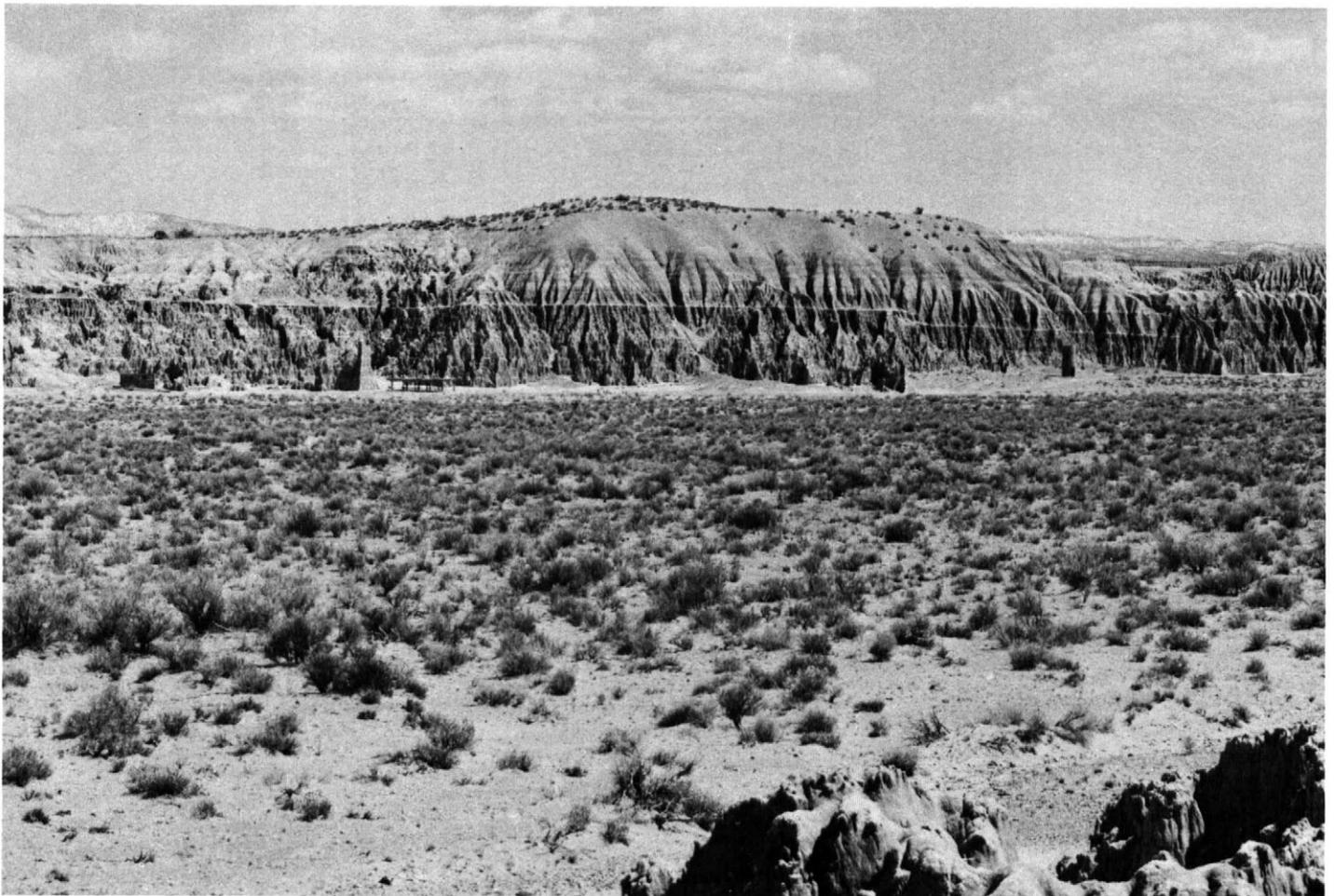


Soil Survey Reports)

SOIL SURVEY OF

Meadow Valley Area, Nevada - Utah, Parts of Lincoln County, Nevada, and Iron County, Utah



United States Department of Agriculture
Soil Conservation Service and
United States Department of the Interior
Bureau of Land Management

In cooperation with

University of Nevada Agricultural Experiment
Station and Utah Agricultural Experiment Station

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

Major fieldwork for this soil survey was completed in the period 1961-71. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service, the Department of the Interior Bureau of Land Management, the University of Nevada Agricultural Experiment Station, and the Utah Agricultural Experiment Station. It is part of the technical assistance furnished to the Meadow Valley Soil Conservation District.

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

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

All the soils of the survey 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 classification of each. It also shows the page where each soil is described and the woodland group, wildlife group, and range site 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 those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability subclasses and units, the range sites, and the woodland groups.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife Habitat."

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

Community planners and others can read about soil properties that affect the choice of sites for recreation areas in the section "Use of the Soils for Recreational Development."

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.

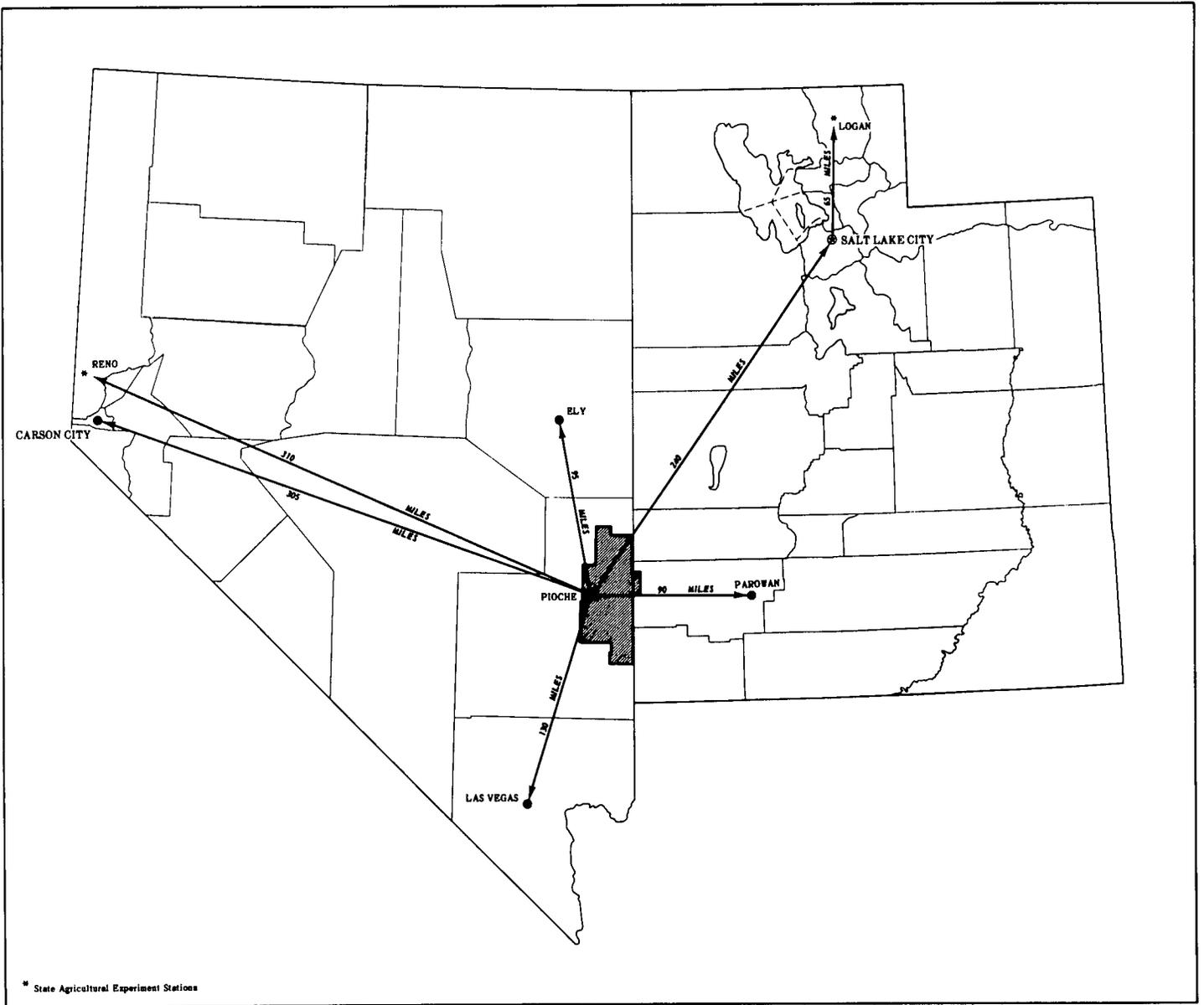
Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in the Meadow Valley Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information in the section "General Nature of the Area."

Cover: Eroded lakebed sediment in Cathedral Gorge State Park, near Panaca, in Lincoln County, Nevada.

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Location of Meadow Valley Area in parts of Lincoln County Nevada and Iron County, Utah.

SOIL SURVEY OF MEADOW VALLEY AREA, NEVADA-UTAH, PARTS OF LINCOLN COUNTY, NEVADA, AND IRON COUNTY, UTAH

BY H. J. BORUP AND D. G. BAGLEY, SOIL CONSERVATION SERVICE

FIELDWORK BY H. J. BORUP AND L. ROOKE, SOIL CONSERVATION SERVICE,
UNITED STATES DEPARTMENT OF AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE,
AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF LAND
MANAGEMENT, IN COOPERATION WITH THE UNIVERSITY OF NEVADA
AGRICULTURAL EXPERIMENT STATION AND THE UTAH AGRICULTURAL EXPERIMENT STATION

MEADOW VALLEY AREA and the rest of the areas surveyed are mostly in southeastern Nevada in the eastern central part of Lincoln County. The Nevada-Utah border forms most of the eastern boundary. The rectangular area, however, includes a small part of Iron County, Utah, where the Meadow Valley Watershed intersects the State line. The distance from the northern boundary to the southern boundary is about 55 miles, and the distance from the western boundary to the eastern boundary is about 27 miles. About 1,406 square miles of the survey area are in Lincoln County, Nevada, and about 10 square miles are in Iron County, Utah. Pioche, the county seat of Lincoln County, is about 22 miles north of the southwestern corner of the survey area and 4 miles east of the western boundary. The southwestern corner of the survey area is about 150 highway miles northeast of Las Vegas, Nevada. Only about 5 percent of the survey area is privately owned.

General Nature of the Area

The survey area exhibits typical basin and range topography. It consists of nearly level flood plains, gently sloping to moderately sloping terraces and alluvial fans, and rolling to very steep mountains. The elevation ranges from about 4,200 feet in Caliente to 9,296 feet at the top of Mount Wilson in the northwestern part of the survey area.

The survey area has dry summers that are warm at the lower elevations and cool at the higher elevations. Winters are cold. The annual precipitation, from both snow and rain, averages from about 8.7 inches in Caliente to about 24 inches in the higher mountains (2).¹

Most of the farming activities in the survey area involve livestock. The production of livestock, mostly cattle, has been continuous throughout most of its recorded history. Sheep are hauled or trailed into the survey area for seasonal grazing. The major forage crops are alfalfa and grass. Irrigation is required for all crop production.

The survey area is sparsely populated. According to the 1970 Census, the communities of Caliente, Panaca, Pioche, and Ursine have a combined population of about 2,130, which is 83 percent of the total survey area population. Although Lincoln County is larger than 20 percent of the States in our country, it supports only about 2,560 people. Excluding Alaska, Lincoln County is one of the least populated areas of the United States mainland.

Settlement and Development²

The first group of pioneers to establish permanent residences in the survey area reached what is now known as Panaca on May 4, 1864. They brought with them cattle and sheep.

As more pioneers established themselves in the survey area, the cattle industry flourished. At one time Panaca Valley and the adjacent rangelands supported about 3,000 head of cattle. At the time of initial settlement, native meadows were common in all of the larger valleys, and range grasses and browse were thick and luxuriant.

In the early 1900's, the cattle industry began to decline as a result of range deterioration caused by drought. Rapid runoff from convection storms cut channels in the valley bottoms and drained most of the natural meadows.

Crop production consisted of alfalfa and grain for cattle and vegetables for local use and for the mine workers of the Pioche District. The production of alfalfa and grains varied with the fluctuation of the livestock industry. Vegetable production decreased concurrently with mining activities.

Active mining in the Pioche District began in 1868 with production of silver ore. Because of the water shortage in Pioche, the mills and the smelter were moved to Bullionville, near the present Panaca townsite. During peak operation, four mills and one smelter were in production at Bullionville. Mining activities began to decline near the turn of the century, but use of the mines increased during World War I and World

¹ Italic numbers in parentheses refer to Literature Cited, p. 164.

² CHARLES MATHEWS, lifelong resident of Panaca, assisted in the preparation of this section.

War II. Mining activities are now at a virtual standstill.

Saw logs for lumber and dimension material for early mining operations and house construction were cut in Gleason Canyon and hauled to a sawmill in Panaca.

In the late 1800's construction of the railroad through Clover Canyon was hampered by floods and financial difficulties. The construction ceased for a few years. Eventually, the link with the west coast was completed when the first train entered Caliente on December 21, 1901. For many years the railroad was the financial backbone of Caliente and vicinity. It began to decline and is now in minimal operational status.

Water Supply

The present drinking water supply for all communities in the Meadow Valley Area comes from pumped ground water. Irrigation water is obtained from both ground water and surface water sources. None of the streams in the survey area flow continuously throughout their full length. Meadow Valley Wash carries the most water for the longest period of time. Generally it flows continuously from Spring Valley through Eagle Valley, Ursine Valley, and Rose Valley to the Echo Canyon Reservoir in the upper end of Dry Valley. From Dry Valley through Caliente, Meadow Valley Wash flow is intermittent, being supplied by springs, pumped irrigation water, and seasonal rains. Water flows in Clover Canyon only during high intensity storms and spring runoff.

Surface water is used for irrigation in Spring Valley, most of Ursine Valley, and parts of Rose Valley, Dry Valley, and Panaca Valley. Surface water was the only source of irrigation until 1940 when the first irrigation well was drilled and put into operation. Now, 50 to 60 percent of the irrigation water is pumped from wells. The common method of using the pumped water is sprinkler irrigation.

Ground water in the survey area is derived mostly from precipitation within the drainage area. The average annual precipitation ranges from about 8 inches at the lower elevations to about 24 inches at the higher elevations. In the low-lying areas where the precipitation is the least, little if any recharge to the ground water occurs. In the mountains most of the recharge occurs because of the greater precipitation.

Ground water is in both artesian and water-table conditions in the survey area. Hydrostatic heads in several wells are above the land surface in Panaca Valley. Two such wells are the Amy Mathews (west well 2S/68-19cl about 3 miles southwest of Panaca) and the Chester Oxborrow (well No. 2, 3S/67-28cl at the northern end of Cove Canyon).

In 1963 there were 59 active large-capacity wells that had an estimated total pumpage of 14,505 acre feet (2). Between 1963 and 1971 about 20 to 25 additional wells were drilled. No production data are available about these wells. About 45 wells are in Panaca Valley.

Several thermal springs are in the survey area. The largest is Panaca Spring in the upper end of Panaca Valley. Smaller thermal springs are in Caliente and on the Delmue ranch in Dry Valley.

According to 1963 U.S. Geological Survey data, the specific conductance (micromhos at 25° C) of water taken from springs, wells, and streams within the survey area ranges from a low of 211 (Parsnip Wash Spring) to a high of 1,700 (U.S.G.S. observation well 2S/68-85b). Reaction ranges from 7.4 to 9.2. Panaca Spring had a specific conductance of 401 and a reaction (pH) of 8.1. Of nearly 80 springs in the survey area, less than 10 percent have been improved for any kind of use (2).

Vegetation³

The vegetation in the survey area varies greatly, reflecting the climate and soil conditions. The vegetation can be grouped into four plant communities.

The first plant community is in the lower parts of valleys and on terraces. Elevation ranges from 4,400 to 5,000 feet. The average annual precipitation generally is 8 inches or less. Slopes range from 0 to 15 percent. The soils on terraces are well drained and shallow to moderately deep over a hardpan. They are strongly effervescent and violently effervescent. The nonirrigated soils of the valley floor are well drained to moderately well drained, nonsaline to strongly saline, and moderately deep to very deep. Slopes range from 0 to 8 percent. The vegetation includes shadscale, fourwing saltbush, budsage, greasewood, winterfat, Indian ricegrass, galleta, and sand dropseed.

The second plant community is in the intermediate terraces and on alluvial fans. Elevation ranges from 5,000 to 6,000 feet. The average annual precipitation ranges from 8 to 10 inches. Slopes range from 2 to 15 percent. The soils are well drained, and they are shallow to a hardpan. They are slightly effervescent to strongly effervescent (when treated with cold, dilute hydrochloric acid) in some horizons above the hardpan. The vegetation includes black sagebrush, big sagebrush, cliffrose, Nevada ephedra, galleta, blue grama, sand dropseed, bluegrass, and needleandthread. Utah juniper and pinon pine increase as elevation and moisture increase.

The third plant community is in the upper parts of terraces and on mountain faces. Elevation ranges from 6,000 to 9,100 feet. The average annual precipitation is 10 to 15 inches. Slopes range from 2 to 75 percent. These soils are well drained. The terrace soils are deep to shallow over a hardpan. The mountain soils are deep to shallow over hard bedrock. Some terrace soils contain strata which are at least slightly effervescent. The rest of the soils exhibit no effervescence and generally are neutral in reaction. The vegetation is mainly pinon pine, Utah juniper, big sagebrush, black sagebrush, grass, and bluebunch wheatgrass.

The fourth plant community is on the high mountains. Elevation ranges from 8,500 to 9,300 feet. The average annual precipitation is 15 inches or more. Slopes range from 15 to 75 percent. These soils are well drained and are deep to very shallow over hard bedrock. They exhibit no effervescence and generally are neutral to slightly acid in reaction. The vegetation is snowberry, bitterbush, bluebunch wheatgrass, and Great Basin wildrye. On the north-facing slopes, the

³ By L. D. SMITH, district conservationist.

dominant vegetation is balsam white fir, Douglas-fir aspen, mountainmahogany, serviceberry, and snowberry.

Industry and Recreation

The major industries in the survey area are livestock and recreation. The northern and eastern parts of the survey area provide grazing from spring to fall under permits issued by the Bureau of Land Management. The cultivated lands provide hay and pasture during winter. Most of the cereal grains fed to the livestock are produced outside the survey area.

Recreation plays a seasonal but important role in the economy of the survey area. Camping, small game and deer hunting, and rock and artifact hunting sites are easily accessible throughout the survey area. Fishing is confined to two areas: Eagle Valley Reservoir north of Ursine and Schroader Reservoir (Beaver Dam State Park) in the southeastern corner of the survey area. The site of the recently constructed Echo Canyon Dam has extensive camping and picnicking facilities. When the reservoir is filled, it will provide good boating and fishing.

Extensive areas of Utah juniper provide an abundance of posts of good quality which are harvested commercially and by local users. Some commercial harvesting of Christmas trees takes place in the northern and east-central parts of the survey area.

Other sources of income to the residents of the survey area are the railroad, the public school system, and the Nevada Girls Training Center, which is a correctional institution. Mining has been economically important in the past, but present production is at a near standstill. In places, however, mining exploration is in progress.

Transportation

Three transportation centers are in the survey area. From south to north they are Caliente, Panaca, and Pioche. Highway travel within the survey area is provided by U.S. Highway 93 along the western edge of the southern half of the survey area. Nevada State road No. 25 intersects U.S. Highway 93 near Panaca and provides the route to Utah and eastward. State road No. 75 leaves State road No. 25 just west of the Panaca Summit and provides a maintained gravel-surfaced route to Crestline, Nevada; Enterprise, Utah; and other points east. U.S. Highway 93 is the present main route from southern Idaho to Los Angeles, California, via Las Vegas, Nevada. U.S. Highway 93 and State road No. 25 are paved and well maintained. State road No. 85 runs from Pioche to the Eagle Valley Reservoir, about 20 miles east of Pioche. State road No. 86 intersects State Route 85 about four miles east of Pioche and runs southeastward to Echo Canyon Dam. State road No. 85 and State Route No. 86 are paved and maintained.

A maintained soil-surfaced road provides access to the scenic back country. It runs from Eagle Valley Reservoir over the rim of the Meadow Valley Watershed east of Mount Wilson to the Pony Springs-Atlanta Road near the northwestern corner of the survey area. Many unimproved roads dissect the survey

area, some of which are hazardous during inclement weather.

The Union Pacific Railroad crosses the southern part of the survey area. It provides no passenger service and is used only for freight. Almost all commodities used in the survey area are brought in by truck.

Four aircraft landing strips are in the survey area. An all-weather strip that has an asphalt runway is on the terrace west of Panaca at an elevation of 4,800 feet. A soil-surfaced strip is adjacent to U.S. Highway 93 about six miles northwest of Pioche at an elevation of 5,840 feet. Both of these strips will accommodate such twin-engine aircraft as DC-3 or F-27, which have a gross weight of as much as about 24,000 pounds. A private strip is on the Oxborrow property near the southern end of Panaca Valley, and a small emergency strip is maintained about four miles southwest of Ursine. None of the landing strips is equipped with landing lights.

Climate⁴

Although the survey area is far removed from the Rockies and the Sierra Nevada, it is largely influenced by these topographical barriers. The Sierras drain much of the moisture of the storms moving from the Pacific. The Rockies divert cold air masses from the Great Basin. The local topography of the mountain peaks which surround the western, northern, and eastern sides of Spring Valley also influence the climate of the valley and the outlying areas. The protection provided by the mountain ranges can cause very warm or hot conditions during the day on the valley floor and on the alluvial fans. At night, however, cold air drainage from the higher elevation can cause lower temperatures on the valley floor than on the adjacent higher alluvial fans. For example, the average shortest growing season on the floor of Spring Valley is estimated to be as low as 70 days. The elevation of the floor is about 6,000 feet. The growing season increases to as much as 100 days on the alluvial fans. Above 7,000 feet the growing season decreases again to between 80 to 100 days. The reason for this paradox is the existence of frequent inversions for many parts of the valley floors of Nevada.

Precipitation ranges from 5 to 8 inches in the valley floor, which includes Lake Valley and Spring Valley. It increases to 15 to 20 inches on the peaks and ridges in the survey area. Intermediate elevations receive about 8 to 15 inches a year.

Data in tables 1 to 4 are based on at least 30 years of records. These tables provide long-term information on temperature, precipitation, and growing season at Caliente and Pioche. The growing season at Pioche averages 148 days. The valley floor of Lake Valley, Dry Valley, and areas including Panaca can expect a growing season of about 120 to 125 days. In the southern section of the survey area, the growing season increases to about 130 days.

Southerly winds can reach high intensities because of the orientation of the mountain ridges and the valley floor which opens to the south. The constraining influence of the mountain range in conjunction with the

⁴ By CLARENCE M. SAKAMOTO, climatologist for Nevada, National Weather Service, U.S. Department of Commerce.

TABLE 1.—*Temperature and precipitation data, Caliente, Nevada*

[Based on records for the period 1936-68]

| Month | Temperature | | | | Precipitation | | | |
|-----------|-----------------------|-----------------------|---|---|-----------------------|---------------------------|------------|------------------|
| | Average daily maximum | Average daily minimum | Two years in 10 will have at least 4 days with— | | Average monthly total | One year in 10 will have— | | Average snowfall |
| | | | Maximum temperature equal to or higher than— | Minimum temperature equal to or lower than— | | Less than— | More than— | |
| °F | °F | °F | °F | In | In | In | In | |
| January | 47.5 | 16.1 | 63 | 2 | 0.74 | 0.03 | 1.72 | 3.1 |
| February | 51.8 | 22.1 | 67 | 8 | .72 | .10 | 1.53 | 2.5 |
| March | 59.8 | 26.1 | 73 | 18 | .94 | .02 | 2.01 | 1.8 |
| April | 70.1 | 34.5 | 83 | 25 | .83 | .06 | 1.84 | .1 |
| May | 79.0 | 42.8 | 91 | 31 | .48 | .01 | .65 | ----- |
| June | 88.7 | 48.9 | 99 | 41 | .35 | .01 | .94 | ----- |
| July | 95.8 | 56.0 | 103 | 47 | .73 | .01 | 2.00 | ----- |
| August | 93.4 | 55.0 | 101 | 45 | .91 | .01 | 2.27 | ----- |
| September | 86.4 | 45.6 | 97 | 35 | .56 | .01 | 1.40 | ----- |
| October | 74.1 | 35.1 | 87 | 25 | .88 | .01 | 1.59 | .3 |
| November | 59.4 | 24.5 | 74 | 15 | .74 | .01 | 1.81 | .5 |
| December | 49.3 | 19.6 | 61 | 7 | .83 | .01 | 2.01 | 3.8 |
| Year | 71.3 | 35.5 | ----- | ----- | 8.71 | ----- | ----- | 12.1 |

TABLE 2.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Caliente, Nevada; based on record for period 1936-60]

| Probability | Dates for given probability and temperature | | | | |
|----------------------------|---|----------------|----------------|----------------|----------------|
| | 16° F or lower | 20° F or lower | 24° F or lower | 28° F or lower | 32° F or lower |
| Spring: | | | | | |
| 1 year in 10 later than | March 28 | April 11 | April 21 | May 10 | May 26 |
| 2 years in 10 later than | March 15 | March 31 | April 12 | May 1 | May 17 |
| 5 years in 10 later than | March 1 | March 21 | April 3 | April 22 | May 8 |
| Fall: | | | | | |
| 1 year in 10 earlier than | November 5 | October 30 | October 19 | October 1 | September 21 |
| 2 years in 10 earlier than | November 13 | November 5 | October 26 | October 9 | September 28 |
| 5 years in 10 earlier than | November 21 | November 11 | November 1 | October 17 | October 5 |

orientation of the mountains lead to predominant southerly or southwesterly valley winds. Winds from all directions, however, can occur. Although no wind records are available, estimation from widespread statistics indicate that windspeed of gusts to 75 miles per hour can be expected with a 50-year average occurrence. Average wind velocities are less than 20 miles per hour.

The survey area lies in the path of warm, moist air masses from the Gulf of Mexico. Consequently, eastern Nevada, including the Meadow Valley Area, can expect an average of 20 to 25 thunderstorm days a year. Hail, which averages 3 to 4 days per year, is usually very small and causes minimal damage.

Precipitation in the survey area, like most semiarid areas, is highly variable. In a 24-hour period as much as 3.02 inches of precipitation has fallen at Pioche and 2.11 inches has fallen at Caliente. Snowfall averages about 12 inches in the southern section of the surrounding area to 60 inches in the mountain peaks. As much as 2 feet of snow has fallen in a 24-hour period.

Average pan evaporation is estimated between 75 and 80 inches annually with the larger amount occurring at the southern end of the valley. Relative humidity averages about 30 percent in summer to about 60 percent in winter. Daytime humidities, however, are considerably lower, averaging from 15 to 20 percent in summer to about 40 percent in winter.

TABLE 3.—*Temperature and precipitation data, Pioche, Nevada*

[Based on records for the period 1941-70]

| Month | Temperature | | | | Precipitation | | | |
|-----------|-----------------------|-----------------------|---|---|-----------------------|---------------------------|------------|------------------|
| | Average daily maximum | Average daily minimum | Two years in 10 will have at least 4 days with— | | Average monthly total | One year in 10 will have— | | Average snowfall |
| | | | Maximum temperature equal to or higher than— | Minimum temperature equal to or lower than— | | Less than— | More than— | |
| °F | °F | °F | °F | In | In | In | In | |
| January | 41.4 | 20.9 | 54 | 9 | 1.47 | 0.19 | 2.77 | 11.2 |
| February | 45.2 | 23.7 | 57 | 12 | 1.24 | .08 | 2.94 | 7.3 |
| March | 50.6 | 26.9 | 62 | 16 | 1.37 | .16 | 3.11 | 8.8 |
| April | 60.4 | 34.5 | 73 | 26 | 1.29 | .18 | 2.77 | 4.2 |
| May | 70.6 | 42.8 | 81 | 33 | .73 | .01 | 1.72 | .5 |
| June | 80.6 | 50.7 | 92 | 41 | .40 | .01 | .93 | .1 |
| July | 88.9 | 58.1 | 95 | 53 | 1.14 | .06 | 2.69 | ----- |
| August | 86.0 | 56.8 | 93 | 51 | 1.25 | .01 | 2.10 | ----- |
| September | 78.8 | 50.0 | 87 | 42 | .64 | .01 | 1.56 | ----- |
| October | 66.4 | 39.7 | 77 | 30 | .95 | .01 | 1.86 | 1.3 |
| November | 51.9 | 28.9 | 63 | 17 | 1.19 | .05 | 2.24 | 4.7 |
| December | 43.2 | 22.8 | 54 | 11 | 1.70 | .01 | 2.70 | 9.4 |
| Year | 63.7 | 38.0 | ----- | ----- | 13.37 | ----- | ----- | 47.5 |

TABLE 4.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Pioche, Nevada; based on record for period 1941-70]

| Probability | Dates for given probability and temperature | | | | |
|----------------------------|---|----------------|----------------|----------------|----------------|
| | 16° F or lower | 20° F or lower | 24° F or lower | 28° F or lower | 32° F or lower |
| Spring: | | | | | |
| 1 year in 10 later than | April 11 | April 23 | May 2 | May 16 | June 5 |
| 2 years in 10 later than | March 27 | April 11 | April 21 | May 7 | May 28 |
| 5 years in 10 later than | March 12 | March 29 | April 11 | April 28 | May 19 |
| Fall: | | | | | |
| 1 year in 10 earlier than | November 7 | October 29 | October 19 | October 7 | September 30 |
| 2 years in 10 earlier than | November 17 | November 5 | October 28 | October 16 | October 8 |
| 5 years in 10 earlier than | November 26 | November 12 | November 5 | October 24 | October 15 |

Physiography and Geology

The survey area is in part of the Colorado River drainage basin. It lies in the eastern part of the Great Basin section of the Basin and Range physiographic province (3).

