or CL CH	A-4 or A-6 A-7
Tourn: TOC-----	1. 7-3. 3	( <sup>1</sup> )	0-8 8-15 15-26 26	Stony loam----- Fine sandy loam----- Sandy clay loam----- Weathered tuff.	ML SC or SM SC	A-4 A-4 A-2 or A-6
*Vylach: VP, VY----- For Pegler part of these units, see Pegler series.	0. 8-1. 7	( <sup>1</sup> )	0-3 3-10 10-20 20	Fine sandy loam----- Sandy clay loam----- Strongly cemented silica hardpan. Fractured tuff.	SC or SM SC or CL	A-4 A-2 or A-6
*Waca: WAE, WAF, WAG, WD, WE----- For Hapgood part of WD, see Hapgood series. For Snag part of WE, see Snag series.	1. 7-3. 3	( <sup>1</sup> )	0-3 3-20 20-30 30	Stony fine sandy loam----- Gravelly sandy loam----- Very gravelly coarse sandy loam. Basalt.	SM or ML GM or SM GM	A-4 A-1 A-1
Waca, shallow variant: WFF-----	0. 8-1. 7	( <sup>1</sup> )	0-19 19	Very gravelly sandy loam----- Fractured andesite.	GM or GP-GM	A-1
Weimer: Wm, Wp----- Ws-----	>5 >5	<sup>8</sup> 0-3 <sup>8</sup> 0-3	0-60 0-60	Clay----- Clay-----	CH CH	A-7 A-7
Welch: WvB-----	>5	<sup>7</sup> 1. 5-3	0-60	Silty clay loam-----	CL or CII	A-6 or A-7
*Zorravista: ZoC, ZR----- For Couch part of ZR, see Couch series.	>5	( <sup>1</sup> )	0-60	Fine sand-----	SM	A-2

<sup>1</sup> No evidence of water table in profile.<sup>2</sup> Seasonally ponded.<sup>3</sup> Mapping unit Cv seasonally ponded.<sup>4</sup> Variable; at surface in some years.<sup>5</sup> Ponded most of the year.<sup>6</sup> Intermittently ponded.<sup>7</sup> Overflowed.<sup>8</sup> Ponded for short periods.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-heave potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
Pct. 30-50 5-10	90-100 90-100	85-95 85-95	75-95 75-95	60-85 65-90	0.6-2.0 <0.06	0.08-0.10 0.14-0.16	6.5-7.0 6.5-8.3	None----- None-----	Moderate----- High-----	High. Moderate.
5-25 0 0	90-100 90-100 90-100	85-90 85-90 85-90	70-85 60-75 70-80	50-70 35-50 30-50	0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.16 0.14-0.15 0.14-0.16	6.0-6.5 6.0-6.5 6.0-6.5	None----- None----- None-----	Low----- Moderate----- Moderate-----	High. High. High.
0 0	90-100 90-100	90-100 90-100	60-85 70-90	35-50 30-55	2.0-6.3 0.2-0.6 <0.06	0.14-0.16 0.14-0.16	8.3-8.5 8.0-8.3	Low----- Low-----	Moderate----- Moderate-----	High. High.
10-30 5-15 0-15	90-100 60-70 30-50	90-100 55-60 25-35	60-85 35-40 15-25	35-55 15-25 10-15	2.0-6.3 2.0-6.3 6.3-20.0	0.13-0.15 0.10-0.12 0.05-0.06	5.0-6.0 5.0-6.0 5.0-6.0	None----- None----- None-----	Low----- Low----- Low-----	High. Moderate. Low.
0-10	30-50	25-35	15-25	10-15	6.3-20.0	0.05-0.06	5.0-6.0	None-----	Low-----	Low.
0 0	100 100	100 100	90-100 90-100	75-95 75-95	<0.06 <0.06	0.14-0.16 0.14-0.16	7.2-8.8 7.5-8.8	None----- Moderate-----	High----- High-----	Moderate. Moderate.
0	100	100	95-100	70-85	0.2-0.6	0.18-0.20	6.2-7.0	None-----	Moderate-----	High.
0	100	100	65-80	20-35	>20.0	0.06-0.07	8.0-8.3	Low-----	Low-----	Moderate.

TABLE 5.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The soils in referring to other series that appear

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
Badland: BA-----	Variable-----	Variable-----	Variable-----	Variable-----	Variable-----
*Bicondoa: Ec, Bd----- For Kising part of Bd, see Kising series.	Unsuited: mostly CH material.	Unsuited: mostly CH material.	Poor: high shrink-swell potential; sea- sonal high water table at a depth of 1 to 3 feet.	Severe: slow permeability; seasonal high water table at a depth of 1 to 3 feet.	Severe: sea- sonal high water table at a depth of 1 to 3 feet.
Bidwell: BeA, BeB-----	Unsuited: mostly CL and GC or SC ma- terial; stratified sand and gravel below a depth of 5 feet.	Unsuited: mostly CL and GC or SC ma- terial; stratified sand and gravel below a depth of 5 feet.	Fair above a depth of 32 inches: mostly CL material. Good below a depth of 32 inches: mostly GC or SC material.	Severe: moder- ately slow permeability.	Moderate: clay loam texture; gravelly sub- stratum.
*Bluebell: BHE, BHF----- For Hapgood part of these units, see Hapgood series.	Unsuited: mostly CL material; bed- rock at a depth of 1.7 to 3 feet.	Unsuited: mostly CL material; bed- rock at a depth of 1.7 to 3 feet.	Fair: mostly very stony CL material above bedrock.	Severe: bedrock at a depth of 1.7 to 3 feet; slopes of more than 15 percent.	Severe: bedrock at a depth of 1.7 to 3 feet; slopes of more than 15 percent.
Boulder Lake: Bo-----	Unsuited: mostly CH material.	Unsuited: mostly CH material.	Poor: mostly CH material; seasonally ponded.	Severe: very slow permea- bility; seasonally ponded.	Severe: clay texture; seasonally ponded.
Bregar: BRC-----	Unsuited: mostly GM or GC material; bedrock at a depth of 0.5 to 1 foot.	Poor: mostly GM or GC ma- terial; bedrock at a depth of 0.5 to 1 foot.	Poor: mostly GM or GC ma- terial; bedrock at a depth of 0.5 to 1 foot.	Severe: bedrock at a depth of 0.5 to 1 foot.	Severe: bedrock at a depth of 0.5 to 1 foot.
Buntingville: BuA, BuB-----	Unsuited: mostly CL material.	Unsuited: mostly CL material.	Poor: mostly CL material; high potential for frost action.	Severe: seasonal high water table at a depth of 3 to 4 feet.	Moderate: sea- sonal high water table at a depth of 3 to 4 feet; clay loam texture.
Campona: CAC, CCB-----	Unsuited: mostly SC and GC material.	Unsuited above a depth of 20 inches: mostly SC ma- terial. Poor below a depth of 20 inches: mostly GC material.	Fair: mostly SC and GC mate- rial; somewhat poorly drained.	Severe: seasonal high water table at a depth of 3 to 5 feet.	Severe: very gravelly ma- terial below a depth of 20 inches.

*engineering properties*

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for in the first column of the table]

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Variable.....	Variable.....	Variable.....	Variable.....	Not applicable.....	Not applicable.
Severe: high shrink-swell potential; seasonal high water table at a depth of 1 to 3 feet.	Severe: high shrink-swell potential; seasonal high water table at a depth of 1 to 3 feet.	Seasonal high water table at a depth of 1 to 3 feet.	Clayey material; high shrink-swell potential; poor compaction characteristics.	Slow permeability; seasonal high water table at a depth of 1 to 3 feet; saline.	Slow permeability; seasonal high water table at a depth of 1 to 3 feet; saline.
Moderate: moderate shrink-swell potential.	Severe: mostly CL material; high potential for frost action.	Moderately rapid permeability in substratum; moderately slow permeability in subsoil.	Fairly good stability and compaction characteristics; low compacted permeability; good resistance to piping.	Not applicable.....	Moderate available water capacity; unit E <sub>6</sub> B has slopes of 2 to 5 percent.
Severe: very stony material; slopes of more than 15 percent.	Severe: slopes of more than 15 percent; mostly CL material.	Slopes restrict storage capacity; bedrock at a depth of 1.7 to 3 feet.	Very stony CL material; bedrock at a depth of 1.7 to 3 feet.	Not applicable.....	Not applicable.
Severe: high shrink-swell potential; seasonally ponded.	Severe: mostly CH material; high shrink-swell potential; seasonally ponded.	All features favorable.	CII material; high shrink-swell potential; poor compaction characteristics.	Not applicable.....	Not applicable.
Severe: bedrock at a depth of 0.5 to 1 foot.	Severe: bedrock at a depth of 0.5 to 1 foot.	Slopes restrict storage capacity; bedrock at a depth of 0.5 to 1 foot.	Mostly GM and GC material; bedrock at a depth of 0.5 to 1 foot.	Not applicable.....	Not applicable.
Moderate: moderate shrink-swell potential.	Moderate: somewhat poorly drained; moderate shrink-swell potential.	Seasonal high water table at a depth of 3 to 4 feet; moderately slow permeability.	Mostly CL material; fair to good stability; fair to good compaction characteristics; low compacted permeability; fair to poor resistance to piping.	Moderately slow permeability; seasonal high water table at a depth of 3 to 4 feet.	Moderately slow permeability; seasonal high water table at a depth of 3 to 4 feet; unit B <sub>u</sub> B has slopes of 3 to 5 percent.
Moderate: moderate shrink-swell potential; somewhat poorly drained.	Moderate: somewhat poorly drained; moderate shrink-swell potential.	Moderate permeability; seasonal high water table at a depth of 3 to 5 feet.	Mostly SC and GC material; fair stability; good compaction characteristics; low compacted permeability.	Moderate permeability; seasonal high water table at a depth of 3 to 5 feet.	Not applicable.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
*Catnip: CK----- For Ninemile part of this unit, see Ninemile series.	Unsuited: mostly CH material.	Unsuited: mostly CH material.	Poor: mostly CH material.	Severe: very slow permeability; bedrock at a depth of less than 40 inches.	Severe: clay material; bedrock at a depth of less than 40 inches.
Couch: Cm, Cn-----	Unsuited: mostly fine-grained material.	Unsuited: mostly fine-grained material.	Poor above a depth of 22 inches: mostly CL and CH material. Fair at a depth of 22 to 40 inches: mostly SM or ML material.	Moderate for unit Cm: moderate permeability below a depth of 22 inches. Severe for unit Cn: very slow permeability below a depth of 40 inches.	Moderate: clay loam texture.
Crutcher: CR, CS-----	Unsuited: mostly CL and CH material.	Unsuited: mostly CL and CH material.	Poor: mostly CL and CH material; moderate to high shrink-swell potential.	Severe: slow permeability.	Severe: silty clay below a depth of 36 inches.
Cummings: Cu-----	Unsuited: mostly CL or CH material.	Unsuited: mostly CL or CH material.	Poor: mostly CL or CH material; moderate shrink-swell potential; seasonally ponded.	Severe: seasonally ponded; moderately slow permeability.	Severe: seasonally ponded.
Cummings, clay subsoil variant: Cv, Cw.	Unsuited: mostly CL and CH material.	Unsuited: mostly CL and CH material.	Poor: mostly CL and CH material; high shrink-swell potential; seasonal high water table at a depth of 1 to 2 feet.	Severe: slow permeability; seasonal high water table at a depth of 1 to 2 feet.	Severe: seasonal high water table at a depth of 1 to 2 feet; clay below a depth of 15 inches.
Dangberg, cold variant: DaA, DbB.	Unsuited: mostly fine-grained material.	Unsuited: mostly fine-grained material.	Poor: mostly CL and CH material; seasonal high water table at a depth of 1.5 to 3 feet; moderate to high shrink-swell potential.	Severe: hardpan at a depth of 1.3 to 2.3 feet; seasonal high water table at a depth of 1.5 to 3 feet.	Severe: hardpan at a depth of 1.3 to 2.3 feet; seasonal high water table at a depth of 1.5 to 3 feet.

## engineering properties—Continued

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Severe: CH material; high shrink-swell potential.	Severe: CH material; high shrink-swell potential.	Slopes up to 9 percent may restrict capacity; bedrock at a depth of 1.7 to 3.3 feet.	Mostly CH material; fair to poor stability; fair to good compaction characteristics; high shrink-swell potential.	Not applicable-----	Not applicable.
Moderate: moderate shrink-swell potential; high potential for frost action.	Severe: mostly CL material; high potential for frost action.	Moderately slow permeability.	Mostly CL, SM, or ML material; fair to poor stability; moderate to low compacted permeability.	Moderately slow permeability; saline; unit C <sub>h</sub> is underlain by clay at a depth of 40 inches; seasonal high water table at a depth of 6 to 7 feet.	Slow intake rate; moderately slow permeability; saline.
Severe: moderate to high shrink-swell potential; high potential for frost action.	Severe: mostly CL and CH material; moderate to high shrink-swell potential; high potential for frost action.	All features favorable.	Mostly CL and CH material; fair to poor stability; low compacted permeability; moderate to high shrink-swell potential.	Not applicable-----	Slow permeability; slow intake rate; saline.
Severe: seasonally ponded.	Severe: seasonally ponded; mostly CL or CH material; high potential for frost action.	Seasonally ponded; moderately slow permeability.	Mostly CL or CH material; fair to poor stability; low compacted permeability.	Seasonally ponded; moderately slow permeability.	Seasonally ponded; slow intake rate.
Severe: seasonal high water table at a depth of 1 to 2 feet; mostly CL and CH material; high shrink-swell potential.	Severe: seasonal high water table at a depth of 1 to 2 feet; mostly CL and CH material; high shrink-swell potential.	Seasonal high water table at a depth of 1 to 2 feet.	Mostly CL and CH material; fair to poor stability; low compacted permeability; high shrink-swell potential.	Slow permeability; seasonal high water table at a depth of 1 to 2 feet.	Slow permeability; seasonal high water table at a depth of 1 to 2 feet.
Severe: seasonal high water table at a depth of 1.5 to 3 feet; CL and CH material; moderate to high shrink-swell potential; hardpan at a depth of 1.3 to 2.3 feet.	Severe: seasonal high water table at a depth of 1.5 to 3 feet; hardpan at a depth of 1.3 to 2.3 feet; mostly CL and CH material.	Seasonal high water table at a depth of 1.5 to 3 feet; hardpan at a depth of 1.3 to 2.3 feet.	Mostly CL and CH material; fair to poor stability; low compacted permeability.	Seasonal high water table at a depth of 1.5 to 3 feet; hardpan at a depth of 1.3 to 2.3 feet; saline.	Very slow permeability; seasonal high water table at a depth of 1.5 to 3 feet; hardpan at a depth of 1.3 to 2.3 feet; saline.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
*Disabel: DC, DD2, DE, DM, DP. For Crutcher part of DD2, see Crutcher series. For Jesse Camp part of DE, see Jesse Camp series. For McConnell part of DM, see McConnell series. For Pegler part of DP, see Pegler series.	Unsuited: mostly CH material.	Unsuited: mostly CH material.	Poor: mostly CH material; high shrink-swell potential.	Severe: slow permeability.	Severe: clay and silty clay texture.
*Donica: DrB, DrE, DrF, DsE, DtC, Du. For Surprise part of Du, see Surprise series.	Poor: mostly GP, GM, or GP-GM material.	Fair: mostly GP, GM, or GP-GM material.	Good for units DrB, DtC, and Du: mostly GP, GM, or GP-GM material. Poor for units DrE, DrF, and DsE: most slopes are more than 25 percent.	Slight for units DrB, DtC, and Du. Severe for units DrE, DrF, and DsE: slopes of more than 25 percent.	Severe: very gravelly material.
*Espil: EB, EF, EM, EP. For Badland part of EB, see Badland. For Fertaline part of EF, see Fertaline series. For Mosquet part of EM, see Mosquet series. For Powley part of EP, see Powley series.	Unsuited: mostly SM, SC, or CH material; hardpan on bedrock at a depth of 0.7 to 1.2 feet.	Unsuited: mostly SM, SC, or CH material; hardpan on bedrock at a depth of 0.7 to 1.2 feet.	Poor: mostly SM, SC, or CH material; hardpan on bedrock at a depth of 0.7 to 1.2 feet.	Severe: hardpan on bedrock at a depth of 0.7 to 1.2 feet.	Severe: hardpan on bedrock at a depth of 0.7 to 1.2 feet.
Fertaline Mapped only in undifferentiated group with Espil soils.	Unsuited: mostly CH material; indurated hardpan at a depth of 1.5 to 2.5 feet.	Unsuited: mostly CH material; indurated hardpan at a depth of 1.5 to 2.5 feet.	Poor: mostly CH material; indurated hardpan at a depth of 1.5 to 2.5 feet.	Severe: very slow permeability.	Severe: clay material; indurated hardpan at a depth of 1.5 to 2.5 feet.
Four Star: Fo, Fr, Fs, Ft	Poor: mostly SM material.	Unsuited: mostly SM material.	Poor: mostly SM material; high potential for frost action; seasonal high water table at a depth of 1 to 3 feet.	Severe: seasonal high water table at a depth of 1 to 3 feet.	Severe: seasonal high water table at a depth of 1 to 3 feet.
Foxmount: FXE	Poor: mostly SM or SC material; bedrock at a depth of 2 to 3.3 feet.	Unsuited: mostly SM or SC material; bedrock at a depth of 2 to 3.3 feet.	Fair: mostly SM or SC material; includes some very cobbly material; slopes of 15 to 30 percent.	Severe: slopes of more than 15 percent.	Severe: bedrock at a depth of 2 to 3.3 feet; slopes of more than 15 percent.