Meadow Valley Watershed, an elliptical basin, comprises about two-thirds of the northern half of the survey area. The basin replenishes the source of Meadow Valley Wash, which crosses the survey area near the northern boundary and the southwestern corner. It eventually reaches the Virgin River at Boulder Dam, where the area is now inundated by Lake Mead. Patterson Wash enters the survey area a

few miles north of Pioche along the western border. It ends in Hamlight Canyon which joins Condor Canyon just below the Mount Diablo base line near the center of the survey area. Another major drainage system begins in the southeastern part of the survey area near Crestline on State Route 75, and flows in a southwesterly direction. It leaves the survey area near Acoma along the Union Pacific Railroad but reenters at the southern boundary and drains into Meadow Valley Wash within the city limits of Caliente.

The flood plains along Meadow Valley Wash range in elevation from about 4,400 feet in Caliente to 6,800 feet in Camp Valley, which lies within the Meadow Valley Watershed. Terraces and alluvial fans are

present on both sides of the major drainageways, and elevation ranges from 4,600 to 6,200 feet in the Panaca area, 5,600 to 6,200 feet near Patterson Wash, and 6,000 to 7,200 feet within the watershed.

The major mountain ranges in the survey area are oriented generally to the north and to the south. Wilson Creek Range forms the western side of the Meadow Valley Watershed and has a maximum elevation of 9,262 feet at Mount Wilson. White Rock Peak has an elevation of 9,196 feet and is the highest point of the White Rock Mountains. These mountains form the northern end of the eastern side of Meadow Valley Watershed. The Needle Mountains are a southern extension of the White Rock Mountains and complete the eastern side of the Meadow Valley Watershed. The peaks of the Needle Mountains are as high as 8,540 feet. Another range of mountains is parallel to and about 7 miles east of Panaca Valley. This range has peaks that have elevations as high as 7,240 feet.

The mountain ranges of the survey area are completely folded and faulted blocks of igneous, metamorphic, and sedimentary rocks. The present topography generally results from movement along the numerous north-trending faults.

Alluvial fans along mountain fronts are formed by soil material washed from the mountains. For the most part, the fans are extensively dissected but retain their original form.

The alluvial fans in Patterson Valley that border the Ely Range on the western side and the Wilson Creek Range on the eastern side nearly merge along the axis of the valley. This results in the development of a very narrow flood plain. The maximum development of the flood plain is east of Pioche. Here it reaches a width of about a mile.

In Spring Valley, Eagle Valley, Rose Valley, and Dry Valley a distinctive, very narrow, flat flood plain has developed. It seldom exceeds a mile in width.

The flood plain of Panaca Valley is the largest flood plain in the Meadow Valley Area. It is broad and flat and has a slope to the south of about 25 feet per mile. It extends up the principal tributary valleys several miles laterally from the axis of the main drainage channel. Cutting, eroding, and dissection of Pliocene lakebeds, Panaca Formation, have formed the flood plain and three distinct terraces in Panaca Valley. The lowest terrace underlies the alluvial bottom lands. The depth of recent alluvium in the Panaca bottom lands ranges from about 15 feet near the mouth of Condor Canyon to about 166 feet at Cove Canyon (2).

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey 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 the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down

into the parent material that has not been changed much by leaching or by the action of plant roots.

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

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

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

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

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered 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. Two such kinds of mapping units are shown on the soil map of the survey area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, or land types, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils joined by a hyphen. Kyler-Rock outcrop 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. Itca-Cedaran association is an example.

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

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

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

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

General Soil Map

The General Soil Map at the back of this survey shows, in color, the soil associations in the Meadow Valley 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 this survey have been grouped into 4 general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations in each group are described in the following pages.

Soils on High Mountains and on Foothills

These well-drained, very shallow to very deep, strongly sloping to very steep soils are on foothills and mountain faces. They formed in residuum derived primarily from ignimbrites.

These soils are mostly in the northern half of the survey area and generally follow the crest of the Meadow Valley Watershed. They are in the part of Iron County, Utah, that is in the survey area. A few isolated areas of these soils are at the highest elevations in the southeastern part of the survey area. Elevation ranges from 7,000 to 9,300 feet. The average annual precipitation is about 14 to 24 inches, and the average annual air temperature is about 35° to 45° F. The frost-free season is about 40 to 80 days.

Two associations are in this group. They make up about 22 percent of the survey area.

1. Tica-Rock outcrop-Hamtah association

Very shallow to very deep, well-drained and somewhat excessively drained, moderately steep to steep soils and rock outcrops; on foothills and mountain faces

The soils of this association are in both large and small areas in the northern part of the survey area. Elevation ranges from 7,000 to 9,200 feet. The average annual precipitation is 14 to 22 inches, and the average annual air temperature is 35° to 47° F. The frost-free season is about 40 to 80 days.

This association makes up about 15 percent of the survey area. It is about 35 percent Tica soils, 25 percent Rock outcrop, 15 percent Hamtah soils, and 25 percent minor soils. Udel soils make up 10 percent of the areas of minor soils, and Fanu, Holtle, Nevta, Nevu, Urtah, Urwil, and Alluvial land make up 15 percent.

Tica soils are on mountain and foothill faces. Slopes are 15 to 30 percent. The surface layer is gray very stony loam and grayish-brown stony loam about 5 inches thick. The next layer is brown stony light clay. Below this is cobbly sandy clay loam. Volcanic bedrock is at a depth of about 18 inches. These soils have a plant cover of pinon pine, scattered Utah juniper, mountainmahogany, big sagebrush, low sagebrush, bitterbrush, and miscellaneous grasses.

Rock outcrop is in both large and small areas throughout the association.

Hamtah soils are on mountain faces. Slopes are 30 to 50 percent. The surface layer is dark grayish-brown very stony clay loam and gravelly clay loam about 21 inches thick. The next layer is brown and pinkish-gray gravelly and very gravelly clay. The underlying layer is variegated brown, strong-brown, and white very gravelly clay loam that extends to a depth of about 60 inches. These soils have a plant cover of big sagebrush, serviceberry, bitterbrush, snowberry, scattered pinon pine, mountainmahogany, bluebunch wheat-

grass, Great Basin wildrye, squirreltail, and Thurber needlegrass.

This association mostly provides grazing, wildlife habitat, and watershed. It is not suitable for irrigated crops or range seeding. The Tica soils are a source for fireplace wood.

2. *Winu-Rock outcrop-Winz association*

Moderately deep to very deep, well-drained, strongly sloping to very steep soils and rock outcrops; on mountain faces

The soils of this association are in a large area in the northwestern corner of the survey area. Elevation ranges from 7,600 to 9,300 feet. The average annual precipitation is 14 to 24 inches, and the average annual air temperature is 38° to 43° F. The frost-free season is about 40 to 50 days.

This association makes up about 7 percent of the survey area. It is about 55 percent Winu soils, 15 percent Rock outcrop, 15 percent Winz soils, and 15 percent minor soils of the Wilpar, Udel, and Nevtah series.

Winu soils are on mountain faces. Slopes are 15 to 75 percent. The surface layer is dark-gray very stony and extremely stony loam about 2 inches thick. The next layer is dark grayish-brown very gravelly clay loam about 7 inches thick. Below this is brown gravelly clay loam about 13 inches thick over light-brown sandy loam. The underlying soil layer is brown loam. Bedrock is at a depth of 38 inches. These soils have a plant cover of low sagebrush, big sagebrush, bitterbrush, serviceberry, mountainmahogany, manzanita, and various grasses.

Rock outcrop is in small areas throughout the association.

Winz soils are on mountain faces. Slopes are 30 to 75 percent. The surface layer is dark duff about 4 inches thick. The next layer is light brownish-gray very stony and extremely stony sandy loam about 5 inches thick. Below this layer is light-gray very gravelly coarse sandy loam about 18 inches thick. The underlying layer is light-gray very gravelly, cobbly, and stony clay that extends to a depth of 60 inches. These soils have a plant cover of mountainmahogany, Douglas-fir, manzanita, serviceberry, various grasses, and a few scattered ponderosa pine.

This association mostly provides grazing, wildlife habitat, and watershed. The Winu and Winz soils are not suitable for irrigated crops or range seeding.

Soils on Low Mountains and on Foothills

These well-drained, very shallow to moderately deep, gently sloping to steep soils are on foothills and on mountain faces. They formed in residuum derived mainly from ignimbrites.

These soils are in large and small areas mainly in the southern part of the survey area. A limited acreage, however, is in the northern part of the survey area. Elevation ranges from 5,000 to 7,500 feet. The average annual precipitation is about 10 to 16 inches, and the average annual air temperature is about 42° to 53° F. The frost-free season is about 60 to 120 days.

One association is in this group. It makes up about 21 percent of the survey area.

3. *Itca-Rock outcrop-Cedaran association*

Very shallow to moderately deep, well-drained, gently sloping to steep soils and rock outcrops; on foothills and mountain faces

The soils of this association are in both large and small areas in the central and southern parts of the survey area. Elevation ranges from 5,000 to 7,500 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 42° to 53° F. The frost-free season is about 60 to 120 days.

This association makes up about 21 percent of the survey area. It is about 40 percent Itca soils, 20 percent Rock outcrop, 20 percent Cedaran soils, 10 percent Zoate soils, and 10 percent minor soils of the Aned, Minu, Decan, Fanu, Patter, Kyler, and Pioche series and Alluvial land and Rock land.

Itca soils are on mountain and foothill faces. Slopes are 2 to 50 percent. The surface layer is grayish-brown stony loam and very stony loam about 2 inches thick. The next layer is dark grayish-brown gravelly clay loam about 12 inches thick. The underlying layer is brown gravelly clay that extends to bedrock at a depth of 14 inches. These soils have a plant cover of pinon pine, Utah juniper, big sagebrush, low sagebrush, bitterbrush, and miscellaneous grasses.

Rock outcrop is in both large and small areas throughout the association.

Cedaran soils are on mountain and foothill faces. Slopes are 4 to 50 percent. The surface layer is grayish-brown cobbly loam about 3 inches thick. The underlying layer is grayish-brown and brown gravelly clay loam that extends to bedrock at a depth of 18 inches. These soils have a plant cover of pinon pine, Utah juniper, big sagebrush, snowberry, bitterbrush, Indian ricegrass, and needleandthread.

This association mostly provides grazing, wildlife habitat, and watershed. It is not suitable for irrigated crops or range seeding.

Soils on Upper Terraces and on Alluvial Fans

These well-drained to excessively drained, shallow to very deep, nearly level to steep soils are on terrace tops and their side slopes and on alluvial fans. They formed in mixed alluvium. The shallow to deep soils contain cemented hardpans of varying thickness.

These soils are in large and small areas throughout the survey area. Elevation ranges from 4,800 to 7,800 feet. The average annual precipitation is about 8 to 16 inches, and the average annual air temperature is about 40° to 53° F. The frost-free season is about 80 to 130 days.

Eight associations are in this group. They make up about 51 percent of the survey area.

4. *Acana-Roval-Seval association*

Shallow and moderately deep, well-drained, nearly level to moderately sloping soils on terraces and alluvial fans and moderately deep, well-drained, steep soils on terrace side slopes

The soils of this association are in both large and small areas in the central part of the survey area. Elevation ranges from 5,000 to 6,200 feet. The average annual precipitation is 8 to 14 inches, and the

average annual air temperature is 45° to 53° F. The frost-free season is about 100 to 120 days.

This association makes up about 10 percent of the survey area. It is about 45 percent Acana soils, 25 percent Roval soils, 10 percent Seval soils, and 20 percent minor soils of the Umil, Cath, Linco, Heist, Ursine, Fanu, Patter, and Geer series and Alluvial land and Badland.

Acana soils are on tops and upper side slopes of terraces and on alluvial fans. Slopes are 2 to 8 percent. The surface layer is pale-brown gravelly sandy loam about 3 inches thick. The next layer is pale-brown sandy clay loam about 7 inches thick. Below this is very pale brown gravelly loamy sand that is weakly stratified and strongly cemented with lime and silica. It is capped by a layer of indurated silica. These soils have a plant cover of black sagebrush, low rabbitbrush, Utah juniper, Nevada ephedra, big sagebrush, squirreltail, needleandthread, and Indian ricegrass.

Roval soils are on dissected valley-fill terraces. Slopes are 2 to 15 percent. The surface layer is pale-brown gravelly loam about 2 inches thick. The next layer is brown gravelly clay loam about 12 inches thick. Below this is a very pale brown cemented hardpan stratified with weakly cemented to indurated silica-lime cemented material. These soils have a plant cover of big sagebrush, black sagebrush, squirreltail, blue grama, Indian ricegrass, and scattered Utah juniper.

Seval soils are on terrace side slopes. Slopes are 30 to 50 percent. The surface layer is grayish-brown very gravelly sandy loam about 3 inches thick. The next layer is brown gravelly sandy clay loam about 3 inches thick. Below this is about 8 inches of light-brown gravelly clay over light-brown gravelly sandy loam that is brittle. The underlying layer is capped by indurated silica. These soils have a plant cover of Utah juniper, cliffrose, big sagebrush, and miscellaneous grasses.

This association mostly provides grazing and wildlife habitat. It is not suitable for irrigated crops or range seeding.

5. Badland-Linco-Acana association

Shallow to very deep, well-drained to excessively drained, strongly sloping to very steep soils on terrace side slopes and gently sloping to moderately sloping soils on terrace tops

The soils of this association are in both large and small irregularly shaped areas in the western part of the survey area (fig. 1). Elevation ranges from 4,800 to 6,600 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 46° to 51° F. The frost-free season is about 100 to 130 days.

This association makes up about 6 percent of the survey area. It is about 40 percent Badland, 35 percent Linco soils, 15 percent Acana soils, and 10 percent minor soils of the Bit, Cath, Cliffdown, Geer, Heist, Sieroclipf, Ursine, and Denmark series and Alluvial land.

Badland is on severely dissected terrace side slopes. Slopes are 30 percent to nearly vertical. This land type has virtually no plant cover.

Linco soils are on terrace side slopes. Slopes are 4

to 30 percent. The surface layer is light brownish-gray gravelly sandy loam about 3 inches thick. The next layer is pinkish-gray gravelly loam about 5 inches thick. Below this layer is pinkish-gray slightly brittle gravelly fine sandy loam about 17 inches thick. The underlying layer is pinkish-gray gravelly fine sandy loam that has thin strata of sandy loam and loam. These soils have a plant cover of black sagebrush, big sagebrush, low rabbitbrush, Nevada ephedra, Utah juniper, Indian ricegrass, needleandthread, and galleta.

Acana soils are on the tops and upper side slopes of terraces and on alluvial fans. Slopes are 2 to 8 percent. The surface layer is pale-brown gravelly sandy loam about 3 inches thick. The next layer is pale-brown slightly plastic sandy clay loam about 7 inches thick. Below this layer is very pale-brown gravelly loamy sand that is weakly to strongly cemented with lime and silica. It is capped by a layer of indurated silica. These soils have a plant cover of black sagebrush, low rabbitbrush, Utah juniper, Nevada ephedra, big sagebrush, squirreltail, needleandthread, and Indian ricegrass.

This association mostly provides scenery and esthetics, grazing, and wildlife habitat. It is not suitable for irrigated crops or range seeding.

6. Basket-Satt-Decathon association

Very deep, well-drained, moderately steep and steep soils on terrace side slopes and moderately deep, well-drained, gently sloping to moderately steep soils on terraces

The soils of this association are in both large and small areas in the northern part of the survey area. Elevation ranges from 6,000 to 7,800 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 40° to 45° F. The frost-free season is about 80 to 110 days.

This association makes up about 5 percent of the survey area. It is about 30 percent Basket soils, 25 percent Satt soils, 15 percent Decathon soils, 15 percent Swisbob soils, and 15 percent minor soils of the Lize, Holtle, Fanu, and Lien series and Alluvial land and Rough broken land.

Basket soils are on terrace side slopes. Slopes are 15 to 50 percent. The surface layer is brown and pinkish-gray gravelly sandy loam and gravelly fine sandy loam about 4 inches thick. The next layer is brown very gravelly coarse sandy clay loam about 6 inches thick. Below this is very gravelly sandy loam about 17 inches thick. The next layer is pinkish-gray very gravelly coarse sand over very gravelly sandy loam that extends to a depth of 60 inches. These soils have a plant cover of pinon pine, Utah juniper, miscellaneous grasses, and a sparse understory of big sagebrush.

Satt soils are on terraces. Slopes are 4 to 30 percent. The surface layer is light brownish-gray stony, very stony, and extremely stony sandy loam about 2 inches thick. The next layer is grayish-brown gravelly sandy clay loam about 5 inches thick. Below this is brown gravelly clay and very gravelly sandy clay about 10 inches thick. The next layer is light-brown very gravelly sandy clay loam about 8 inches thick over a very pale brown indurated hardpan cemented with silica and lime. These soils have a plant cover of pinon

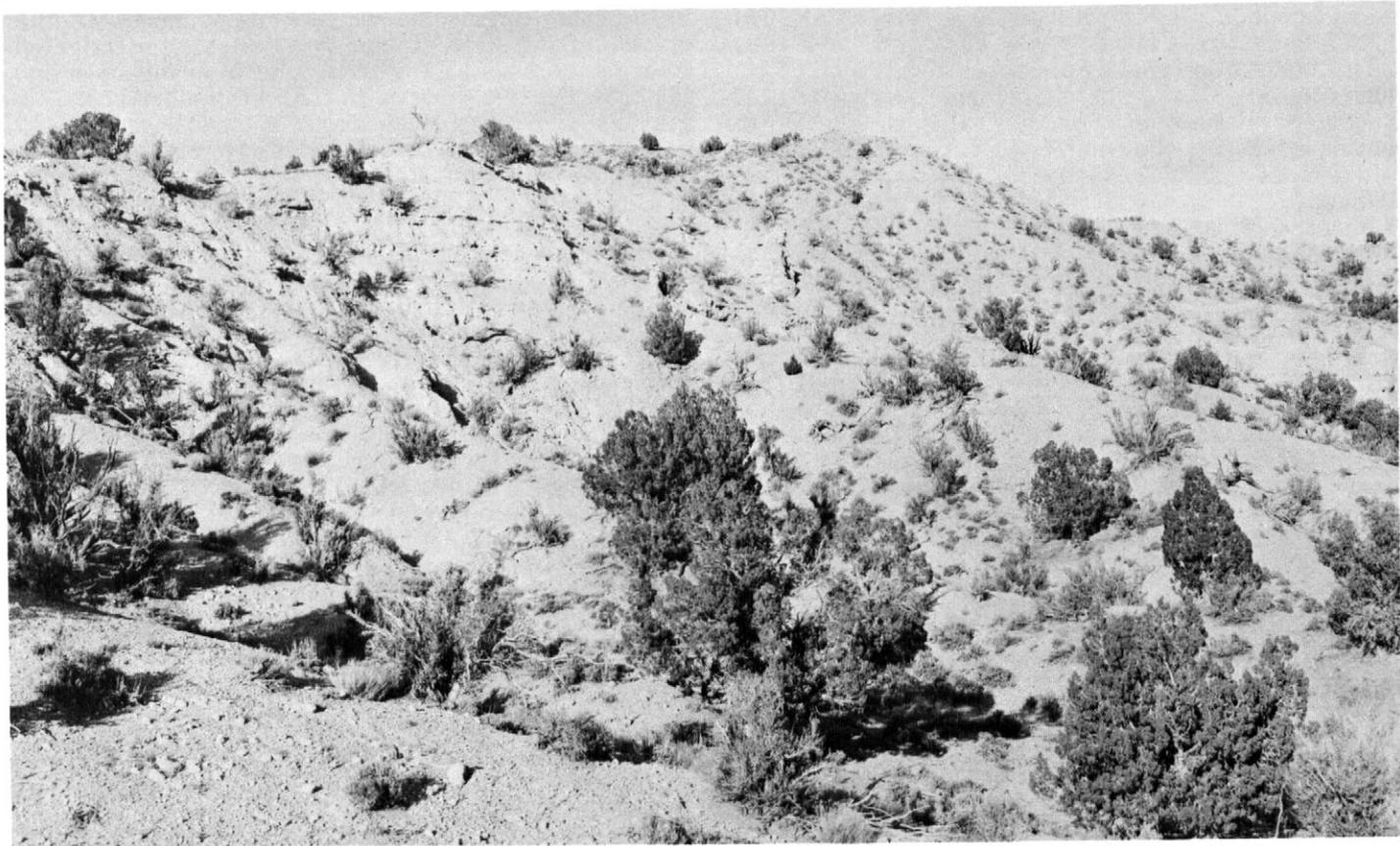


Figure 1.—Area of association 5.

pine, Utah juniper, big sagebrush, black sagebrush, bitterbrush, and scattered miscellaneous grasses.

Decathon soils are on terrace tops. Slopes are 2 to 8 percent. The surface layer is light brownish-gray gravelly loam about 4 inches thick. The next layer is a sequence of brown clay loam and gravelly sandy clay loam, and very pale brown gravelly sandy loam about 23 inches thick. Below this is a white hardpan strongly cemented with silica and lime about 10 inches thick. It is capped by and contains a thin layer of indurated silica. These soils have a plant cover of pinon pine, Utah juniper, and black sagebrush.

This association mostly provides grazing, wildlife habitat, and watershed. It is not suitable for irrigated crops. The Basket and Satt soils are a potential source of Christmas trees, juniper posts, and pinenuts.

7. Cath-Timpahute-Jarab association

Shallow to very deep, well-drained, nearly level to strongly sloping soils on terraces, terrace side slopes, and alluvial fans

The soils of this association are in both small and medium areas in the west-central part of the survey area. Elevation ranges from 5,500 to 6,400 feet. The average annual precipitation is 8 to 14 inches, and the average annual air temperature is 45° to 53° F. The frost-free season is about 100 to 120 days.

This association makes up about 3 percent of the survey area. It is about 35 percent Cath soils, 30 per-

cent Timpahute soils, 25 percent Jarab soils, and 10 percent minor soils of the Minu, Patter, Acana, and Heist series and Alluvial land.

Cath soils are on broad, moderately dissected terraces. Slopes are 2 to 8 percent. The surface layer is pale-brown gravelly loam about 3 inches thick. The next layer is brown and light-brown clay loam about 10 inches thick. Below this is reddish-brown gravelly clay loam about 6 inches thick. The next layer is reddish-brown very gravelly sandy clay loam about 6 inches thick. The underlying layer is stratified white, pale-brown, and light brownish-gray material strongly cemented with lime and silica. It extends to a depth of 60 inches or more. These soils have a plant cover of big sagebrush, black sagebrush, and scattered Utah juniper, and a thin understory of galleta and Indian ricegrass.

Timpahute soils are on broad terraces. Slopes are 0 to 15 percent. The surface layer is pale-brown gravelly loam about 3 inches thick. The next layer is brown clay loam about 7 inches thick. Below this is brown and light-brown clay about 15 inches thick. The next layer consists of a light-gray gravelly hardpan strongly cemented with silica and lime. It is capped by a layer of indurated silica about 17 inches thick. These soils have a plant cover of big sagebrush, squirreltail, needleandthread, blue grama, and scattered Utah juniper.

Jarab soils are on terraces and on alluvial fans.

Slopes are 2 to 15 percent. The surface layer is brown cobbly and gravelly loam about 5 inches thick. The next layer is brown gravelly clay loam about 5 inches thick. Below this is white and very pale brown gravelly loam and gravelly sandy loam weakly to strongly cemented. It is capped by and contains thin indurated silica which extends to a depth of 60 inches. These soils have a plant cover of Utah juniper, cliffrose, black sagebrush, pinon pine, and galleta.

This association mostly provides grazing and wildlife habitat. Cath soils are suitable for range seeding and marginally suitable for irrigated crops if water is available.

8. Decan-Uana-Shroe association

Moderately deep to very deep, well-drained, gently sloping to moderately steep soils on terrace tops, alluvial fans, and side slopes

The soils of this association are in both large and small areas in the southeastern part of the survey area. Elevation ranges from 5,000 to 7,000 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 41° to 48° F. The frost-free season is about 80 to 130 days.

This association makes up about 10 percent of the survey area. It is about 50 percent Decan soils, 15 percent Uana soils, 15 percent Shroe soils, 10 percent Aned soils, and 10 percent minor soils of the Acoma, Fanu, Heist, Linco, Geer, and Patter series and Alluvial land and Badland.

Decan soils are on terraces and alluvial fans. Slopes are 2 to 30 percent. The surface layer is grayish-brown gravelly clay loam about 3 inches thick. The next layer is brown clay about 14 inches thick. Below this is pink loam about 6 inches thick. The next layer is sandy loam weakly to strongly cemented with silica. It is capped by and contains continuous layers of indurated silica. These soils have a plant cover of Utah juniper, pinon pine, big sagebrush, black sagebrush, bitterbrush, needleandthread, and Indian ricegrass.

Uana soils are on strongly dissected old valley-fill terraces. Slopes are 2 to 15 percent. The surface layer is dark grayish-brown gravelly loam and sandy clay loam about 3 inches thick. The next layer is dark-brown and dark grayish-brown clay about 9 inches thick. Below this is pinkish-gray over white clay loam about 15 inches thick. The next layer is white and light grayish-brown brittle sandy loam weakly to strongly cemented with lime. It is capped by very thin indurated silica laminae. These soils have a plant cover of Utah juniper, pinon pine, big sagebrush, black sagebrush, bitterbrush, and Indian ricegrass.

Shroe soils are on old valley-fill terrace tops and on side slopes. Slopes are 2 to 30 percent. The surface layer is brown gravelly loam about 2 inches thick. The next layer is cobbly sandy clay loam about 4 inches thick. Below this is brown gravelly sandy clay loam about 4 inches thick. The next layer is brown gravelly clay about 6 inches thick. Below this is brown very gravelly sandy loam about 24 inches thick. The underlying layer is light-brown loam that extends to a depth of 60 inches. These soils have a plant cover of Utah juniper, big sagebrush, needleandthread, squirreltail, and scattered pinon pine.

This association mostly provides grazing, wildlife habitat, and watershed. It is not suitable for irrigated crops. The Shroe soils are suitable for range seeding. These soils are a potential source of juniper posts.

9. Homestake-Lize-Buster association

Very deep, well-drained, nearly level to steep soils on terrace tops and terrace side slopes

The soils of this association are in both narrow and broad areas in the north-central part of the survey area. Elevation ranges from 5,800 to 7,500 feet. The average annual precipitation is 8 to 14 inches, and the average annual air temperature is 40° to 45° F. The frost-free season is about 80 to 110 days.

This association makes up about 4 percent of the survey area. It is about 30 percent Homestake soils, 20 percent Lize soils, 15 percent Buster soils, about 15 percent Holsine soils, and 20 percent minor soils of the Hottle, Usine, Fanu, Poorma, Linco, and Basket series and Badland, Rough broken land, and Alluvial land.

Homestake soils are on terrace tops. Slopes are 2 to 15 percent. The surface layer is grayish-brown gravelly and very stony sandy loam about 2 inches thick. The next layer is dark grayish-brown gravelly sandy clay loam about 4 inches thick. Below this is about 19 inches of stratified dark grayish-brown gravelly clay loam and very gravelly clay, brown very gravelly clay loam, and brownish-gray very cobbly and gravelly sandy clay loam. The underlying layer is very pale brown, weakly cemented, very cobbly sandy clay loam and gravelly loamy sand. These soils have a plant cover of pinon pine, Utah juniper, big sagebrush, bitterbrush, needleandthread, and squirreltail.

Lize soils are on terrace side slopes. Slopes are 15 to 50 percent. The surface layer is grayish-brown stony fine sandy loam about 2 inches thick. The next layer is dark grayish-brown gravelly loam about 5 inches thick. Below this is about 28 inches of dark grayish-brown and grayish-brown gravelly clay loam. The underlying layer is light brownish-gray gravelly sandy loam. These soils have a plant cover of pinon pine, Utah juniper, big sagebrush, bitterbrush, and needleandthread.