engineering properties—Continued

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Severe: CH material; high shrink-swell potential.	Severe: CH material; high shrink-swell potential.	All features favorable.	Mostly CH material; fair to poor stability; fair to poor compaction characteristics; low compacted permeability; high shrink-swell potential.	Drainage required for reclamation; slow permeability; saline.	Slow permeability; saline.
Slight for units DrB, DtC, and Du. Severe for units DrE, DrF, and DsE: slopes of more than 15 percent.	Slight for units DrB, DtC, and Du. Severe for units DrE, DrF, and DsE: slopes of more than 15 percent.	Rapid permeability; slopes in units DrB, DtC, DrE, DrF, and DsE restrict storage capacity.	Mostly GP, GM, or GP-GM material; fair stability; high to moderate compacted permeability.	Not applicable-----	Low available water capacity for units DrB and Du; rapid permeability.
Severe: hardpan on bedrock at a depth of 0.7 to 1.2 feet.	Severe: hardpan on bedrock at a depth of 0.7 to 1.2 feet.	Hardpan on bedrock at a depth of 0.7 to 1.2 feet; slopes limit storage capacity.	Mostly SM, SC, or CH material at a depth of 0.7 to 1.2 feet; fair stability; low compacted permeability.	Not applicable-----	Not applicable.
Severe: high shrink-swell potential; indurated hardpan at a depth of 1.5 to 2.5 feet.	Severe: mostly CH material; high shrink-swell potential.	Slopes of up to 9 percent limit storage capacity.	Mostly CH material; fair to poor stability; fair to poor compaction characteristics; high shrink-swell potential.	Not applicable-----	Not applicable.
Severe: high potential for frost action; seasonal high water table at a depth of 1 to 3 feet.	Severe: high potential for frost action; seasonal high water table at a depth of 1 to 3 feet.	Seasonal high water table at a depth of 1 to 3 feet; moderately rapid permeability.	Mostly SM material; fair stability; moderate compacted permeability; poor resistance to piping.	Seasonal high water table at a depth of 1 to 3 feet; moderately rapid permeability unit Ft has slow permeability; below a depth of about 40 inches.	Seasonal high water table at a depth of 1 to 3 feet; unit Ft has slow permeability below a depth of about 40 inches.
Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.	Slopes restrict capacity; moderate permeability in material over bedrock.	Mostly SM or SC material; includes some very cobbly material; fair stability; low to moderate compacted permeability; fair resistance to piping.	Not applicable-----	Not applicable.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
Gorzell: GRE, GSC-----	Poor: SM or SC material above a depth of about 30 inches; GP-GM or GM material below a depth of 30 inches.	Fair: GP-GM or GM material below a depth of 30 inches.	Poor: mostly SM, SC, and GP-GM or GM material; high potential for frost action.	Severe: moderately slow permeability; unit GRE has slopes of more than 15 percent.	Severe: very gravelly material; unit GRE has slopes of more than 15 percent.
*Hapgood: HAE, HDG, HF, HG, HH, HI. For Home Camp part of HF, see Home Camp series. For Snag part of HG and HI, see Snag series. For Newlands part of HH and HI, see Newlands series.	Poor: mostly SM or SC material; stratified sand and gravel below a depth of 5 feet.	Unsuited: mostly SM or SC material; stratified sand and gravel below a depth of 5 feet.	Poor: mostly SM or SC material; moderate shrink-swell potential; high potential for frost action; bedrock at a depth of 3.3 to 5 feet.	Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.
Hart Camp----- Mapped only as a part of the Powley-Espil association.	Unsuited: mostly SC material; bedrock at a depth of 0.8 to 1.7 feet.	Unsuited: mostly SC material; bedrock at a depth of 0.8 to 1.7 feet.	Poor: mostly SC material; bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.
*Hartig: HK----- For Hapgood part of this unit, see Hapgood series.	Poor: mostly SM material; bedrock at a depth of 1.7 to 3.3 feet.	Unsuited: mostly SM material; bedrock at a depth of 1.7 to 3.3 feet.	Fair: mostly cobbly SM material; moderate potential for frost action.	Severe: bedrock at a depth of 1.7 to 3.3 feet; slopes of more than 15 percent.	Severe: bedrock at a depth of 1.7 to 3.3 feet; slopes of more than 15 percent.
*Home Camp: HL, HME, HMF. For Hapgood part of HL, see Hapgood series. For Newlands part of HME and HMF, see Newlands series.	Unsuited: mostly GC and SC or CL material; bedrock at a depth of 1.7 to 3.3 feet.	Unsuited: mostly GC and SC or CL material; bedrock at a depth of 1.7 to 3.3 feet.	Fair for units HL and HME: mostly SC material; slopes of 5 to 30 percent. Poor for unit HMF: slopes of 30 to 50 percent.	Severe: most slopes are more than 15 percent; bedrock at a depth of 1.7 to 3.3 feet.	Severe: most slopes are more than 15 percent; bedrock at a depth of 1.7 to 3.3 feet.
Hovey: Hn, Ho-----	Unsuited: mostly CL or MH material.	Unsuited: mostly CL or MH material.	Poor: mostly CL or MH material; seasonal high water table at a depth of 2 to 3 feet.	Severe: slow permeability; seasonal high water table at a depth of 2 to 3 feet.	Severe: seasonal high water table at a depth of 2 to 3 feet.

## engineering properties—Continued

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Moderate for unit GSC: slopes of 5 to 9 percent. Severe for unit GRE: slopes of more than 15 percent.	Moderate for unit GSC: slopes of 5 to 9 percent. Severe for unit GRE: slopes of more than 15 percent.	Rapid permeability below a depth of 30 inches; slopes restrict capacity.	Mostly SC material above a depth of 30 inches; fair stability; low compacted permeability. Pervious GP-GM or GM material below a depth of 30 inches.	Not applicable-----	Not applicable.
Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.	Fractured bedrock at a depth of 3.3 to 5 feet; moderate permeability; slopes restrict capacity.	Mostly SM or SC material; fair stability; low to moderate compacted permeability; fair resistance to piping.	Not applicable-----	Not applicable.
Severe: bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.	Moderately slow permeability; bedrock at a depth of 0.8 to 1.7 feet; slopes restrict capacity.	Mostly SC material; fair stability; low compacted permeability; bedrock at a depth of 0.8 to 1.7 feet.	Not applicable-----	Not applicable.
Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.	Moderate permeability in material on bedrock; slopes restrict capacity.	Mostly cobbly SM material; fair stability; moderate compacted permeability; poor resistance to piping.	Not applicable-----	Not applicable.
Severe: most slopes are more than 15 percent.	Severe: most slopes are more than 15 percent.	Bedrock at a depth of 1.7 to 3.3 feet; slopes restrict capacity.	Mostly GC and SC or CL material; fair stability; low compacted permeability.	Not applicable-----	Not applicable.
Severe: high potential for frost action; seasonal high water table at a depth of 2 to 3 feet; moderate shrink-swell potential.	Severe: high potential for frost action; seasonal high water table at a depth of 2 to 3 feet; moderate shrink-swell potential.	Seasonal high water table at a depth of 2 to 3 feet.	Mostly CL or MH material; poor stability; medium to high compressibility.	Seasonal high water table at a depth of 2 to 3 feet; slow permeability; saline.	Seasonal high water table at a depth of 2 to 3 feet; slow permeability; slow intake rate; saline.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
*Hussa: HrA, HrB, HsA, HuA, HvA, HwA, Hz. For Couch part of Hz, see Couch series.	Unsuited: mostly CL material.	Unsuited: mostly CL material.	Poor: mostly CL material; moderate shrink-swell potential; high potential for frost action.	Severe: seasonal high water table at a depth of 2 to 4 feet; moderately slow permea- bility.	Severe: seasonal high water table at a depth of 2 to 4 feet.
HxB, HyB-----	Unsuited: mostly CL material.	Unsuited: mostly CL material.	Poor: mostly CL material; moderate shrink-swell potential; high potential for frost action; seasonal high water table at a depth of 1 to 2 feet.	Severe: seasonal high water table at a depth of 1 to 2 feet.	Severe: seasonal high water table at a depth of 1 to 2 feet.
Jesse Camp: JcA, JcB, JeA--	Unsuited: mostly ML or CL material.	Unsuited: mostly ML or CL material.	Poor: mostly ML or CL material; high potential for frost action.	Moderate: moderate per- meability.	Moderate: silt loam and very fine sandy loam texture.
Karlo: KAB-----	Unsuited: mostly CH material.	Unsuited: mostly CH material.	Poor: mostly CH material; high shrink- swell potential.	Severe: slow permeability; bedrock at a depth of 1.7 to 3.3 feet.	Severe: clay texture; bed- rock at a depth of 1.7 to 3.3 feet.
Kisring: Kr, Ks-----	Unsuited: mostly fine- grained material.	Unsuited: mostly fine- grained material.	Poor: mostly CL or CH and ML or CL material high potential for frost action; moderate to high shrink- swell potential.	Severe: seasonal high water table at a depth of less than 5 feet; slow per- meability.	Moderate for unit Kr: seasonal high water table at a depth of 3 to 5 feet. Severe for unit Ks: sea- sonal high water table at a depth of 1 to 2 feet.
Langston----- Mapped only in associa- tion with Old Camp soils.	Fair: mostly SW-SM or SP-SM material below a depth of about 15 inches.	Poor: mostly SW-SM or SP-SM material below a depth of about 15 inches.	Good: mostly SW-SM or SP-SM material below a depth of about 15 inches.	Slight: all features favorable.	Severe: very gravelly sands.
*Lolak: LK, Lm, LN----- For Zorravista part of LN, see Zorravista series.	Unsuited: CH material.	Unsuited: CH material.	Poor: CH ma- terial; high shrink-swell potential; seasonal high water table at a depth of 4 to 5 feet.	Severe: very slow permea- bility; seasonal high water table at a depth of 4 to 5 feet.	Severe: clay textured mate- rial; seasonal high water table at a depth of 4 to 5 feet.

## engineering properties—Continued

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Moderate: seasonal high water table at a depth of 2 to 4 feet; moderate shrink-swell potential.	Severe: high potential for frost action; seasonal high water table at a depth of 2 to 4 feet.	Seasonal high water table at a depth of 2 to 4 feet.	Mostly CL material; fair stability; low compacted permeability.	Seasonal high water table at a depth of 2 to 4 feet; some units saline; moderately slow permeability.	Seasonal high water table at a depth of 2 to 4 feet; some units saline; moderately slow permeability.
Severe: seasonal high water table at a depth of 1 to 2 feet.	Severe: high potential for frost action; seasonal high water table at a depth of 1 to 2 feet.	Seasonal high water table at a depth of 1 to 2 feet.	Mostly CL material; fair stability; low compacted permeability.	Seasonal high water table at a depth of 1 to 2 feet; moderately slow permeability.	Seasonal high water table at a depth of 1 to 2 feet; moderately slow permeability.
Severe: mostly ML or CL material; moderate shrink-swell potential; high potential for frost action.	Severe: mostly ML or CL material; high potential for frost action.	Moderate permeability.	Mostly ML or CL material; fair to poor stability; moderate to low compacted permeability; fair to poor resistance to piping.	Not applicable-----	Slow intake rate; low to moderate salinity.
Severe: high shrink-swell potential.	Severe: mostly CH material; high shrink-swell potential.	Bedrock at a depth of 1.7 to 3.3 feet.	Mostly CH material; fair to poor stability; high shrink-swell potential; high compressibility.	Not applicable-----	Not applicable.
Severe: high potential for frost action; moderate to high shrink-swell potential; seasonal high water table at a depth of less than 5 feet.	Severe: mostly CL or CH and ML or CL material; high potential for frost action; seasonal high water table at a depth of less than 3 feet.	Seasonal high water table in unit Kr at a depth of 3 to 5 feet; seasonal high water table in unit Ks at a depth of 1 to 2 feet.	Mostly CL or CH and ML or CL material; fair to poor stability; medium compressibility; fair to good resistance to piping.	Slow permeability; saline; seasonal high water table in unit Kr at a depth of 3 to 5 feet; seasonal high water table in unit Ks at a depth of 1 to 2 feet.	Slow permeability; saline; seasonal high water table in unit Kr at a depth of 3 to 5 feet; seasonal high water table in unit Ks at a depth of 1 to 2 feet.
Slight: all features favorable.	Slight: all features favorable.	Rapid and very rapid permeability below a depth of about 15 inches.	Mostly SW-SM or SP-SM material; fair stability; high compacted permeability; fair resistance to piping.	Not applicable-----	Not applicable.
Severe: CH material; high shrink-swell potential.	Severe: CH material; high shrink-swell potential.	Seasonal high water table at a depth of 4 to 5 feet.	CH material; fair to poor stability; high compressibility; high shrink-swell potential.	Not applicable-----	Not applicable.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
Longval: LOC-----	Poor: mostly SM material; bedrock at a depth of 1.7 to 3.3 feet.	Unsuited: SM material; bedrock at a depth of 1.7 to 3.3 feet.	Poor: SM material; high potential for frost action.	Severe: bedrock at a depth of 1.7 to 3.3 feet.	Severe: bedrock at a depth of 1.7 to 3.3 feet.
Lyonman: LYE, LYF-----	Unsuited: mostly CL material.	Unsuited: mostly CL material.	Poor: CL material; high potential for frost action; cobbly material; slopes mostly more than 25 percent.	Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.
Madeline: MAD, MAF-----	Unsuited: SC material; bedrock at a depth of 0.8 to 1.7 feet.	Unsuited: SC material; bedrock at a depth of 0.8 to 1.7 feet.	Poor: very stony SC material; bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet; unit MAD has slopes of 2 to 30 percent; unit MAF has slopes of 30 to 50 percent.	Severe: bedrock at a depth of 0.8 to 1.7 feet; unit MAD has slopes of 2 to 30 percent; unit MAF has slopes of 30 to 50 percent.
Marsh: Mh-----	Unsuited: ponded for most of year.	Unsuited: ponded for most of year.	Poor: ponded for most of year; variable material including organic matter.	Severe: ponded for most of year; variable material including organic matter.	Severe: ponded for most of year.
Mascamp: MLC-----	Unsuited: extremely cobbly and stony SC material; bedrock at a depth of 0.8 to 1.7 feet.	Unsuited: extremely cobbly and stony SC material; bedrock at a depth of 0.8 to 1.7 feet.	Poor: extremely cobbly and stony SC material; bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.
*McConnel: MMB, MNA, MO. For Badland part of MO, see Badland.	Fair: GP-GM or GM and GW or GP material.	Fair to good: GP-GM or GM and GW or GP material.	Good: GP-GM or GM and GW or GP material.	Slight: all features favorable; contamination of ground water is a hazard.	Severe: very gravelly sand texture.
Mendeboure----- Mapped only in association with Rubble land.	Unsuited: very stony SC or CL material; bedrock at a depth of 1.7 to 3.3 feet.	Unsuited: very stony SC or CL material; bedrock at a depth of 1.7 to 3.3 feet.	Poor: very stony SC or CL material; slopes of 30 to 50 percent; bedrock at a depth of 1.7 to 3.3 feet.	Severe: bedrock at a depth of 1.7 to 3.3 feet; slopes of 30 to 50 percent.	Severe: bedrock at a depth of 1.7 to 3.3 feet; slopes of 30 to 50 percent; very stony material.
*Mosquet: MS----- For Home Camp part of this unit, see Home Camp series.	Unsuited: very stony SC or CL material; bedrock at a depth of 0.5 to 2 feet.	Unsuited: very stony SC or CL material; bedrock at a depth of 0.5 to 2 feet.	Poor: very stony SC or CL material; bedrock at a depth of 0.5 to 2 feet.	Severe: bedrock at a depth of 0.5 to 2 feet; slopes of 5 to 30 percent.	Severe: bedrock at a depth of 0.5 to 2 feet; slopes of 5 to 30 percent; very stony material.

## engineering properties—Continued

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Severe: SM material; high potential for frost action.	Severe: SM material; high potential for frost action.	Moderately rapid permeability; bedrock at a depth of 1.7 to 3.3 feet.	SM material; fair stability; moderate compacted permeability; poor resistance to piping.	Not applicable-----	Not applicable.
Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent; CL material has high potential for frost action.	Slopes restrict capacity; bedrock at a depth of 3.3 to 5 feet.	CL material; fair stability; medium to high compressibility.	Not applicable-----	Not applicable.
Severe: bedrock at a depth of 0.8 to 1.7 feet; unit MAD has slopes of 2 to 30 percent; unit MAF has slopes of 30 to 50 percent.	Severe: bedrock at a depth of 0.8 to 1.7 feet; very stony CL material; unit MAD has slopes of 2 to 30 percent; unit MAF has slopes of 30 to 50 percent.	Slow permeability; bedrock at a depth of 0.8 to 1.7 feet; slopes restrict capacity.	Very stony CL material; bedrock at a depth of 0.8 to 1.7 feet.	Not applicable-----	Not applicable.
Severe: ponded for most of year; variable material including organic matter.	Severe: ponded for most of year; variable material including organic matter.	Ponded for most of year; variable material.	Ponded for most of year; variable material including organic matter.	Not applicable-----	Not applicable.
Severe: bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.	Slopes restrict capacity; bedrock at a depth of 0.8 to 1.7 feet.	Extremely cobbly and stony SC material; bedrock at a depth of 0.8 to 1.7 feet.	Not applicable-----	Not applicable.
Slight: all features favorable.	Slight: all features favorable.	Rapid and very rapid permeability.	GP-GM or GM and GW or GP material; fair to good stability; high compacted permeability.	Not applicable-----	Not applicable.
Severe: slopes of 30 to 50 percent.	Severe: very stony SC or CL material; slopes of 30 to 50 percent.	Slopes restrict capacity; bedrock at a depth of 1.7 to 3.3 feet.	Very stony SC or CL material; fair stability; bedrock at a depth of 1.7 to 3.3 feet.	Not applicable-----	Not applicable.
Severe: bedrock at a depth of 0.5 to 2 feet; slopes of 5 to 30 percent.	Severe: bedrock at a depth of 0.5 to 2 feet; slopes of 5 to 30 percent; very stony SC or CL material.	Slopes restrict capacity; bedrock at a depth of 0.5 to 2 feet.	Very stony SC or CL material; fair stability; bedrock at a depth of 0.5 to 2 feet.	Not applicable-----	Not applicable.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
Nevador: NdA, NdB, NeA, NeB.	Poor: SM material; 15 to 30 percent fines below a depth of 36 inches; stratified sand and gravel below a depth of 5 feet.	Unsuited: mostly CL and SM material; stratified sand and gravel below a depth of 5 feet.	Fair above a depth of 3 feet: mostly CL and SM or ML material; high potential for frost action. Fair below a depth of 3 feet: mostly SM material; moderate potential for frost action.	Moderate: moderate permeability below a depth of 1.5 feet; moderately rapid permeability below a depth of 3 feet; contamination of ground water is a hazard.	Severe: sandy texture below a depth of 3 feet.
*Newlands: NH For Hapgood part of this unit, see Hapgood series.	Unsuited: CL material; bedrock at a depth of 2.3 to 5 feet.	Unsuited: CL material; bedrock at a depth of 2.3 to 5 feet.	Poor: CL material; high potential for frost action; bedrock at a depth of 2.3 to 5 feet.	Severe: moderately slow permeability; slopes of 5 to 30 percent.	Moderate to severe: bedrock at a depth of 2.3 to 5 feet; CL material; slopes of 5 to 30 percent.
*Ninemile: NK For Karlo part of this unit, see Karlo series.	Unsuited: CL or CH material; bedrock at a depth of 0.8 to 1.7 feet.	Unsuited: CL or CH material; bedrock at a depth of 0.8 to 1.7 feet.	Poor: CL or CH material; high shrink-swell potential; bedrock at a depth of 0.8 to 1.7 feet.	Severe: very slow permeability; bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.
*Old Camp: OC, OG For Langston part of OG, see Langston series.	Unsuited: stony and cobbly GC material; bedrock at a depth of 0.8 to 1.7 feet.	Unsuited: stony and cobbly GC material; bedrock at a depth of 0.8 to 1.7 feet.	Poor: stony and cobbly GC material; bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.
*Olson: OS For Badland part of this unit, see Badland.	Good source below hardpan at a depth of about 1.7 feet; stratified sand and gravel below a depth of 5 feet.	Poor source below hardpan at a depth of about 1.7 feet; stratified sand and gravel below a depth of 5 feet.	Good: SM material; 10 to 20 percent fines below hardpan at a depth of about 1.7 feet; stratified sand and gravel below a depth of 5 feet.	Severe: indurated hardpan at a depth of 0.8 to 1.7 feet.	Severe: indurated hardpan at a depth of 0.8 to 1.7 feet; gravelly loamy sand below a depth of 1.7 feet.
Pegler Mapped only in association with Disabel and Vylach soils.	Unsuited: SC or CL material; bedrock at a depth of 0.7 to 1.1 feet.	Unsuited: SC or CL material; bedrock at a depth of 0.7 to 1.1 feet.	Poor: SC or CL material; bedrock at a depth of 0.7 to 1.1 feet.	Severe: fractured bedrock at a depth of 0.7 to 1.1 feet.	Severe: bedrock at a depth of 0.7 to 1.1 feet.
Playas: PA	Unsuited: fine-grained material.	Unsuited: fine-grained material.	Poor: mostly silty and clayey material; intermittently ponded.	Severe: intermittently ponded; very slow permeability.	Severe: intermittently ponded.

## engineering properties—Continued

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Severe: CL and SM or ML material; high potential for frost action.	Severe: mostly CL, SM or ML, and SM material; high to moderate potential for frost action.	Moderate and moderately rapid permeability below a depth of 1.5 feet.	Mostly CL, SM or ML, and SM material; fair stability; moderate compacted permeability; fair to poor resistance to piping.	Not applicable-----	Moderate available water capacity; units NdB and NeB subject to erosion because of slopes of 2 to 5 percent.
Severe: CL material; high potential for frost action; slopes of 5 to 30 percent.	Severe: CL material; high potential for frost action; slopes of 5 to 30 percent.	Slopes restrict capacity; bedrock at a depth of 2.3 to 5 feet.	CL material; fair stability; low compacted permeability; medium to high compressibility.	Not applicable-----	Not applicable.
Severe: bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.	Slopes restrict capacity; bedrock at a depth of 0.8 to 1.7 feet.	CL or CH material; high shrink-swell potential; fair to poor stability; high compressibility; bedrock at a depth of 0.8 to 1.7 feet.	Not applicable-----	Not applicable.
Severe: bedrock at a depth of 0.8 to 1.7 feet.	Severe: bedrock at a depth of 0.8 to 1.7 feet.	Slopes restrict capacity; bedrock at a depth of 0.8 to 1.7 feet.	Stony and cobbly GC material; bedrock at a depth of 0.8 to 1.7 feet.	Not applicable-----	Not applicable.
Severe: indurated hardpan at a depth of 0.8 to 1.7 feet.	Severe: indurated hardpan at a depth of 0.8 to 1.7 feet; SM material below hardpan.	Indurated hardpan at a depth of 0.8 to 1.7 feet; slopes restrict capacity; rapid permeability in material below hardpan.	SC or GC material; fair stability; low compacted permeability. SM material below hardpan; fair stability; high compacted permeability.	Not applicable-----	Not applicable.
Severe: bedrock at a depth of 0.7 to 1.1 feet.	Severe: bedrock at a depth of 0.7 to 1.1 feet.	Fractured bedrock at a depth of 0.7 to 1.1 feet.	SC or CL material; bedrock at a depth of 0.7 to 1.1 feet.	Not applicable-----	Not applicable.
Severe: intermittently ponded.	Severe: intermittently ponded; clayey and silty material.	Intermittently ponded.	Clayey and silty material; poor stability; high compressibility; fair to poor resistance to piping	Not applicable-----	Not applicable.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
*Powley: PGC, PH, PM----- For Espil part of PH, see Espil series. For Mascamp part of PM, see Mascamp series.	Unsuited: SC and CH material; indurated hardpan at a depth of 1.4 to 1.7 feet.	Unsuited: SC and CH material; indurated hardpan at a depth of 1.4 to 1.7 feet.	Poor: SC and CH material; high shrink-swell potential; indurated hardpan at a depth of 1.4 to 1.7 feet.	Severe: very slow permeability; indurated hardpan at a depth of 1.4 to 1.7 feet.	Severe: indurated hardpan at a depth of 1.4 to 1.7 feet.
Raglan: RAB, RgA-----	Unsuited: ML material.	Unsuited: ML material.	Poor: ML material; high potential for frost action.	Severe: moderately slow permeability.	Slight: all features favorable.
Riverwash: RH-----	Variable-----	Variable-----	Variable-----	Severe: overflowed.	Variable-----
Rock outcrop----- Mapped only in undifferentiated group with Rubble land.	Unsuited-----	Unsuited-----	Unsuited-----	Not applicable-----	Severe: bedrock at surface.
*Rubble land: RM, RN, RR----- For Home Camp part of RM, see Home Camp series. For Mendeboure part of RN, see Mendeboure series. For Rock outcrop part of RR, see Rock outcrop.	Unsuited-----	Unsuited-----	Unsuited-----	Severe: slopes of more than 15 percent; extremely stony and bouldery.	Severe: extremely stony and bouldery.
Schamp: SCE-----	Unsuited: CH and SC material.	Unsuited: CH and SC material.	Poor: CH and SC material; high shrink-swell potential.	Severe: moderately slow permeability; slopes of 2 to 30 percent.	Severe: clay textured material; slopes of 2 to 30 percent.
Simpson: SdB, SGC, SmA-----	Good below a depth of about 2.5 feet: mostly SP-SM material; stratified sand and gravel below a depth of 5 feet.	Fair below a depth of about 2.5 feet: mostly SP-SM material; stratified sand and gravel below a depth of 5 feet.	Good below a depth of about 2.5 feet: mostly SP-SM material; stratified sand and gravel below a depth of 5 feet.	Slight: rapid permeability below a depth of about 2.5 feet; contamination of ground water is a hazard.	Severe: loamy sand and very gravelly sand below a depth of about 2.5 feet; contamination of ground water is a hazard.
Snag: SNF-----	Unsuited: mostly SM material; 30 to 50 percent fines.	Unsuited: mostly SM material; 30 to 50 percent fines.	Poor: very stony SM material; slopes of 30 to 50 percent.	Severe: bedrock at a depth of 3.3 to 5 feet; slopes of 30 to 50 percent.	Severe: very stony material; slopes of 30 to 50 percent.

## engineering properties—Continued

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Severe: indurated hardpan at a depth of 1.4 to 1.7 feet.	Severe: indurated hardpan at a depth of 1.4 to 1.7 feet.	Indurated hardpan at a depth of 1.4 to 1.7 feet; slopes restrict capacity.	SC and CH material; indurated hardpan at a depth of 1.4 to 1.7 feet.	Not applicable.....	Not applicable.
Severe: ML material; high potential for frost action.	Severe: ML material; high potential for frost action.	Moderately slow permeability.	ML material; poor stability; poor compaction characteristics; moderate compacted permeability; poor resistance to piping.	Not applicable.....	Slow intake rate; salinity in areas converted to irrigated cropland.
Severe: overflowed.	Severe: overflowed.	Variable.....	Variable.....	Not applicable.....	Not applicable.
Severe: bedrock at surface.	Severe: bedrock at surface.	Variable.....	Not applicable.....	Not applicable.....	Not applicable.
Severe: extremely stony and bouldery.	Severe: extremely stony and bouldery.	Variable.....	Stones and boulders good source of riprap material.	Not applicable.....	Not applicable.
Severe: high shrink-swell potential; slopes of 2 to 30 percent.	Severe: CH material; high shrink-swell potential; slopes of 2 to 30 percent.	Slopes restrict capacity.	Mostly CH and SC material; fair to poor stability; high shrink-swell potential; medium to high compressibility.	Not applicable.....	Not applicable.
Severe: SC and SM material; high potential for frost action.	Severe: SC and SM material; high potential for frost action.	Rapid permeability in material at a depth of about 2.5 feet.	Mostly SC and SM material; fair stability; medium to low compacted permeability; good to poor resistance to piping.	Not applicable.....	Moderate available water capacity units SdB and SGC are erodible because of slope.
Severe: slopes of 30 to 50 percent.	Severe: very stony SM material; high potential for frost action; slopes of 30 to 50 percent.	Slopes restrict capacity; moderately rapid permeability; bedrock at a depth of 3.3 to 5 feet.	Mostly very stony SM material; fair stability; moderate compacted permeability; poor resistance to piping.	Not applicable.....	Not applicable.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
Surprise: SrA, SrB, SrC-----	Poor: mostly SM and GM material; stratified sand and gravel below a depth of 5 feet.	Poor source of GM material below a depth of about 3 to 4 feet; stratified sand and gravel below a depth of 5 feet.	Moderate: mostly SM material; moderate potential for frost action; stratified sand and gravel below a depth of 5 feet.	Slight: all features favorable; contamination of ground water is a hazard.	Moderate: gravelly texture.
*Suryya: SUB2, SV----- For Zorravista part of SV, see Zorravista series.	Fair below a depth of about 1 foot: mostly GP-GM material; stratified sand and gravel below a depth of 5 feet.	Fair below a depth of about 1 foot: mostly GP-GM material; stratified sand and gravel below a depth of 5 feet.	Good: mostly GP-GM material; stratified sand and gravel below a depth of 5 feet.	Slight: all features favorable; contamination of ground water is a hazard.	Severe: very gravelly sand texture.
Survyya, hardpan variant: SYB2.	Poor: SM material below a depth of about 2.5 feet; 15 to 25 percent fines; stratified sand and gravel below a depth of 5 feet.	Unsuited: SM material below a depth of about 2.5 feet; 15 to 25 percent fines; stratified sand and gravel below a depth of 5 feet.	Good: SM material below a depth of about 2.5 feet; stratified sand and gravel below a depth of 5 feet.	Severe: silica-cemented hardpan at a depth of about 10 to 25 inches.	Severe: silica-cemented hardpan at a depth of about 10 to 25 inches.
*Toney: TN----- For Ninemile part of this unit, see Ninemile series.	Unsuited: CH material; bedrock at a depth of 1.7 to 3.3 feet.	Unsuited: CH material; bedrock at a depth of 1.7 to 3.3 feet.	Poor: CH material; high shrink-swell potential; bedrock at a depth of 1.7 to 3.3 feet.	Severe: very slow permeability; bedrock at a depth of 1.7 to 3.3 feet.	Severe: clay material; bedrock at a depth of 1.7 to 3.3 feet.
Tourn: TOC-----	Unsuited: mostly SC material; bedrock at a depth of 1.7 to 3.3 feet.	Unsuited: mostly SC material; bedrock at a depth of 1.7 to 3.3 feet.	Poor: mostly SC material; bedrock at a depth of 1.7 to 3.3 feet; moderate shrink-swell potential; high potential for frost action.	Severe: bedrock at a depth of 1.7 to 3.3 feet; moderately slow permeability.	Severe: bedrock at a depth of 1.7 to 3.3 feet.
*Vylach: VP, VY----- For Pegler part of these units, see Pegler series.	Unsuited: mostly SC or CL material; silica-cemented hardpan on bedrock at a depth of 0.8 to 1.7 feet.	Unsuited: mostly SC or CL material; silica-cemented hardpan on bedrock at a depth of 0.8 to 1.7 feet.	Poor: mostly SC or CL material; high potential for frost action; silica-cemented hardpan on bedrock at a depth of 0.8 to 1.7 feet.	Severe: silica-cemented hardpan on bedrock at a depth of 0.8 to 1.7 feet.	Severe: silica-cemented hardpan on bedrock at a depth of 0.8 to 1.7 feet.