Buster soils are on terrace tops. Slopes are 0 to 8 percent. The surface layer is light brownish-gray fine sandy loam about 3 inches thick. The next layer is brown loam about 4 inches thick. Below this is about 10 inches of brown sandy clay loam over pale-brown clay loam about 5 inches thick. The next layer is white loam that has a few discontinuous, strongly silica-cemented lenses. These soils have a plant cover of Utah juniper, black sagebrush, big sagebrush, cliffrose, low rabbitbrush, Indian ricegrass, needleandthread, galleta, three-awn, and blue grama.

This association mostly provides grazing, wildlife habitat, and watershed. Buster soil is marginally suitable for irrigated crops if water becomes available. The Buster soils are also suitable for range seeding.

10. Minu-Vil association

Shallow, well-drained, nearly level to moderately sloping soils on terraces

The soils of this association are in irregularly shaped areas mostly in the central part of the survey

area. Elevation ranges from 6,000 to 6,500 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is about 80 to 110 days.

This association makes up about 5 percent of the survey area. It is about 70 percent Minu soils, 10 percent Vil soils, and 20 percent minor soils of the Timpahute, Vicu, Linco, Poorma, and Acana series and Alluvial land.

Minu soils are on terrace tops. Slopes are 0 to 8 percent. The surface layer is light brownish-gray stony or gravelly sandy loam about 3 inches thick. The next layer is brown gravelly clay loam about 6 inches thick. Below this is very pale brown gravelly light clay loam about 4 inches thick. The next layer is a very pale brown gravelly sandy loam hardpan. It is weakly to strongly cemented with silica and lime that contains thin, indurated silica layers. These soils have a plant cover of Utah juniper, pinon pine, cliffrose, big sagebrush, black sagebrush, and miscellaneous grasses.

Vil soils are on dissected alluvial fans. Slopes are 2 to 8 percent. The surface layer is grayish-brown gravelly loam about 7 inches thick. The next layer is brown gravelly sandy clay loam about 5 inches thick. Below this is white gravelly loam that is weakly cemented with silica and lime. The next layer is a white hardpan cemented with silica and lime. It contains many thin, indurated silica laminae. These soils have a plant cover of Utah juniper, pinon pine, black sagebrush, big sagebrush, squirreltail, and Indian ricegrass.

This association mostly provides grazing, wildlife habitat, and watershed. These soils are not suitable

for irrigated crops or for range seeding. Minu and Vil soils are a potential source of juniper posts. Pine nuts are abundant in some locations.

11. Ursine-Denmark-Sierocliiff association

Shallow and moderately deep, well-drained, nearly level to moderately steep soils on terrace tops, terrace side slopes, and alluvial fans

The soils of this association are in both large and small areas along the western border of the survey area (fig. 2). Elevation ranges from 4,800 to 6,500 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 46° to 53° F. The frost-free season is about 100 to 130 days.

This association makes up about 8 percent of the survey area. It is about 30 percent Ursine soils, 25 percent Denmark soils, 10 percent Sierocliiff soils, 10 percent Met soils, and 25 percent minor soils of the Deerlodge, Jarab, Cath, Heist, Geer, Pamsdel, and Linco series and Alluvial land, Badland, and Slickens.

Ursine soils are on tops and side slopes of moderately and strongly dissected terraces and alluvial fans. Slopes are 2 to 30 percent. The surface layer is light brownish-gray gravelly loam about 8 inches thick. The next layer is very pale brown very gravelly loam about 8 inches thick. The underlying layer is white calcareous gravelly loamy sand and gravelly sandy loam weakly cemented with silica and lime containing many thin continuous indurated silica laminae. It extends to a depth of 60 inches or more. These soils have a plant cover of black sagebrush, low rabbitbrush, shadscale,

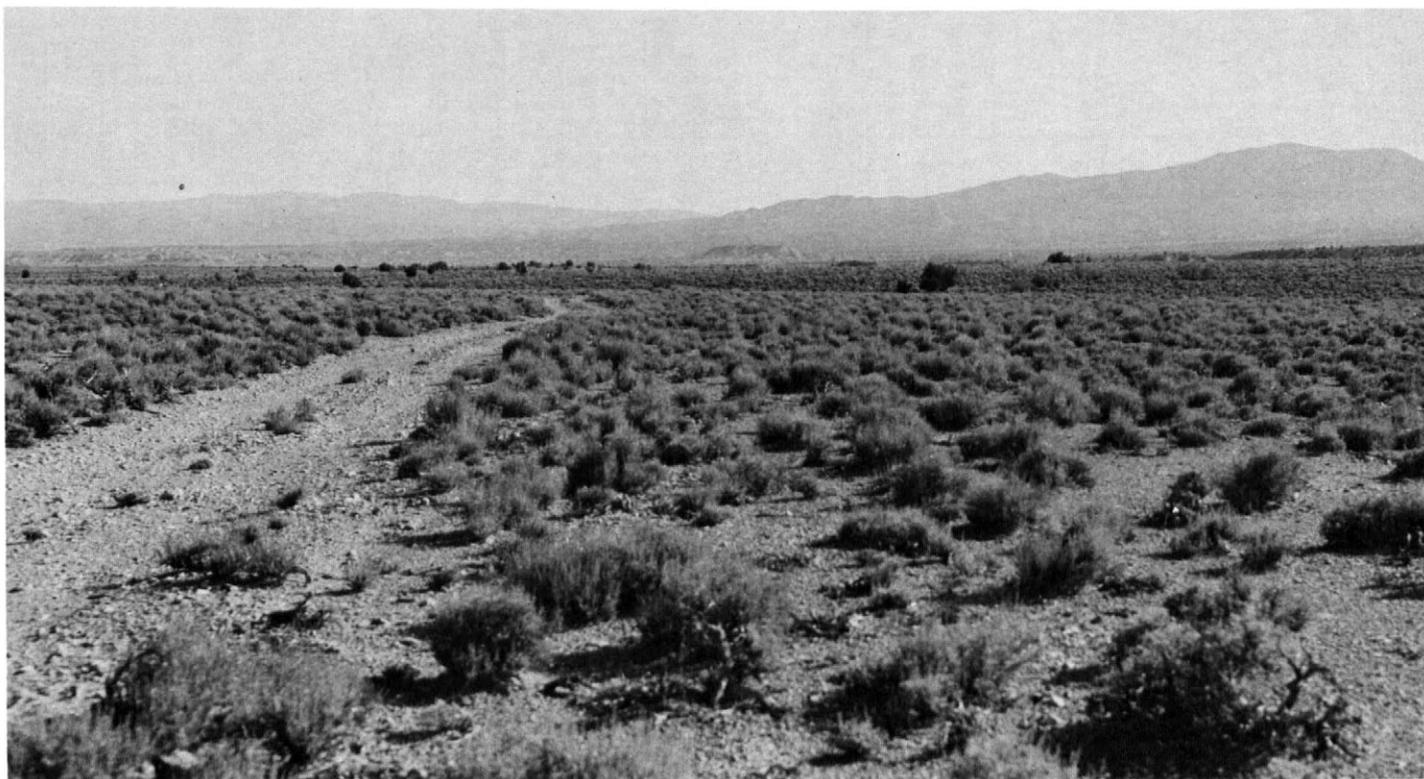


Figure 2.—Area of association 11. Denmark soils are in the foreground.

cliffrose, Indian ricegrass, galleta, three-awn, needle-and-thread, Nevada ephedra, scattered Utah juniper, big sagebrush, and blue grama.

Denmark soils are on old alluvial fans and terraces. Slopes are 2 to 15 percent. The surface layer is light-brown and light-gray gravelly loam about 3 inches thick. The next layer is pale-brown gravelly loam about 12 inches thick. Below this is pale-brown and white gravelly sandy loam and loamy sand weakly to strongly cemented with silica and lime. It is capped by and contains a thin indurated layer cemented with lime. These soils have a plant cover of black sagebrush, squirrel-tail, galleta, and scattered Utah juniper.

Sieroclip soils are on alluvial fans. Slopes are 2 to 8 percent. The surface layer is light brownish-gray gravelly sandy loam about 3 inches thick. The next layer is pale-brown gravelly clay loam about 8 inches thick. Below this is about 10 inches of white gravelly loam weakly cemented with lime. The next layer is a white to very pale brown and light-gray indurated hardpan strongly cemented with lime. These soils have a plant cover of black sagebrush, scattered Utah juniper, cliffrose, Nevada ephedra, big sagebrush, and miscellaneous grasses.

This association mostly provides grazing and wild-life habitat. It is not suitable for range seeding.

Soils on Flood Plains, on Lower Terraces, and on Alluvial Fans

These well drained and moderately well drained, very deep, nearly level to gently sloping soils are on flood plains, and gently sloping to moderately sloping soils are on low alluvial terraces and fans. They formed in alluvium derived mainly from eroding lacustrine sediment.

These soils are in small, narrow areas in the valleys and the lower interterrace drainways. The two associations which make up this group occur in separate temperature regimes. In one association (association 12), elevation ranges from 4,400 to 6,100 feet. The average annual air temperature is about 45° to 52° F, and the average annual precipitation is about 8 to 12 inches. The frost-free season is about 100 to 130 days. In the second association (association 13) elevation ranges from 5,800 to 7,800 feet. The average annual air temperature is about 42° to 45° F, and the average annual precipitation is about 8 to 12 inches. The frost-free season is about 40 to 100 days.

These associations make up about 6 percent of the survey area.

12. Geer-Heist-Patter association

Very deep, well drained and moderately well drained, nearly level to moderately sloping soils on flood plains and short alluvial fans

The soils of this association are in long, narrow areas in the southern part of the survey area. Elevation ranges from 4,400 to 6,100 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 45° to 52° F. The frost-free season is about 100 to 130 days.

This association makes up about 4 percent of the survey area. It is about 50 percent Geer soils, 15 per-

cent Heist soils, 15 percent Patter soils, and 20 percent minor soils of the Cliffdown, Pahrana-gat, Stampede, and Shroe series and Alluvial land.

Geer soils are on bottom lands. Slopes are 0 to 2 percent. The surface layer is light yellowish-brown silt loam or fine sandy loam about 4 inches thick. The underlying layer is stratified light-gray, pale-brown, and brown silt loam and very fine sandy loam, loam, and loamy sand, which extends to a depth of 60 inches. In some areas the seasonal high water table rises to 48 inches. Also, some areas of this soil are slightly to strongly saline. These soils have a plant cover of big sagebrush, greasewood, winterfat, Indian ricegrass, needleandthread, horsebrush, fourwing saltbush, shad-scale, galleta, and dropseed, and miscellaneous annuals. Cultivated crops, including alfalfa and pasture grasses, are grown where irrigation water is available.

Heist soils are on bottom lands and on short alluvial fans. Slopes are 0 to 8 percent. The surface layer is light brownish-gray gravelly sandy loam about 24 inches thick. The underlying layer is very pale brown gravelly sandy loam and sandy loam which extends to a depth of 60 inches. These soils have a plant cover of big sagebrush, rabbitbrush, scattered fourwing saltbush, Indian ricegrass, galleta, and Utah juniper.

Patter soils are on bottom lands and on alluvial fans. Slopes are 0 to 4 percent. The surface layer is pale-brown loam about 5 inches thick. The next layer is pale-brown very fine sandy loam about 11 inches thick. The underlying layer is pale-brown silt loam which extends to a depth of 60 inches. These soils have a plant cover of big sagebrush, rabbitbrush, Indian ricegrass, fourwing saltbush, scattered Utah juniper, and miscellaneous grasses.

This association mostly provides grazing, wildlife habitat, and the production of alfalfa and pasture grasses. It is suitable for irrigated crops if water is available and excessive salts are reduced where necessary. Pahrana-gat soils produce a significant part of the meadow grasses and alfalfa.

13. Hottle-Fanu-Poorma association

Very deep, well-drained, nearly level to moderately sloping soils on flood plains, low alluvial terraces, and alluvial fans

The soils of this association are in narrow long areas in the northern part of the survey area. Elevation ranges from 5,800 to 7,800. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is about 40 to 100 days.

This association makes up about 2 percent of the survey area. It is about 35 percent Hottle soils, 30 percent Fanu soils, 20 percent Poorma soils, and 15 percent minor soils of the Poorma, clay variant, Bicondo-a, and Four Star series.

Hottle soils are on flood plains and on short alluvial fans. Slopes are 0 to 8 percent. The surface layer is gray and grayish-brown loam about 13 inches thick. The underlying layer is light brownish-gray loam and silt loam that extends to a depth of 60 inches. These soils have a plant cover of big sagebrush, Great Basin wildrye, bluestem wheatgrass, squirreltail, and Indian ricegrass.

Fanu soils are on narrow flood plains and on low alluvial terraces. Slopes are 0 to 8 percent. The surface layer is dark grayish-brown gravelly fine sandy loam about 9 inches thick. The underlying layer is stratified grayish-brown loam, light sandy clay loam, and sandy loam that extends to a depth of 60 inches or more. These soils have a plant cover of big sagebrush, squirreltail, Indian ricegrass, bluestem wheatgrass, and scattered Utah juniper.

Poorma soils are on narrow flood plains and on alluvial fans. Slopes are 0 to 4 percent. The surface layer is pale-brown very fine sandy loam about 3 inches thick. The next layer is pale-brown silt loam and very fine sandy loam cemented with silica nodules. It extends to a depth of 60 inches or more. These soils have a plant cover of big sagebrush, squirreltail, Indian ricegrass, needleandthread, and cheatgrass.

This association mostly provides grazing, wildlife habitat, and irrigated meadow grasses. It is suitable for irrigated crops if water is available. The major soils are suitable for range seeding. Bicondoa soils produce a significant amount of meadow grasses on the very poorly drained and poorly drained sites and alfalfa on the drained sites.

Descriptions of the Soils

This section describes the soil series and mapping units in the Meadow Valley Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

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

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

Part of the Meadow Valley Area was mapped at high intensity and part at low intensity. This has resulted in two kinds of mapping units, which are distinguished in the text and on the maps by different map symbols. The symbol for a high-intensity mapping unit consists of a capital letter and a small letter. That for a low-intensity mapping unit consists of two or

three capital letters, and a final number if the soil of the unit is eroded.

Characteristics of the soil series of the survey area are mostly within the range defined for the series. Where a soil has one or more features considered to be outside the defined range, the differences are explained.

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 are the capability unit, range site, wildlife group, and woodland group in which the mapping unit has been placed. The page for the description of each capability unit, and the range site, wildlife group, and woodland group can be learned 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 5. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (4).

Acana Series

The Acana series consists of well-drained soils that formed in stratified lacustrine sediment derived mainly from ignimbrite. These soils are shallow to a hardpan. They are on smooth or undulating dissected valley-fill terraces or alluvial fans. Slopes are mostly 2 to 8 percent. The vegetation is black sagebrush and varying amounts of low rabbitbrush, Utah juniper, Nevada ephedra, big sagebrush, squirreltail, needleandthread, and Indian ricegrass. Elevation ranges from 5,000 to 6,100 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 46° to 50° F. The frost-free season is about 100 to 120 days.

In a representative profile the surface layer is pale-brown gravelly sandy loam about 3 inches thick. The next layer is pale-brown very friable, slightly plastic sandy clay loam about 7 inches thick. It is underlain by very pale brown gravelly loamy sand about 14 inches thick. The loamy sand has thin discontinuous silica laminae in the upper part and is crudely stratified weakly and strongly cemented with silica and lime in the lower part. Underlying this is very pale brown to pale-brown very gravelly and gravelly loamy sand that extends to a depth of 60 inches or more.

Permeability is moderately slow above the very slowly permeable hardpan. Available water capacity is very low. Effective rooting depth is 10 to 20 inches.

The Acana soils are used for grazing and wildlife habitat.

Representative profile of Acana gravelly sandy loam, 2 to 8 percent slopes, under native vegetation, 1,320 feet south and 1,320 feet west of the NE. corner of sec. 9, T. 2 S., R. 69 E., Mount Diablo baseline and meridian:

A1—0 to 3 inches, pale-brown (10YR 6/3) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; common fine interstitial pores; 25 percent gravel; mildly alkaline; abrupt, smooth boundary.

TABLE 5.—Approximate acreage and proportionate extent of the soils

| Soil | Acres | Percent | Soil | Acres | Percent |
|---|--------|---------|---|---------|---------|
| Acana gravelly sandy loam, 2 to 8 percent slopes | 43,467 | 4.83 | Lize-Tica association | 4,695 | 0.52 |
| Acana-Ursine association | 3,178 | .35 | Met-Ursine association | 7,967 | .88 |
| Acoma gravelly sandy loam, 2 to 15 percent slopes | 5,823 | .65 | Minu gravelly sandy loam, 2 to 8 percent slopes | 7,385 | .82 |
| Alluvial land | 521 | .06 | Minu stony sandy loam, 0 to 8 percent slopes | 27,955 | 3.11 |
| Aned sandy loam, 2 to 8 percent slopes | 9,265 | 1.03 | Nevtah-Rock outcrop association | 11,950 | 1.33 |
| Badland | 18,881 | 2.10 | Nevu gravelly sandy loam, 4 to 15 percent slopes | 4,227 | .47 |
| Badland-Bit association | 6,046 | .67 | Pahrnagat silt loam, drained, strongly saline | 941 | .10 |
| Badland-Buster association, eroded | 9,638 | 1.07 | Pahrnagat silt loam, strongly saline | 406 | .05 |
| Basket gravelly fine sandy loam, 30 to 50 percent slopes | 6,365 | .71 | Pahrnagat silty clay loam | 275 | .03 |
| Basket-Lize association | 3,675 | .41 | Pahrnagat silty clay loam, drained | 499 | .05 |
| Bicondoa sandy loam | 216 | .02 | Pamsdel gravelly loam, 2 to 8 percent slopes | 4,638 | .52 |
| Bicondoa silty clay loam, drained | 413 | .05 | Patter-Geer association | 8,172 | .91 |
| Bicondoa complex | 605 | .07 | Patter-Heist association | 1,360 | .15 |
| Buster-Rough broken land association | 3,890 | .43 | Patter-Shroe association | 762 | .08 |
| Cath gravelly loam, 2 to 8 percent slopes | 10,072 | 1.12 | Pioche-Rock outcrop complex | 4,536 | .50 |
| Cedaran-Decan association | 3,556 | .40 | Poorma very fine sandy loam, 0 to 4 percent slopes | 3,045 | .34 |
| Cedaran-Rock outcrop complex | 11,521 | 1.28 | Poorma silt loam, clay variant | 1,500 | .17 |
| Cliffdown-Geer association | 6,246 | .70 | Rock land | 4,492 | .50 |
| Decan-Uana association | 59,609 | 6.62 | Royal gravelly loam, 2 to 15 percent slopes | 24,324 | 2.70 |
| Decathon gravelly loam, 2 to 8 percent slopes | 2,800 | .31 | Royal-Acana association | 4,456 | .50 |
| Decathon-Basket association, moderately steep | 3,025 | .34 | Satt stony sandy loam, 4 to 15 percent slopes, eroded | 2,175 | .24 |
| Decathon-Basket association, steep | 9,405 | 1.04 | Satt stony fine sandy loam, 2 to 8 percent slopes, eroded | 1,930 | .21 |
| Deerlodge association | 897 | .10 | Satt association | 9,264 | 1.03 |
| Deerlodge-Ursine association | 6,594 | .73 | Seval very gravelly sandy loam, 30 to 50 percent slopes | 2,482 | .28 |
| Denmark gravelly loam, 2 to 15 percent slopes | 11,808 | 1.31 | Shroe gravelly loam, 2 to 15 percent slopes | 8,231 | .91 |
| Denmark-Linco association | 4,711 | .52 | Shroe-Badland association | 3,752 | .42 |
| Fanu gravelly fine sandy loam, 0 to 8 percent slopes | 4,898 | .54 | Sierocliiff gravelly sandy loam, 2 to 8 percent slopes | 7,106 | .80 |
| Geer fine sandy loam, gravel substratum | 3,067 | .34 | Slickens | 176 | .02 |
| Geer silt loam | 1,170 | .13 | Stampede gravelly loam | 916 | .10 |
| Geer silt loam, slightly saline | 3,037 | .34 | Swisbob very stony loam, 4 to 8 percent slopes | 6,520 | .72 |
| Geer silt loam, strongly saline | 1,334 | .15 | Tica-Nevtah association | 13,460 | 1.50 |
| Geer silt loam, wet | 776 | .10 | Tica-Rock outcrop association | 37,369 | 4.17 |
| Geer-Heist association | 6,417 | .71 | Timpahute gravelly loam, 0 to 4 percent slopes | 9,754 | 1.08 |
| Hamtah-Tica association | 21,320 | 2.36 | Udel-Rock outcrop association | 11,645 | 1.30 |
| Hamtah-Udel association | 18,835 | 2.10 | Umil gravelly loam, 2 to 4 percent slopes | 7,970 | .88 |
| Heist gravelly sandy loam, 0 to 8 percent slopes | 3,958 | .44 | Ursine gravelly loam, 2 to 15 percent slopes | 9,457 | 1.05 |
| Heist gravelly sandy loam, sand substratum, 0 to 8 percent slopes | 1,079 | .12 | Ursine gravelly loam, 15 to 30 percent slopes | 2,429 | .27 |
| Holsine-Ursine association | 3,750 | .42 | Ursine-Badland association | 10,432 | 1.16 |
| Hottle loam, 0 to 8 percent slopes | 4,320 | .48 | Urtah-Rock outcrop association | 3,135 | .35 |
| Hottle-Four Star association | 715 | .08 | Urwil stony fine sandy loam, 2 to 15 percent slopes | 4,066 | .45 |
| Homestake gravelly sandy loam, 4 to 8 percent slopes | 10,850 | 1.20 | Vicu stony sandy loam, 2 to 8 percent slopes | 2,575 | .30 |
| Homestake very stony sandy loam, 2 to 8 percent slopes | 3,100 | .34 | Vil gravelly loam, 2 to 8 percent slopes | 5,622 | .62 |
| Itca stony clay loam, 2 to 15 percent slopes | 12,872 | 1.43 | Wilpar very stony sandy loam, 30 to 50 percent slopes | 5,320 | .60 |
| Itca-Cedaran association | 85,650 | 9.52 | Winu extremely stony loam, 50 to 75 percent slopes | 12,760 | 1.42 |
| Itca-Rock outcrop association | 53,433 | 5.91 | Winu-Rock outcrop association | 34,940 | 3.88 |
| Jarab cobbly loam, 2 to 15 percent slopes | 6,137 | .68 | Winz association | 5,460 | .61 |
| Kyler-Rock outcrop complex | 2,442 | .27 | Zoate cobbly loam, 15 to 50 percent slopes | 9,067 | 1.01 |
| Kyler-Rock outcrop association | 4,316 | .48 | Zoate-Rock outcrop association | 12,261 | 1.36 |
| Lien gravelly fine sandy loam, 2 to 4 percent slopes | 3,170 | .35 | | | |
| Linco-Acana association | 16,390 | 1.82 | | | |
| Linco-Badland association | 16,838 | 1.87 | | | |
| Lize association | 3,900 | .43 | | | |
| | | | Total | 899,860 | 100.00 |

B2t—3 to 10 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; weak, medium, prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and few coarse roots; common fine interstitial pores and tubular pores; few thin clay bridges between sand grains and few thin clay films on ped faces and in some pores; 5 percent gravel; strongly effervescent, strongly alkaline; abrupt, smooth boundary.

IIC1sica—10 to 17 inches, very pale brown (10YR 8/3) gravelly loamy sand, pale brown (10YR 6/3) moist; massive; hard, very friable, nonsticky and nonplastic; common very fine and medium interstitial pores; 30 percent gravel; few, very thin (1 millimeter or less), discontinuous, weakly cemented laminae of silica; many white (10YR 8/2) lime bridges between sand grains and as coatings on sand grains and gravel; violently effervescent, very strongly alkaline; abrupt, wavy boundary.

- IIC2sicam—17 to 24 inches, very pale brown (10YR 8/3) gravelly loamy sand; material crudely stratified and weakly and strongly cemented with lime; continuously capped by and stratified with few, very thin (1/16 inch or less), light yellowish-brown (10YR 6/4) laminae of silica, pale brown (10YR 6/3) and yellowish brown (10YR 5/4) moist; massive; hard and extremely hard, very friable, very firm and extremely firm, nonsticky and nonplastic; common very fine and fine roots, mostly matted, on laminae of silica; many very fine and fine interstitial pores; 45 percent gravel; many white (10YR 8/2) lime coatings on laminae and pebbles and as bridges between sand grains; violently effervescent, very strongly alkaline; abrupt, wavy boundary.
- IIC3sica—24 to 32 inches, very pale brown (10YR 8/3) very gravelly loamy sand, pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) moist; massive; hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine and fine and few medium interstitial pores; 50 percent gravel; thin, discontinuous, weakly cemented strata of silica and lime that are very hard and firm; many, very thin (less than 1/16 inch), light yellowish-brown (10YR 6/4) coatings of silica and lime on pebbles and as bridges between sand grains; violently effervescent, strongly alkaline; abrupt, wavy boundary.
- IIC4ca—32 to 40 inches, very pale brown (10YR 8/3) gravelly loamy sand, pale brown (10YR 6/3) moist; massive; hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine and fine and few medium interstitial pores; 50 percent gravel; violently effervescent, strongly alkaline; abrupt, wavy boundary.
- IIC5—40 to 60 inches, pale-brown (10YR 6/3) gravelly loamy sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine and fine interstitial pores; 50 percent gravel; few, thin, discontinuous, hard and friable, very pale brown (10YR 8/3) lenses weakly cemented with lime, pale brown (10YR 6/3) moist; strongly effervescent, very strongly alkaline.

A hardpan is at a depth ranging from 10 to 20 inches. The surface layer is about 25 percent gravel and contains some cobbles. In a few places in the A1 horizon the soil material is effervescent. Reaction ranges from mildly alkaline to moderately alkaline. This horizon has platy structure or is massive. The B2t horizon is effervescent in the upper part in some places but not in others. This horizon has prismatic or subangular blocky structure. The B2t horizon is mostly sandy clay loam or light clay loam, but in places it is also heavy loam. It is as much as 35 percent gravel.

Acana gravelly sandy loam, 2 to 8 percent slopes (ACC).—This soil is in large areas on moderately and strongly dissected terraces in the central and west-central parts of the survey area. It has the profile described as representative of the series.

Included with this soil in mapping, and making up about 20 percent of the mapped acreage, are areas of Cath, Heist, Linco, and Ursine soils and Badland.

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

This soil is not suitable for irrigated crops, because it has a very low available water capacity and a high degree of dissection. It is used mainly for grazing but is used as wildlife habitat to a limited extent. Dryland capability subclass VII_s; range site NV 28-41; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Acana-Ursine association (AE).—This association is in medium-sized areas on moderately dissected terraces

in the central part of the survey area. It is about 75 percent Acana gravelly sandy loam, 2 to 8 percent slopes, and 20 percent Ursine gravelly loam, 2 to 15 percent slopes. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of Heist and Linco soils and Badland.

The Acana soil is on the upper part of terraces. It has a subsoil of clay loam. Runoff is medium, and the hazard of erosion is moderate.

The Ursine soil is on the lower part of terraces. It is 10 to 20 inches deep to a hardpan and has a subsoil that is loam and 35 to 80 percent gravel. Runoff is medium, and the hazard of erosion is moderate.

The soils of this association are not suitable for irrigated crops, mostly because of their low available water capacity. They are used mainly for grazing and as wildlife habitat. Acana part in range site NV 28-41; dryland wildlife suitability group 3-42. Ursine part in range site NV 28-40; dryland wildlife suitability group 4-43. Both parts are assigned to dryland capability subclass VII_s; neither one is assigned to a woodland suitability group.

Acoma Series

The Acoma series consists of deep, well-drained soils that formed in alluvium from ignimbrite and reworked lacustrine sediment. These soils are on rounded tops and side slopes of dissected old valley-fill terraces. Slopes are 2 to 15 percent. The vegetation is Utah juniper, a few scattered pinon pine, big sagebrush, low rabbitbrush, squirreltail, and needleandthread. Elevation ranges from 5,000 to 5,800 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 45° to 48° F. The frost-free season is about 100 to 120 days.

In a representative profile the surface layer is brown gravelly sandy loam about 4 inches thick. The next layer is brown plastic gravelly sandy clay about 26 inches thick. It is underlain by light-brown and brown very gravelly sandy clay loam that extends to a depth of 60 inches.

Permeability is mostly slow in Acoma soils. Available water capacity is low. Effective rooting depth is 60 inches or more.

The Acoma soils are used mostly for grazing and wildlife habitat.