## engineering properties—Continued

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Moderate: moderate potential for frost action.	Moderate: moderate potential for frost action.	Moderately rapid permeability.	Mostly SM material; fair stability; moderate compacted permeability; poor resistance to piping.	Not applicable-----	Moderate available water capacity; units SrB and SrC are erodible because of slope.
Slight: all features favorable.	Slight: all features favorable.	Very rapid permeability.	Mostly GP-GM material; fair stability; high compacted permeability; fair resistance to piping.	Not applicable-----	Not applicable.
Severe: silica-cemented hardpan at a depth of about 10 to 25 inches.	Severe: silica-cemented hardpan at a depth of about 10 to 25 inches.	Silica-cemented hardpan at a depth of about 10 to 25 inches; rapid permeability in material below a depth of about 2.5 feet.	Mostly SM material below a depth of 2.5 feet; fair stability; moderate compacted permeability; poor resistance to piping.	Not applicable-----	Not applicable.
Severe: CH material; high shrink-swell potential.	Severe: CH material; high shrink-swell potential; bedrock at a depth of 1.7 to 3.3 feet.	Bedrock at a depth of 1.7 to 3.3 feet; slopes restrict capacity.	CH material; fair to poor stability; high compressibility.	Not applicable-----	Not applicable.
Moderate: SC material; moderate shrink-swell potential; slopes of 2 to 15 percent.	Severe: SC material; moderate shrink-swell potential; high potential for frost action.	Bedrock at a depth of 1.7 to 3.3 feet; slopes restrict capacity.	SC material; fair stability; low compacted permeability.	Not applicable-----	Not applicable.
Severe: silica-cemented hardpan on bedrock at a depth of 0.8 to 1.7 feet.	Severe: silica-cemented hardpan on bedrock at a depth of 0.8 to 1.7 feet.	Bedrock at a depth of 0.8 to 1.7 feet.	Mostly SC or CL material; silica-cemented hardpan on bedrock at a depth of 0.8 to 1.7 feet.	Not applicable-----	Not applicable.

TABLE 5.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil limitations for—	
	Sand	Gravel	Road fill	Septic tank filter fields	Shallow excavations
*Waca: WAE, WAF, WAG, WD, WE. For Hapgood part of WD, see Hapgood series. For Snag part of WE, see Snag series.	Poor: mostly GM material; bedrock at a depth of 1.7 to 3.3 feet.	Poor: mostly GM material; bedrock at a depth of 1.7 to 3.3 feet.	Fair for units WAE and WD: GM material; slopes of 5 to 30 percent. Poor for units WAF, WAG, and WE: GM material; slopes of more than 30 percent.	Severe: bedrock at a depth of 1.7 to 3.3 feet.	Severe: very gravelly texture; bedrock at a depth of 1.7 to 3.3 feet.
Waca, shallow variant: WFF	Poor: mostly GM material; bedrock at a depth of 0.8 to 1.7 feet.	Poor: mostly GM material; bedrock at a depth of 0.8 to 1.7 feet.	Poor: mostly GM material; bedrock at a depth of 0.8 to 1.7 feet; slopes of 15 to 50 percent.	Severe: bedrock at a depth of 0.8 to 1.7 feet; slopes of 15 to 50 percent.	Severe: bedrock at a depth of 0.8 to 1.7 feet; slopes of 15 to 50 percent.
Weimer: Wm, Wp, Ws	Unsuited: CH material; ponds for short periods.	Unsuited: CH material; ponds for short periods.	Poor: CH material; high shrink-swell potential; seasonal high water table at a depth of 0 to 3 feet.	Severe: very slow permeability; seasonal high water table at a depth of 0 to 3 feet; ponds for short periods.	Severe: CH material; seasonal high water table at a depth of 0 to 3 feet; ponds for short periods.
Welch: WvB	Unsuited: CL or CH material; subject to flooding.	Unsuited: CL or CH material; subject to flooding.	Poor: CL or CH material; moderate shrink-swell potential; seasonal high water table at a depth of 1.5 to 3 feet.	Severe: seasonal high water table at a depth of 1.5 to 3 feet; subject to flooding.	Severe: seasonal high water table at a depth of 1.5 to 3 feet; subject to flooding.
*Zorravista: ZcC, ZR For Couch part of ZR, see Couch series.	Fair: SM material; 20 to 35 percent fines.	Unsuited: SM material; no gravel.	Moderate: SM material; moderate potential for frost action.	Slight to moderate: slopes of 0 to 15 percent; contamination of ground water is a hazard.	Severe: loose sandy material.

*engineering properties—Continued*

Soil limitations for—Continued		Soil features affecting—			
Dwellings without basements	Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Cropland and pasture drainage	Irrigation
Moderate to severe for units WAE and WD: slopes of 5 to 30 percent. Severe for units WAF, WAG, and WE: slopes of 30 to 70 percent.	Moderate to severe for units WAE and WD: slopes of 5 to 30 percent. Severe for units WAF, WAG, and WE: slopes of 30 to 70 percent.	Rapid permeability; slopes restrict capacity; bedrock at a depth of 1.7 to 3.3 feet.	Mostly GM material; fair stability; moderate compacted permeability.	Not applicable-----	Not applicable.
Severe: bedrock at a depth of 0.8 to 1.7 feet; slopes of 15 to 50 percent.	Severe: bedrock at a depth of 0.8 to 1.7 feet; slopes of 15 to 50 percent.	Slopes restrict capacity; bedrock at a depth of 0.8 to 1.7 feet.	Mostly GM material; fair stability; moderate compacted permeability; bedrock at a depth of 0.8 to 1.7 feet.	Not applicable-----	Not applicable.
Severe: CH material; seasonal high water table at a depth of 0 to 3 feet; ponds for short periods.	Severe: CH material; high shrink-swell potential; seasonal high water table at a depth of 0 to 3 feet; ponds for short periods.	Seasonal high water table at a depth of 0 to 3 feet; ponds for short periods.	CH material; fair to poor stability; high compressibility.	Not applicable-----	Not applicable.
Severe: seasonal high water table at a depth of 1.5 to 3 feet; subject to flooding.	Severe: seasonal high water table at a depth of 1.5 to 3 feet; subject to flooding.	Seasonal high water table at a depth of 1.5 to 3 feet.	CL or CH material; fair to poor stability; medium to high compressibility.	Seasonal high water table at a depth of 1.5 to 3 feet; subject to flooding; subject to gullyng; moderately slow permeability.	Seasonal high water table at a depth of 1.5 to 3 feet; subject to flooding; subject to gullyng.
Slight to moderate: slopes of 0 to 15 percent.	Moderate: slopes of 0 to 15 percent; moderate potential for frost action.	Very rapid permeability.	SM material; 20 to 35 percent fines; fair stability; high compacted permeability; poor resistance to piping.	Not applicable-----	Not applicable.

TABLE 6.—*Engineering*  
[Tests performed by California]

Soil name and location of sample	Parent material	Report number	Depth	Moisture-density data <sup>1</sup>		Mechanical analysis <sup>2</sup>		
				Maximum dry density	Optimum moisture	Percentage passing sieve—		
						2 in.	1½ in.	1 in.
Bidwell loam Modoc County, Calif., 1.25 mi. N. of junction of Calif. Hwy. 299 and Surprise Valley Rd. 2,500 ft. N. and 2,600 ft. W. of SE. corner of sec. 32, T. 43 N., R. 16 E., Mount Diablo base line and meridian.	Alluvium derived from tuff and basalt.	D-31792	In. 0-10	102.1	Pct. 11.0			
Cummings muck, clay subsoil variant Modoc County, Calif., 1,400 ft. N. and 50 ft. E. of S. quarter of corner sec. 33, T. 39 N., R. 17 E., Mount Diablo base line and meridian.	Volcanic ash superimposed on clayey lacustrine material derived from tuff and basic volcanic rock.	D-31782 D-31783	8-15 15-38	55.5 86.6	54.4 15.4			
Gorzell gravelly loam Modoc County, Calif., approximately 150 ft. N. and E. of apparent center of sec. 29, T. 45 N., R. 17 E., Mount Diablo base line and meridian.	Alluvium and lacustrine material derived from tuff, andesite, and basalt.	D-31790 D-31791	0-8 8-12	113.7 109.0	14.4 16.7			100 100
Hovey silty clay loam Modoc County, Calif., about 3 mi. SE. of Fort Bidwell and 350 ft. S. and 1,200 ft. W. of N. quarter corner of sec. 23, T. 46 N., R. 16 E.	Silty alluvium derived from basic rock and modified by limy ground water.	D-31788 D-31789	0-8 8-30	74.9 80.0	35.9 36.0			
Madeline gravelly clay loam Lassen County, Calif., 4.9 mi. easterly from Madeline Post Office near center of sec. 19, T. 38 N., R. 18 E., Mount Diablo base line and meridian.	Alluvium derived primarily from tuff and basalt and minor admixtures of volcanic ash.	D-31793 D-31794	0-8 8-14	102.8 86.5	18.6 29.0	100	99 100	97 99
Newlands loam Lassen County, Calif., about 200 ft. W. of S. quarter corner of sec. 4, T. 36 N., R. 17 E., Mount Diablo base line and meridian.	Alluvium and colluvium derived from basic rock.	D-31784 D-31785	0-8 16-27	101.3 105.9	17.1 16.4	100	98	100 97
Simpson sandy loam Modoc County, Calif., about 1.8 mi. N. of center of Cederville and about 1,300 ft. S. and 160 ft. W. of N. quarter corner of sec. 2, T. 43 N., R. 16 E.	Alluvium derived from tuff, basalt, and andesite.	D-31786 D-31787	0-7 7-12	115.9 105.5	14.7 16.6			
Surprise gravelly sandy loam Modoc County, Calif., about 2 mi. N. of Eagleville and about 250 ft. S. and 900 ft. E. of N. quarter corner of sec. 14, T. 40 N., R. 16 E., Mount Diablo base line and meridian.	Alluvium derived from mixed basic extrusive rock.	D-31780 D-31781	0-9 9-28	124.0 127.7	10.5 11.0		100 100	99 98

<sup>1</sup> Based on the method of test for relative compaction of untreated and treated soils and aggregates, test method No. Calif. 216 E.

<sup>2</sup> Mechanical analysis by the California Division of Highways Method 202 and 203. Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the California procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data in this table are not suitable for use in naming the textural class of a soil.

## test data

Division of Highways]

Mechanical analysis <sup>2</sup> —Continued											Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued							Percentage smaller than—						AASHTO <sup>3</sup>	Unified <sup>4</sup>
$\frac{3}{4}$ in.	$\frac{3}{8}$ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	Pct.			
100	99	98	93	72	63	48	46	33	20	10	35	18	A-6	SC
			100	100	100	96	93	81	52	30		<sup>5</sup> NP	A-4	ML
			100	100	100	92	97	91	67	51	91	65	A-7-6	CH
98	88	75	61	52	50	39	38	26	14	7	34	5	A-4	SM
99	95	86	77	68	64	49	46	31	15	9	31	7	A-4	SM
			100	94	91	77	75	69	36	19	71	32	A-7-5	MH
			100	99	98	87	85	46	31	23	50	11	A-7-5	ML-MH
95	90	85	76	64	62	55	54	43	29	18	41	18	A-7-6	CL
97	95	93	91	81	76	65	64	58	46	34	60	37	A-7-6	CH
99	92	79	67	51	47	39	37	27	17	11	48	17	A-7-5	SM
96	91	83	70	58	55	50	49	43	37	30	47	24	A-7-6	SC-CL
			99	68	48	22	19	11	6	3		NP	A-2-4	SM
		100	99	76	60	43	41	35	27	19	49	28	A-7-6	SC
96	87	77	64	42	36	21	18	9	5	3	29	4	A-1-b	SM
95	85	71	55	29	22	11	9	3	1	1		NP	A-1-b	SP-SM

<sup>3</sup> Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145-59.

<sup>4</sup> Based on Unified Soil Classification System for roads, airfields, embankments, and foundations. MIL-STD-619B, United States Department of Defense.

<sup>5</sup> NP=Nonplastic.

The engineering interpretations reported here do not eliminate the need for sampling and testing at sites selected for specific engineering works, especially those involving heavy loads or excavations deeper than the depths of layers here reported. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil 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 terms used by soil scientists may be unfamiliar to engineers, and some words have different meanings in soil science than they have in engineering.

### **Engineering classification systems**

The two systems most commonly used in classifying soils for engineering are the AASHTO system (1) adopted by the American Association of State Highway Officials, and the Unified system (10) used by the Soil Conservation Service engineers, Department of Defense, and others.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction. 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 soils of high bearing strength, the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and are the poorest soils for subgrade. The best soils for subgrade are, therefore, classified as A-1, the next best as A-2, and so on to class A-7. If 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, and A-7-5, A-7-6. If soil material is near a classification boundary, it is given a symbol showing both classes; for example, A-2 or A-4. The relative engineering values of the soils within a group can be indicated by group index numbers, ranging from 0 for the best material to 20 for the poorest. Laboratory test data are needed to establish group index numbers. Although such data are available for certain soils of this survey area (see table 6), no group indexes are shown.

The AASHTO and Unified classifications for tested soils are shown in table 6; estimated classifications for all soils mapped in the survey area are given in table 4.

In the Unified System soils are classified according to particle-size distribution, plasticity index, 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, ML-MH.

### **Soil properties significant to engineering**

Table 4 provides estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and detailed experience in working with the individual kinds of soil in the survey area.

USDA texture is determined by the relative proportions of sand, silt, and clay particles in the soil. "Sand," "silt,"

"clay," and some of the other terms in the USDA textural classification are defined in the Glossary.

Permeability, as used in table 4, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on the structure and porosity of the soils. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available water capacity is the capacity of a soil to store 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.

Reaction is 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 acidic or alkaline. Increasing values of pH from pH 7.0 indicate increased alkalinity; decreasing values from pH 7.0 indicate increased acidity.

Salinity of the soil is based on the electrical conductivity of the saturated soil extract, as expressed in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its corrosiveness to other materials.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials. High shrink-swell clays are extensive in soils throughout the survey area. The detrimental effects of shrink-swell action have been reflected in damage to roads, fences, and other structures.

Potential for frost action is an indication of the potential effects on structures that result from freezing and subsequent thawing of soil materials. Such action pertains not only to the effect of heaving on structures as freezing progresses, but also to excessive wetting and loss of soil strength upon thawing.

Corrosion of untreated steel pipe in contact with soil is not covered in table 4, but it is considered to be a severe hazard in Surprise Valley-Home Camp Area. The hazard is most critical in the wet soils; soils of the more acid parts of the survey area; and the acid soils of the more humid mountainous areas. Corrosion of concrete in contact with soil is a moderate to severe hazard in the saline soils and most of the soils in arid parts of the survey area where salts tend to accumulate in the subsoil or substratum.

### **Interpretations of engineering properties**

Table 5 contains selected interpretations useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized, but some very important desirable features are also listed. The ratings and other interpretations in this table are based on the estimated engineering properties of the soils given in table 4; on available test data, including those in table 6, and on field experience. Although the information directly applies only to soil depths indicated in table 4, it is reasonably reliable to depths of about 5 or 6 feet.

Table 5 rates the soils according to their suitability as a source of sand, gravel, and road fill. It gives the degree of limitations and principal reasons for assigning a rating of moderate or severe where soils are used as sites for septic tank absorption fields, shallow excavations, dwellings without basements, and local roads and streets. It gives the soil features that affect the construction, operation, or maintenance of pond reservoir areas; embankments, dikes, and levees; cropland and pasture drainage structures; and irrigation systems.

Ratings for sand and gravel are based on the probability that mapped areas of the soil contain deposits of sand and gravel and provide guidance in locating them. The ratings do not indicate the quality or size of the deposits.

Road fill is material used as an embankment to support the subbase and base course or surface course. The ratings indicate the performance of soil material moved from borrow areas for these purposes.

Limitations for septic tank absorption fields are related mainly to permeability, location of water table, and susceptibility to flooding.

Shallow excavations are those less than 6 feet deep. They are made for a variety of purposes, such as basements, ditches, graves, underground cables, pipelines, and sewers.

Ratings for dwellings are based chiefly on soil characteristics affecting foundations, but slope, susceptibility to flooding, seasonal wetness, depth to bedrock, and other conditions are considered.

Ratings for local roads and streets pertain to construction and maintenance of improved roads and streets having some kind of all-weather surfacing, commonly asphalt or concrete, that are expected to carry automobile traffic all year, but not fast-moving, heavy trucks.

Pond reservoir areas are affected mainly by seepage loss of water, and the soil features considered are those that influence such seepage.

Features of both the subsoil and the substratum are important considerations in constructing embankments, dikes, and levees.

The factors considered for cropland and pasture drainage of soils affected by wetness are those features of the soil that affect the installation and performance of surface and subsurface drainage systems.

The factors considered for irrigation are those features of the soil that affect its stability under irrigation.

### Engineering test data

Table 6 contains the results of engineering tests performed by the Division of Highways, State of California, on several important soils in Surprise Valley-Home Camp Area. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering. The following paragraphs explain and define some of the data given in table 6.

Maximum dry density is the maximum unit dry weight of the soil when it has been compacted at optimum moisture content by the prescribed method of compaction. The moisture content which gives the highest dry unit of weight is called the optimum moisture content for the specific method of compaction.

Mechanical analysis data show the percentages, by weight, of soil particles that pass through sieves of speci-

fied sizes. Sand and other coarser materials do not pass through the No. 200 sieve; silt and clay do. Percentages of particles smaller than openings in the No. 200 sieve were determined by the hydrometer method, rather than by the pipette method that most soil scientists use in determining the clay in soil samples.

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 from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to 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.

The AASHO and Unified classifications are explained under the heading "Engineering Classification Systems."

### Hydrologic groups

Information about runoff is essential to flood-control planning. In an engineering handbook<sup>3</sup> developed by hydrologists of the Soil Conservation Service, the Forest Service, and other agencies, the major soils of the United States are placed in four hydrologic groups. The basis of the groupings is intake of water at the end of long-duration storms, after prior wetting and opportunity for swelling, without consideration to the protective effects of vegetation. The criteria for the four groups, and the soil series of the survey area that are in each group, are as follows:

*Group A.*—This group consists of soils that have a high infiltration rate even when thoroughly wetted. These soils are mainly deep, well-drained to excessively drained sands or gravels. They have a high rate of water transmission and a low runoff potential. The soil series of this survey area that are in group A are: Donica and Zorravista.

*Group B.*—This group consists of soils that have a moderate infiltration rate when thoroughly wetted. These soils are mainly moderately deep to deep, moderately well drained to well drained, and moderately fine textured to moderately coarse textured. These soils have a moderate rate of transmission. The soil series of this survey area in group B are: Bidwell, Cummings, Gorzell, Hapgood, Hartig, Longval, McConnel, Newlands, Snag, and Surprise.

*Group C.*—This group consists of soils that have a slow infiltration rate when thoroughly wetted. These soils are mainly those that have a layer that impedes the downward movement of water or that have a moderately fine texture to fine texture and a slow infiltration rate. They have a slow rate of water transmission. The soil series of this survey area that are in Group C are: Bicondoa, Bluebell, Buntingville, Campone, Couch, Four Star, Foxmount, Home Camp, Hovey, Jesse Camp, Langston, Lolak, Lyonman, Mendeboure, Nevador, Schamp, Simpson, Survya, Tourn, Waca, and Welch.

*Group D.*—This group consists of soils that have a very slow infiltration rate when thoroughly wetted. These soils

<sup>3</sup> Engineering Handbook, Hydrology, Supplement A., Sec. 4, Soil Conservation Service, USDA.

are mainly clay soils of a high swelling potential; soils that have a high permanent water table; soils that have a claypan or clay layer at or near the surface; and shallow soils over nearly impervious materials. They have a very slow rate of water transmission. The soils series of this survey area that are in Group D are: Boulder Lake, Bregar, Catnip, Cummings, clay variant, Crutcher, Disabel, Dangberg, cold variant, Espil, Fertaline, Hussa, Karlo, Kising, Madeline, Mascamp, Mosquet, Ninemile, Old Camp, Olson, Pegler, Powley, Raglan, Survya, hardpan variant, Toney, Vylach, Waca, shallow variant, and Weimer.

## **Formation and Classification of the Soils**

In this section, the factors that influence soil formation are discussed and the soils are classified in the higher categories of the classification system.

### **Factors of Soil Formation**

Soil is a natural body on the surface of the earth, in which plants grow. It is a mixture of rock and mineral matter, organic matter, water, and air, which occur in varying proportions. The rocks and minerals are fragmented and partly or wholly weathered. Soils have distinctive layers, or horizons, that are the product of environmental forces acting upon materials deposited or accumulated by geological agencies. The layers are more distinct in some soils than in others.

The characteristics of the soil at any given point are determined by the interaction of (1) the parent material; (2) the climate in which the parent material has accumulated and has existed since accumulation; (3) the relief or topography, which influences the local, or internal environment of the soil, its drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and wind; (4) the biological forces that act upon the soil material; and (5) the length of time that climate, relief, and biological factors have acted on the parent material.

#### **Parent material**

Parent material is the weathered rock or unconsolidated material from which soils form. The hardness, grain size, and porosity of the parent material and its content of weatherable minerals greatly influence soil formation. Main sources of parent material in Surprise Valley-Home Camp Area are: hard rock, weakly to strongly consolidated pyroclastic rocks, alluvium, and sandy eolian material.

Hard rock sources of parent material principally include massive and jointed basalt, rhyolite, and andesite. These rocks contain considerable minerals that weather to form clays. Rhyolite contains considerable quartz and yields much quartz sand as a weathering product. The various kinds of hard rock in the Area provide the parent material for a large part of the soils on mountains and plateaus. Generally, under comparable conditions, basalt, rhyolite, and andesite weather at a slower rate than other kinds of rock in the Area.

Volcanic tuff, ash, breccia, obsidian, and agglomerate are interbedded with basalt, andesite, and rhyolite on the mountains and plateaus. Tuff also is interbedded with

some of the older valley alluvium. Ash occurs in varying amounts in most of the parent materials within the survey Area. The pyroclastic rocks have a mineralogical composition comparable to the various hard volcanic-flow rocks with which they are associated. They consequently weather to yield similar clays and other products of weathering. Because they are generally softer and more porous, the pyroclastic rocks are believed to weather more rapidly than the more massive hard rocks.

Alluvium, which is the parent material for the major area of soils in the valleys, consists of sandy, loamy, and clayey materials of mixed mineralogical composition that washed from surrounding uplands. These parent materials were deposited on alluvial fans, or narrow flood plains, and in lake basins. Alluvial deposits on alluvial fans and flood plains are mostly loamy textured and contain varying amounts of gravel, cobblestones and stones in places. Because of high porosity, particle-size characteristics, and a high content of weatherable minerals, these kinds of alluvial deposits have a potential for rapid weathering.

Alluvial deposits in lake basins consist mostly of silty and clayey material that contains varying amounts of saline salts. Gravel and sand occur within the basins as bars, embankments, and other shoreline deposits. Weathering of the silty materials can proceed rapidly under favorable conditions because of the high content of weatherable minerals and high porosity. The clayey materials contain low amounts of weatherable minerals and have low permeability. Weathering is consequently slow and less obvious than in other parent materials in the Area.

Eolian deposits are in localized dune areas within valleys and generally border the east side of playas and intermittent lakes. These materials are sands of mixed mineralogical composition. They are porous and, under favorable conditions, have a potential for considerable alteration.

Because of the general mineralogical similarity in the parent materials of Surprise Valley-Home Camp Area, soil formation under comparable climate, relief, and biological conditions tends toward the development of soils that have similar kinds and sequences of horizons. Notable exceptions are those soils that formed in clayey parent materials, and those soils that contain considerable amounts of volcanic ash and glass. High shrink-swell action in clayey materials tends to restrict the development of subsurface horizons by causing mixing. The availability of silica in materials that contain ash and glass tends to form subsurface horizons cemented with silica.

#### **Climate**

The climate of Surprise Valley-Home Camp Area generally is characterized by warm, dry summers and cool, moist winters. The average annual precipitation ranges from about 6 inches at the lowest elevation to about 20 inches in some of the higher elevation areas. The average annual air temperature ranges from about 49° to 42° F. or lower in some of the high mountains. Major climatic variations are the result of the effect of topography and relief. As a consequence, the soils within the Area reflect a general zonation with increasing elevation.

At the lowest elevations (4,400 to 4,600 feet) the precipitation is about 6 to 8 inches. Weathering of parent materials is slow, leaching is incomplete, and eluviation and illuviation proceeds at a minimal rate. The cover consists

mostly of a sparse stand of drought- and salt-tolerant shrubs. Typical soils are low in content of organic matter and have a light-colored, thin A horizon.

As the elevation increases there is an accompanying increase in precipitation. This is reflected by deeper leaching of salts and calcium carbonate, decreasing reaction, changes in kind and density of vegetation, and thickening and darkening in the color of the A horizon.

At high elevations where the precipitation is about 20 inches, leaching of salts and carbonates is more intensive, the soils are slightly to medium acid, and the A horizon is thick and high in content of organic matter.

Freezing and thawing generally occur during winter throughout the Area, except for those parts that generally are insulated by snow cover. The effects of frost action are discernible by the heaving of plants, development of miniature stone-rings, and erosion of surface soil resulting from saturation during daytime thaw.

### **Biological forces**

Plants, animals, insects, and microflora are important biological forces that affect soil formation in the survey area. Plants appear to have the dominant effect.

On the poorly drained areas, the dense growth of sedges, grass, and other plants supply the organic matter that gives Bicondoa, Buntingville, Four Star, Welch, and other soils a dark color.

Plants, because of climatic controls, reflect considerable variations in kinds and amounts of vegetation as elevation increases. On basins, flood plains, alluvial fans, and terraces of the low elevations, the plants are principally desert shrubs. Because of the scarcity of available moisture, plants cover only a small part of the surface. They add little organic matter to the soil, give little protection from wind, and provide meager shade. Salt-tolerant shrubs, which occur in this kind of plant cover, also tend to recycle salts from deeper subsurface layers to the surface soil.

Alluvial fans, terraces, and foothills of higher elevations have a plant cover of shrubs and grass, which is transitional from the desert shrub to the upland shrub and tree plant cover. The density of plants in these areas is somewhat greater, and the soils have accumulated more organic matter and have a darker colored A horizon.

The plateaus and mountainous areas have denser stands of plants, which are dominated by shrubs, grass, and trees. Because of the more abundant vegetation, the A horizon of the soils in these areas is dark colored, has granular structure, and has increased considerably in thickness.

### **Relief**

Relief, through its controls on drainage, runoff, and erosion, has had an important effect on soil formation in the survey area. Physiographic features of the area, which control relief to a considerable extent, include: (1) north-south oriented mountain ranges; (2) volcanic plateaus; and (3) enclosed valleys.

The mountain ranges are mainly characterized by excessive relief. Runoff is rapid to very rapid, and erosion is capable of functioning at a rapid rate. The removal of material by erosion slows soil development. Because of erosion soil development is reflected primarily by dark A horizons. B2t horizons and cambic horizons occur on some more stable landscapes where there is enough vegetation to check erosion. Bluebell, Campone, Foxmcount, Hapgood,

Hartig, and Waca soils are examples of soils where soil formation has been unable to act over sufficient periods of time on parent material because of the effects of erosion.

The volcanic plateaus have normal to subnormal relief. Runoff is slow to medium, and the removal of material by erosion is minimal. Because erosion is so slow, soil development has been able to proceed over a considerable period of time. The soils developed on these landscapes consequently have a relatively thin A horizon and a clayey B2t horizon, and they are underlain by bedrock or duripan. Catnip, Espil, Fertaline, and Toney soils are examples of soils that have developed on the plateaus.

The valleys are essentially basins that receive drainage from surrounding uplands. A typical valley is characterized by having a nearly flat playa or intermittent lake in its lowest part, which is bordered by lacustrine terraces and numerous relict beach bars, embankments, and other shoreline features. Large alluvial fans flank upland mountains and encroach on the lower lying terraces, lake shorelines, and playas.

The terraces, alluvial fans, and shoreline features have mostly normal relief. Erosion is essentially in equilibrium with the rate of soil development. Examples of soils that have formed on these landscapes include Bidwell, Donica, Nevador, and Surprise soils.

The low flat terraces and narrow flood plains have flat or concave relief. Runoff is very slow, and the drainage-restricted wetness in these soils causes mottling. The soils in these areas support dense stands of meadow vegetation that has resulted in a dark-colored A horizon because of the large additions of organic matter to the soil. Some soils that are subject to a high water table contain excessive soluble salts in their upper horizons. These soils are light colored and some have salt crusts on their surface. Examples of some of the soils developed on flat or concave surfaces include Bicondoa, Buntingville, Hovey, and Husa soils.

### **Time**

The effect of time on soil formation in Surprise Valley-Home Camp Area is readily apparent. The existence of flood plains, lacustrine terraces, sequences of alluvial fans, and the stable volcanic plateaus indicates the relative age of soils formed on these landscapes.

The flood plains and presently aggrading alluvial fans are the most recent parent materials. Some recent parent materials that have been exposed to weathering by erosion are also in the steep mountains. Soils on these recent landforms have little or no profile development other than the formation of an A horizon. Crutcher soils on flood plains and Hapgood soils in upland areas are examples of soils that formed in recent parent material.

The intensity of soil development increases in sequence from recent to older landscapes. On lacustrine terraces that are believed to date back to the close of the Pleistocene epoch and on alluvial fans and stable mountain areas of comparable age, the soils have developed an A horizon and a cambic B horizon or weak B2t horizon. Hartig, McConnell, Pegler, Raglan, and Surprise soils are examples of soils that formed on landscapes of this age.

On landscapes that are believed to date back to late interpluvial periods of the Wisconsin stage, the soils have developed distinct A1 and B2t horizons and, in some areas, Cca and Csi horizons. The B2t horizon is more strongly

expressed and ranges in texture from clay loam to light clay. Major soil development in these soils probably took place prior to the Recent epoch. Bidwell, Hart Camp, Mosquet, Nevador, and Newlands soils are examples of soils believed to date back to late in the Wisconsin age.

Older alluvial fans, terraces, and plateaus are believed to date back to the earlier part of the early Wisconsin stage of the Pleistocene epoch. Soils on these landscapes have an A1 horizon and a fine and very fine, prismatic B2t horizon. Some soils on these landscapes have also developed indurated, silica-cemented hardpans. Stones and cobblestones are only on the surface of some of these soils, possibly indicating frost activity during glacial periods of the Pleistocene epoch or a residual effect from longtime weathering and deepening of the soil profile. Soils that are believed to represent total effects of soil development over a period of time dating to the early Wisconsin age include Catnip, Espil, Fertaline, Madeline, Ninemile, and Toney soils.

Comparisons of soil profiles and the relative age of landscapes indicate that soils having distinct argillic (Bt) horizons may have developed their primary characteristics during the Wisconsin stage of the Pleistocene epoch. This indicates that soil development in Surprise Valley-Home Camp Area has not been a rapid process.

## Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. First through soil classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and range lands; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as counties and continents.

The present system of soil classification (8) was adopted for general use by the National Cooperative Soil Survey in 1965. It has been under continual study and revision. The system has six categories. Beginning with the most inclusive, these are the order, the suborder, the great group, the subgroup, the family, and the series. These categories are defined briefly in the paragraphs that follow. The classification of the soil series of the Surprise Valley-Home Camp Area into the more inclusive categories is shown in table 7.

**ORDER.** Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. Four of the orders—Aridisols, Entisols, Inceptisols, and Mollisols—are represented in this survey area.

**SUBORDER.** Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborder has a narrower climatic range than the order. The criteria are chiefly chemical or physical properties that reflect either the presence of waterlogging or differences in climate and vegetation.

**GREAT GROUP.** Each suborder is divided into great groups according to the presence or absence of certain significant genetic horizons, or of certain significant properties of these horizons if they are present, or of certain significant soil properties at specified depths.

**SUBGROUP.** Each great group is divided into subgroups, representing the central (typic) segment of the great group, and others, called intergrades, that have some properties of another group, suborder, or order.

**FAMILY.** Families are established within each subgroup, principally on the basis of properties important to the growth of plants, but also on the basis of properties relevant to other uses of the soils. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of specified horizons or defined layers.

**SERIES.** The series consists of a group of soils that formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface soil, are similar in significant characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

## General Nature of the Area

The Surprise Valley-Home Camp Area has a typical basin and range topography with north-south oriented mountain ranges and valleys that have internal drainage. A small area in northeastern Lassen County drains to the Pit River, then on to the Pacific Ocean via the Sacramento River. The Warner Mountains, to the west of Surprise Valley, are very steep and rugged mountains that have been uplifted through faulting. These mountains have peaks that are over 9,000 feet in elevation. They provide watershed storage areas for irrigation water in Surprise Valley.

Ninety-seven percent of the cultivated acreage is on lake terraces, alluvial fans, and flood plains along the eastern base of the Warner Mountains in Surprise Valley. These areas are irrigated; alfalfa, small grain, meadow hay, and pasture are the principal crops. Dryland farming is very limited. Headquarters for practically all ranching operations are in this area.