Representative profile of Acoma gravelly sandy loam, under native vegetation, 1,200 feet north and 1,700 feet east of the SW. corner of sec. 2, T. 5 S., R. 70 E., Mount Diablo baseline and meridian:

- A1—0 to 4 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; few very fine interstitial and tubular pores; neutral; abrupt, wavy boundary.
- B21t—4 to 9 inches, brown (7.5YR 5/4) gravelly sandy clay, dark brown (7.5YR 3/4) moist; weak, coarse, prismatic structure; hard, firm, sticky and plastic; common medium and very few fine roots; common very fine tubular pores; few thin clay films on ped faces and in pores; 15 percent gravel; mildly alkaline; clear, wavy boundary.
- B22t—9 to 15 inches, brown (7.5YR 5/4) sandy clay, dark brown (7.5YR 3/4) moist; weak, coarse, prismatic structure; hard, firm, sticky and very plastic; few very fine and microroots; few very fine and fine tubular pores; common clay films in pores; few

- clay films on ped faces; 5 percent gravel; neutral; clear, wavy boundary.
- B3t—15 to 30 inches, light-brown (7.5YR 6/4) gravelly sandy clay, brown (7.5YR 4/4) moist; massive; hard, firm, sticky and plastic; few medium roots; few fine tubular pores; 30 percent very fine gravel; neutral; clear, wavy boundary.
- C1ca—30 to 40 inches, light-brown (7.5YR 6/4) very gravelly sandy clay loam, brown (7.5YR 4/4) moist; massive; hard, friable, sticky and plastic; few very fine roots; common very fine interstitial pores and few fine tubular pores; 50 percent gravel; most pebbles have lime coats; few lime seams; strongly effervescent in seams and on pebble coats, slightly effervescent in matrix, mildly alkaline; clear, wavy boundary.
- C2—40 to 60 inches, brown (7.5YR 5/2) very gravelly sandy clay loam, dark brown (7.5YR 3/2) moist; massive; hard, friable, slightly sticky and plastic; many micropores; 60 percent gravel; strongly effervescent, mildly alkaline.

Twenty percent of the surface is covered with gravel. The A horizon is gravelly sandy loam or gravelly loam. The B2t horizon is 15 to 35 percent gravel. The C horizon is 40 to 70 percent gravel and is slightly effervescent to strongly effervescent.

Acoma gravelly sandy loam, 2 to 15 percent slopes (AGD).—This soil is in large areas on moderately and strongly dissected terraces in the southeastern part of the survey area. Included in mapping, and making up about 20 percent of the mapped acreage, are Linco, Heist, and Geer soils.

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

This soil is not suitable for irrigated crops because of extensive dissection. It is used mostly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 1c1; not assigned to a range site.

Alluvial Land

Alluvial land consists either of river-washed material that is very gravelly and cobbly throughout, and that has very little soil material, or medium-textured to coarse-textured soils and alluvium. These materials appear separately or together but generally not in a regular pattern. Where they are together, the soils and alluvium generally are at slightly higher elevations than the river-washed material. The vegetation is on high positions of the landscape and consists mostly of willows, various annuals, miscellaneous grasses, and big sagebrush. Some cottonwood trees have become established in the more stable areas. The lower lying areas are barren. Elevation ranges from 4,400 to 5,000 feet. The average annual air temperature is 50° to 53° F. The frost-free season is 110 to 130 days.

Permeability is moderate to very rapid in this land type. Available water capacity ranges from very low to high. Runoff is slow to very rapid, and the hazard of accelerated erosion is severe or very severe.

This land type is used mainly for wildlife habitat. It is also used for grazing to a limited extent. In places at high elevations where the soil material is most suitable, it is used for producing alfalfa.

Alluvial land (AL).—This land type is in long narrow areas within or adjacent to active streams or intermittent drainageways. This highly stratified material contains very few fines. Included in mapping are areas

of Heist and similar soils at the mouth of washes and between the toes of escarpments and flood plains.

Depth to the water table is extremely variable from one area of this land type to another. Some areas are subject to very frequent damaging flooding.

This land type is used mostly as wildlife habitat and to a limited extent for grazing. Small areas where sites are most favorable produce alfalfa. These areas, however, are subject to a serious hazard of flooding. In Clover Canyon, the least sloping parts of the soils included in mapping are used for irrigated crops and produce alfalfa (fig. 3). Dryland capability subclass VIII_w; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Aned Series

The Aned series consists of shallow, well-drained soils that formed in alluvium, mainly ignimbrite. These soils are on dissected old valley-fill terraces or alluvial fans. Slopes are 2 to 8 percent. The vegetation is Utah juniper, pinon pine, big sagebrush, cliffrose, Nevada ephedra, squirreltail, and needleandthread. Elevation ranges from 5,000 to 5,800 feet. The average annual precipitation is 12 to 16 inches, and the average annual air temperature is 45° to 48° F. The frost-free season is about 100 to 120 days.

In a representative profile the surface layer is grayish-brown sandy loam and loam about 4 inches thick. The next layer is brown clay loam about 14 inches thick. It is underlain by light yellowish-brown, very thin, continuous laminae. They are cemented with silica and stratified with white and very pale brown strongly cemented materials and by gravelly loamy sand and gravelly sandy loam that is weakly cemented with lime and extends to a depth of at least 30 inches.

Permeability is moderately slow above a very slowly permeable hardpan in the Aned soils. Available water capacity is very low. Effective rooting depth is 10 to 20 inches.

The Aned soils are used for grazing, wildlife habitat, and watershed.

Representative profile of Aned sandy loam, 2 to 8 percent slopes, under native vegetation, 2,640 feet north and 2,440 feet east of the SW. corner of sec. 31, T. 2 S., R. 71 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine vesicular pores; neutral; abrupt, smooth boundary.
- A12—2 to 4 inches, grayish-brown (10YR 5/2) loam; very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine roots; few very fine vesicular pores and many very fine interstitial pores; neutral; abrupt, smooth boundary.
- B1t—4 to 6 inches, brown (7.5YR 5/2) light clay loam, brown (7.5YR 4/2) moist; weak, medium, prismatic structure; hard, firm, sticky and plastic; common very fine and few fine roots; common fine tubular pores and interstitial pores; few thin clay films on ped faces and common thin clay films in pores; neutral; abrupt, wavy boundary.
- B2t—6 to 16 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate, medium, prismatic structure; hard, firm, sticky and plastic; few very fine and common medium and coarse roots; common fine tubular pores and many very fine inter-



Figure 3.—Cattle grazing on alfalfa-grass pasture on Heist soils, included with the miscellaneous land type Alluvial land. This formerly nonproductive area has been converted to a useful and profitable one through proper conservation and other good management practices.

stitial pores; common thin clay films on ped faces and many thin clay films in pores; neutral; clear, wavy boundary.

B3t—16 to 18 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) moist; weak, medium, prismatic structure; hard, firm, sticky and plastic; few very fine tubular pores and many very fine interstitial pores; neutral; abrupt, wavy boundary.

Csicam—18 to 30 inches, light yellowish-brown (10YR 6/4) very thin (less than 2 millimeters thick) continuous laminae cemented with silica that is stratified with white (10YR 8/2) and very pale brown (10YR 7/3) material; strongly cemented by lime materials and gravelly loamy sand and gravelly sandy loam that are weakly cemented with lime, yellowish brown (10YR 5/4), pale brown (10YR 6/3) moist; massive; extremely hard, very hard and slightly hard, extremely firm, very firm and friable; common very fine and few fine roots matted on the surface of the upper laminae; weakly cemented with lime subhorizons contain many white (10YR 8/2) lime coatings on pebbles and as bridges between some sand grains; laminae interior are non-effervescent; the remainder of the horizon is violently effervescent, strongly alkaline.

About 10 percent of the surface is covered by gravel. The A11 horizon is sandy loam or gravelly loam. This horizon is platy in structure or is massive. The dry soil material in the A11 horizon is slightly hard or soft. The

B2t horizon is prismatic or subangular blocky in structure. The individual indurated layers in the Csicam horizon vary in thickness from 1 to 8 millimeters. Their aggregate thickness is 5 to 20 millimeters. Depth to the Csicam horizon ranges from 10 to 20 inches.

Aned sandy loam, 2 to 8 percent slopes (ANC).—This soil is in a large area on moderately dissected valley-fill terraces and alluvial fans. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of Decan and Fanu soils.

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

This soil is not suitable for irrigated crops. It is used mostly for grazing, wildlife habitat, and watershed. Dryland capability subclass VII_s; dryland wildlife suitability group 334; woodland suitability group 1c1; not assigned to a range site.

Badland

Badland consists of strongly dissected terrace remnants of the Panaca and Muddy Creek Formations and terrace side slopes. Slopes range from 30 percent to nearly vertical. Geologic erosion is active. Except for

scattered Utah juniper and miscellaneous browse, vegetation is quite sparse. Elevation ranges from 4,800 to 6,600 feet. The average annual precipitation is 8 to 14 inches, and the average annual air temperature is 40° to 52° F.

Badland has scenic and esthetic value and is used mostly for recreation.

Badland (BA).—This land type consists of large, strongly dissected, rough, complex exposures of the Panaca Formation in the southwestern part of the survey area and small areas of varying shape throughout the rest of the survey area.

Runoff is medium to very rapid. The hazard of accelerated erosion is severe or very severe.

Included with Badland in mapping and making up about 20 percent of the mapped acreage, are areas of Acana, Cath, Geer, Heist, Cliffdown, Denmark, Ursine, Linco, and Sieroclim soils, generally on isolated small terrace remnants or in and along drainageways.

Badland is not suitable for irrigated crops. Many areas are scenic and have esthetic value. Dryland capability subclass VIIIe; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Badland-Bit association (BB).—This association is in small areas on eroded terraces and alluvial fans along the west-central edge of the survey area. It is about 50 percent Badland and 40 percent Bit fine sandy loam, 0 to 8 percent slopes. Included in mapping and making up about 10 percent of the mapped acreage, are areas of Sieroclim soils and Alluvial land.

Badland, an exposure of the Panaca Formation, is on severely eroded terrace side slopes. Elevation ranges from 5,000 to 6,100 feet. Runoff is very rapid, and the hazard of erosion is very severe.

The gently sloping Bit soil is on smooth alluvial fans and terraces. Runoff is medium, and the hazard of erosion is moderate.

Badland is scenic and has only esthetic value. The Bit soil is suitable for irrigated crops, but areas are small. This soil is used mostly for grazing and wildlife habitat. Badland part in dryland capability subclass VIIIe; not assigned to a range site, wildlife suitability group, or wildlife suitability group. Bit part in irrigated capability unit IIIe-25; dryland capability subclass VI; range site NV 28-46; irrigated wildlife suitability group 2-32-I; dryland wildlife suitability group 3-32; not assigned to a woodland suitability group.

Badland-Buster association, eroded (BD2).—This association is a large eroded area on ridges, narrow terraces, and small mesas in the northern part of the survey area. Some of the landforms have become isolated from the main body. This association is about 30 percent Badland; 25 percent Buster loamy sand, 0 to 8 percent slopes, eroded; and 25 percent Holsine gravelly sandy loam, 0 to 8 percent slopes. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Holtle, Usine, Fanu, Poorma, and other Buster soils.

Badland, an exposure of the Muddy Creek Formation, is severely eroded and steep and very steep. It is on terrace side slopes. Elevation ranges from 6,000 to 6,600 feet. Runoff is rapid, and the hazard of erosion is severe.

The nearly level to moderately sloping Buster soil is

on upper terraces, ridgetops, and mesas. It has a profile similar to that described as representative of the Buster series, but the surface layer is loamy sand that is severely eroded, and the underlying cemented layer is at a shallower depth. Runoff is medium, the hazard of water erosion is moderate, and the hazard of soil blowing is very severe.

The nearly level to moderately sloping Holsine soil is on lower terraces. It has the profile described as representative of the Holsine series. Runoff is medium, and the hazard of erosion is moderate.

Badland and the Buster and Holsine soils are not suitable for irrigated crops. Badland is scenic and used only for esthetic purposes. Badland part in dryland capability subclass VIIIe; not assigned to a range site, wildlife suitability group, or woodland suitability group. Buster part in dryland capability subclass VI; dryland wildlife suitability group 334; woodland suitability group 201; not assigned to a range site. Holsine part in dryland capability subclass VIc; range site NV 28-41; wildlife suitability group 3-42; not assigned to woodland suitability group.

Basket Series

The Basket series consists of deep, well-drained soils that formed in alluvium from ignimbrite. These soils are on terrace side slopes. Slopes are 15 to 50 percent. The vegetation is pinon pine, Utah juniper, big sagebrush, and a few miscellaneous grasses. Elevation ranges from 6,000 to 7,200 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is about 40° to 45° F. The frost-free season is about 100 to 110 days.

In a representative profile the surface layer is brown gravelly sandy loam about 1 inch thick over a pinkish-gray gravelly fine sandy loam about 3 inches thick. The next layer is brown very gravelly sandy clay loam over brown and light-brown very gravelly and gravelly sandy loam about 23 inches thick. It is underlain by pinkish-gray very gravelly coarse sand over a gravelly sandy loam that extends to a depth of 60 inches or more.

Permeability is moderate in Basket soils. Available water capacity is low. Effective rooting depth is 60 inches or more.

The Basket soils are used for grazing, wildlife habitat, and watershed.

Representative profile of Basket gravelly fine sandy loam, 30 to 50 percent slopes, under native vegetation, 960 feet east and 470 feet north of the south ¼ sec. 4, T. 2 N., R. 70 E., Mount Diablo baseline and meridian:

- A11—0 to 1 inch, brown (7.5YR 5/2) gravelly sandy loam, dark brown (7.5YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; very few medium and few fine interstitial pores and few fine and very fine vesicular pores; neutral; abrupt, smooth boundary.
- A12—1 to 4 inches, pinkish-gray (7.5YR 6/2) gravelly fine sandy loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and medium vesicular pores; neutral; abrupt, wavy boundary.
- IIB2t—4 to 10 inches, brown (7.5YR 5/4) very gravelly coarse sandy clay loam, dark brown (7.5YR 4/3) moist; massive; very hard, friable, sticky and plastic; many fine and medium roots; common fine

and medium interstitial pores; many thin and few moderately thick clay bridges between sand grains and many thin clay films in pores, 60 percent gravel; neutral; clear, wavy boundary.

IIB31t—10 to 17 inches, brown (7.5YR 5/4) very gravelly heavy sandy loam, dark brown (7.5YR 4/4) moist; massive; very hard, friable, slightly sticky and slightly plastic; many fine and medium roots; common fine and medium interstitial pores; common thin clay bridges between sand grains and clay films in pores; 60 percent gravel; neutral; gradual, irregular boundary.

IIB32t—17 to 27 inches, light-brown (7.5YR 6/4) gravelly sandy loam, dark brown (7.5YR 4/4) moist; massive; very hard, friable, nonsticky and nonplastic; common very fine and few fine tubular pores; common thin clay bridges between sand grains and clay films in pores; common, fine, distinct, noneffervescent white mottles; 40 percent gravel; neutral; clear, smooth boundary.

IIIC1ca—27 to 39 inches, pinkish-gray (7.5YR 7/2) very gravelly coarse sand, brown (7.5YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; 65 percent gravel; many very fine and fine interstitial pores; several 1- to 2-inch thick areas and seams of weak, white (10YR 8/2) lime cementation; slightly effervescent but violently effervescent in areas and seams, strongly alkaline; abrupt, smooth boundary.

IVC2—39 to 60 inches, pinkish-gray (7.5YR 7/2) gravelly sandy loam, brown (7.5YR 4/2) moist; massive; slightly hard, friable, nonplastic and nonsticky; few fine and very fine roots; many very fine and fine interstitial pores; several hard white ½- to ¼-inch thick, horizontal lime seams; slightly effervescent matrix, violently effervescent in seams, strongly alkaline.

About 30 percent of the surface is covered by gravel. A duff layer that is 1 to 3 inches thick is under the pino and juniper canopy in some places. The A1 horizon is platy in structure in places. The B2t horizon is sandy clay loam and heavy sandy loam. This horizon has a gravel content that ranges from 50 to 70 percent.

Basket gravelly fine sandy loam, 30 to 50 percent slopes (BKF).—This soil is in long narrow areas on terrace side slopes in the northern part of the survey area. It has the profile described as representative of the series.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, are areas of Decathlon and other Basket soils. Also included are soils making up about 10 percent of the mapped acreage that have clay horizons and are located on moderately sloping and strongly sloping terrace foot slopes.

Runoff is medium or rapid, and the hazard of erosion is moderate or severe.

This soil is not suitable for irrigated crops. It is used mostly for grazing, wildlife habitat, and watershed. Dryland capability subclass VIIe; dryland wildlife suitability group 324; woodland suitability group 2f1; not assigned to a range site.

Basket-Lize association (BL).—This association is in small, narrow areas on a number of parallel hogback ridgelike terraces in the northern part of the survey area. This association is about 30 percent Basket gravelly fine sandy loam, 30 to 50 percent slopes; 30 percent Lize stony fine sandy loam, 30 to 50 percent slopes; and 30 percent Satt very stony sandy loam, 4 to 15 percent slopes.

Included with this soil in mapping are areas of Holtle soils and Rough broken land that make up about 10 percent of the mapped acreage.

The Basket soil differs from other soils of the mapping unit by occupying steep side slopes that have a southern exposure. Runoff is rapid, and the hazard of erosion is severe.

The Lize soil is on side slopes that have a northern exposure. Runoff is rapid, and the hazard of erosion is severe.

The Satt soil is on terrace tops. Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are not suitable for irrigated crops. They are used mostly for wildlife habitat and limited grazing. Basket part in dryland capability subclass VIIe; dryland wildlife suitability group 324; woodland suitability group 2f1. Lize part in dryland capability subclass VIIi; dryland wildlife suitability group 324; woodland suitability group 1x1. Satt part in dryland capability subclass VIIi; dryland wildlife suitability group 324; woodland suitability group 1x1. None of the three parts are assigned to a range site.

Bicondoa Series

The Bicondoa series consists of deep, poorly drained and very poorly drained soils that formed in clayey alluvium derived from reworked old lacustrine sediment from tuff and basalt. They are on flood plains. Slopes are 0 to 2 percent. The vegetation is meadow grasses and alfalfa. Elevation ranges from 5,500 to 6,200 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 50 to 100 days.

In a representative profile the surface layer is very dark grayish-brown silt loam and silty clay loam about 4 inches thick. The next layer is dark-brown to very dark grayish-brown or very dark gray very plastic clay, silty clay, and silty clay loam about 23 inches thick. It is underlain by very dark gray and black very plastic clay that extends to a depth of 60 inches or more.

Permeability is slow in Bicondoa soils. Available water capacity is high to very high. The seasonal high water table is at or near the surface in the Bicondoa peat and ranges to below 5 feet in some of the drained phases. Effective rooting depth is 60 inches or more.

The Bicondoa soils are used for irrigated crops and pasture.

Representative profile of Bicondoa silty clay loam, 0 to 2 percent slopes, in an area of Bicondoa complex, 1,600 feet south of the NE. corner of sec. 6, T. 2 N., R. 70 E., Mount Diablo baseline and meridian:

A11—0 to 4 inches, very dark grayish-brown (10YR 3/2) finely stratified silty clay loam and silt loam, dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) dry; weak, fine and medium, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; many very fine interstitial pores and few very fine and fine tubular pores; slightly effervescent, mildly alkaline; abrupt, smooth boundary.

A12—4 to 11 inches, very dark grayish-brown (10YR 3/2) stratified light clay and silty clay, brown (10YR 5/3) and gray (10YR 5/1) dry; strong, fine and very fine, subangular blocky structure; hard, friable, very sticky and very plastic; many very fine and fine and common medium roots; many very

- fine and fine interstitial pores and tubular pores and few medium tubular pores; strongly effervescent, moderately alkaline; clear, smooth boundary.
- A13—11 to 19 inches, very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate, medium and coarse, subangular blocky structure; hard, friable, very sticky and very plastic; many very fine and fine and common medium roots; many very fine and fine interstitial pores and tubular pores; strongly effervescent, moderately alkaline; clear, smooth boundary.
- A14—19 to 27 inches, dark-brown (10YR 3/3) silty clay loam with finely stratified colors of very dark gray (10YR 3/1); brown (10YR 5/3), and dark gray (10YR 4/1) dry; common, fine and medium, distinct black (N 2/0) mottles; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine and common fine roots; many very fine and fine interstitial pores and tubular pores; slightly effervescent, moderately alkaline; abrupt, smooth boundary.
- C1g—27 to 48 inches, very dark gray (N 3/0) clay, common, medium, faint black (5Y 2/1) mottles and thin black (10YR 2/1) strata, gray (N 6/0) dry; strong, medium, subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine and common fine roots; many very fine and fine interstitial pores; mildly alkaline; gradual, smooth boundary.
- A1bg—48 to 60 inches, black (N 2/0) clay; many medium, distinct greenish-gray (5GY 5/1) mottles, dry; massive; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine and fine interstitial pores; mildly alkaline.

The surface layer is covered by a root mat 1 to 2 inches thick. A root mat ranging to 6 inches thick is on the very poorly drained soils. The A11 horizon is subangular blocky or granular in structure or is massive. One to several black or very dark gray buried A horizons are throughout the profile. The profile generally is stratified by clay and silty clay, but thin strata of coarse sandy loam, fine sandy loam, or silt loam are common. These soils generally are calcareous above a depth of 20 to 30 inches and are noncalcareous or calcareous below this depth.

Bicondoia sandy loam (Bm).—This soil is in small, narrow areas on nearly level flood plains in the central valleys of the survey area. It has a profile similar to that described as representative of the series, but the surface layer is sandy loam about 9 inches thick, and there are thin strata of coarse sandy loam below a depth of 40 inches. Included in mapping and making up about 5 percent of the mapped acreage, are areas of other Bicondoia soils.

Runoff is very slow, and the hazard of erosion is slight. This soil has been partly drained by channeling. Occasionally the water table rises to 5 or 6 feet below the surface. This soil is subject to frequent flooding during winter.

This soil is suitable for irrigated crops. It is used for the production of pasture and alfalfa (fig. 4). Irrigated capability unit IIIw-123; irrigated wildlife suitability group 2-23-I; not assigned to a range site or woodland suitability group.

Bicondoia silty clay loam, drained (Bn).—This level to nearly level soil is in small, narrow areas on flood plains in the central valleys of the survey area. It has a profile similar to that described as representative of the series, but the water table has been lowered to below a depth of 6 feet by channeling. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other Bicondoia soils.

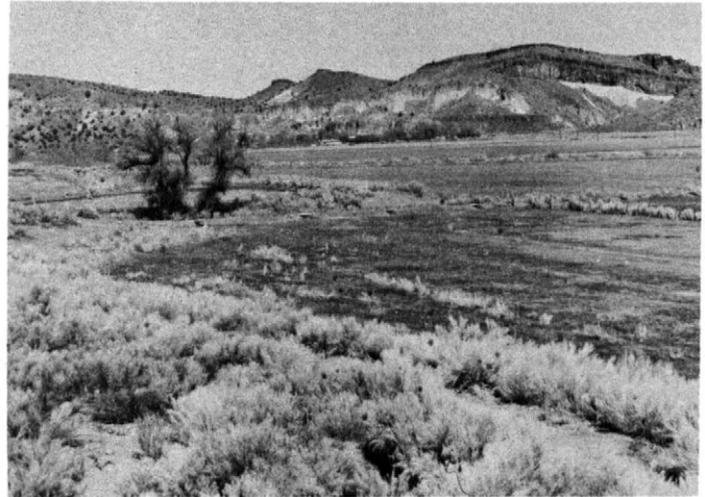


Figure 4.—Area in Rose Valley. The cultivated soils are Bicondoia sandy loam and Bicondoia silty clay loam, drained. Heist gravelly sandy loam, 0 to 8 percent slopes, is at the lower left.

Areas not under cultivation have a plant cover of big sagebrush, low rabbitbrush, and miscellaneous grasses.

Runoff is slow, and the hazard of erosion is slight. The soil is subject to infrequent flooding. Channeling will occur where water flow is uncontrolled. The seasonal high water table is at a depth of 6 feet or lower.

This soil is suitable for irrigated crops. It is used mostly for production of alfalfa and for pasture. Irrigated capability unit IIIw-123; irrigated wildlife group 2-23-I; not assigned to a range site or woodland suitability group.

Bicondoia complex (Bo).—This level to nearly level complex is in small areas on flood plains in the north-central valleys of the survey area. This complex is about 70 percent Bicondoia silty clay loam, 0 to 2 percent slopes, and 25 percent Bicondoia peat, 0 to 2 percent slopes. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other Bicondoia soils.

Bicondoia silty clay loam differs from the other soils in the mapping unit by being poorly drained and by lacking a surface layer of peat. The seasonal high water table is at a depth to 1 to 1½ feet.

Bicondoia peat is at slightly lower elevations along the drainageways leading from springs. It has a profile similar to that described as representative of the series, but it has a surface layer of peat 6 to 10 inches thick and has very poor drainage. The seasonal high water table is at a depth of 0 to 1 foot.

The Bicondoia soils have a plant cover of meadow grasses. Runoff is very slow, and the hazard of erosion is slight. These soils are subject to frequent flooding.

Both Bicondoia soils are suitable for meadow grass hay or for pasture if not drained. Both soils are used mostly for production of grass hay and pasture (fig. 5). Irrigated capability unit IVw-123; irrigated wildlife suitability group 4-11-I. Not assigned to a range site or woodland suitability group.

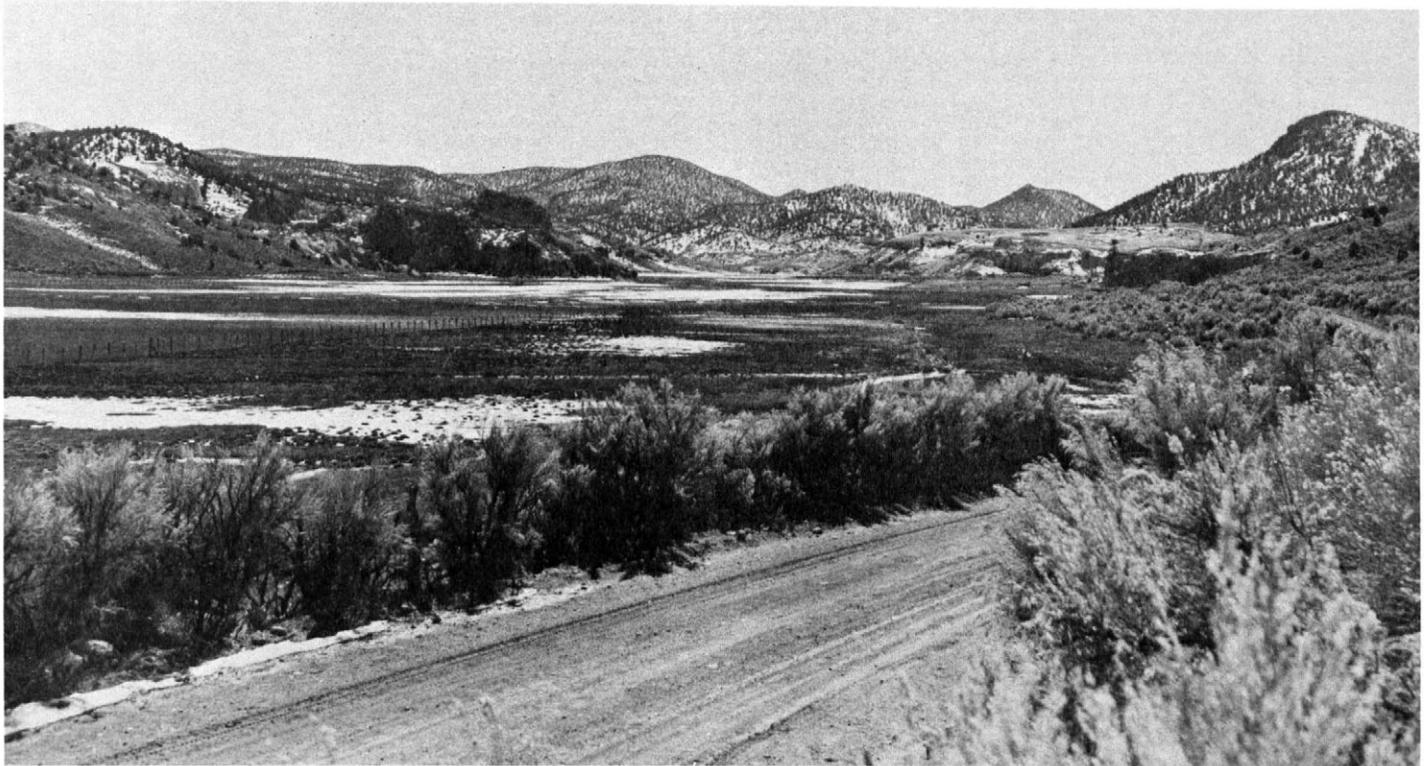


Figure 5.—Area in Spring Valley. The cultivated soils are in the Bicondoa complex.