The Home Camp part consists of steep mountains, volcanic plateaus, lake terraces, alluvial fans, flood plains, and playas. It is used for range and provides spring, summer, and fall grazing for livestock that is raised on the base properties of Surprise Valley.

## Water Supply

Approximately 10 perennial creeks flow into Surprise Valley, the major ones being Bidwell, Cedar, Owl, Eagle, and Bare. The water yield of these creeks varies from

TABLE 7.—*Classification of soil series into higher categories*

[The category of the great group is not shown separately in this table, because the second word of the subgroup name is the name of the great group]

Series	Family	Subgroup	Order
Bicondoa	Fine, montmorillonitic (calcareous), frigid	Fluventic Haplaquolls	Mollisols.
Bidwell	Fine-loamy, mixed, mesic	Aridic Calcic Argixerolls	Mollisols.
Bluebell	Loamy-skeletal, mixed	Argic Pachic Cryoborolls	Mollisols.
Boulder Lake	Fine, montmorillonitic, nonacid, frigid	Vertic Haplaquepts	Inceptisols.
Bregar	Loamy-skeletal, mixed, frigid	Lithic Xerollic Haplargids	Aridisols.
Buntingville	Fine-loamy, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Campane	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols.
Catnip	Very fine, montmorillonitic, frigid	Xerollic Natrargids	Aridisols.
Couch	Fine, montmorillonitic, mesic	Xerollic Natrargids	Aridisols.
Crutecher	Fine, montmorillonitic (calcareous), frigid	Xeric Torrifuvents	Entisols.
Cummings	Medial, calcareous, frigid	Mollic Andaquepts	Inceptisols.
Cummings, clay sub-soil variant.	Medial over clayey, calcareous, frigid	Histic Andaquepts	Inceptisols.
Dangberg, cold variant.	Fine, montmorillonitic, frigid	Aquic Haplic Nadurargids	Aridisols.
Disabel	Fine, montmorillonitic, frigid	Xerollic Natrargids	Aridisols.
Donica	Loamy-skeletal, mixed, mesic	Aridic Haploxerolls	Mollisols.
Espil	Fine, montmorillonitic, frigid	Aridic Durixerolls	Mollisols.
Fertaline	Fine, montmorillonitic, frigid	Xerollic Nadurargids	Aridisols.
Four Star	Coarse-loamy, mixed, noncalcareous, frigid	Cumulic Haplaquolls	Mollisols.
Foxmount	Loamy-skeletal, mixed	Typic Cryoborolls	Mollisols.
Gorzell	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Durixerollic Haplargids	Aridisols.
Haggood	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols.
Hart Camp	Loamy, mixed, frigid, shallow	Aridic Argixerolls	Mollisols.
Hartig <sup>1</sup>	Loamy-skeletal, mixed, frigid	Aridic Haploxerolls	Mollisols.
Home Camp	Clayey-skeletal, montmorillonitic	Argic Cryoborolls	Mollisols.
Hovey	Fine-loamy, mixed, frigid	Aquic Calciorrhids	Aridisols.
Hussa	Fine-loamy, mixed (calcareous), frigid	Fluventic Haplaquolls	Mollisols.
Jesse Camp	Fine-silty, mixed, frigid	Xerollic Camborhids	Aridisols.
Karlo	Very fine, montmorillonitic, frigid	Torrertic Haploxerolls	Mollisols.
Kisring	Fine-loamy, mixed, mesic	Aquic Duric Calciorrhids	Aridisols.
Langston	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Xerollic Haplargids	Aridisols.
Lolak	Fine, montmorillonitic (calcareous), frigid	Fluventic Halaquepts	Inceptisols.
Longval	Coarse-loamy, mixed	Typic Cryumbrepts	Inceptisols.
Lyonman	Fine-loamy, mixed	Argic Cryoborolls	Mollisols.
Madeline	Clayey, montmorillonitic, frigid	Aridic Lithic Argixerolls	Mollisols.
Mascamp	Loamy-skeletal, mixed, frigid	Aridic Lithic Argixerolls	Mollisols.
McConnel	Sandy-skeletal, mixed, mesic	Xerollic Camborhids	Aridisols.
Mendeboure	Clayey-skeletal, montmorillonitic, frigid	Pachic Argixerolls	Mollisols.
Mosquet	Clayey, montmorillonitic	Ruptic-Haplic Argic Lithic Cryoborolls	Mollisols.
Nevador	Fine-loamy, mixed, mesic	Durixerollic Haplargids	Aridisols.
Newlands	Fine-loamy, mixed	Argic Cryoborolls	Mollisols.
Ninemile	Clayey, montmorillonitic, frigid	Aridic Lithic Argixerolls	Mollisols.
Old Camp	Loamy-skeletal, mixed, mesic	Lithic Xerollic Haplargids	Aridisols.
Olson	Fine-loamy, mixed, frigid	Xerollic Durargids	Aridisols.
Pegler	Loamy, mixed, mesic, shallow	Typic Camborhids	Aridisols.
Powley	Fine, montmorillonitic, frigid	Aridic Durixerolls	Mollisols.
Raglan	Fine-loamy, mixed, mesic	Duric Camborhids	Aridisols.
Schamp	Fine, montmorillonitic, mesic	Xerollic Haplargids	Aridisols.
Simpson	Fine, montmorillonitic, mesic	Aridic Argixerolls	Mollisols.
Snag	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols.
Surprise	Coarse-loamy, mixed, mesic	Aridic Haploxerolls	Mollisols.
Survya	Clayey over sandy or sandy-skeletal, montmorillonitic, mesic	Typic Natrargids	Aridisols.
Survya, hardpan variant.	Fine-loamy, mixed, mesic	Typic Nadurargids	Aridisols.
Toney	Fine, montmorillonitic, frigid	Xerollic Natrargids	Aridisols.
Tourn	Medial	Andeptic Cryoborolls	Mollisols.
Vylach	Fine-loamy, mixed, mesic	Haplic Durargids	Aridisols.
Waca	Cindery	Typic Cryandepts	Inceptisols.
Waca, shallow variant	Loamy-skeletal, mixed	Lithic Cryumbrepts	Inceptisols.
Weimer	Very fine, montmorillonitic, noncalcareous, frigid	Vertic Haplaquolls	Mollisols.
Welch	Fine-loamy, mixed, noncalcareous, frigid	Cumulic Haplaquolls	Mollisols.
Zorravista	Mixed, mesic	Xeric Torrripsamments	Entisols.

<sup>1</sup> These soils are taxadjuncts to the Hartig series. They have bedrock at a depth of 20 to 40 inches and are dry in most years.

year to year, depending upon the amount of snow during the previous winter. The peak runoff from most of these creeks occurs during May (5). The flow during June has been calculated to equal one-third to two-thirds of the flow during May, and the flow during July is typically less than one-half to about one-fourth of that for June. In normal years these creeks yield adequate water for irrigation of most crops grown. All creek waters are adjudicated by the California Department of Water Resources.

Several reservoirs provide a more uniform flow of irrigation water on favored ranches. The Fee, Sworinger, and Newlands reservoirs are the major ones in the Area. The steep gradients of the creeks, together with the porous nature of the alluvium, discourages the construction of reservoirs on most creeks in the Warner Mountains. A few reservoir sites on the east side of the Valley may prove to be desirable storage areas.

Water quality generally is good. During runoff in spring most of the creeks provide water of excellent quality for irrigation, but in recent years, more reliance has been placed upon ground-water wells for irrigation. This is because much of the creek water is lost as heavy runoff early in spring and through deep percolation. The water from ground-water wells is also of good quality and desirable for irrigation water.

Several hot springs are in Surprise Valley. These springs are poor sources of irrigation water for cultivated crops because they contain excessive amounts of soluble salts, sodium and boron. The water is mainly used to irrigate native meadows of plants that tolerate salt in the immediate vicinity of the springs.

In the Nevada part of the survey area, Upper Cockrell and Lower Cockrell are the major reservoirs. They provide good-quality irrigation water for the farming development at Duck Flat. Most of the streams in the Home Camp Area are relatively short, have irregular profiles, and have canyons that are generally narrow and steep-sided (7). Two of the major perennial streams in the Home Camp Area are Wall Canyon Creek, which drains to the Upper Cockrell Reservoir, and Lost Creek. The streams are fed principally by snowmelt and storm runoff, and their flow, therefore, is short lived, occurring mostly during the spring and early in summer. Most of the streams flow to small reservoirs or to playas on the valley floors during periods of peak flow. Much of the stream flow, however, seeps into streambeds and probably is the largest source of recharge to ground-water reservoirs.

There are few ground-water irrigation wells in the Home Camp part of the survey area, but there are many wells that are used as a source of water for livestock and for wildlife.

## Vegetation

Vegetation throughout the Area is highly variable and dependent on climatic and soil conditions. It is grouped into four broad categories:

(1) Vegetation on low-lying alluvial fans and lake terraces and adjacent to playas in a precipitation zone of 4 to 8 inches. This group consists of shadscale (*Atriplex confertifolia*), bud sagebrush (*Artemisia spinescens*), greasewood (*Sarcobatus vermiculatus*), inland saltgrass

(*Distichlis stricta*), alkali seepweed (*Suaeda fruticosa*), and iodinebush (*Allenrolfea occidentalis*).

(2) Vegetation on intermediate alluvial fans and lake terraces in a precipitation zone of 8 to 10 inches. This group includes big sagebrush (*Artemisia tridentata*), spiny hopsage (*Grayia spinosa*), and rabbitbrush (*Chrysothamnus* spp.).

(3) Vegetation on upland terraces, alluvial fans, mountain plateaus, and mountain slopes in a precipitation zone of 10 to 16 inches. This group includes big sagebrush (*Artemisia tridentata*), low sagebrush (*Artemisia arbuscula*), antelope bitterbrush (*Purshia tridentata*), serviceberry (*Amelanchier alnifolia*), snowberry (*Symphoricarpos occidentalis*), Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), needlegrass (*Stipa* spp.), and many annual and perennial forbs.

(4) Vegetation in the mountainous uplands in a precipitation zone of 16 to over 20 inches. This group is composed of ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi*), white fir (*Abies concolor*), lodgepole pine (*Pinus contorta*), Western white pine (*Pinus monticola*), curl-leaf mountainmahogany (*Cercocarpus ledifolius*), and aspen (*Populus tremuloides*).

## Industry and Recreation

Industries in the Area consist of livestock, timber, and recreational enterprises.

Livestock production is the principal agricultural enterprise in the Area. The Home Camp part of the Area provides for spring through fall grazing under grazing permits granted by the Bureau of Land Management. The National Forest lands of the Warner Mountains provide for summer grazing under permits granted by the Forest Service. The cultivated lands are used for the production of cereal grains and hay and pasture plants for livestock late in fall and in winter.

The timber resource is only in the Warner Mountains and has contributed largely to the local economy through a single sawmill at Cedarville, California. There are approximately 53,000 acres of timbered lands in the Area.

Recreation plays an important role in the economy of the Area. Camping, hunting, fishing, and rock and artifact hunting are readily available throughout the Area.

## Transportation

Four service centers are in the Area along the west side of Surprise Valley in California. From north to south, they are Fort Bidwell, Lake City, Cedarville, and Eagleville.

Highway transportation is provided by California State Route 299, Surprise Valley Road, and Nevada State Routes 8A, 34, and 81.

California State Route 299 and the Surprise Valley Road intersect at Cedarville. California State Route 299 provides access from Cedarville to U.S. Highway No. 395 to the west and joins Nevada State Route 8A at the California-Nevada State line to the east, connecting Cedarville with Denio, Nevada. Surprise Valley Road traverses the western side of Surprise Valley and provides access to Adel, Oregon to the north. It joins Nevada State Route 81 at the California-Nevada State line. Nevada State Route 81 intersects Nevada State Route 34 at Gerlach,

Nevada, providing access from Reno, Nevada to Cedarville. State Route 34 turns northward from Gerlach through the northeastern part of the Area, connecting Gerlach with Adel, Oregon.

Practically all of the major secondary roads in Surprise Valley are paved and well maintained. The many access roads within the boundaries of the Modoc National Forest are graveled and well maintained during the summer.

The Home Camp part of the Area has many unimproved roads leading into isolated areas. These are infrequently traveled and can be dangerous, especially during stormy weather.

No railroad facilities are in the survey area. The nearest railroad is at Alturas, California, which is 23 miles west of Cedarville. All products are trucked into and out of the Area. Two small, well-maintained airstrips used by small aircraft are at Fort Bidwell and Cedarville.

## Climate <sup>4</sup>

Surprise Valley-Home Camp Area is more than 100 miles inland from the Pacific Ocean, and much of the topography within that distance consists of rugged mountain ranges. The direct influence of the Pacific Ocean on the Area is therefore negligible, even though the ocean generally dominates the weather over the western part of the continent. Most migrating winter storms move inland from the Pacific carrying a heavy load of moisture as a result of the long trajectory of the air over the water. A great deal of moisture is extracted as the air moves inland over the mountains in western California. The air then descends in the lee of the mountains before passing across the Area; consequently, precipitation is considerably lighter than it would be without the influence of the mountains to the west. Where the air is again lifted by the local mountains within the Area, precipitation totals and intensities tend to increase.

While the average temperature normally decreases with elevation, this relation is not always so in the case of extreme temperatures. Both maximum and minimum temperatures are influenced by features of local topography. Low temperatures in particular can change sharply within short distances as a result of drainage or blocking of cold air.

Weather in winter in this Area is marked by the frequent passage of low pressure systems and by the predominance of maritime polar air. Precipitation is frequent, but amounts generally are light over the plateaus and somewhat heavier in the mountains. Much of the winter precipitation is snow. At high elevations, snow cover can persist for extended periods during the winter. At lower elevations, snowfall is lighter, and temperatures are warmer; hence the snow generally does not remain on the ground for more than a few days at a time.

Precipitation amounts gradually decrease after February or March as the track of the storm centers tends to migrate northward. There is, however, a secondary maximum in May. This increase is associated with the passage of lows aloft moving across the region. Summer produces

very few storms in the Area, except for occasional thunderstorms, and precipitation is very light.

*Precipitation.*—Seasonal precipitation totals amount to only 11 inches per year near Sheldon and Vya, increasing to 20 inches in the Warner Mountains. In one year out of four on the average, these totals drop to 10 inches and 16 inches, respectively. Totals for the wettest year in each four years are 13 inches and 26 inches.

The heavier rainfall of less than 3 hours duration generally is associated with thundershowers late in spring and in summer. Heavy rainfall of longer duration frequently is associated with winter storms moving across the Area. The storms in winter are likely to extend over a wider area than do the thundershowers.

Snowfall is general over the region, and the annual total ranges from about 40 inches to 50 inches at lower elevations to more than 70 inches in some mountain areas. Occasionally snowfall is heavy, and monthly totals of 35 inches to 40 inches have been reported. Undoubtedly, there are heavier snowfalls in the mountains, but no measurements are available for those areas.

*Temperature.*—Summer temperatures are moderate to warm. Average temperatures in July are generally in the 80's, and extreme temperatures range from a little below 100° F. up to 110° F. Maximum temperatures of 90° F. or higher occur from 25 to 40 days per year. Temperatures drop at night to the middle and upper 40's.

In January, the average minimum temperatures range from 12° F. to 19° F., while the extreme lows have dropped to from -20° F. to -30° F. A minimum temperature of 32° F. or colder generally occurs 150 to 200 days per year. In the middle of winter, daytime temperatures generally are comfortable, and the average maximum temperature in January is in the middle 30's.

Under clear skies, there is rapid radiational cooling at night, generally resulting in low temperatures, especially in spots where cold air can be trapped. This nighttime radiational cooling results in occasional late freezes in the spring and early freezes in the fall.

The growing season, as defined by 32° F. temperatures in the spring and fall, ranges from 40 days in the eastern part of the Area to as much as 130 days in the Cedarville area. Median dates of the last 32° F. temperature reading in the spring ranged from late in May to late in June, while the first freeze in the fall is early in August around Sheldon and late in September in the Cedarville and Lake City areas.

The growing season at a temperature of 28° F. is about 30 days longer than that at 32° F. In the spring, the median date of the last 28° F. temperature reading ranges from May to early in June, while the date of the first 28° F. temperature reading in the fall ranges from late in September to the middle of October. Since most of the weather-observing stations in the Area are from 4,300 to 5,300 feet above sea level, only very limited data are available from higher elevations.