Bit Series

The Bit series consists of well-drained soils that are moderately deep to a hardpan. They formed in loamy alluvium superimposed over gravelly alluvium. Both of the alluviums are derived from mixed rock sources that include limestone, dolomite, quartzite, and reworked lacustrine sediment containing pyroclastic materials. These soils are on terraces, alluvial fans, and old broad terrace drainageways. Slopes are 2 to 4 percent. The vegetation is big sagebrush, low rabbitbrush, Nevada ephedra, and a few miscellaneous grasses. Elevation ranges from 5,800 to 6,100 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 45° to 50° F. The frost-free season is 100 to 130 days.

In a representative profile the surface layer is brown fine sandy loam about 2 inches thick. The next layer is light brownish-gray fine sandy loam and very fine sandy loam about 22 inches thick. Below this is white gravelly loam that is weakly cemented with lime and is about 10 inches thick. It is underlain by light-gray to white, stratified, indurated to weakly cemented with silica and lime, gravelly material about 12 inches thick. The next layer is light-gray sandy loam that extends to a depth of 69 inches.

Permeability is moderate above the very slowly permeable hardpan in the Bit soils. Available water capacity is low. Effective rooting depth is 20 to 40 inches.

The Bit soils are suitable for irrigated crops if water is available. They are used for grazing and wildlife habitat.

Representative profile of Bit fine sandy loam, 2 to 4 percent slopes, in an area of Badland-Bit association; 500 feet east of the NW. corner of sec. 21, T. 2 N. R. 67 E., Mount Diablo baseline and meridian:

- A1—0 to 2 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine interstitial pores; strongly effervescent, strongly alkaline; abrupt, smooth boundary.
- C1—2 to 6 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and medium roots; common fine interstitial pores and tubular pores; strongly effervescent, strongly alkaline; abrupt, smooth boundary.
- C2—6 to 15 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; common fine tubular pores and interstitial pores; strongly effervescent, strongly alkaline; abrupt, smooth boundary.
- C3—15 to 24 inches, light brownish-gray (10YR 6/2) very fine sandy loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores and common very fine and fine interstitial pores; strongly effervescent, very strongly alkaline; abrupt, smooth boundary.
- IIC4ca—24 to 34 inches, white (10YR 8/2) gravelly loam, light gray (10YR 7/2) moist; massive; hard, firm, nonsticky and nonplastic; few fine roots; common fine and very fine interstitial pores; 45 percent limestone gravel; weakly cemented with lime; violently effervescent, very strongly alkaline; abrupt, wavy boundary.
- IIC5cam—34 to 38 inches, light-gray (10YR 7/2), very

thin (1 to 2 millimeters thick), continuous laminae stratified by white (10YR 8/1) gravelly materials strongly cemented with lime, brown (10YR 5/3) and light gray (10YR 7/2) moist; massive; extremely hard and extremely firm; few very fine and fine roots matted on laminae surfaces; few fine and common very fine interstitial pores in the strongly lime cemented material; few very thin (1 millimeter thick or less) discontinuous, light yellowish-brown (10YR 6/4) laminae cemented with silica, brown (10YR 5/3) moist; almost the entire horizon dissolves in acid; violently effervescent, very strongly alkaline; clear, smooth boundary.

IIC6cam—38 to 46 inches, white (10YR 8/2), very gravelly sandy loam, strongly cemented with lime gravelly materials and weakly cemented with lime, light gray (10YR 7/2) moist; massive; extremely hard and hard, very firm and firm; common fine and very fine interstitial pores in strongly cemented part and many very fine and fine and few medium interstitial pores in weakly cemented part; violently effervescent, strongly alkaline; abrupt, wavy boundary.

IIIC7ca—46 to 69 inches, light-gray (10YR 7/2) sandy loam, light brownish gray (10YR 6/2) moist; massive; hard, firm, nonsticky and nonplastic; common very fine interstitial pores; violently effervescent, strongly alkaline.

About 3 percent of the surface is covered by gravel. The A horizon has weak or moderate, very thin to thick, platy structure or is massive. It is soft or slightly hard. The horizons between depths of 10 and 40 inches are dominantly very fine sandy loam or loam but include strata of silt loam, fine sandy loam, or sandy loam. The lower horizons are as much as 50 percent coarse fragments but average 15 to 35 percent. Ccam horizon has individual laminae that are 1 to 5 millimeters thick. The combined thickness of all laminae is 5 to 20 millimeters. The laminae are stratified by weakly or strongly lime cemented material.

Bit soils have been mapped only as a component of the Badland-Bit association (BB).

Buster Series

The Buster series consists of moderately shallow, well-drained soils that formed in alluvium from ignimbrites superimposed on ancient gravelly and very gravelly lacustrine deposits. They are on terrace tops adjacent to the flood plains. Slopes are 0 to 8 percent. The vegetation is Utah juniper, black sagebrush, big sagebrush, Indian ricegrass, cliffrose, low rabbitbrush, needleandthread, galleta, three-awn, and blue grama. Elevation ranges from 6,000 to 6,600 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 80 to 100 days.

In a representative profile the surface layer is light brownish-gray fine sandy loam about 3 inches thick. The next layer is brown heavy loam about 4 inches thick over brown sandy clay loam about 10 inches thick. The layer below it is very pale brown clay loam about 5 inches thick. It is underlain by white loam weakly cemented with a few discontinuous, strongly silica-cemented lenses about 10 inches thick. The next layer is light-gray gravelly loamy coarse sand that extends to a depth of 60 inches or more.

Permeability is moderately slow in the Buster soils. Available water capacity is low. Effective rooting depth is 20 to 40 inches.

The Buster soils are used for grazing and wildlife habitat. These soils are suitable for irrigated crops if irrigation water is available.

Representative profile of Buster fine sandy loam, 0

to 2 percent slopes, in an area of Buster-Rough broken land association, 2,640 feet north and 1,320 feet west of the SE. corner of sec. 19, T. 3 N., R. 69 E., Mount Diablo baseline and meridian:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate, thick, platy structure parting to weak, fine, subangular blocky; slightly hard, very friable, nonsticky and nonplastic; very few fine and very fine interstitial pores; surface covered by a 1-inch fine gravelly loamy fine sand mulch; neutral; abrupt, smooth boundary.

B1—3 to 7 inches, brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) moist; weak, fine and medium, subangular blocky structure parting to moderate, very fine, subangular blocky; slightly hard, very friable, slightly sticky and plastic; common fine and very fine roots; common fine and very fine interstitial pores and few fine tubular pores; neutral; clear, smooth boundary.

B2t—7 to 17 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many fine and few medium roots; common fine and medium interstitial pores and few fine and medium tubular pores; few thin clay films on ped faces and in pores, and as bridges between sand grains; neutral; clear, smooth boundary.

B3ca—17 to 22 inches, very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; strong, thick, platy structure; hard, friable, slightly sticky and slightly plastic; many fine and few medium roots; common fine and few medium interstitial pores; violently effervescent, moderately alkaline; abrupt, smooth boundary.

C1sica—22 to 32 inches, white (10YR 8/2) loam, light gray (10YR 7/2) moist; massive; very hard, firm, nonsticky and nonplastic; many fine and few medium roots matted on discontinuous plates; common very fine interstitial pores; weakly cemented with lime that has few discontinuous lenses strongly cemented with silica; violently effervescent, strongly alkaline; clear, smooth boundary.

IIC2—32 to 60 inches, light-gray (10YR 7/2) gravelly loamy coarse sand, light brownish gray (10YR 6/2) moist; single grained; loose when dry and moist; many medium and fine interstitial pores; strongly effervescent, moderately alkaline.

The surface layer is fine gravelly loamy fine sand or fine sand mulch 1 to 2 inches thick in places. A few small pebbles are on the surface. The B2t horizon is loam, sandy clay loam, or clay loam and averages 25 to 35 percent clay. This horizon has weak or moderate, fine to coarse, subangular or angular blocky structure. In the C1sica horizon random, very thin, discontinuous lenses strongly cemented with silica range from common to few. The IIC horizon is variably stratified very gravelly sandy loam, gravelly loamy coarse sand or gravelly sand (or both) that have thin strata of silt loam in places. The depth to the lenses strongly cemented with silica is 20 to 40 inches.

Buster-Rough broken land association (BR).—This association is in large areas extensively broken by wide and deep gullies on terrace tops, side slopes, and faces in the northern part of the survey area. This association is about 55 percent Buster fine sandy loam, 0 to 2 percent slopes, and 25 percent Rough broken land. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Holte loam on the flood plains and a soil similar to the Linco soil on the terrace side slopes and faces.

The nearly level Buster soil differs from the other soils in the mapping unit by its position on the terrace tops. Runoff is slow or medium, and the hazard of erosion is slight or moderate.

Rough broken land differs from other soils in the

mapping unit by its position on the interterrace areas. Runoff is rapid or very rapid, and the hazard of erosion is severe or very severe.

The soils in this association are used mainly for grazing and wildlife habitat. The Buster soils are potentially suitable for crops if irrigation water is available. The size of the fields is also a limiting factor. Buster part in irrigated capability unit IIIs-115, VIc dryland; range site NV 28-46; irrigated wildlife suitability group 2-42-I; dry wildlife suitability group 3-42; not assigned to woodland suitability group. Rough broken land part in dryland capability subclass VIIe; not assigned to range site, wildlife suitability group, or woodland suitability group.

Cath Series

The Cath series consists of deep, well-drained soils that formed in alluvium mainly from quartzite and lacustrine sediments high in pyroclastic materials and that have been influenced somewhat by limestone and dolomite. They are on smooth or slightly convex, broad, dissected valley-fill terrace tops. Slopes are 2 to 8 percent. The vegetation is big sagebrush, black sagebrush, galleta, Indian ricegrass, and a few scattered Utah juniper. Elevation ranges from 5,500 to 6,000 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 49° to 53° F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is pale-brown gravelly loam about 3 inches thick. Below this is brown to light-brown clay loam about 11 inches thick. Next is a layer of reddish-brown gravelly clay loam about 6 inches thick. Below this layer is reddish-brown very gravelly sandy clay loam that has silica and lime coats on many pebbles and is about 6 inches thick. It is underlain by white materials weakly cemented with lime that have very thin discontinuous indurated silica laminae and extends to a depth of 60 inches or more.

Permeability is slow in Cath soils. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more.

The Cath soils are suitable for irrigated crops if irrigation water is available. They are used for grazing and wildlife habitat.

Representative profile of Cath gravelly loam, 2 to 8 percent slopes, under native vegetation, 2,640 feet east and 1,320 feet north of the SW. corner of sec. 12, T. 1 S., R. 67 E., Mount Diablo baseline and meridian:

- A1—0 to 3 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; moderate, thick, platy structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine vesicular pores; neutral; abrupt, smooth boundary.
- A&B—3 to 4 inches, brown (10YR 5/3) and pale-brown (10YR 6/3) clay loam, dark yellowish brown (10YR 4/4) moist; weak, thin, platy structure; soft, very friable, sticky and plastic; common fine roots; many very fine interstitial pores; many clean sand grains; mildly alkaline; abrupt, smooth boundary.
- B&A—4 to 6 inches, brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/4) moist; weak, thin, platy structure; soft, very friable, sticky and plastic; common fine roots; many very fine interstitial pores; few clean sand grains; mildly alkaline; abrupt, smooth boundary.

B2t—6 to 14 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, friable, very sticky and very plastic; common fine roots; common fine tubular pores and few fine interstitial pores; common thin clay films on ped faces and in pores, and as bridges between sand grains; mildly alkaline; abrupt, smooth boundary.

B3tca—14 to 20 inches, reddish-brown (5YR 5/4) gravelly clay loam, reddish brown (5YR 5/4) moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, friable, sticky and plastic; common fine roots; common fine interstitial pores; few thin clay bridges between sand grains; effervescent matrix but violently effervescent in many medium and large white (10YR 8/2) lime masses; moderately alkaline; abrupt, smooth boundary.

B2tsicab—20 to 26 inches, reddish-brown (5YR 5/4) very gravelly sandy clay loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable, sticky and plastic; common fine roots; many fine interstitial pores; many pebbles coated by silica and lime; slightly effervescent in matrix but strongly effervescent on coated pebbles; strongly alkaline; abrupt, smooth boundary.

Csicab—26 to 60 inches, white (10YR 8/2 and 8/1) very gravelly sandy loam weakly cemented with lime and silica, pale brown and light brownish gray (10YR 6/3 and 6/2) moist; massive; very hard, firm; very few very fine roots in matrix and few very fine roots on laminae; few very fine and fine interstitial pores and tubular pores; few very pale brown (10YR 8/3), very thin (2 millimeters and less), discontinuous, indurated silica laminae; many silica and lime bridges between sand grains, coating sand grains, and lining tubular pores; violently effervescent, strongly alkaline.

About 30 percent of the surface is covered by gravel. The A1 horizon has weak or moderate, thin to thick, platy structure or is massive. The B2t horizon is clay loam or sandy clay loam and averages 25 to 35 percent clay. This horizon has weak or moderate medium or coarse prismatic structure. The B2t horizon is hard or slightly hard. In the Csica horizons are individual discontinuous silica laminae that are as much as 3 millimeters thick.

Cath gravelly loam, 2 to 8 percent slopes (CAC).—This soil is in medium and large areas on moderately dissected terraces in the west-central part of the survey area. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of Acana, Heist, and Jarab soils and Alluvial land. Runoff is slow, and the hazard of erosion is slight.

This soil is suitable for irrigated crops if irrigation water is available. It is used mainly for grazing and wildlife habitat. Irrigated capability unit IIIe-25; dryland capability subclass VIc; range site NV 28-45; irrigated wildlife suitability group 2-42-I; dry wildlife suitability group 3-42; not assigned to a woodland suitability group.

Cedaran Series

The Cedaran series consists of shallow, well-drained soils that formed in gravelly residuum derived from ignimbrite. They are on mountain slopes and foothills. Slopes are 4 to 50 percent. The vegetation is pinon pine, Utah juniper, big sagebrush, snowberry, bitterbrush, Indian ricegrass, and needleandthread. Elevation ranges from 6,000 to 7,000 feet, but ranges to 5,500 feet on northern slopes. The average annual precipitation is 12 to 16 inches, and the average annual

air temperature is 42° to 45° F. The frost-free season is 60 to 100 days.

In a representative profile the surface layer is grayish-brown cobbly loam and gravelly clay loam about 8 inches thick. The next layer is brown gravelly clay loam that rests on hard tuff and is about 10 inches thick.

Permeability is moderately slow in the Cedar soil. Available water capacity is very low. Effective rooting depth is 10 to 20 inches.

The Cedar soil is used for grazing, wildlife habitat, and watershed.

Representative profile of Cedar cobbly loam, 4 to 30 percent slopes, in an area of Itca-Cedar association, 660 feet south of the NE. corner of sec. 7, T. 4 S., R. 71 E., Mount Diablo baseline and meridian:

A11—0 to 3 inches, grayish-brown (10YR 5/2) cobbly loam, dark brown (10YR 3/3) moist; weak, thick, platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine vesicular pores; 15 percent cobbles and 15 percent gravel; neutral; abrupt, smooth boundary.

A12—3 to 8 inches, grayish-brown (10YR 5/2) gravelly clay loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; soft, friable, sticky and plastic; common fine and medium roots; common fine tubular pores and few fine interstitial pores; 40 percent gravel; neutral; abrupt, smooth boundary.

B2—8 to 18 inches, brown (10YR 5/3) gravelly clay loam, dark grayish brown (10YR 4/2) moist; moderate, fine, subangular blocky structure; slightly hard, friable, sticky and plastic; common fine, medium, and coarse roots; common fine tubular pores and many very fine interstitial pores; 45 percent gravel; neutral; abrupt, wavy boundary.

R—18 to 20 inches, hard tuff.

Bedrock is at a depth ranging from 10 to 20 inches. About 15 percent of the surface is covered by gravel, and 10 percent is covered by cobbles. Also, a few stones are on the surface. The A1 horizon has weak, thin to thick, platy structure; weak or moderate, fine or medium, subangular blocky structure; or is massive. It is soft or slightly hard. The B2 horizon has weak or moderate, fine to coarse, subangular blocky structure or is massive. Textures in the B2 horizon are dominantly loam or clay loam but in places include strata of silt loam or sandy clay loam modified by gravel or cobbles. Any one horizon is 20 to 60 percent coarse fragments, but the average is 35 to 50 percent, with gravel dominating.

Cedar-Decan association (CD).—This association is in small areas along the Nevada-Utah border. It is on foothill faces and adjacent valley-fill terraces and on alluvial fans in the southeastern part of the survey area. This association is about 50 percent Cedar cobbly loam, 4 to 30 percent slopes, and 35 percent Decan gravelly clay loam, 2 to 15 percent slopes. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of Rock outcrop and Alluvial land.

The moderately sloping to moderately steep Cedar soil differs from the other soils within the mapping unit by its position on foothill faces. Runoff is medium or rapid, and the hazard of erosion is severe.

The Decan soil differs from other soils in the mapping unit by its position on terraces and alluvial fans. Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are used mainly for

grazing and wildlife habitat. They are not suitable for crops. Cedar part in dryland capability subclass VIIe; wildlife suitability group 334; woodland suitability group 2d1. Decan part in dryland capability subclass VIIs; wildlife suitability group 334; woodland suitability group 1c1. Neither part assigned to a range site.

Cedar-Rock outcrop complex (CE).—This complex is in moderately large broad areas on mountain faces and hillsides in the southern part of the survey area. It is about 50 percent Cedar cobbly loam, 4 to 30 percent slopes, and 35 percent Rock outcrop.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, are areas of Itca soils. In places at lower elevations where severe geologic erosion has taken place, small remnant areas of Fanu and Patter soils occur.

The moderately sloping to moderately steep Cedar soil differs from other soils in the mapping unit by its position on hillsides and mountain faces. Runoff is medium or rapid, and the hazard of erosion is moderate to severe.

Rock outcrop is in small areas scattered throughout the mapping unit, and stony and extremely stony areas are adjacent to and below the Rock outcrop.

The soils and Rock outcrop in this complex are used mainly for grazing, wildlife habitat, and watershed. The Cedar soil is not suitable for crops. Dryland capability subclass VIIs. Cedar part in dryland wildlife suitability group 334 and woodland suitability group 2d1; not assigned to a range site. Rock outcrop part not assigned to a range site, wildlife suitability group, or woodland suitability group.

Cliffdown Series

The Cliffdown series consists of deep, somewhat excessively drained soils that formed in gravelly loamy alluvium from limestone, dolomite, tuff, quartzite, and sandstone. They are on smooth alluvial fans. Slopes are 2 to 8 percent. The vegetation is black sagebrush, fourwing saltbrush, galleta, needleandthread, Fremont mahonia, and scattered Utah juniper. Elevation ranges from 4,400 to 5,200 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 48° to 52° F. The frost-free season is 110 to 130 days.

In a representative profile the surface layer is light brownish-gray gravelly sandy loam about 3 inches thick. The next layer is light brownish-gray sandy loam that has many sand-size pan fragments and is about 10 inches thick. It is underlain by very pale brown very gravelly stratified sandy loam and loamy sand that extends to a depth of 60 inches or more. This layer is 35 to 70 percent pebbles and pan fragments, most of which are less than 1 inch in diameter.

Permeability is moderately rapid in the Cliffdown soils. Available water capacity is low. Effective rooting depth is 60 inches or more.

The Cliffdown soils are used for grazing, wildlife habitat, and watershed.

Representative profile of Cliffdown gravelly sandy loam, 2 to 8 percent slopes, in an area of Cliffdown-Geer association; 200 feet east of the SW. corner of

sec. 21, T. 2 S., R. 68 E., Mount Diablo baseline and meridian:

- A1—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak, thick, platy structure; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine vesicular pores; strongly effervescent, strongly alkaline; abrupt, smooth boundary.
- C1—2 to 12 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, nonsticky and nonplastic; few fine and very fine roots; common fine and very fine interstitial pores; many sand-size angular and platy pan fragments; strongly effervescent, strongly alkaline; clear, smooth boundary.
- C2—12 to 60 inches, very pale brown (10YR 7/3) very gravelly stratified sandy loam and loamy sand, brown (10YR 5/3) moist; massive; hard in place, slightly hard when displaced; very friable, nonsticky and nonplastic; few fine and common medium roots; 50 percent pebbles and angular pan fragments mostly less than 1 inch in diameter; many very fine and common fine interstitial pores; violently effervescent, moderately alkaline.

About 20 percent of the surface is covered by gravel. In places the A1 horizon has hues of 10YR and 7.5YR. The C1 horizon texture is sandy loam or fine sandy loam modified by 15 to 30 percent gravel. The C2 horizon contains thin nearly gravel-free strata of sandy loam and loamy fine sand in some places. The weighted average of coarse fragments in this horizon ranges from 35 to 70 percent.

The Cliffdown soils mapped in the Meadow Valley Area are slightly cooler and receive more precipitation than Cliffdown soils mapped on other areas. These differences do not affect their use and management.

Cliffdown-Geer association (CG).—This association is in small, narrow and broad areas on flood plains and short alluvial fans in the southwestern part of the survey area. It is about 70 percent Cliffdown gravelly sandy loam, 2 to 8 percent slopes, and 20 percent Geer fine sandy loam, 0 to 2 percent slopes. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Heist soils.

The gently to moderately sloping Cliffdown soil is on the alluvial fans. This soil is moderately coarse textured material modified by more than 35 percent coarse fragments. Runoff is slow, and the hazard of erosion is slight.

The level to nearly level Geer soil differs from other soils in the mapping unit by its position on the flood plains, and it is nearly gravel free. Runoff is slow, and the hazard of erosion is slight.

The Geer soils in this association are suitable for crops if irrigation water is available. The soils are used mainly for grazing and wildlife habitat. Cliffdown part in dryland capability subclass VII_s; range site NV 28-37; irrigated wildlife suitability group 3-43-I; dryland wildlife suitability group 4-43. Geer part in irrigated capability unit IIc-1; dryland capability subclass VIc; range site NV 28-44; irrigated wildlife suitability group 2-33-I; dryland wildlife suitability group 3-32. Neither part assigned to a woodland suitability group.

Decan Series

The Decan series consists of moderately deep, well-drained soils that formed in loamy alluvium from ignimbrites that have been influenced somewhat by

reworked old lacustrine sediment high in pyroclastic materials. These soils are on rounded tops and side slopes of strongly dissected old valley-fill terraces and alluvial fans. Slopes are 2 to 30 percent. The vegetation is Utah juniper, pinon pine, big sagebrush, black sagebrush, bitterbrush, needleandthread, and Indian ricegrass. Elevation ranges from 6,000 to 6,600 feet. The average annual precipitation is 12 to 16 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 80 to 100 days.

In a representative profile the surface layer is grayish-brown gravelly clay loam over dark grayish-brown clay loam about 3 inches thick. The next layer is brown, very sticky and very plastic clay about 14 inches thick. Below this is pink slightly hard loam about 6 inches thick. It is underlain by light-brown silica indurated laminae. This layer caps materials strongly cemented with silica and stratified with sandy loam that is weakly cemented with silica. It contains many coarse and very coarse pockets and seams of white lime segregations and extends to a depth of at least 30 inches.

Permeability is slow above the very slowly permeable hardpan in Decan soils. Available water capacity is low. Effective rooting depth is 20 to 26 inches.

The Decan soils are used for grazing and wildlife habitat.

Representative profile of Decan gravelly clay loam, 2 to 15 percent slopes, in an area of Decan-Uana association, 1,200 feet north of the SE. corner of sec. 6, T. 4 S., R. 71 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate, thick, platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine vesicular pores; slightly acid; abrupt, smooth boundary.
- A12—2 to 3 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong, very fine, granular structure; slightly hard, friable, sticky and plastic; common very fine roots; many very fine interstitial pores and few very fine tubular pores; common very thin colloidal coats on many ped faces; slightly acid; abrupt, smooth boundary.
- B21t—3 to 8 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium, prismatic structure; hard, firm, very sticky and very plastic; common very fine and few fine and medium roots; common very fine tubular pores; many pressure cutans on ped faces and common thin clay films in pores; slightly acid; clear, wavy boundary.
- B22t—8 to 17 inches, brown (7.5YR 4/4) clay, dark brown (7.5YR 3/2) moist; moderate, medium, prismatic structure; hard, firm, very sticky and very plastic; common very fine and few fine and medium roots; common very fine tubular pores; many pressure cutans and common thin clay films in pores; neutral; abrupt, wavy boundary.
- B3ca—17 to 23 inches, pink (7.5YR 7/4) loam, brown (7.5YR 5/4) moist; weak, medium, prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine, medium, and very fine roots; many very fine interstitial pores; few thin clay bridges between sand grains; matrix noneffervescent but violently effervescent in many fine and medium, prominent, white (10YR 8/2) lime masses; mildly alkaline; abrupt, wavy boundary.
- Csicam—23 to 30 inches, continuous, very thin (1 to 2 millimeters thick), light-brown (7.5YR 6/4) silica-indurated laminae capping light-brown (7.5YR) materials strongly cemented with silica and strati-

fied with sandy loam that is weakly cemented with silica; brown and strong brown (7.5YR 5/4 and 5/6) and light gray (10YR 7/2) moist; massive; extremely hard to hard, extremely firm to firm, and brittle; common very fine and few fine roots matted on the laminae surface; no pores in the laminae but common very fine and fine interstitial pores in the remainder of the horizon; many coarse and very coarse pockets and seams of white (10YR 8/1) lime segregations; strongly cemented strata contain common, very thin (0.5 to 1 millimeter thick), discontinuous silica laminae and silica bridges between sand grains; silica and lime bridges also occur in limy pockets; weakly effervescent in the matrix but violently effervescent in limy pockets; strongly alkaline.

The silica-indurated hardpan is at a depth ranging from 20 to 26 inches. About 25 percent of the surface is covered by gravel and a few cobbles. A11 horizon is gravelly clay loam and gravelly sandy clay loam. It ranges from 2 to 3 inches in thickness. It has thick, platy structure or is massive. The Bt horizon is dominantly clay but contains heavy clay loam and has an accumulative thickness of 12 to 18 inches. The Bt horizon is 10 to 35 percent coarse fragments. The C horizon is capped by silica-indurated laminae that are 1 to 10 millimeters thick. The remainder of the C horizon is either strongly cemented with silica; contains common to many discontinuous unoriented laminae less than 2 millimeters thick; or is stratified by strongly and weakly cemented silica. The weakly cemented part has a few 1 millimeter or less discontinuous, unoriented laminae.

Decan-Uana association (DA).—This association is in large areas on strongly dissected, rounded, and somewhat flattened tops and side slopes of old valley-fill terraces and alluvial fans in the south-central part of the survey area. Slopes are 2 to 30 percent. This association is about 40 percent Decan gravelly clay loam, 2 to 15 percent slopes; about 30 percent Decan gravelly clay loam, 15 to 30 percent slopes; and 20 percent Uana gravelly loam, 2 to 15 percent slopes. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Fanu, Tica, Uana soils having a gravelly clay loam surface, and Alluvial land.

The gently sloping to strongly sloping Decan soil differs from other soils in the mapping unit by its position on the upper side slopes and tops of the terraces. Runoff is slow or medium, and the hazard of erosion is slight or moderate.

The moderately steep Decan soil differs from other soils in the mapping unit by its position on the steeper parts of the side slopes, and it has a thicker surface layer and thinner subsoil than is typical for the series. Runoff is medium, and the hazard of erosion is moderate.

The gently sloping to strongly sloping Uana soil differs from other soils in the mapping unit by its position on the upper parts of the terraces and generally on the north-facing slopes. Runoff is slow or medium, and the hazard of erosion is slight or moderate.

The soils in this association are not suitable for crops. They are used mainly for grazing and wildlife habitat and are an integral part of the watershed. Decan gravelly clay loam, 2 to 15 percent slopes, part in dryland capability subclass VII_s; dryland wildlife suitability group 334; woodland suitability group 1c1. Decan gravelly clay loam, 15 to 30 percent slopes, part in dryland capability subclass VII_e; dryland wildlife suitability group 324; woodland suitability group 1c1. Uana part in dryland capability subclass VII_s; dry-

land wildlife suitability group 324; woodland suitability group 1c1. None of the three parts assigned to a range site.

Decathon Series

The Decathon series consists of moderately deep, well-drained soils that formed in alluvium from rhyodacitic ignimbrite. They are on undulating to gently rolling terraces. Slopes are 2 to 8 percent. The vegetation is pinon pine, Utah juniper, and black sagebrush. Elevation ranges from 6,000 to 6,500 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 90 to 100 days.

In a representative profile the surface layer is light brownish-gray gravelly loam about 4 inches thick. The next layer is brown clay loam and gravelly sandy loam over light-brown heavy loam about 16 inches thick. It is underlain by very pale brown gravelly sandy loam that has very hard, fine nodules and is 7 inches thick. The next layer is white very gravelly loamy sand that has a few hard nodules weakly cemented with lime that extends to a depth of 60 inches or more.

Permeability is moderately slow above the hardpan and very slow within the hardpan in Decathon soils. Available water capacity is low. Effective rooting depth is 24 to 36 inches.

The Decathon soils are used for grazing and wildlife habitat.

Representative profile of Decathon gravelly loam, 2 to 8 percent slopes, in an area of Decathon-Basket association, at the SW. corner of sec. 14, T. 3 N., R. 69 E., Mount Diablo baseline and meridian:

- A1—0 to 4 inches, light brownish-gray (10YR 6/2) gravelly loam, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky and slightly plastic; few very fine roots; many very fine and fine vesicular pores; few bleached sand grains; neutral; clear, smooth boundary.
- B21t—4 to 10 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/2) moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, friable, sticky and plastic; many very fine, common fine, and few medium roots; many very fine interstitial pores; common thin clay films on ped faces and in pores and many thin clay bridges between sand grains; mildly alkaline; clear, smooth boundary.
- B22t—10 to 15 inches, brown (7.5YR 5/4) gravelly sandy clay loam, brown (7.5YR 4/3) moist; moderate, medium and fine, subangular blocky structure; very hard, friable, sticky and plastic; many very fine and few fine roots; many very fine and few fine interstitial and tubular pores; common thin clay films in pores as bridges between sand grains and few thin clay films on ped faces; moderately alkaline; clear, wavy boundary.
- B3t—15 to 20 inches, light-brown (7.5YR 6/4) heavy loam, brown (7.5YR 4/4) moist; massive; very hard, friable, slightly sticky and plastic; many very fine and fine roots; many very fine tubular pores; common thin clay films in pores and as bridges between sand grains; strongly effervescent in soft lime masses; moderately alkaline; clear, wavy boundary.
- C1sica—20 to 27 inches, very pale brown (10YR 7/3) gravelly sandy loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and nonplastic; few fine and very fine roots; common very fine interstitial pores and a few very fine tubular

pores; few clay bridges between sand grains; few medium, very hard, fine durinodes; violently effervescent; moderately alkaline; abrupt, smooth boundary.

C2sicam—27 to 38 inches, white (10YR 8/2) indurated duripan, very pale brown (10YR 7/3) moist; massive; extremely hard, extremely firm; many continuous very thin pale-brown (10YR 6/3) indurated-silica lenses on which roots mat; common opalescent coatings on gravel-soil mass interfaces; remainder of horizon is strongly cemented with lime; common very fine interstitial pores in lime-cemented part; violently effervescent; strongly alkaline; clear, smooth boundary.

IIC3—38 to 60 inches, white (10YR 8/2) very gravelly loamy sand, very pale brown (10YR 7/5) moist; massive; hard, very friable, nonsticky and nonplastic; very few very fine and fine roots; many fine and very fine interstitial pores; few very hard nodules weakly cemented with lime; violently effervescent; moderately alkaline.

The duripan is at a depth ranging from 24 to 36 inches. About 25 percent of the surface is covered by gravel. The A horizon is 3 to 5 inches thick. It is gravelly loam, gravelly fine sandy loam, or very fine sandy loam, and it is 1 to 4 percent organic matter. The A horizon has a depth ranging from 3 to 5 inches. The B2t horizon is clay loam, gravelly clay loam, or gravelly sandy clay loam. It has coarse, prismatic or medium to fine, subangular blocky structure. The hardpan is many continuous 1/64- to 1/8-inch thick opal lenses stratified by a weakly to strongly lime and silica cemented matrix. In places the C materials both above and below the hardpan contain nodules that are strongly cemented with lime and silica. The C horizon is various strata of sandy loam to sand modified by gravel.

Decathon gravelly loam, 2 to 8 percent slopes (DCC).

—This soil is in small, broad areas on intermediate terraces in the north-central part of the survey area. The soil has the profile described as representative of the series. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Basket and Fanu soils. Runoff is medium, and the hazard of erosion is slight or moderate.

This soil is not suitable for irrigated crops because of topography and depth to hardpan. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2o1; not assigned to a range site.

Decathon-Basket association, moderately steep (DED).

—This association is in small areas on old valley-fill terraces in the north-central part of the survey area. It is about 60 percent Decathon gravelly loam, 2 to 8 percent slopes, and 20 percent Basket gravelly sandy loam, 15 to 30 percent slopes. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Holtle and other Basket soils.

The gently sloping to moderately sloping Decathon soil differs from other soils in the mapping unit by its position on the terrace tops. Runoff is medium, and the hazard of erosion is slight or moderate.

The moderately steep Basket soil differs from the other soils in the mapping unit by its position on the terrace side slopes. It has a profile similar to that described as representative for the Basket series, but the surface layer is a little thinner and the subsoil is very gravelly clay or clay loam. Runoff is medium to high, and the hazard of erosion is moderate or severe.

The soils in this association are not suitable for crops. They are used mainly for grazing, wildlife habitat, and watershed. Decathon part in dryland capa-

bility subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2o1. Basket part in dryland capability subclass VII_e; dryland wildlife suitability group 324; woodland suitability group 2f1. Neither part assigned to a range site.

Decathon-Basket association, steep (DEE).—This association is in large, broad areas on intermediate terraces in the north-central part of the survey area. It is about 40 percent Decathon gravelly loam, 2 to 8 percent slopes, and 40 percent Basket gravelly fine sandy loam, 30 to 50 percent slopes. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Holtle soils and other Basket soils.

The gently sloping to moderately sloping Decathon soil is on the terrace tops. Runoff is medium, and the hazard of erosion is slight or moderate.

The steep Basket soil differs from other soils in the mapping unit by its position on the terrace side slopes. It has a profile similar to that described as representative of the Decathon series, but the light-brown surface layer has been removed in some places by erosion. Runoff is medium or rapid, and the hazard of erosion is moderate or severe.

The soils in this association are not suitable for crops. They are used mainly for grazing, wildlife habitat, and watershed. Decathon part in dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2o1. Basket part in dryland capability subclass VII_e; dryland wildlife suitability group 324; woodland suitability group 2f1. Neither part assigned to a range site.

Deerlodge Series

The Deerlodge series consists of moderately deep, well-drained soils that formed in alluvium derived mainly from quartz and lacustrine sediment high in pyroclastic materials that contain some limestone. They are on smooth or undulating, dissected, broad, high terraces that have nearly flat and rounded tops. Slopes are 4 to 30 percent. The vegetation is black sagebrush, big sagebrush, cliffrose, Nevada ephedra, Indian ricegrass, galleta, needleandthread, sand dropseed, and scattered Utah juniper. Elevation ranges from 5,000 to 5,800 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 49° to 53° F. The frost-free season is 100 to 130 days.

In a representative profile the surface layer is brown gravelly sandy loam about 3 inches thick. The next layer is dark-brown and brown sandy clay loam about 11 inches thick. Below this is brown gravelly sandy clay loam about 9 inches thick. It is underlain by a very pale brown indurated hardpan that has several continuous horizontal thin silica laminae stratified with white materials strongly cemented with lime. This pan extends to a depth of at least 30 inches.

Permeability is moderately slow above the hardpan in Deerlodge soils. Available water capacity is low. Effective rooting depth is 20 to 28 inches.

The Deerlodge soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Deerlodge gravelly sandy loam, 4 to 15 percent slopes, in an area of Deerlodge-Ursine association, 1,320 feet east of the center of sec.

5, T. 3 S., R. 67 E., Mount Diablo base line and meridian:

- A1—0 to 3 inches, brown (10YR 5/3) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; many fine interstitial pores; mildly alkaline; abrupt, smooth boundary.
- B1t—3 to 8 inches, dark-brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 4/3) moist; moderate, fine, subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common fine tubular pores, few thin clay films in pores; mildly alkaline; abrupt, smooth boundary.
- B21t—8 to 14 inches, brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, friable, sticky and plastic; common fine roots; common fine tubular pores; common thin clay films in pores and few on ped faces; mildly alkaline; abrupt, smooth boundary.
- B22t—14 to 23 inches, brown (7.5YR 5/4) gravelly sandy clay loam, brown (7.5YR 4/4) moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; common fine roots; common fine tubular pores; common thin clay films on ped faces and in pores; noneffervescent in ped interiors but strongly effervescent in common, medium, distinct, white (7.5YR 8/1) lime coatings on ped faces; moderately alkaline; abrupt, wavy boundary.
- Csicam—23 to 30 inches, very pale brown (10YR 8/3) indurated duripan that has several continuous, horizontal, thin (2 to 5 millimeters thick) silica laminae stratified with white (10YR 8/2 and 8/1) materials strongly cemented with lime and silica; pale brown (10YR 6/3) and light gray (10YR 8/2) moist; massive; extremely hard, extremely firm; common very fine and fine microroots matted on the upper surface but no roots within the horizon; many very fine and fine interstitial pores; many bridges cemented with lime and silica between sand grains, many lime and silica coatings on sand grains and as films in pores; few, thin, brownish-yellow (10YR 6/4) silica laminae; violently effervescent; moderately alkaline.

The duripan is at a depth of 20 to 28 inches. The surface layer is covered by about 25 percent gravel and a few cobbles. The soils are generally noncalcareous in the upper horizons but in places are effervescent in the A1 horizon. The A1 horizon is 20 to 25 percent gravel and is 2 to 4 inches thick. The Bt horizons have a cumulative thickness of 17 to 20 inches. The B2t horizon has textures of heavy loam or light clay loam but is dominantly sandy clay loam. Gravel content is as much as 35 percent and occurs in any B horizon. The hardpan contains horizontal continuous silica laminae ranging from 2 to 8 millimeters in thickness and are spaced at ½- to 6-inch intervals. The intervening material between laminae is mainly cemented with lime but contains silica in the form of discontinuous laminae, coatings, and bridges on and between sand grains and pebbles and as linings in pores in places.

Deerlodge association (DG).—This association is in small, broad areas in the southwestern part of the survey area on strongly dissected terraces that have rounded tops. Slopes are 4 to 30 percent. This association is about 60 percent Deerlodge gravelly sandy loam, 4 to 15 percent slopes, and 35 percent Deerlodge gravelly loam, 15 to 30 percent slopes.

Included with this association in mapping, and making up about 5 percent of the mapped acreage, are areas of Deerlodge soils that have slopes greater than 30 percent; a soil similar to Deerlodge soil that has a hardpan at a depth of 15 to 20 inches; and Alluvial land.

The moderately sloping to strongly sloping Deerlodge soil differs from other soils in the mapping unit

by its position on the rounded tops of the terraces and upper side slopes. Runoff is medium and rapid, and the hazard of erosion is moderate.

The moderately steep Deerlodge soil differs from other soils in the mapping unit by its position on the lower but steeper sides of the terraces. It has a profile similar to that described as representative of the Deerlodge series, but the surface layer is gravelly loam and the subsoil contains slightly more gravel. Runoff is rapid, and the hazard of erosion is severe.

The soils in this association are not suitable for crops. They are used mainly for grazing, wildlife habitat, and watershed. Deerlodge gravelly sandy loam, 4 to 15 percent slopes, part in dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 3-42. Deerlodge gravelly loam, 15 to 30 percent slopes, part in dryland capability subclass VII_e; range site NV 28-40; dryland wildlife suitability group 3-42. Neither part assigned to a woodland suitability group.

Deerlodge-Ursine association (DH).—This association is in large, broad and small, narrow areas on smooth to convex alluvial fans and dissected, broad high terraces in the southwestern part of the survey area. Slopes are 2 to 15 percent. This association is about 50 percent Deerlodge gravelly sandy loam, 4 to 15 percent slopes, and 40 percent Ursine gravelly loam, 2 to 15 percent slopes. Included in mapping and making up about 10 percent of the mapped acreage, are areas of Linco soils, Badland, and Alluvial land.

The moderately sloping to strongly sloping Deerlodge soil differs from other soils in the mapping unit by its position on the upper parts of the terraces and its clay loam subsoil.

The gently sloping to strongly sloping Ursine soil differs from other soils in the mapping unit by its position on the lower parts of the terraces and on alluvial fans, and it lacks a subsoil that has clay accumulation.

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

The soils in this association are not suitable for crops. They are used mainly for grazing, wildlife habitat, and watershed. Deerlodge part in dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 3-42. Ursine part in dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 4-43. Both parts not assigned a woodland suitability group.

Denmark Series

The Denmark series consists of shallow, well-drained soils that formed in alluvium derived from limestone and sandstone. They are on alluvial fans on old valley fill and terraces. Slopes are 2 to 15 percent. The vegetation is black sagebrush, squirreltail, galleta, and some scattered Utah juniper. Elevation ranges from 5,200 to 6,000 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 47° to 51° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is light brownish-gray gravelly loam about 3 inches thick. Below it is pale-brown loam over pale-brown to light-gray gravelly loam about 17 inches thick. This is under-

lain by 20 inches of white material that is weakly to strongly cemented with lime and silica and has a very pale-brown lime- and silica-indurated laminar capping 1/8-inch thick. Below this, to a depth of about 64 inches, is light-gray very gravelly fine sandy loam.

Permeability is moderately rapid above the hardpan in Denmark soils. Available water capacity is very low. Effective rooting depth is 10 to 20 inches.

The Denmark soils are used for grazing, wildlife habitat, and watershed.

Representative profile of Denmark gravelly loam, 2 to 15 percent slopes, under native vegetation, 2,640 feet north and 200 feet east of the SW. corner of sec. 5, T. 2 S., R. 67 E., Mount Diablo baseline and meridian:

- A1—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly loam, dark brown (10YR 4/3) moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; many fine vesicular pores and many fine and very fine tubular pores; violently effervescent; strongly alkaline; clear, smooth boundary.
- C1—3 to 9 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine tubular pores; violently effervescent; strongly alkaline; clear, smooth boundary.
- C2—9 to 15 inches, pale-brown (10YR 6/3) gravelly loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and many very fine roots; many fine and very fine tubular pores; violently effervescent; strongly alkaline; clear, wavy boundary.
- C3ca—15 to 20 inches, light-gray (10YR 7/2) gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine and fine tubular pores; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- C4casim—20 to 40 inches, very pale brown (10YR 8/3) continuous lime- and silica-indurated laminar capping, 1/8-inch thick, that has a very pale brown (10YR 7/3) to brown (10YR 4/3) surface coating; underlain by white (10YR 8/1) material that is weakly to strongly cemented with lime and silica and is stratified with common, continuous and discontinuous, lime- and silica-indurated laminae; vertical and diagonal cracks are lime and silica coated; few fine roots matted on laminae; violently effervescent; strongly alkaline; clear, wavy boundary.
- C5—40 to 58 inches, light-gray (10YR 7/2) very gravelly fine sandy loam, brown (10YR 5/3) moist; massive; hard in place, loose when displaced; nonsticky and nonplastic; many fine and very fine interstitial pores; 70 percent gravel and 10 percent cobbles; coarse fragments are silica and lime coated; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- C6—58 to 64 inches, light-gray (10YR 7/2) very gravelly fine sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, nonsticky and nonplastic; many fine and very fine interstitial pores; 65 percent gravel and 5 percent cobbles; coarse fragments silica and lime coated; few, fine, distinct, white (10YR 8/2) lime masses; violently effervescent; very strongly alkaline.

About 30 percent of the surface is covered by gravel and a few cobbles. Hardpan is at a depth that ranges from 10 to 20 inches (fig. 6). Between a depth of 10 inches and the hardpan, the content of cobble and angular fragments range from 10 to 35 percent but average 20 percent or more. The A horizon is gravelly sandy clay loam to gravelly sandy loam and is moderately alkaline to strongly alkaline. The



Figure 6.—Exposed hardpan in Denmark soils.

Ccam horizon is indurated sandy loam or gravelly sandy loam that is weakly to strongly cemented with lime and silica and is capped by and contains continuous and discontinuous lime- and silica-indurated laminae throughout. Depth between laminae is variable and the laminae are 1/8 to 1/16 inch in thickness.

Denmark gravelly loam, 2 to 15 percent slopes (DMD).—This soil is in large areas on strongly dissected terraces and some alluvial fans along the west-central border of the survey area. The soil has the profile described as representative of the series. Included in mapping, and making up about 15 percent of the mapped acreage, are Cath soils, other Denmark soils that have gravelly sandy loam surfaces, Badland, and Alluvial land.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing, wildlife habitat, and watershed. Dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Denmark-Linco association (DN).—This association is in small areas in alluvial fans on old valley-fill and terraces near the southwestern border of the survey area. Slopes are 2 to 30 percent. It is about 60 percent Denmark cobbly loam, 2 to 15 percent slopes, and 30 percent Linco gravelly sandy loam, 15 to 30 percent slopes. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of other Denmark soils that have gravelly loam surfaces, other Linco soils that have slopes of less than 15 percent, and some Alluvial land.

The gently sloping to strongly sloping Denmark soil differs from other soils in the mapping unit by its position on the upper side slopes of the alluvial fans and terraces. It has a profile similar to that described as representative of the series, but the surface layer is cobbly and lighter in color and the depth to hardpan is less. Runoff is medium to slow, and the hazard of erosion is moderate.

The moderately sloping to moderately steep Linco

soil differs from other soils in the mapping unit by its position on the terrace side slopes. Runoff is medium, and the hazard of erosion is moderate to severe.

The soils in this association are not suitable for crops. They are used for grazing, wildlife habitat, and watershed. Denmark part in dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 3-42. Linco part in dryland capability subclass VII_e; range site NV 28-40; dryland wildlife suitability group 3-42. Neither part assigned to a woodland suitability group.

Fanu Series

The Fanu series consists of deep, well-drained soils that formed in loamy alluvium derived from rhyodacitic ignimbrite that has a mixture of limestone. They are on narrow flood plains and low-lying alluvial fans. Slopes are 0 to 8 percent. The vegetation is big sagebrush, squirreltail, Indian ricegrass, bluestem wheatgrass, and some scattered Utah juniper. Elevation ranges from 5,800 to 6,800 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 70 to 80 days.

In a representative profile the surface layer is dark grayish-brown gravelly fine sandy loam about 9 inches thick. The next layer is grayish-brown loam and light sandy clay loam about 12 inches thick. It is underlain by grayish-brown stratified heavy loam and sandy loam and grayish-brown coarsely stratified sandy clay loam and sandy loam that extends to a depth of 60 inches or more.

Permeability is moderate in Fanu soils. Available water capacity is high. Effective rooting depth is 60 inches or more. These soils are subject to occasional flooding in localized areas along narrow flood plains and adjacent to stream channels.

The Fanu soils are suitable for irrigated pasture and hay where irrigation water is available. They are used for grazing and wildlife habitat.

Representative profile of Fanu gravelly fine sandy loam, 0 to 8 percent slopes, 240 feet east and 1,080 feet south of the west quarter corner of sec. 4, T. 2 N., R. 70 E., Mount Diablo baseline and meridian:

- A1—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly fine sandy loam, very dark brown (10YR 2/2) moist; massive; soft, very friable, slightly sticky and nonplastic; few medium and coarse and common fine and very fine roots; many fine and very fine interstitial pores; neutral; clear, wavy boundary.
- B2—9 to 14 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few medium and coarse and common fine and very fine roots; many very fine and fine interstitial pores and many fine tubular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.
- B3—14 to 21 inches, grayish-brown (10YR 5/2) light sandy clay loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, sticky and slightly plastic; common fine and medium roots; common very fine and fine interstitial pores and many fine tubular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.
- C1ca—21 to 27 inches, grayish-brown (10YR 5/2) heavy

loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, sticky and slightly plastic; common very fine and few medium roots; common fine tubular pores; few vertical large cicada channels; few fine and medium white (10YR 8/2) lime masses; violently effervescent; moderately alkaline; abrupt, smooth boundary.

- C2ca—27 to 34 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; many very fine and common fine interstitial pores and few very fine tubular pores; few large vertical cicada channels; violently effervescent; moderately alkaline; abrupt, smooth boundary.

- C3ca—34 to 60 inches, grayish-brown (10YR 5/2) coarsely stratified sandy clay loam and sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable and very friable, sticky and nonsticky, plastic and nonplastic; few fine and common very fine roots; many very fine and common fine interstitial pores; few very fine tubular pores; common fine, distinct, white (10YR 8/2) lime masses; violently effervescent; moderately alkaline.

The Cca horizon is at a depth of 17 to 28 inches. The A1 horizon is 1 to 4 percent organic matter and is 7 to 12 inches thick. Between 10 and 40 inches the material is usually stratified and includes fine sandy loam, sandy loam, loam, and sandy clay loam. It averages 18 to 25 percent clay and is as much as 25 percent gravel. The Cca horizon has few to common, fine to medium, soft lime segregations.

Fanu gravelly fine sandy loam, 0 to 8 percent slopes (FAC).—This soil is in long, narrow areas on flood plains and low alluvial fans. Included in mapping and making up about 10 percent of the mapped acreage, are areas of other Fanu soils and Alluvial land.

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

This soil is suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Irrigated capability unit IV_e-60; dryland capability subclass VI_c; irrigated wildlife suitability group 2-42-1; dryland wildlife suitability group 4-41; range site NV 28-44; not assigned to a woodland suitability group.

Four Star Series

The Four Star series consists of deep to very deep, poorly drained soils that formed in loamy alluvium derived mainly from volcanic rocks such as tuff ignimbrites that have some mixture of rhyolite, basalt, and andesite. They are on narrow, wet bottom land in mountainous areas. Slopes are 0 to 4 percent. The vegetation is mainly meadow grass consisting of sedges and carex. Elevation ranges from 6,800 to 7,500 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 60 to 80 days.

In a representative profile the surface layer is stratified light-gray to black loam, gravelly coarse sandy loam, silty clay loam, and sandy loam about 13 inches thick. The next layer is black stratified fine gravelly loam, fine sandy loam, coarse sandy loam, fine sandy loam, silt loam, and coarse sand about 28 inches thick. It is underlain by very dark gray finely stratified fine sandy loam, fine sand, coarse sand, very fine sandy loam, and silt loam that extends to a depth of 60 inches or more.

Permeability is moderate in Four Star soils. Avail-

able water capacity is moderate. Runoff is slow to very slow, and the hazard of erosion is moderate. A seasonal high water table is at a depth of 1 to 2 feet. The effective rooting depth is 60 inches or more.

The Four Star soils are suitable for irrigated meadow hay and pasture. They are used mainly for grazing and wildlife habitat.

Representative profile of Four Star loam, in an area of Holtle-Four Star association, 50 feet south and 20 feet east of the NW. corner of sec. 16, T. 6 N., R. 68 E., Mount Diablo baseline and meridian:

A11—0 to 13 inches, finely stratified very dark gray (10YR 3/1), black (10YR 2/1), very dark brown (10YR 2/2), and very dark grayish-brown (10YR 3/2) loam, gravelly coarse sandy loam, silty clay loam, and sandy loam; gray (10YR 5/1), very dark gray (10YR 3/1), and dark grayish brown (10YR 4/2) dry; weak, coarse, subangular blocky structure parting to moderate, fine and medium, subangular blocky; various strata are hard, very friable, firm, nonsticky to sticky and nonplastic to plastic; many very fine, common fine, and few medium roots; many very fine and fine interstitial pores and few fine and very fine tubular pores; slightly acid; abrupt, wavy boundary.

IIA12—13 to 23 inches, black (10YR 2/1) stratified fine gravelly loam and fine sandy loam that has common medium and large faint (10YR 3/1) organic stains, dark gray (10YR 4/1) dry; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, common fine, and few medium roots; many very fine and fine interstitial and tubular pores; neutral; clear, wavy boundary.

IIA13—23 to 41 inches, black (10YR 2/1) and very dark brown (10YR 2/2) finely stratified coarse sandy loam, fine sandy loam, silt loam, and coarse sand that has many medium and coarse prominent yellowish-red (5YR 5/6) and reddish-yellow (7.5YR 6/6), and many fine and medium distinct very dark brown (7.5YR 2/2) iron mottles; dark gray (10YR 4/1), grayish brown (10YR 5/2), and gray (10YR 5/1) dry; massive or single grained; slightly hard or loose, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; slightly acid; clear, wavy boundary.

IIICg—41 to 60 inches, very dark gray (N 3/0, 5Y 3/1, and 2.5Y 3/1) finely stratified fine sandy loam, fine sand, coarse sand, very fine sandy loam, and silt loam, gray (N 6/0, 5Y 6/1, and 2.5Y 5/1) dry; massive or single grained; hard or loose, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; neutral.

One to several buried black or very dark gray A1 horizons occur frequently. The C horizon is highly stratified fine sandy loam, coarse sandy loam, clay loam, and coarse sand. Fine sandy loam and coarse sandy loam textures are dominant.

The Four Star soils, as mapped in the survey area, are at a higher elevation than in other areas where this series occurs. This difference does not affect the use and management of these soils.

In the survey area, the soils of the Four Star series have been mapped only as a part of the Holtle-Four Star association (HR).

Geer Series

The Geer series consists of very deep, moderately well drained soils that formed in mixed alluvium, mainly ignimbrite, basalt, limestone, and lacustrine sediment. These soils are on flood plains and alluvial

fans. Slopes are mostly 0 to 2 percent. The vegetation is mostly big sagebrush, greasewood, winterfat, Indian ricegrass, needleandthread, horsebrush, fourwing saltbush, shadscale, galleta, and sand dropseed. Elevation ranges from 4,400 to 6,100 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 46° to 52° F. The frost-free season is 100 to 130 days.

In a representative profile the surface layer is light yellowish-brown and light-gray silt loam about 9 inches thick. It is underlain by pale-brown, very pale brown, and light-gray, stratified loamy sand, very fine sandy loam, silt loam, and loam that extends to a depth of 60 inches or more.

Permeability is mostly moderate in the Geer soils. Available water capacity ranges from low to high depending on salt content. Effective rooting depth is 60 inches or more. In some areas the seasonal high water table is at a depth of 4 to 5 feet.

The Geer soils are suitable for irrigated crops. They are used mostly for grazing and wildlife habitat. Some areas are used for irrigated pasture and hay.

Representative profile of Geer silt loam, under native vegetation, 100 feet north of the SE. corner of sec. 17, T. 2 S., R. 68 E., Mount Diablo base line and meridian:

A11—0 to 4 inches, light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; moderate, thin, platy structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine tubular pores; strongly effervescent; strongly alkaline; clear, smooth boundary.

A12—4 to 9 inches, light-gray (10YR 7/2) silt loam, yellowish brown (10YR 5/4) moist; moderate, thick, platy structure or structureless (massive); soft, very friable, sticky and slightly plastic; few fine roots; few fine tubular pores; strongly effervescent; strongly alkaline; slightly saline; clear, smooth boundary.

C1—9 to 12 inches, light-gray (10YR 7/2) silt loam, (10YR 5/3) moist; massive; slightly hard, friable, sticky and plastic; few fine and medium roots; few fine tubular pores; strongly effervescent; moderately alkaline; slightly saline; abrupt, smooth boundary.

C2—12 to 14 inches, pale-brown (10YR 6/3) loamy sand, dark yellowish brown moist; massive; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; many very fine and fine interstitial pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C3—14 to 20 inches, very pale brown (10YR 7/3) stratified very fine sandy loam and silt loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and slightly sticky, nonplastic and slightly plastic; few fine roots; few fine tubular pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C4—20 to 22 inches, pale-brown (10YR 6/3) loamy sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; many very fine and fine interstitial pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C5—22 to 31 inches, light-gray (10YR 7/2) stratified very fine sandy loam and silt loam, yellowish brown (10YR 5/4) moist; moderate, thick, platy structure or structureless (massive); soft, very friable, nonsticky and nonplastic; common fine roots; few fine tubular pores; slightly effervescent; strongly alkaline; abrupt, smooth boundary.

C6—31 to 60 inches, very pale brown (10YR 7/3) and brown (10YR 5/3) stratified very fine sandy loam, loam, and silt loam, yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplas-

tic; few fine and medium roots; few fine tubular pores and many fine and very fine interstitial pores; strongly effervescent; very strongly alkaline.

Reaction ranges from moderately alkaline to very strongly alkaline and is generally lower in cultivated areas. The soils range from nonsaline affected to strongly saline affected. The A1 horizon is fine sandy loam and silt loam. This horizon is platy in structure or is massive. The upper part of the C horizon is very fine sandy loam or silt loam that has thin strata of loamy sand or loam.

Geer soils mapped in the Meadow Valley Area are slightly cooler and receive more precipitation than Geer soils mapped in other areas. These differences do not affect their use and management.

Geer fine sandy loam, gravel substratum (GE).—This level to nearly level soil is in small areas on short alluvial fans in the central and southwestern parts of the survey area. It has a profile similar to that described as representative of the series, but the surface layer is different in texture and, below a depth of 20 inches, the soil material is 5 to 30 percent gravel. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of Heist soils and other Geer soils.

Runoff is slow, and the hazard of erosion is moderate. The soil is subject to occasional flooding.