*Heating degree days.*—The heating degree day is a unit that expresses the amount of heating required to keep living quarters at a comfortable temperature. If the average temperature for a given day is lower than 65° F., heating degree day units will accumulate that day; if the average temperature is higher than 65° F., no heating degree day units will accumulate. Thus, an average tem-

<sup>4</sup> E. ROBERT ELFORD, State climatologist, National Weather Service, San Francisco, California, and E. ARLO RICHARDSON, State climatologist, National Weather Service, Salt Lake City, Utah, helped to prepare this section.

perature of 60° F. results in the accumulation of 5 degree days, while an average temperature of 55° F. accumulates 10 degree days. Annual totals in the Area range from 6,000 degree days in the western part to more than 8,000 degree days in the eastern part.

*Evaporation.*—The only records of evaporation available near the Area are from Tulelake, and because of temperatures in winter, the record doesn't cover the entire year. Based on extrapolation from available records, it appears that the annual evaporation from a Class A pan in the survey Area is between 60 and 65 inches, about 80 percent of which is lost during May through October. Lakes or reservoirs probably lose only 73 percent to 74 percent as much by evaporation as does a Class A pan, making the annual total loss for these larger bodies of water around 45 inches.

*Relative humidity.*—Cool temperatures and frequent precipitation in winter result in fairly high relative humidity percentages. Averages in January are around 65 percent. On a midsummer afternoon relative humidity readings are 15 percent or 20 percent on the average and at night are about 30 percent. Drying north or east winds occasionally cause the humidity to drop below 10 percent, creating a serious fire hazard.

*Wind.*—Because the plateau is at an elevation of 4,000 feet and areas are broad and open, winds occasionally become strong. Very few actual measurements are available, but estimates made on the basis of other wind data indicate that where the exposure is typical, a wind of 55 miles per hour or more occurs every other year, a wind of 75 miles per hour or more once in 50 years, and a wind of 90 miles per hour once in 100 years. Protected areas are less subject to strong winds than open and exposed spots. Most of the time, however, wind speeds are less than 15 miles per hour.

*Sunshine and cloudiness.*—Weather stations in the Area do not report the amount of sunshine and cloudiness. By interpolation from other points, however, indications are that the average cloudiness varies from about 70 percent of the sky covered in winter to as little as 20 percent of the sky covered in summer. These figures refer only to the hours between sunrise and sunset; cloudiness at night can be somewhat greater.

The percentage of possible sunshine ranges from about 45 percent in winter to 90 percent in summer.

## Physiography and Geology

The Surprise Valley-Home Camp Area is along the northwestern fringe of the Great Basin section of the Basin and Range Physiographic Province. Physiographically, the Area can be divided basically into north-south trending mountains and intermontane valleys or basins. Most of these valleys are enclosed basins that receive all of the drainage from surrounding mountains.

Tremendous volcanic activity occurred here during the Tertiary period. Vast quantities of lava, mainly of basaltic nature, and associated pyroclastic materials flowed, or were deposited, over the landscape in almost continuous interbedded masses.

The present relief was formed at the same time as, or later than, much of this volcanic activity as a result of

differential uplifting and settling of extensive parts of the lava plateau. The Warner Mountains, west of Surprise Valley, and Hays Canyon Range, east of Surprise Valley, are the most prominent of the mountains formed by faulting. Their crests reach elevations of 7,000 to 10,000 feet and are at least 2,500 feet above the adjacent valley floors.

Other mountains in the Area are not so high, though several peaks reach an elevation of 7,000 feet. A resistant layer of basalt caps the surface throughout much of the Area and overlies tuffs and agglomerates that are more susceptible to erosion. The resultant topography is characterized by relatively flat or gently rolling uplands that are dissected by vertical canyon walls. Block faulting serves to heighten this feature in many areas where nearly vertical escarpments rise several hundred feet.

The oldest rocks occur in the Home Camp part of the Area and consist of Canyon rhyolite and associated welded tufts of the Oligocene epoch (2). The most recent is Pleistocene basalt in the northeastern part of Lassen County (3, 4). Intermediate-aged volcanic rocks consist of interbedded basalt, andesite, rhyolite, and pyroclastics of Miocene and Pliocene age.

Time and erosion have only begun to modify the fault-block topography. Most stream channels and valleys are in early stages of development. The stream channels characteristically have steep-sided canyons and steep, irregular stream gradients. The major valleys are structural troughs, or grabens, that were displaced downward by faulting relative to the mountain ranges, and for the most part have no drainage outlet. As such, they have become catchment basins for stream flow from the surrounding mountains and sediment load carried by the streams.

During the Pleistocene epoch considerable amounts of water drained into the valleys. A series of deep lakes were formed in the main valleys, and shallow lakes were formed in adjacent pocket valleys. The most notable of these were in Surprise Valley and adjacent Duck Flat. Relict shoreline features, such as wave-cut cliffs, wave-built terraces, and offshore bars are the most prominent geomorphic features of these valleys.

With the advent of reduced precipitation and warming temperatures, dessication of the lakes occurred, leaving the valleys in their present form. The present valley floors consist of playas where excess runoff collects during periods of above normal precipitation. These are essentially flat, and their elevations depend on the vertical displacement of the fault blocks and amount of subsequent filling. The lowest valley in the Area is Surprise Valley with an elevation of about 4,400 feet.

Intermediate slopes between the valley floors and surrounding mountains were formed by accumulation of stream deposits and mudflows. These have formed relatively short, moderately steep to nearly level alluvial fans and flood plains. In many areas along the west side of Surprise Valley the streams have deeply dissected existing offshore lake bars and other lake-built features. The upper boundaries of the alluvial apron are clearly identified by the abrupt slope changes along the mountain fronts, while their lower boundaries grade to the playas on the valley floors. Dunes of windblown sand cover much of the valley floors surrounding the east side of the playas.

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## 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 impaired.
- Alluvial fan.** A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.
- Alluvium.** Fine material, such as sand, silt, or clay, that has been deposited on land by streams.
- Available water capacity.** The capacity of a soil to hold water available for use by most plants. It is commonly defined as the difference between the amount of water in a soil at field capacity and the amount in the same soil at the permanent wilting point. Commonly expressed as inches of water per inch of soil.
- Calcareous soil.** A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
- Clay.** As a soil separate, the mineral particles less than 0.002 millimeter in diameter. As a soil textural class, soil that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:
- Loose.*—Noncoherent; will not hold together in a mass.
- Friable.*—When moist, crushes under moderate 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; tends to stretch somewhat and pull apart, rather than pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Cemented.*—Hard and brittle; little affected by moistening.

**Continental climate.** The climate in areas distant from the ocean; characterized by considerable variation in temperature and in other weather conditions.

**Control section.** That part of a soil profile containing the horizons that determine the placement of the soil in the new system of soil classification. Generally, these horizons are between a depth of 10 inches and 40 inches.

**Cutans.** Pressure faces formed on structured soil aggregates in soils that are high in montmorillonitic clay.

**Decreaser (range).** Any of the climax plants most heavily grazed. Because they are the most palatable, they are the first to be destroyed by overgrazing.

**Durinodes.** Silica-cemented soil aggregates.

**Duripan.** A subsurface horizon that is cemented by silica to the point that fragments from the air-dry horizon will not slake after prolonged soaking in water or hydrochloric acid.

**Eluviation.** The movement of material from one place to another within the soil, in either true solution or colloidal suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.

**Flood plain.** Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

**Green manure.** A crop grown for the purpose of being turned under at an early stage of maturity or soon after maturity for soil improvement.

**Ground water (geology).** Water that fills all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

**Habitat.** The natural abode of a plant or animal; it refers to the kind of environment in which a plant or animal normally lives as opposed to its range, or geographical distribution.

**Hardpan.** A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, 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 the following: soluble salts, clay, and sesquioxides (iron and aluminum oxides).

*B horizon.*—The mineral horizon below the A horizon. The B horizon is in part a layer of change from the overlying A horizon 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.

**Illuviation.** The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

**Increasers (range).** Species in the climax vegetation that increase in relative amount as the more desirable plants are

reduced by close grazing; they are commonly shorter than decreases and some are less palatable to livestock.

**Infiltration rate.** The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. It may be limited either by the infiltration capacity of the soil or by the rate at which water is applied to the surface soil.

**Intermittent stream.** A stream or part of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources.

**Invaders (range).** Plants that come in and grow after the climax vegetation has been reduced by grazing.

**Lacustrine deposit.** Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

**Leaching.** The removal of soluble material from soils or other material by percolating water.

**Mottled.** 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.

**Ostracods.** Fresh-water clam-shaped fossils that occur in Pleistocene lake sediment.

**Ped.** An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

**Permeability, soil.** The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid*.

**pH value.** A numerical means for designating relatively weak acidity and alkalinity, as in soils and other biological systems. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed as a pH value. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid---	Below 4.5	Mildly alkaline-----	7.4 to 7.8
Very strongly acid_	4.5 to 5.0	Moderately alkaline_	7.9 to 8.4
Strongly acid-----	5.1 to 5.5	Strongly alkaline----	8.5 to 9.0
Medium acid-----	5.6 to 6.0	Very strongly alka-	
Slightly acid-----	6.1 to 6.5	line -----	9.1 and
Neutral -----	6.6 to 7.3		higher

**Residuum (or residual material).** Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residuum is not soil but is frequently the material in which a soil forms.

**Runoff.** The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Saline-alkali soil.** A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The salts, exchangeable sodium, and alkaline reaction occur in the soil in such location that growth of most crop plants is less than normal.

**Saline soil.** A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

**Sand.** As a soil separate, rock or mineral fragments ranging from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but sand can 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, 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.

**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 *single grain* (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.** Any layer beneath the solum, or true soil; the C horizon or R layer.

**Surface layer.** A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil; about 5 to 8 inches thick. The plowed layer.

**Terrace.** An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, 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.

**Wilting point.** The moisture content of soil on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark humid atmosphere. At wilting point the percentage of water available to plants approximates the minimum content of the moisture in the soil at a depth below that affected by surface evaporation.

GUIDE TO MAPPING UNITS

For full information about any given mapping unit, read both the description of the mapping unit and the description of the series to which the mapping unit belongs. For woodland interpretations, see the section "Management of Woodland," page 81. Additional information and interpretations are given in tables as follows:

Acreage and extent of soils, table 1, page 9.  
 Estimated yields of principal crops, table 2, page 73.

Engineering interpretations, tables 4, 5, and 6, pages 84, 98, and 118.

Map symbol	Mapping unit	Described on page	Capability unit				Range site		Wildlife suitability group	
			Irrigated		Dryland		Symbol	Page	Number	Page
			Symbol	Page	Symbol	Page				
BA	Badland-----	8	-----	---	VIIIe-224	72	-----	---	--	--
Bc	Bicondoa clay 1/-----	10	IVw-67	67	-----	---	-----	---	2	79
Bd	Bicondoa-Kisring complex: 1/-----	10	-----	---	-----	---	-----	---	-----	-----
	Bicondoa-----	--	VIw-64	68	VIIw-205	70	NV 23-10	76	4	80
	Kisring-----	--	-----	---	VIIw-227	70	NV 23-10	76	4	80
BeA	Bidwell loam, 0 to 2 percent slopes 1/-----	11	IIc-1	65	VIc-220	69	NV 23-22	78	1	79
BeB	Bidwell loam, 2 to 5 percent slopes 1/-----	11	IIe-20	64	VIc-220	69	NV 23-22	78	1	79
BHE	Bluebell-Hapgood association, moderately steep:-----	12	-----	---	-----	---	-----	---	-----	-----
	Bluebell-----	--	-----	---	VIIIs-211	70	-----	---	10	81
	Hapgood-----	--	-----	---	VIIIs-236	71	NV 23-7	75	6	80
BHF	Bluebell-Hapgood association, steep:-----	12	-----	---	-----	---	-----	---	-----	-----
	Bluebell-----	--	-----	---	VIIIs-211	70	-----	---	10	81
	Hapgood-----	--	-----	---	VIIIs-236	71	NV 23-7	75	6	80
Bo	Boulder Lake clay 1/-----	13	-----	---	VIw-204	69	NV 23-3	74	11	81
BRC	Bregar rocky loam, 2 to 15 percent slopes--	13	-----	---	VIIIs-237	71	NV 23-8	75	8	80
BuA	Buntingville loam, 0 to 2 percent slopes 1/-----	14	IIw-60	64	-----	---	-----	---	2	79
BuB	Buntingville loam, 2 to 5 percent slopes 1/-----	14	IIw-62	65	VIw-200	68	NV 23-13	76	2	79
CAC	Campone gravelly loam, drained, 2 to 15 percent slopes-----	15	-----	---	VIw-200	68	NV 23-13	76	5	80
CCB	Campone clay loam, 0 to 5 percent slopes--	15	-----	---	VIw-200	68	NV 23-13	76	5	80
CK	Catnip-Ninemile association:-----	16	-----	---	-----	---	-----	---	-----	-----
	Catnip-----	--	-----	---	VIIIs-239	72	NV 23-17	77	8	80
	Ninemile-----	--	-----	---	VIIIs-237	71	NV 23-17	77	8	80
	Karlo-----	--	-----	---	VIIIs-241	72	NV 23-1	74	8	80
Cm	Couch loam 1/-----	17	IVs-64	67	VIIIs-221	71	NV 23-2	74	4	80
Cn	Couch loam, clay substratum 1/-----	17	-----	---	VIIIs-221	71	NV 23-2	74	4	80
CR	Crutcher very fine sandy loam-----	18	IIIs-64	66	VIIs-226	69	NV 23-2	74	4	80
CS	Crutcher silty clay loam-----	18	IVs-64	67	VIIIs-221	71	NV 23-2	74	4	80
Cu	Cummings silty clay loam 1/-----	19	IVw-67	67	-----	---	-----	---	11	81
Cv	Cummings muck, clay subsoil variant 1/-----	19	VIw-64	68	-----	---	-----	---	2	79
Cw	Cummings muck, clay subsoil variant, drained 1/-----	20	IVw-67	67	-----	---	-----	---	2	79
DaA	Dangberg loam, cold variant, 0 to 2 percent slopes 1/-----	21	IVw-64	67	VIIw-229	70	NV 23-10	76	4	80
DbB	Dangberg loam, cold variant, drained, 2 to 5 percent slopes 1/-----	21	IVw-64	67	VIIw-229	70	NV 23-2	74	4	80
DC	Disabel silty clay loam-----	22	IIIs-41	65	VIIs-226	69	NV 23-5	74	7	80
DD2	Disabel-Crutcher association, eroded:-----	22	-----	---	-----	---	-----	---	-----	-----
	Disabel-----	--	IIIs-64	66	VIIIs-221	71	NV 23-2	74	4	80
	Crutcher-----	--	IVs-64	67	VIIIs-221	71	NV 23-2	74	4	80
DE	Disabel-Jesse Camp association, overwash:-----	22	-----	---	-----	---	-----	---	-----	-----
	Disabel-----	--	IIIw-91	66	VIw-226	69	NV 23-9	75	7	80
	Jesse Camp-----	--	IIIw-91	66	VIw-226	69	NV 23-5	74	7	80
	Crutcher-----	--	IIIw-91	66	VIw-226	69	NV 23-5	74	7	80
DM	Disabel-McConnel association:-----	22	-----	---	-----	---	-----	---	-----	-----
	Disabel-----	--	IIIs-41	65	VIIs-226	69	NV 23-5	74	7	80
	McConnel-----	--	-----	---	VIIIs-285	72	NV 23-12	76	9	80
	Badland-----	--	-----	---	VIIIe-224	72	-----	---	--	--