This soil is suitable for irrigated crops. It is used as wildlife habitat and, to a limited extent, for grazing and production of alfalfa. Irrigated capability unit IIIs-45; irrigated wildlife suitability group 2-33-I; dryland wildlife suitability group 3-33; not assigned to a range site or woodland suitability group.

Geer silt loam (Gf).—This level to nearly level soil is in small areas on flood plains and alluvial fans in the southwestern part of the survey area. It has the profile described as representative of the series.

Included with this soil in mapping, and making up about 6 percent of the mapped acreage, are areas of saline-affected Geer soils and other Geer soils that are hummocky, have a fine sandy loam surface layer, and have slopes of as much as 4 percent.

Runoff is slow or medium, and the hazard of erosion is slight or moderate. The soil is subject to occasional flooding.

This soil is suitable for irrigated crops. A small acreage is in grain. It is also used to a limited extent for grazing and wildlife habitat. Irrigated capability unit IIc-1; irrigated wildlife suitability group 2-33-I, dryland wildlife suitability group 3-33; not assigned to a range site or woodland suitability group.

Geer silt loam, slightly saline (Gg).—This level to nearly level soil is in small, narrow sections on flood plains and short alluvial fans in the central and southwestern parts of the survey area. It has a profile similar to that described as representative of the series, but it is slightly saline affected.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, are areas of other Geer soils; a soil similar to the Geer soil that is 10 to 18 inches thick over a Pahrnagat-like soil, and is at the lower end of Panaca Valley near Beaver Dam road; and a soil similar to the Geer soil that has a finer textured subsoil.

Runoff is slow or medium, and the hazard of erosion is slight. The soil is subject to occasional flooding. A

seasonal high water table rises to a depth of about 4 feet.

This soil is suitable for irrigated crops. It is used mostly to grow alfalfa and to a limited extent for grazing and wildlife habitat. Irrigated capability unit IIw-61; irrigated wildlife suitability group 2-33-I; dryland wildlife suitability group 3-33; not assigned to a range site or woodland suitability group.

Geer silt loam, strongly saline (Gh).—This level to nearly level soil is in small, narrow areas on flood plains in the central and southwestern parts of the survey area. It has a profile similar to that described as representative of the series, but it is strongly saline affected in areas that are under a cover of native vegetation and is moderately and strongly saline affected in cultivated areas.

Included with this soil in mapping are areas of Pahrnagat soils. Also included, in the lower part of Panaca Valley near Beaver Dam road, is a soil similar to the Geer soil that has a finer textured subsoil. These inclusions make up about 10 percent of the mapped acreage.

Runoff is slow or medium, and the hazard of erosion is slight or moderate. The soil is subject to occasional flooding. A seasonal high water table is at a depth of 4 to 6 feet in fall and early in winter.

This soil is suitable for irrigated crops if excessive salts are leached out. Continual irrigation helps reduce salt content. The soil is used to grow alfalfa and to a limited extent for grazing and wildlife habitat. Dryland capability subclass VIIw; range site NV 28-47; dryland wildlife suitability group 4-24; not assigned to a woodland suitability group.

Geer silt loam, wet (Gk).—This level to nearly level soil is in small, narrow spots on flood plains in the central and southwestern parts of the survey area. It has a profile similar to that described as representative of the series, but in sequence from the top it is gray or grayish-brown silt loam about 4 inches thick that is nonsaline to moderately saline affected; pale-brown stratified silt loam and very fine sandy loam about 25 inches thick that is slightly to moderately saline affected; yellowish-brown or brown silt loam or very fine sandy loam about 8 inches thick that is weakly cemented with silica; and yellowish-brown or brown stratified silt loam and very fine sandy loam that extends to a depth of 60 inches or more. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other Geer soils.

Permeability is moderately slow. Runoff is slow or medium, and the hazard of erosion is slight. Roots are slightly restricted by weak cementation in the lower part of the subsoil. A seasonal high water table is at a depth of 2 to 5 feet and is at its highest point in fall and winter. The soil is subject to occasional flooding.

This soil is suitable for irrigated crops if irrigation water is properly managed. It is used mostly for irrigated pasture, grazing, and wildlife habitat. Irrigated capability unit IIIw-60; irrigated wildlife suitability group 1-14-I; not assigned to a range site or woodland suitability group.

Geer-Heist association (GM).—This association is in large and small areas on flood plains and alluvial fans in the southwestern and central parts of the survey

area. Slopes are 0 to 8 percent. This association is about 50 percent Geer fine sandy loam, 0 to 2 percent slopes, and 35 percent Heist gravelly sandy loam, 0 to 8 percent slopes. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of other Geer and Heist soils.

The nearly level Geer soil is on slightly lower positions on flood plains. It has a profile similar to that described as representative of the Geer series, but the surface layer is fine sandy loam. Runoff is slow or medium, and the hazard of erosion is slight or moderate.

The nearly level to moderately sloping Heist soil is on alluvial fans adjacent to terrace side slopes. Runoff is slow, and the hazard of erosion is moderate.

The soils in this association are suitable for crops, and a small acreage of the Geer soil is in alfalfa. They are used for grazing and wildlife habitat. Geer part in irrigated capability unit IIc-1; dryland capability subclass VIc; range site NV 28-44; irrigated wildlife suitability group 2-33-I; dryland wildlife suitability group 3-32. Heist part in irrigated capability unit IIIe-25; dryland capability subclass VIIi; range site NV 28-44; irrigated wildlife suitability group 2-42-I; dryland wildlife suitability group 3-42. Neither part assigned to a woodland suitability group.

Hamtah Series

The Hamtah series consists of deep, well-drained soils that formed in residuum weathered from rhyodacitic ignimbrite. They are on mountain faces. Slopes are 30 to 50 percent. The vegetation is big sagebrush, serviceberry, bitterbrush, some scattered pinon pine and mountainmahogany, bluebunch wheatgrass, squirreltail, and needlegrass. Elevation ranges from 7,200 to 8,500 feet. The average annual precipitation is 16 to 20 inches, and the average annual air temperature is 40° to 43° F. The frost-free season is less than 60 days.

In a representative profile the upper part of the surface layer is dark grayish-brown very stony clay loam about 10 inches thick. The next 11 inches is dark grayish-brown gravelly clay loam. Below this is about 20 inches of brown gravelly clay over pinkish-gray very gravelly clay. The underlying layer is variegated brown, strong-brown, and white very gravelly clay loam that extends to a depth of 60 inches or more.

Permeability is slow in Hamtah soils. Available water capacity is moderate. Effective rooting depth is more than 60 inches.

These soils are used for grazing, wildlife habitat, and watershed.

Representative profile of Hamtah very stony clay loam, 30 to 50 percent slopes, in an area of Hamtah-Tica association, 2,900 feet east and 1,740 feet north of SW. corner of sec. 17, T. 3 N., R. 71 E., Mount Diablo baseline and meridian:

A11—0 to 10 inches, dark grayish-brown (10YR 4/2) very stony clay loam, very dark brown (10YR 2/2) moist; weak, fine and medium, granular structure; soft, very friable, sticky and plastic; many very fine and few fine, medium, and coarse roots; many very fine interstitial pores; class 2 stoniness; slightly acid; gradual, smooth boundary.

A12—10 to 21 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark brown (10YR 2/2) moist; weak, fine and medium, granular structure;

slightly hard, very friable, sticky and plastic; many very fine and few fine, medium, and coarse roots; many very fine interstitial pores and many very fine and few fine tubular pores; neutral; gradual, smooth boundary.

B21t—21 to 33 inches, brown (7.5YR 5/2) gravelly clay, brown (7.5YR 4/2) moist; massive; hard, friable, sticky and plastic; many very fine and few fine and medium roots; many very fine interstitial pores and tubular pores; many moderately thick clay films in pores and as bridges between sand grains; 30 percent gravel; neutral; gradual, smooth boundary.

B22t—33 to 41 inches, pinkish-gray (7.5YR 6/2) very gravelly clay, brown (7.5YR 4/2) moist; massive; hard, friable, very sticky and very plastic; common very fine roots; many very fine interstitial pores and tubular pores; many moderately thick clay films in pores and as bridges between sand grains; 60 percent gravel; neutral; clear, smooth boundary.

B3t—41 to 60 inches, variegated brown (7.5YR 5/4), strong-brown (7.5YR 5/6), and white (10YR 8/1) very gravelly clay loam; dark brown (7.5YR 3/3), brown (7.5YR 5/2), and white (10YR 8/1) moist; original rock structure visibly parting to moderate, fine and very fine, angular blocky fragments; hard, firm, sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; many moderately thick clay films along fracture planes; neutral.

Bedrock is at a depth of 58 to 80 inches. The surface layer is covered by about 15 percent gravel, 3 percent cobbles, and 3 percent stones. Stones, classes 1 and 2, are common on the surface but are almost absent in the profile. In areas where mountainmahogany grows, there is a 1- to 2-inch thick O horizon. The organic-matter content is 2 to 6 percent. The B2t horizon is gravelly or very gravelly clay or heavy clay loam that is, on an average, 35 to 50 percent gravel. This horizon is 20 to 30 inches thick. The B3t horizon generally has variegated colors because of differential weathering of much of the original rock. Structure is visible, but it parts readily to weak or moderate fine and very fine angular or subangular blocky fragments.

Hamtah-Tica association (HA).—This association is in large, broad areas on hills and mountain faces in the east-central part of the survey area. Slopes are 15 to 50 percent. It is about 50 percent Hamtah very stony clay loam, 30 to 50 percent slopes; about 25 percent Tica very stony loam, 15 to 30 percent slopes; and 15 percent Rock outcrop. The Rock outcrop is scattered throughout areas of both soils. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Nevta and Udel soils.

The steep Hamtah soil differs from other soils in the mapping unit by its position on the mountain faces. Runoff is medium, and the hazard of erosion is moderate.

The moderately steep Tica soil differs from other soils in the mapping unit by its position on the lower hilly slopes. Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are not suitable for crops. They are used mainly for grazing and wildlife habitat, and they are an integral part of the watershed. Hamtah part in dryland capability subclass VIIi; range site NV 28-50; dryland wildlife suitability group 3-41; not assigned to a woodland suitability group. Tica part in dryland capability subclass VIIi; dryland wildlife suitability group 324; woodland suitability group 2x1; not assigned to a range site.

Hamtah-Udel association (HC).—This association is

in large, broad areas on foothills, side slopes, and mountains in the east-central part of the survey area. Slopes are 30 to 50 percent. It is about 50 percent Hamtah very stony clay loam, 30 to 50 percent slopes; 25 percent Udel very gravelly sandy loam, 30 to 50 percent slopes; and about 15 percent Rock outcrop. The Rock outcrop is scattered throughout both soils. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Nevta and Tica soils.

The steep Hamtah soil differs from other soils in the mapping unit by its position on the mountain faces, and it is a deep soil. Runoff is medium, and the hazard of erosion is moderate.

The steep Udel soil differs from other soils in the mapping unit by its position of foothill side slopes and mountains, but the depth to bedrock is dominantly less than 10 inches. Runoff is rapid, and the hazard of erosion is severe.

The soils in this association are not suitable for crops. They are used mainly for grazing and wildlife habitat. Hamtah part in dryland capability subclass VII_s; range site NV 28-50; dryland wildlife suitability group 3-41; not assigned to woodland suitability group. Udel part in dryland capability subclass VII_s; dryland wildlife suitability group 434; woodland suitability group 2d1; not assigned to a range site. Rock outcrop part in dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Heist Series

The Heist series consists of deep, well-drained soils that formed in alluvium derived mainly from reworked old valley-fill material. They are on bottom lands and short alluvial fans. Slopes are 0 to 8 percent. The vegetation is big sagebrush, rabbitbrush, some fourwing saltbush, Indian ricegrass, galleta, and a few scattered Utah juniper. Elevation ranges from 5,000 to 6,100 feet. The average annual precipitation is 8 to 12 inches, and the average annual temperature is 46° to 49° F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is light brownish-gray gravelly sandy loam and sandy loam about 4 inches thick. The next layer is light brownish-gray and very pale brown gravelly sandy loam about 31 inches thick. Below this is very pale brown sandy loam that extends to a depth of 60 inches or more.

Permeability is moderately rapid in the Heist soils. Available water capacity is low. Effective rooting depth is 60 inches or more.

The Heist soils are used for grazing, wildlife habitat, and irrigated crops.

Representative profile of Heist gravelly sandy loam, 0 to 8 percent slopes, in an area of Patter-Heist association, 1,200 feet north and 1,200 feet west of the SE. corner of sec. 21, T. 2 N., R. 67 E., Mount Diablo base-line and meridian:

A11—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many very fine interstitial pores; 20 percent gravel; violently effervescent; moderately alkaline; abrupt, smooth boundary.

A12—2 to 4 inches, light brownish-gray (10YR 6/2) sandy loam, brown (10YR 4/3) moist; massive; soft, very

friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 15 percent gravel; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C1—4 to 24 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many fine and very fine interstitial pores; 25 percent gravel; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C2—24 to 35 inches, very pale brown (10YR 7/3) gravelly sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many very fine interstitial pores; 25 percent gravel; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C3—35 to 60 inches, very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; many very fine interstitial pores; 5 percent gravel; violently effervescent; strongly alkaline.

About 20 percent of the surface is covered by gravel. The textures of the upper 40 inches are somewhat variable, but they are predominantly sandy loam or fine sandy loam modified by as much as 50 percent gravel. The gravel content will average from 5 to 35 percent. Thin strata as much as 10 inches thick of loam, sandy clay loam, or loamy sand are present in places. These soils normally are calcareous throughout but are noncalcareous in the upper 1 to 3 inches in places. The combined thickness of the A horizons ranges from 3 to 6 inches.

Heist gravelly sandy loam, 0 to 8 percent slopes (HDC).—This soil is in small areas on short alluvial fans in the central part of the survey area. Included in mapping and making up about 5 percent of the mapped acreage are areas of Geer soils and other Heist soils.

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

This soil is suitable for irrigated crops where irrigation water is available. Where the soil is less sloping, limited areas are used for home gardens. It is used mainly for grazing and wildlife habitat. Irrigated capability unit IIIe-25; dryland capability subclass VII_s; range site NV 28-44; irrigated wildlife suitability group 2-42-I; dryland suitability group 3-42; not assigned to a woodland suitability group.

Heist gravelly sandy loam, sand substratum, 0 to 8 percent slopes (HEC).—This soil is in small, narrow areas on short alluvial fans in the central part of the survey area. It has a profile similar to that described as representative of the series, but below a depth of 20 to 35 inches the soil material is light brownish-gray very friable loamy sand that extends to a depth of 60 inches or more. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of Geer soils and other Heist soils.

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

This soil is suitable for irrigated crops. In Dry Valley a limited acreage is being used for the production of alfalfa. The soil is used mainly for grazing and wildlife habitat. Irrigated capability unit IIIe-25; dryland capability subclass VII_s; range site NV 28-44; dryland wildlife suitability group 3-42, irrigated wildlife suitability group 2-42-I, not assigned to a woodland suitability group.

Holsine Series

The Holsine series consists of deep, well-drained soils

that formed in alluvium derived mainly from ignimbrites and limestone that have some influence from volcanic ash. They are on terrace tops. Slopes are 0 to 8 percent. The vegetation is black sagebrush, Indian ricegrass, galleta, blue grama, three-awn grass, needle-and-thread, big sagebrush, some scattered Utah juniper and pinon pine, cliffrose, low rabbitbrush, and Nevada ephedra. Elevation ranges from 5,800 to 6,600 feet. The average annual precipitation is 8 to 10 inches, and the average annual temperature is 42° to 45° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is pale-brown gravelly sandy loam over pinkish-gray very gravelly coarse sandy loam about 4 inches thick. The next layer is white very gravelly coarse sandy loam that has pockets of pinkish-gray very gravelly coarse sandy loam about 8 inches thick. Below this is very pale brown and light-brown very fine sandy loam that extends to a depth of 60 inches or more.

Permeability is moderate in Holsine soils. Available water capacity is low. Effective rooting depth is 60 inches or more.

The Holsine soils are used mainly for grazing and wildlife habitat.

Representative profile of Holsine gravelly sandy loam, 0 to 8 percent slopes, in an area of Holsine-Usine association, 960 feet south and 720 feet east of the NW corner of sec. 28, T. 3 N., R. 70 E., Mount Diablo base-line and meridian:

A11—0 to 2 inches, pale-brown (10YR 6/3) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine and fine interstitial pores and few fine and very fine vesicular pores; violently effervescent; moderately alkaline; abrupt, smooth boundary.

A12—2 to 4 inches, pinkish-gray (7.5YR 6/2) very gravelly coarse sandy loam, dark brown (7.5YR 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine and fine interstitial pores; few thin clay coatings on pebbles; few lime-coated sand grains; violently effervescent; moderately alkaline; abrupt, wavy boundary.

C1ca—4 to 12 inches, white (10YR 8/2) with pockets of pinkish-gray (7.5YR 6/2) very gravelly coarse sandy loam, pale brown (10YR 6/3) and brown (7.5YR 4/3) moist; massive; hard, firm, slightly sticky and slightly plastic; many very fine roots; many very fine and fine interstitial pores; few fine clay coatings on gravel in pockets; weakly cemented except for soft, very friable, nonsticky and nonplastic pockets; violently effervescent; moderately alkaline; abrupt, smooth boundary.

IIC2ca—12 to 19 inches, very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 4/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine interstitial pores and few fine and very fine tubular pores; clear, irregular boundary with tongues that extend to a depth of 30 inches in places; many (30 percent) medium and large white (10YR 8/2) lime masses and seams resembling root channels; violently effervescent; strongly alkaline.

IIC3ca—19 to 60 inches, light-brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine interstitial pores and few very fine and fine tubular pores; violently effervescent, many medium distinct white (10YR 8/2) lime masses and veins; strongly alkaline.

About 30 percent of the surface is covered by gravel. The

upper 9 to 16 inches of these soils is 60 to 90 percent gravel, mostly ½ inch in diameter or smaller. Depth to Cca horizon ranges from 3 to 8 inches. This horizon is 8 to 28 inches thick. The unconformable lacustrine sediment is dominantly very fine sandy loam or silt loam but includes thin strata of fine sandy loam. These strata are modified by as much as 25 percent gravel in places.

Holsine-Usine association (HN).—This association is in large areas on terrace tops and side slopes in the north-central part of the survey area. Slopes are 0 to 30 percent. It is about 45 percent Holsine gravelly sandy loam, 0 to 8 percent slopes; 30 percent Usine cobbly sandy loam, 8 to 30 percent slopes; and 20 percent Buster loamy sand, 0 to 8 percent slopes, eroded. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of Fanu and Poorma soils and Badland.

The nearly level to moderately sloping Holsine soil differs from other soils in the mapping unit by its position on terrace tops. Runoff is slow or medium, and the hazard of erosion is slight or moderate.

The strongly sloping to moderately steep Usine soil differs from other soils in the mapping unit by its position on the terrace side slopes. It has the profile described as representative of the series. Runoff is rapid, and the hazard of erosion is severe.

The nearly level to moderately sloping Buster soil differs from other soils in the mapping unit by its position on the higher terraces. Runoff is low or medium, and the hazard of erosion is slight or moderate.

The soils in this association are not suitable for crops. They are used for grazing and wildlife habitat. Holsine part in dryland capability subclass VII_s; range site NV 28-41; dryland wildlife suitability group 3-42. Usine part in dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 3-42. Buster part in dryland capability subclass VII_s; dryland wildlife suitability group 334; woodland suitability group 2o1; not assigned to a range site. Holsine and Usine soils are not assigned to a woodland suitability group.

Holtle Series

The Holtle series consists of very deep, well-drained soils that formed in alluvium mainly from rhyodacitic ignimbrite. They are on flood plains and short alluvial fans. Slopes are 0 to 8 percent. The vegetation is big sagebrush, Great Basin wildrye, bluestem wheatgrass, squirreltail, and Indian ricegrass. Elevation ranges from 5,800 to 7,800 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 42° to 44° F. The frost-free season is 40 to 80 days.

In a representative profile the surface layer is gray and grayish-brown loam about 13 inches thick. The next layer is light brownish-gray loam about 15 inches thick. Below this is light brownish-gray silt loam that is 50 percent very hard nodules and is about 29 inches thick. It is underlain by light brownish-gray silt loam that extends to a depth of 60 inches or more.

Permeability is moderate in the Holtle soils. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more.

The Holtle soils are suitable for irrigated crops when

irrigation water is available. They are used mainly for grazing and wildlife habitat.

Representative profile of Hottle loam, 0 to 8 percent slopes, under native vegetation, 100 feet north of the SE. corner of sec. 36, T. 4 N., R. 69 E., Mount Diablo baseline and meridian:

- A11—0 to 4 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; moderate, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots; common very fine and interstitial pores; neutral; abrupt, smooth boundary.
- A12—4 to 9 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, thin platy; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; many very fine interstitial pores and common fine and medium and few coarse tubular pores; neutral; abrupt, smooth boundary.
- A13—9 to 13 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; many very fine interstitial pores and common fine and medium tubular pores; neutral; clear, smooth boundary.
- B2—13 to 23 inches, light brownish-gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure; hard, very friable, nonsticky and slightly plastic; common very fine and few fine and medium roots; common very fine interstitial pores and common fine and medium tubular pores; many vertical large ($\frac{1}{2}$ - to 2-inch) cicada channels and burrows with a few filled; neutral; gradual, smooth boundary.
- C1sica—28 to 57 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine and medium roots; common very fine interstitial pores and common fine and medium tubular pores; 50 percent very hard, firm, brittle cylindrical, randomly oriented durinodes; strongly effervescent, moderately alkaline; clear, smooth boundary.
- C2—57 to 60 inches, light brownish-gray (10YR 6/2) silt loam, dark brown (10YR 3/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine interstitial pores and many very fine and common fine tubular pores; several large vertical cicada channels; slightly effervescent, moderately alkaline.

The surface layer is covered by a few small pebbles. The A horizons are 10 to 20 inches thick. The A1 horizon is 1 to 5 percent organic matter. The texture between 10 and 40 inches is loam, very fine sandy loam, or silt loam. Strata of fine sandy loam or sandy loam that has as much as 20 percent gravel occurs in places. The C1sica horizon contains lime-coated nodules that range from hard to very hard.

Hottle loam, 0 to 8 percent slopes (HOC).—This soil is in small areas on flood plains and short alluvial fans in the north-central part of the survey area. This soil has the profile described as representative of the series. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other Hottle-like soils. In the vicinity of Eagle Valley Reservoir a soil similar to the Ursine soil that has 4 to 8 percent slopes is present.

Runoff is slow, and the hazard of erosion is moderate. This soil is subject to occasional flooding when situated on short alluvial fans at the mouth of lateral drainways.

This soil is suitable for irrigated crops. It is used for

grazing and wildlife habitat. Irrigated capability unit IVe-60; dryland capability subclass VIc; range site NV 28-44; irrigated wildlife suitability group 2-42-I; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Hottle-Four Star association (HR).—This association is in small, narrow areas on bottom lands within narrow valleys in the northern part of the survey area. It is about 70 percent Hottle loam, 0 to 8 percent slopes, and 30 percent Four Star loam, 0 to 4 percent slopes. Included in mapping, and making up a very small percentage of the mapped acreage, are areas of Alluvial land.

The nearly level to moderately sloping Hottle soil differs from other soils in the mapping unit by its position on the well-drained flood plain and short alluvial fans. Runoff is slow, and the hazard of erosion is moderate.

The nearly level to gently sloping Four Star soil differs from other soils in the mapping unit by its position on the lower flood plains that are usually wet. Runoff is very slow or slow, and the hazard of erosion is moderate.

The soils in this association are not usually suitable for irrigated crops because of their small size and position. The Four Star soil is suitable for the production of subirrigated grassland. These soils are used mainly for grazing and wildlife habitat. Hottle part in irrigated capability unit IVe-60; dryland capability subclass VIc; irrigated wildlife suitability group 2-42-I; dryland wildlife suitability group 3-42; not assigned to a range site or a woodland suitability group. Four Star part in irrigated capability unit IVw-123; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Homestake Series

The Homestake series consists of deep, well-drained soils that formed in alluvium mainly from rhyodacitic ignimbrites. They are on terrace tops. Slopes are 2 to 15 percent. The vegetation is pinon pine, Utah juniper, big sagebrush, bitterbrush, needleandthread, and squirreltail. Elevation ranges from 6,800 to 7,500 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 41° to 44° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is grayish-brown gravelly sandy loam and dark grayish-brown gravelly light sandy clay loam about 6 inches thick. The next layer is dark grayish-brown gravelly clay loam. Below it is dark grayish-brown very gravelly clay over brown very gravelly heavy clay loam. At a depth of 20 inches is brownish-gray and light brownish-gray very cobbly sandy clay loam about 5 inches thick. It is underlain by very pale brown, weakly cemented very cobbly and gravelly light sandy clay loam about 16 inches thick. The next layer is very pale brown and pink weakly cemented very cobbly loamy sand that extends to a depth of 60 inches.

Permeability is slow in the Homestake soils. Available water capacity is low. Effective rooting depth is 60 inches or more.

The Homestake soils are not suitable for irrigated

crops. They are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Homestake gravelly sandy loam, 4 to 8 percent slopes, under native vegetation, 2,340 feet south and 2,340 feet east of the NW. corner of sec. 18, T. 4 N., R. 69 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, granular structure; soft, very friable, slightly sticky and nonplastic; few very fine roots; few fine and many very fine interstitial pores; 45 percent gravel; neutral; abrupt, smooth boundary.
- A12—2 to 6 inches, dark grayish-brown (10YR 4/2) gravelly light sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, granular structure; soft, very friable, slightly sticky and plastic; many very fine and few fine, medium, and coarse roots; few fine and many very fine interstitial pores; 35 percent gravel; neutral; clear, smooth boundary.
- B1t—6 to 11 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, dark brown (10YR 3/3) moist; moderate, very fine, subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and few fine, medium, and coarse roots; few fine and many very fine interstitial pores and tubular pores; few moderately thick clay bridges between sand grains and thin clay films in pores and on ped faces; 40 percent gravel; neutral; clear, smooth boundary.
- B21t—11 to 15 inches, dark grayish-brown (10YR 4/2) very gravelly clay, dark yellowish brown (10YR 3/4) moist; moderate, fine, subangular blocky structure; hard, friable, very sticky and very plastic; common very fine and few fine, medium, and coarse roots; many very fine interstitial pores and tubular pores; few moderately thick clay bridges between sand grains and thin continuous clay films in pores and on ped faces; 50 percent gravel; neutral; clear, smooth boundary.
- B22tca—15 to 20 inches, brown (10YR 4/3) very gravelly heavy clay loam, dark yellowish brown (10YR 3/4) moist; moderate, medium and fine, subangular blocky structure; hard, friable, very sticky and very plastic; common very fine and few fine, medium, and coarse roots; many very fine interstitial pores and tubular pores; few moderately thick clay bridges between sand grains and thin continuous clay films in pores and of ped faces; common medium, pale-brown (10YR 6/3) weathered pebbles; 55 percent gravel; strongly effervescent, has common fine and medium distinct white (10YR 8/2) lime masses; moderately alkaline; clear, smooth boundary.
- B3tca—20 to 25 inches, brownish-gray (10YR 5/2) and light brownish-gray (10YR 6/2) very cobbly sandy clay loam, brown (10YR 5/3) moist; massive, hard, friable, sticky and plastic; few very fine and fine roots; many very fine interstitial pores and tubular pores; few moderately thick clay films as bridges between sand grains and in pores; many medium, very pale brown (10YR 7/3) and pale-brown (10YR 6/3) weathered pebbles; 50 percent cobbles and 25 percent gravel; violently effervescent, has many medium and large distinct white (10YR 8/2) lime masses; moderately alkaline; clear, smooth boundary.
- C1sica—25 to 41 inches, very pale brown (10YR 7/3) weakly cemented very cobbly light sandy clay loam that has small areas and coatings of pale brown (10YR 6/3) and white (10YR 8/2), pale brown (10YR 6/3), brown (10YR 4/3), and light gray (10YR 7/2) moist; massive; very hard, firm, slightly sticky and plastic; few medium, very fine, and fine horizontally oriented roots; many very fine interstitial pores and few very fine tubular

pores; few horizontally and diagonally discontinuous silica laminae; silica film coating on sand grains and as bridges between sand grains; 50 percent cobbles and 25 percent gravel; violently effervescent; strongly alkaline; gradual, smooth boundary.

- C2si—41 to 60 inches, very pale brown (10YR 8/3) and pink (7.5YR 7/4) weakly cemented very cobbly loamy sand; pale brown (10YR 6/3) and light brown (7.5YR 6/4) moist; common, fine, prominent, black (10YR 2/1) and few medium distinct, strong-brown (7.5YR 5/8) moist mottles; massive; very hard, firm, nonsticky and nonplastic; many very fine interstitial pores and few very fine tubular pores; common moderately thick pale-brown (10YR 6/3) silica bridges between sand grains and as films in pores, yellowish brown (10YR 5/4) moist; strongly effervescent in spots; strongly alkaline.