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit				Range site		Wildlife suitability group	
			Irrigated		Dryland		Symbol	Page	Number	Page
			Symbol	Page	Symbol	Page				
DP	Disabel-Pegler association:	22								
	Disabel-----	--	IIIs-64	66	VIIs-221	71	NV 23-2	74	4	80
	Pegler-----	--			VIIs-231	71	NV 23-12	76	9	80
DrB	Donica gravelly sandy loam, 2 to 5 percent slopes 1/-----	23	IVe-20	66	VIIs-243	72	NV 23-22	78	1	79
DrE	Donica gravelly sandy loam, 15 to 30 percent slopes 1/-----	23			VIIE-228	70	NV 23-22	78	3	80
DrF	Donica gravelly sandy loam, 30 to 50 percent slopes 1/-----	23			VIIE-228	70	NV 23-22	78	3	80
DsE	Donica very gravelly sandy loam, 5 to 30 percent slopes 1/-----	23			VIIs-243	72	NV 23-22	78	3	80
DtC	Donica very stony sandy loam, 2 to 15 percent slopes 1/-----	23			VIIs-243	72	NV 23-22	78	3	80
Du	Donica-Surprise complex: 1/-----	23			VIIs-243	72	NV 23-22	78	3	80
	Donica-----	--			VIIs-243	72	NV 23-22	78	3	80
	Surprise-----	--	IVe-20	66	VIc-220	69	NV 23-22	78	3	80
EB	Espil-Badland association:	24								
	Espil-----	--			VIIs-231	71	NV 23-21	78	8	80
	Badland-----	--			VIIE-224	72			--	--
EF	Espil and Fertaline soils:	24								
	Espil-----	--			VIIs-231	71	NV 23-21	78	8	80
	Fertaline-----	--			VIIs-231	71	NV 23-21	78	8	80
EM	Espil-Mosquet association:	25								
	Espil-----	--			VIIs-231	71	NV 23-21	78	8	80
	Mosquet-----	--			VIIs-239	72	NV 23-14	77	8	80
EP	Espil-Powley association:	25								
	Espil-----	--			VIIs-231	71	NV 23-21	78	8	80
	Powley-----	--			VIIs-231	71	NV 23-20	78	7	80
Fo	Four Star loam 1/-----	26	IIIw-60	66					2	79
Fr	Four Star loam, cold 1/-----	26	IVw-120	67					2	79
Fs	Four Star loam, seeped 1/-----	26	Vw-60	68					2	79
Ft	Four Star loam, clay substratum 1/-----	27	IIIw-63	66					2	79
FXE	Foxmount gravelly loam, 15 to 30 percent slopes-----	27			VIe-200	68			10	81
GRE	Gorzell stony loam, 5 to 30 percent slopes-----	28			VIIs-236	71	NV 23-6	75	7	80
GSC	Gorzell gravelly loam, 2 to 15 percent slopes-----	28			VIc-220	69	NV 23-6	75	7	80
HAE	Hapgood fine sandy loam, 5 to 30 percent slopes-----	29			VIIs-236	71			10	81
HDG	Hapgood very stony fine sandy loam, 50 to 75 percent slopes-----	29			VIIs-236	71	NV 23-7	75	6	80
HF	Hapgood-Home Camp association:	29								
	Hapgood-----	--			VIIs-236	71	NV 23-7	75	6	80
	Home Camp-----	--			VIIs-236	71	NV 23-7	75	6	80
HG	Hapgood-Snag association:	29								
	Hapgood-----	--			VIIs-236	71	NV 23-7	75	6	80
	Snag-----	--			VIIs-211	70	NV 23-19	78	6	80
HH	Hapgood and Newlands soils:	29								
	Hapgood-----	--			VIIs-236	71	NV 23-7	75	6	80
	Newlands-----	--			VIIs-236	71	NV 23-7	75	6	80
HI	Hapgood-Snag-Newlands association:	30								
	Hapgood-----	--			VIIs-236	71	NV 23-7	75	6	80
	Snag-----	--			VIIs-211	70	NV 23-19	78	6	80
	Newlands-----	--			VIIs-236	71	NV 23-7	75	6	80
HK	Hartig-Hapgood association:	31								
	Hartig-----	--			VIe-200	68	NV 23-16	77	6	80
	Hapgood-----	--			VIIs-236	71	NV 23-7	75	6	80
	Mosquet-----	--			VIIs-239	72	NV 23-14	77	8	80

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit				Range site		Wildlife suitability group	
			Irrigated		Dryland		Symbol	Page	Number	Page
			Symbol	Page	Symbol	Page	Symbol	Page		
HL	Home Camp-Hapgood association:	32								
	Home Camp-----	--			VIIIs-236	71	NV 23-7	75	6 80	
	Hapgood-----	--			VIIIs-236	71	-----	--	10 81	
HME	Home Camp-Newlands association, hilly:	32								
	Home Camp-----	--			VIIIs-236	71	NV 23-7	75	6 80	
	Newlands-----	--			VIIIs-236	71	NV 23-7	75	6 80	
HMF	Home Camp-Newlands association, steep:	32								
	Home Camp-----	--			VIIIs-236	71	NV 23-7	75	6 80	
	Newlands-----	--			VIIIs-236	71	NV 23-7	75	6 80	
Hn	Hovey silty clay loam 1/-----	33	IIIw-60	66					2 79	
Ho	Hovey silty clay loam, cold 1/-----	33	IVw-120	67					2 79	
HrA	Hussa loam, drained, 0 to 2 percent slopes 1/-----	34	IIw-60	64	VIw-200	68	NV 23-13	76	2 79	
HrB	Hussa loam, drained, 2 to 5 percent slopes 1/-----	34	IIw-62	65	VIw-200	68	NV 23-13	76	2 79	
HsA	Hussa loam, slightly saline-alkali, 0 to 2 percent slopes 1/-----	34	IVw-61	67	VIw-200	68	NV 23-10	76	2 79	
HúA	Hussa loam, clay substratum, drained, 0 to 2 percent slopes 1/-----	34	IIw-62	65	VIw-200	68	NV 23-13	76	2 79	
HvA	Hussa clay loam, 0 to 2 percent slopes 1/--	34	IIIw-60	56					2 79	
HwA	Hussa clay loam, clay substratum, 0 to 2 percent slopes 1/-----	34	IIIw-63	66					2 79	
HxB	Hussa silty clay loam, seeped, 0 to 9 percent slopes 1/-----	35	Vw-60	68					2 79	
HyB	Hussa silty clay loam, seeped, cold, 0 to 9 percent slopes 1/-----	35	Vw-60	68					2 79	
Hz	Hussa-Couch complex: 1/-----	35								
	Hussa-----	--	IVw-61	67	VIw-200	68	NV 23-10	76	2 79	
	Couch-----	--	IVs-64	67	VIIIs-221	71	NV 23-2	74	4 80	
JcA	Jesse Camp fine sandy loam, 0 to 2 percent slopes 1/-----	36	IIC-1	65	VIc-220	69	NV 23-2	74	4 80	
JcB	Jesse Camp fine sandy loam, 2 to 5 percent slopes 1/-----	36	IIE-20	64	VIc-220	69	NV 23-2	74	4 80	
JeA	Jesse Camp silt loam, overwash, 0 to 2 percent slopes 1/-----	36	IIIw-91	66	VIw-226	69	NV 23-5	74	7 80	
KAB	Karlo very cobbly clay, 0 to 9 percent slopes-----	37			VIIIs-241	72	NV 23-1	74	8 80	
Kr	Kisring fine sandy loam 1/-----	37			VIw-227	70	NV 23-10	76	4 80	
Ks	Kisring fine sandy loam, wet 1/-----	37			VIIw-227	70			2 79	
LK	Lolak loamy sand, overflow-----	39			VIIw-205	70	NV 23-2	74	4 80	
Lm	Lolak silty clay 1/-----	39			VIIw-205	70	NV 23-10	76	4 80	
LN	Lolak-Zorravista association:	39								
	Lolak-----	--			VIIw-205	70	NV 23-10	76	4 80	
	Zorravista-----	--			VIIIs-224	71	NV 23-11	76	9 80	
LOC	Longval fine sandy loam, 2 to 15 percent slopes-----	40			VIc-220	69			10 81	
LYE	Lyonman sandy loam, 15 to 30 percent slopes-----	40			VIe-200	68			10 81	
LYF	Lyonman sandy loam, 30 to 50 percent slopes-----	41			VIIe-200	69			10 81	
MAD	Madeline very stony loam, 2 to 30 percent slopes-----	41			VIIIs-237	71	NV 23-15	77	6 80	
MAF	Madeline very stony loam, 30 to 50 percent slopes-----	41			VIIIs-237	71	NV 23-15	77	6 80	
Mh	Marsh 1/-----	41			VIIw-200	70			-- --	
MLC	Mascamp extremely stony sandy loam, 2 to 15 percent slopes-----	42			VIIIs-237	71	NV 23-20	78	7 80	
MMB	McConnel sandy loam, 0 to 5 percent slopes-----	43			VIIIs-285	72	NV 23-12	76	9 80	
MNA	McConnel sandy loam, overwash, 0 to 2 percent slopes-----	43			VIIw-222	70	NV 23-5	74	7 80	

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Map symbol	Mapping unit	on page	Capability unit				Range site		Wildlife suitability group	
			Described Irrigated		Dryland		Symbol	Page	Number	Page
			Symbol	Page	Symbol	Page				
MO	McConnel-Badland association:	43								
	McConnel-----	--			VIIIs-285	72	NV 23-12	76	9 80	
	Badland-----	--			VIIIe-224	72			-- --	
MS	Mosquet-Home Camp association:	44								
	Mosquet-----	--			VIIIs-237	71	NV 23-14	77	8 80	
	Home Camp-----	--			VIIIs-236	71	NV 23-7	75	6 80	
NdA	Nevador loamy fine sand, 0 to 2 percent slopes 1/-----	45	IIs-43	65	VIIIs-229	71	NV 23-6	75	7 80	
NdB	Nevador loamy fine sand, 2 to 5 percent slopes 1/-----	45	IIs-43	65	VIIIs-229	71	NV 23-6	75	7 80	
NeA	Nevador fine sandy loam, 0 to 2 percent slopes 1/-----	45	IIC-1	65	VIc-220	69	NV 23-6	75	7 80	
NeB	Nevador fine sandy loam, 2 to 5 percent slopes 1/-----	45	IIe-20	64	VIc-220	69	NV 23-6	75	7 80	
NH	Newlands-Hapgood association:	46								
	Newlands-----	--			VIIIs-236	71	NV 23-7	75	6 80	
	Hapgood-----	--			VIIIs-236	71	NV 23-7	75	6 80	
NK	Ninemile-Karlo association:	47								
	Ninemile-----	--			VIIIs-237	71	NV 23-17	77	8 80	
	Karlo-----	--			VIIIs-241	72	NV 23-1	74	8 80	
	Madeline-----	--			VIIIs-237	71	NV 23-15	77	6 80	
OC	Old Camp association:	47								
	Old Camp extremely stony loam-----	--			VIIIs-237	71	NV 23-6	75	7 80	
	Old Camp very rocky loam-----	--			VIIIs-237	71	NV 23-6	75	7 80	
OG	Old Camp-Langston association:	48								
	Old Camp-----	--			VIIIs-231	71	NV 23-6	75	7 80	
	Langston-----	--			VIc-220	69	NV 23-6	75	7 80	
OS	Olson-Badland association:	49								
	Olson-----	--			VIIIs-231	71	NV 23-6	75	7 80	
	Badland-----	--			VIIIe-224	72			-- --	
PA	Playas-----	49			VIIIw-207	73			-- --	
PGC	Powley gravelly fine sandy loam, 2 to 15 percent slopes-----	50			VIIIs-231	71	NV 23-20	78	7 80	
PH	Powley-Espil association:	50								
	Powley-----	--			VIIIs-231	71	NV 23-20	78	7 80	
	Espil-----	--			VIIIs-231	71	NV 23-21	78	8 80	
	Hard Camp-----	--			VIIIs-231	71	NV 23-20	78	7 80	
PM	Powley-Mascamp association:	50								
	Powley-----	--			VIIIs-231	71	NV 23-20	78	7 80	
	Mascamp-----	--			VIIIs-237	71	NV 23-20	78	7 80	
RAB	Raglan very fine sandy loam, 2 to 9 percent slopes-----	51			VIIIs-261	72	NV 23-4	74	9 80	
RgA	Raglan very fine sandy loam, alkali, 0 to 2 percent slopes 1/-----	51	IIC-1	65	VIIIs-261	72	NV 23-4	74	9 80	
RH	Riverwash-----	51			VIIIw-233	73			-- --	
RM	Rubble land-Home Camp association:	52								
	Rubble land-----	--			VIIIs-236	73			-- --	
	Home Camp-----	--			VIIIs-236	71	NV 23-24	79	10 81	
RN	Rubble land-Mendeboire association:	52								
	Rubble land-----	--			VIIIs-236	73			-- --	
	Mendeboire-----	--			VIIIs-239	72	NV 23-18	77	6 80	
RR	Rubble land and Rock outcrop:	52								
	Rubble land-----	--			VIIIs-236	73			-- --	
	Rock outcrop-----	--			VIIIs-236	73			-- --	
SCE	Schamp stony loam, 2 to 30 percent slopes-----	53			VIIIs-236	71	NV 23-20	78	7 80	
SdB	Simpson sandy loam, 2 to 5 percent slopes 1/-----	54	IIe-21	64	VIIs-226	69	NV 23-22	78	1 79	
SGC	Simpson gravelly sandy loam, 5 to 15 percent slopes-----	54	IVe-20	66	VIIs-226	69	NV 23-22	78	3 80	

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Map symbol	Mapping unit	Described on page	Capability unit						Wildlife suitability group	
			Irrigated		Dryland		Range site		Number	Page
			Symbol	Page	Symbol	Page	Symbol	Page		
SmA	Simpson loam, 0 to 2 percent slopes <u>1</u> /-----	54	IIs-41	65	VIIs-226	69	NV 23-22	78	1	79
SNF	Snag very stony sandy loam, 30 to 50 percent slopes-----	54	-----	--	VIIIs-211	70	NV 23-19	78	6	80
SrA	Surprise gravelly sandy loam, 0 to 2 percent slopes <u>1</u> /-----	55	IIC-1	65	VIc-220	69	NV 23-22	78	1	79
SrB	Surprise gravelly sandy loam, 2 to 5 percent slopes <u>1</u> /-----	55	IIE-20	64	VIc-220	69	NV 23-22	78	1	79
SrC	Surprise gravelly sandy loam, 5 to 15 percent slopes <u>1</u> /-----	55	IIE-20	66	VIc-220	69	NV 23-22	78	3	80
SUB2	Survya fine sandy loam, 0 to 9 percent slopes, eroded-----	56	-----	--	VIIIs-261	72	NV 23-4	74	9	80
SV	Survya-Zorravista association:	56								
	Survya-----	--			VIIIs-261	72	NV 23-4	74	9	80
	Zorravista-----	--			VIIIs-224	71	NV 23-11	76	9	80
SYB2	Survya fine sandy loam, hardpan variant, 0 to 9 percent slopes, eroded-----	57	-----	--	VIIIs-231	71	NV 23-2	74	9	80
TN	Toney-Ninemile association:	58								
	Toney-----	--			VIIIs-239	72	NV 23-17	77	8	80
	Ninemile-----	--			VIIIs-237	71	NV 23-17	77	8	80
TOC	Tourn stony loam, 2 to 15 percent slopes---	58	-----	--	VIIIs-211	70	-----	--	10	81
VP	Vylach-Pegler association:	59								
	Vylach-----	--			VIIIs-231	71	NV 23-12	76	9	80
	Pegler-----	--			VIIIs-231	71	NV 23-12	76	9	80
VY	Vylach-Pegler association, overwash:	59								
	Vylach-----	--			VIIIs-231	71	NV 23-6	75	7	80
	Pegler-----	--			VIIIs-231	71	NV 23-6	75	7	80
WAE	Waca stony fine sandy loam, 5 to 30 percent slopes-----	60	-----	--	VIIIs-211	70	-----	--	10	81
WAF	Waca stony fine sandy loam, 30 to 50 percent slopes-----	60	-----	--	VIIIs-211	70	-----	--	10	81
WAG	Waca stony fine sandy loam, 50 to 75 percent slopes-----	60	-----	--	VIIIs-211	70	-----	--	10	81
WD	Waca-Hapgood association:	60								
	Waca-----	--			VIIIs-211	70	-----	--	10	81
	Hapgood-----	--			VIIIs-236	71	NV 23-7	75	6	80
WE	Waca-Snag association:	60								
	Waca-----	--			VIIIs-211	70	-----	--	10	81
	Snag-----	--			VIIIs-211	70	NV 23-19	78	6	80
WFF	Waca very gravelly sandy loam, shallow variant, 15 to 50 percent slopes-----	61	-----	--	VIIIs-211	70	-----	--	10	81
Wm	Weimer clay <u>1</u> /-----	62	-----	--	VIW-204	69	NV 23-23	79	11	81
Wp	Weimer clay, drained <u>1</u> /-----	62	-----	--	VIW-204	69	NV 23-3	74	11	81
Ws	Weimer clay, slightly alkali <u>1</u> /-----	62	-----	--	VIW-204	69	NV 23-23	79	11	81
WvB	Welch silty clay loam, 0 to 9 percent slopes <u>1</u> /-----	62	-----	--	Vw-200	68	NV 23-13	76	5	80
ZoC	Zorravista fine sand, 0 to 15 percent slopes <u>1</u> /-----	63	-----	--	VIIIs-224	71	NV 23-11	76	9	80
ZR	Zorravista-Couch association:	63								
	Zorravista-----	--			VIIIs-224	71	NV 23-11	76	9	80
	Couch-----	--	IVs-64	67	VIIIs-221	71	NV 23-2	74	4	80

1/  
High-intensity mapping unit.

# Accessibility Statement

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