About 30 percent of the surface layer is covered by gravel, some cobbles, and a few stones. The weakly cemented C horizon is at a depth of 20 to 32 inches. Some stones, up to class 2 stoniness, are on the surface in places. The combined thickness of the layers in the A horizon is 5 to 10 inches. This horizon is 30 to 50 percent gravel. The B2t horizon is 35 to 45 percent clay and 50 to 70 percent cobbles and gravel. The C horizon is weakly cemented with silica and lime in the upper part. Many very thin silica films (coatings in pores) cement pebbles and sand grains. Also, few to common, thin, discontinuous, unoriented silica and lime cemented laminae are present.

Homestake gravelly sandy loam, 4 to 8 percent slopes (HSC).—This soil is in large, broad areas on terrace tops in the northeastern part of the survey area. The soil has the profile described as representative of the series. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Basket soils on the south-facing sides of terraces and Lize soils on the north-facing sides of terraces.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2f1; not assigned to a range site.

Homestake very stony sandy loam, 2 to 8 percent slopes (HTC).—This soil is in small areas on the terrace tops in the northwestern part of the survey area. It has a profile similar to that described as representative of the series, but it has a very stony surface and slopes approach 8 percent. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Holtle soils and other Homestake soils.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2x1; not assigned to a range site.

Itca Series

The Itca series consists of shallow, well-drained soils that formed in residuum weathered from rhyodacitic ignimbrite. They are on steep foothills and mountains. Slopes are 2 to 50 percent. The vegetation is pinon pine, Utah juniper, big sagebrush, low sagebrush, bitterbrush, and various grasses. Elevation ranges from

5,800 to 7,000 feet. The average annual precipitation is 12 to 16 inches, and the average annual air temperature is 43° to 45° F. The frost-free season is 60 to 80 days.

In a representative profile the surface layer is grayish-brown stony loam about 2 inches thick. The next layer is dark grayish-brown gravelly clay loam about 3 inches thick. It is underlain by brown gravelly clay about 9 inches thick. Hard ignimbrite bedrock is at a depth of 14 inches.

Permeability is slow above the bedrock in Itca soils. Available water capacity is very low. Effective rooting depth is 10 to 20 inches.

The Itca soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Itca stony loam, 15 to 30 percent slopes, under native vegetation, 1,000 feet north of the south quarter corner of sec. 21, T. 2 S., R. 70 E., Mount Diablo baseline and meridian:

A1—0 to 2 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) moist; weak, medium, platy structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine vesicular pores; 40 percent cobbles and stones; neutral; abrupt, smooth boundary.

B1—2 to 5 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure; slightly hard, friable, sticky and plastic; common fine roots; few tubular pores; 30 percent gravel; neutral; clear, smooth boundary.

B21t—5 to 10 inches, brown (10YR 5/3) gravelly clay, brown (7.5YR 4/2) moist; weak, medium, prismatic structure parting to moderate, medium, sub-angular blocky; hard, firm, sticky and very plastic; few fine and many medium and coarse roots; few fine tubular pores; few thin clay films on ped faces and in pores; 40 percent gravel; neutral; abrupt, smooth boundary.

B22t—10 to 14 inches, brown (7.5YR 5/4) gravelly clay, brown (7.5YR 4/4) moist; moderate, medium, prismatic structure; hard, firm, sticky and very plastic; many medium and coarse roots; common fine tubular pores; common thin clay films on ped faces and in pores; 40 percent gravel; neutral; abrupt, irregular boundary.

R—14 inches, bedrock.

Bedrock is at a depth ranging from 10 to 20 inches. The surface layer is stony and has Class 1, 2, or 3 stoniness. About 10 percent of the surface is covered by gravel, 40 percent by cobbles, and 1 percent by stones. The A1 horizon is loam or clay loam that is 10 to 50 percent gravel and cobbles. The B2t horizon is dominantly clay but it is heavy clay loam in places. It is modified by 35 to 50 percent gravel and cobbles, which in places range to as much as 85 percent.

Itca stony clay loam, 2 to 15 percent slopes (IND).—This soil is in large, broad areas on foothill faces in the north-central and south-central parts of the survey area. It has a profile similar to that described as representative of the series, but it has a surface layer of stony clay loam and is 2 or 3 inches deeper to bedrock.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, are areas of Rock outcrop. Also included are areas of a moderately deep, gravelly, medium-textured soil and other Itca soils.

Runoff is medium or rapid, and the hazard of erosion is slight or moderate.

This soil is not suitable for irrigated crops. It is used for grazing, wildlife habitat, and watershed. Dryland

capability subclass VII_s; dryland suitability group 324; woodland suitability group 2d1; not assigned to a range site.

Itca-Cedaran association (IO).—This association is in large areas on foothills and mountains along the eastern boundary of the survey area. Slopes are 15 to 50 percent. It is about 45 percent Itca stony loam, 15 to 30 percent slopes; about 25 percent Cedaran stony loam, 15 to 50 percent slopes; and about 25 percent Rock outcrop.

Included with this soil in mapping are areas of other Itca soils that have very stony loam surfaces and slopes as much as 50 percent, Aned soils, and Alluvial land. Also included, in the vicinity of Eagle Valley reservoir, is a small body of coarse-textured, stony and very gravelly alluvial soil. These inclusions make up about 10 percent of the mapped acreage.

The moderately steep Itca soil differs from other soils in the mapping unit by having a gravelly, very plastic clay subsoil and by its depth to ignimbrite. Runoff is medium or rapid, and the hazard of erosion is slight or moderate.

The moderately steep to steep Cedaran soil differs from other soils in the mapping unit by having a gravelly clay loam subsoil, and its depth to hard tuff is about 18 inches. It has a profile similar to that described as representative of the series, but it has a thicker, darker stony loam surface layer and a thin sandy loam layer immediately above the bedrock. Runoff is medium or rapid, and the hazard of erosion is moderate to severe.

The Rock outcrop is in large and small areas scattered throughout both soils but generally at higher elevations.

The soils in this association are used for grazing and wildlife habitat. They are also an integral part of the watershed. Itca and Cedaran parts in dryland capability subclass VII_s; dryland wildlife suitability group 434; woodland suitability group 2d1; not assigned to a range site. Rock outcrop part in dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Itca-Rock outcrop association (IR).—This association is in medium-sized, narrow areas on mountain faces along the eastern boundary of the survey area. Slopes are 15 to 50 percent. It is about 60 percent Itca very stony loam, 15 to 50 percent slopes, and 25 percent Rock outcrop.

Included with these soils in mapping are areas of Minu and other Itca soils and Alluvial land. Also included, in the vicinity of Eagle Valley Reservoir, are areas of soils similar to the Usine soils. These inclusions make up about 15 percent of the mapped acreage.

The moderately steep to steep Itca soil differs from other soils in the mapping unit by having a very stony surface, and it is 2 or 3 inches shallower to hard bedrock in some places. Some small areas that have steeper slopes are included. Runoff is medium or rapid, and the hazard of erosion is slight or moderate.

Areas of Rock outcrop vary in size throughout the mapping unit.

The Itca soil is not suitable for crops. It is used mostly for grazing, wildlife habitat, and watershed. Itca part in dryland capability subclass VII_s; dryland wildlife suitability group 434; woodland suitability

group 2x1; not assigned to a range site. Rock outcrop part in dryland capability subclass VIIIs; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Jarab Series

The Jarab series consists of well-drained soils that are shallow to a hardpan. They formed in alluvium derived mainly from quartzite, limestone, and eroding lacustrine sediment. They are on high terraces or alluvial fans adjacent to steep mountain faces. Slopes are 2 to 15 percent. The vegetation is Utah juniper, cliff-rose, black sagebrush, pinon pine, and galleta. Elevation ranges from 5,600 to 6,200 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 48° to 53° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is brown cobbly loam about 2 inches thick over brown gravelly loam about 3 inches thick. The next layer is brown gravelly clay loam about 5 inches thick. It contains pan fragments as much as 3 inches in diameter. This layer is underlain by white, continuous, indurated hardpan with thin silica laminae over material that is weakly and strongly cemented with lime, which alternates with thin strata of very pale brown, soft, calcareous gravelly loam. This layer extends to a depth of at least 35 inches.

Permeability is moderately slow above the hardpan in Jarab soils. Available water capacity is very low. Effective rooting depth is restricted by the indurated hardpan at a depth of 10 to 20 inches.

The Jarab soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Jarab cobbly loam, 2 to 15 percent slopes, under native vegetation, 1,300 feet south and 600 feet east of the NW. corner of sec. 30, T, 1 N., R. 67 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) moist; weak, thick, platy structure; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine vesicular pores; 25 percent cobbles; strongly effervescent; strongly alkaline; abrupt, smooth boundary.
- A12—2 to 5 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; common fine interstitial pores and tubular pores; 30 percent gravel; strongly effervescent; moderately alkaline; abrupt, smooth boundary.
- C1—5 to 10 inches, brown (10YR 5/3) gravelly clay loam, dark brown (10YR 3/3) moist; weak, fine, sub-angular blocky structure; slightly hard, very friable, sticky and slightly plastic; common fine and very fine roots; many fine tubular and interstitial pores; 45 percent pan fragments that are as much as 3 inches in diameter; strongly effervescent; moderately alkaline; abrupt, wavy boundary.
- C2sicam—10 to 35 inches, white (10YR 8/2), continuous, indurated, thin (1/32 inch to 1/8 inch) silica laminae, light gray (10YR 7/2) moist; capped and randomly integrated by material weakly and strongly cemented with lime which alternates with thin strata of very pale brown (10YR 7/3) soft calcareous gravelly loam; cemented by lime material is white (10YR 8/2) and very pale brown (10YR 8/3) dry and light gray (10YR 7/2) moist; massive; very hard and extremely hard; violently effervescent; strongly alkaline.

About 15 percent of the surface is covered by gravel, and

25 percent is covered by cobbles. Most areas are cobbly but some are gravelly. The A1 horizon is loam or clay loam modified by cobbles or gravel. The C1 horizon is loam or clay loam and is 35 to 50 percent pan fragments and gravel. The indurated hardpan is at a depth of 10 to 20 inches. It ranges from mildly alkaline to very strongly alkaline, and it is strongly effervescent or violently effervescent.

Jarab cobbly loam, 2 to 15 percent slopes (JCD).—This soil is in a small area on moderately dissected terraces in the west-central part of the survey area near the town of Pioche. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of Cath soils and Alluvial land.

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

This soil is not suitable for irrigated crops. It is used for grazing and wildlife habitat. Dryland capability subclass VIIIs; dryland wildlife suitability group 324; woodland suitability group 2d1; not assigned to a range site.

Kyler Series

The Kyler series consists of very shallow, well-drained soils that formed in gravelly and cobbly loamy residuum weathered from limestone. They are on foothills and mountains. Slopes are 15 to 50 percent. The vegetation is black sagebrush, cliffrose, Utah juniper, pinon pine, needleandthread, and Indian ricegrass. Elevation ranges from 5,200 to 7,200 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 45° to 50° F. The frost-free season is 80 to 120 days.

In a representative profile the surface layer is pale-brown very cobbly loam and cobbly loam about 3 inches thick. The next layer is pinkish-gray gravelly loam about 4 inches thick. It is underlain by gray limestone bedrock that is at a depth of 7 inches.

Permeability is moderate above the bedrock in the Kyler soils. Available water capacity is very low. Effective rooting depth is 6 to 15 inches.

The Kyler soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Kyler very cobbly loam, 15 to 30 percent slopes, in an area of Kyler-Rock outcrop complex, 2,140 feet north of the SE. corner of sec. 36, T. 1 N., R. 67 E., Mount Diablo baseline and meridian:

- A11—0 to 1 inch, pale-brown (10YR 6/3) very cobbly loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine, many fine, and few medium roots; many fine vesicular pores; 75 percent cobbles and gravel; violently effervescent; moderately alkaline; abrupt, smooth boundary.
- A12—1 to 3 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and many fine and medium roots; many very fine and fine interstitial pores; 50 percent gravel and cobbles; violently effervescent; moderately alkaline; abrupt, smooth boundary.
- C1—3 to 7 inches, pinkish-gray (7.5YR 6/2) gravelly loam, brown (7.5YR 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine and many fine and medium roots; many very fine and fine interstitial pores; 40 percent gravel and cobbles; violently effervescent, strongly alkaline; abrupt, smooth boundary.
- R—7 to 10 inches, gray (N 6/0) limestone.

Bedrock is at a depth of 6 to 15 inches. About 20 percent of the surface is covered by gravel, and 30 percent is covered by cobbles and a few stones. Stoniness includes Class 1 and 2. Texture is dominantly loam but includes strata of fine sandy loam and silt loam. On the average the soil material is 35 to 60 percent cobbles, gravel, and stones but can range to 70 percent in any one horizon.

Kyler-Rock outcrop complex (KO).—This complex is in narrow areas on foothills underlain by tilted limestone beds in the west-central part of the survey area. It is about 55 percent Kyler very cobbly loam, 15 to 30 percent slopes, and 30 percent Rock outcrop. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of other Kyler soils and a soil similar to the Kyler soil.

The Kyler soil differs from other soils in the mapping unit by occupying the areas between the long, narrow ridges of tilted limestone beds. It has the profile described as representative of the series. Runoff is medium, and the hazard of erosion is severe.

Rock outcrop forms long, narrow ridges of tilted beds. It is throughout the mapping area.

This complex is not suitable for irrigated crops. It is used for grazing, wildlife habitat, and watershed. Dryland capability subclass VII_s; Kyler part in range site NV 28-39; dryland wildlife suitability group 4-43; not assigned to a woodland suitability group. Rock outcrop part not assigned to a range site, wildlife suitability group, or woodland suitability group.

Kyler-Rock outcrop association (KR).—This association is in broad, medium-sized areas on the mountain faces in the west-central part of the survey area. It is about 35 percent Kyler stony loam, 30 to 50 percent slopes; 20 percent Kyler very stony loam, moderately deep variant, 50 to 75 percent slopes; and 25 percent Rock outcrop. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of other Kyler soils and a shallow soil similar to the Kyler soil.

The steep Kyler soil differs from other soils in the mapping unit by occupying the higher elevations and is less than 15 inches deep to bedrock. It has a profile similar to that described as representative of the series, but it has a stony surface. Runoff is medium, and the hazard of erosion is severe.

The very steep Kyler soil differs from other soils in the mapping unit by being on the north-facing slopes and is 20 to 40 inches deep to bedrock. It has the profile described as representative of the Kyler variant. Runoff is rapid, and the hazard of erosion is moderate or severe.

Rock outcrop is in large areas commonly at the higher elevations. It is mostly with Kyler stony loam, 30 to 50 percent slopes.

This association is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Kyler stony loam part in dryland capability subclass VII_s; range site NV 28-52; dryland wildlife suitability group 4-43; not assigned to a woodland suitability group. Kyler very stony loam, moderately deep variant, part in dryland capability subclass VII_s; dryland wildlife suitability group 334; woodland suitability group 1x1; not assigned to a range site. Rock outcrop part in dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Kyler Variant

The Kyler variant consists of moderately deep well-drained soils that formed in residuum or colluvium derived from limestone and dolomite. Areas are on mountain faces. Slopes are 50 to 75 percent. These soils have a northerly aspect and remain snow covered longer than other Kyler soils. The vegetation is Utah juniper, pinon pine, big sagebrush, cliffrose, blue grama, snowberry, and currant. Elevation ranges from 6,000 to 7,200 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 45° to 51° F. The frost-free season is 80 to 100 days.

In a representative profile the surface layer is grayish-brown and brown very stony and gravelly loam that has many pan fragments and is about 11 inches thick. The next layer is very pale brown very gravelly loam weakly cemented with lime. It contains many pan fragments and is about 11 inches thick. It is underlain by stratified very pale brown and light brownish-gray gravelly and very gravelly heavy loam that extends to hard bedrock at a depth of 43 inches.

Permeability is moderate. Available water capacity is low. Effective rooting depth is 25 to 45 inches.

The Kyler variant is used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Kyler very stony loam, moderately deep variant, 50 to 75 percent slopes, in an area of Kyler-Rock outcrop association, 100 feet east of the apparent north quarter corner of sec. 21, T. 1 N., R. 67 E., Mount Diablo baseline and meridian:

- A11—0 to 6 inches, grayish-brown (10YR 5/2) very stony loam, dark brown (10YR 3/3) moist; weak, medium, crumb structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; many fine interstitial pores and common fine tubular pores; 20 percent gravel and 10 percent cobbles; violently effervescent; moderately alkaline; abrupt, smooth boundary.
- A12—6 to 11 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) moist; massive; soft, very friable, nonsticky and slightly plastic; many fine, medium, and coarse roots; common fine and very fine interstitial pores and common fine tubular pores; 40 percent gravel; violently effervescent; strongly alkaline; clear, smooth boundary.
- C1ca—11 to 22 inches, very pale brown (10YR 7/3) very gravelly loam weakly cemented by lime, brown (10YR 5/3) moist; massive; hard, firm, slightly sticky and slightly plastic; many fine, medium, and coarse roots; common fine interstitial pores and tubular pores; 60 percent gravel, mostly pan fragments, and 5 percent cobbles; gravel and cobbles are lime coated; violently effervescent; strongly alkaline; clear, wavy boundary.
- C2ca—22 to 34 inches, very pale brown (10YR 8/3) and pale-brown (10YR 6/3) very gravelly heavy loam, light yellowish brown (10YR 6/4) and dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine, common medium, and few coarse roots; common fine interstitial pores and tubular pores; 60 percent gravel; violently effervescent; strongly alkaline; clear, irregular boundary.
- C2—34 to 43 inches, light brownish-gray (10YR 6/2) very gravelly heavy loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; common fine interstitial pores and tubular pores; 60 percent angular gravel; strongly effervescent; strongly alkaline; abrupt, irregular boundary.
- R—43 inches, bedrock.

A thin horizon of partly decomposed leaves and needles generally is under the trees and browse. The bedrock is at a depth ranging from 25 to 45 inches. About 20 percent of the surface is covered by gravel, 10 percent is covered by cobbles, and 4 percent is covered by stones. Surface stoniness is Class 2-4.

The Kyler variant occurs only in Kyler-Rock outcrop association (KR). Runoff is rapid, and the hazard of erosion is severe.

Lien Series

The Lien series consists of well-drained soils that are very shallow to hardpan and formed in alluvium derived from ignimbrites. They are on alluvial fans and terrace tops. Slopes are 2 to 4 percent. The vegetation is Utah juniper, pinon pine, black sagebrush, and miscellaneous grasses. Elevation ranges from 6,000 to 7,100 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 41° to 45° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is light brownish-gray gravelly fine sandy loam about 3 inches thick. The next layer is pale-brown very gravelly fine sandy loam about 5 inches thick. It is underlain by a 16-inch white duripan cemented with silica and lime. The underlying layer is light yellowish-brown loamy fine sand that extends to a depth of 60 inches or more.

Permeability is moderately rapid above the very slowly permeable hardpan in the Lien soils. Available water capacity is very low. Effective rooting depth is 6 to 12 inches.

The Lien soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Lien gravelly fine sandy loam, 2 to 4 percent slopes, under native vegetation, at the approximate NE. corner of sec. 19, T. 6 N., R. 68 E., Mount Diablo baseline and meridian:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few roots; many fine and few medium vesicular pores; 40 percent gravel, mostly old pan fragments; violently effervescent; moderately alkaline; abrupt, wavy boundary.

C1—3 to 8 inches, pale-brown (10YR 6/3) very gravelly fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse horizontal roots; many very fine and fine and few medium interstitial pores; 60 percent gravel, ½- to ¾-inch thick pan fragments; violently effervescent; moderately alkaline; abrupt, wavy boundary.

C2sicam—8 to 24 inches, white (10YR 8/2) indurated duripan, light gray (10YR 7/2) moist; massive, appearing as layers of thick plates; extremely hard and extremely firm; very fine roots matted along fracture planes and between plates; very few very fine interstitial pores; acid insoluble, laminar, 1/32-inch-thick brown silica coatings on upper plate surfaces and in pores and root channels; violently effervescent; moderately alkaline; abrupt, smooth boundary.

C3si—24 to 60 inches, light yellowish-brown (10YR 6/4) loamy fine sand weakly cemented by silica and lime, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm and brittle; very few very fine roots; many very fine tubular pores that are partly filled by very pale brown (10YR 7/3) silica and lime coatings; has few fine and medium distinct white (10YR 8/2) lime veins; violently effervescent; strongly alkaline.

About 40 percent of the surface is covered by gravel. The

indurated hardpan is at a depth ranging from 6 to 12 inches. The A1 and C1 horizons have weak, medium or fine, subangular blocky structure, or are massive. Textures are fine sandy loam, sandy loam, or loam modified by 50 to 70 percent angular gravel and cobbles. The duripan is massive, but it has a thick, platy appearance. Thin strongly silica- and lime-cemented laminae and coatings make up 20 to 40 percent of the C2sicam horizon.

Lien gravelly fine sandy loam, 2 to 4 percent slopes (LAB).—This soil is in a small area on alluvial fans and terrace tops in the northeastern part of the survey area. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other soils similar to the Lien soils and some alluvium in the drainage ways.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 434; woodland suitability group 2d1; not assigned to a range site.

Linco Series

The Linco series consists of deep, well-drained soils that formed in alluvium derived mainly from reworked old lacustrine sediment. They are on terrace side slopes. Slopes are 4 to 30 percent. The vegetation is black sagebrush, big sagebrush, scattered rabbitbrush, Nevada ephedra, Utah juniper, Indian ricegrass, needleandthread, and galleta. Elevation ranges from 4,800 to 6,100 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 46° to 51° F. The frost-free season is 100 to 130 days.

In a representative profile the surface layer is light brownish-gray gravelly sandy loam about 3 inches thick. The next layer is pinkish-gray gravelly loam over pinkish-gray, slightly brittle gravelly fine sandy loam about 22 inches thick. It is underlain by pinkish-gray gravelly fine sandy loam that is about 35 percent gravel. This layer has thin, gravel-free strata of sandy loam and loamy sand. It extends to a depth of 60 inches or more.

Permeability is moderate in the Linco soils. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more.

The Linco soils are used mainly for grazing and wildlife habitat.

Representative profile of Linco gravelly sandy loam, 4 to 15 percent slopes, under native vegetation, 2,640 feet east and 1,300 feet north of the south corner of sec. 32, T. 2 S., R. 69 E., Mount Diablo baseline and meridian:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine interstitial pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—3 to 8 inches, pinkish-gray (7.5YR 7/2) gravelly loam, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; common fine roots; many very fine and fine interstitial pores; strongly effervescent; moderately alkaline; abrupt, irregular boundary.

C2sica—8 to 25 inches, pinkish-gray (7.5YR 7/2) gravelly fine sandy loam, brown (7.5YR 5/4) moist; mas-

sive; hard, firm and slightly brittle; few medium roots; many very fine and fine interstitial pores; weakly cemented; violently effervescent; strongly alkaline; abrupt, irregular boundary.

C3—25 to 60 inches, pinkish-gray (7.5YR 7/2) gravelly fine sandy loam, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few medium roots; many fine interstitial pores; 30 percent gravel; few thin ($\frac{1}{4}$ inch to $\frac{1}{2}$ inch thick) strata of gravel-free sandy loam and loamy sand; violently effervescent; strongly alkaline and very strongly alkaline.

About 30 percent of the surface is covered by gravel and a few cobbles. The brittle, weakly cemented with silica and lime horizon is at a depth of 4 to 8 inches. The A horizon is 2 to 5 inches thick. Very gravelly strata occur at random, but the average gravel content above 40 inches is 20 to 35 percent. These soils are coarsely stratified by loam, sandy loam, fine sandy loam, loamy sand, loamy fine sand, or clay loam. Any one horizon can have two or more textures. Any or all strata are modified by gravel, and the average clay content is less than 18 percent.

Linco-Acana association (LC).—This association is in narrow areas along the perimeter of large, broad terraces; on the tops of terrace remnants; and on some sides of terraces. It is in the central part of the survey area. The association is about 45 percent Linco gravelly sandy loam, 15 to 30 percent slopes, and 35 percent Acana gravelly sandy loam, 2 to 8 percent slopes. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of other Linco soils, Badland, and alluvium.

The moderately steep Linco soil differs from other soils in the mapping unit by its position on the sides of terrace. Runoff is rapid, and the hazard of erosion is severe.

The gently sloping to moderately sloping Acana soil differs from other soils in the mapping unit by its position on the terrace tops. It has the profile described as representative of the series. Runoff is medium, and the hazard of erosion is moderate.

This association is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Linco part in dryland capability subclass VIIe; range site NV 28-40; dryland wildlife suitability group 3-42. Acana part in dryland capability subclass VIIs; range site NV 28-41; dryland wildlife suitability group 3-42. Neither part assigned to a woodland suitability group.

Linco-Badland association (LD).—This association is in both broad and narrow areas on eroded fingerlike ends of terraces in the west-central part of the survey area. It is about 45 percent Linco gravelly sandy loam, 4 to 15 percent slopes; 20 percent Linco gravelly sandy loam, 15 to 30 percent slopes; and 20 percent Badland. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of Acana and Cath soils and some alluvium.

The moderately sloping to strongly sloping Linco soil differs from other soils in the mapping unit by its gentler slopes. It has the profile described as representative of the series. Runoff is medium, and the hazard of erosion is moderate.

The moderately steep Linco soil differs from other soils in the mapping unit by its steeper slopes. It has a profile similar to that described as representative of the series, but the soil is more sloping. Runoff is rapid, and the hazard of erosion is severe.

Badland is on the severely eroded sides of terraces.

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

This association is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Badland is used only for esthetic purposes. Linco gravelly sandy loam, 4 to 15 percent slopes, part in dryland capability subclass VIIs; range site NV 28-40; dryland wildlife suitability group 3-42. Linco gravelly sandy loam, 15 to 30 percent slopes, part in dryland capability subclass VIIe; range site NV 28-40; dryland wildlife suitability group 3-42. Badland part in dryland capability subclass VIIIe; not assigned to a range site, wildlife suitability group, or woodland suitability group. Neither Linco part assigned to a woodland suitability group.

Lize Series

The Lize series consists of deep, well-drained soils that formed in alluvium derived mainly from ignimbrites. They are on sides of terraces. Slopes are 15 to 50 percent. The vegetation is pinon pine, Utah juniper, big sagebrush, bitterbrush, and needleandthread. Elevation ranges from 6,300 to 7,200 feet. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 40° to 45° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is about 7 inches of grayish-brown stony fine sandy loam over dark grayish-brown slightly hard gravelly loam. The next layer is dark grayish-brown and grayish-brown hard gravelly clay loam about 28 inches thick. It is underlain by light brownish-gray, calcareous, slightly hard gravelly sandy loam that extends to a depth of 60 inches or more.

Permeability is moderately slow in the Lize soils. Available water capacity is low to moderate. Effective rooting depth is more than 60 inches.

The Lize soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Lize stony fine sandy loam, 15 to 30 percent slopes, in an area of Lize association, 500 feet east of the SW. corner of sec. 4, T. 4 N., R. 69 E., Mount Diablo baseline and meridian:

A11—0 to 2 inches, grayish-brown (10YR 5/2) stony fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few very fine roots; common very fine interstitial pores and few very fine and fine tubular pores; 35 percent gravel, stones, and cobbles; neutral; abrupt, smooth boundary.

A12—2 to 7 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores and common fine tubular pores; 25 percent gravel; many thin colloidal coats on sand grains and few clean sand grains; neutral; clear, smooth boundary.

B2t—7 to 27 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark brown (10YR 2/2) moist; moderate, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine and few medium roots; many very fine and fine interstitial pores and few very fine and fine tubular pores; 25 percent gravel; common thin clay films on ped faces and in pores; neutral; gradual, wavy boundary.

- B3t—27 to 35 inches, grayish-brown (10YR 5/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; common very fine and few fine and medium roots; many very fine and fine interstitial pores and few very fine and fine tubular pores; 30 percent gravel; many thin clay films in pores and few thin clay films on ped faces; neutral; clear, wavy boundary.
- Cca—35 to 60 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and few fine and medium roots; many very fine and fine interstitial pores and few very fine and fine tubular pores; 45 percent gravel; few, fine, distinct, white (10YR 8/2) lime coatings on gravel; slightly effervescent; moderately alkaline.

About 35 percent of the surface is covered by gravel, a few cobbles, and stones. Surface layer stoniness is Class 1 and 2. The A and B horizons combined are 28 to 40 inches thick. The A1 horizons have a combined thickness ranging from 6 to 13 inches. These horizons are mainly gravelly fine sandy loam, but some areas are gravelly loam or gravelly sandy loam. The B2t horizon is mainly gravelly clay loam but ranges to gravelly sandy clay loam or gravelly heavy loam. The average clay content of this horizon ranges from 25 to 35 percent, and the horizon is 20 to 35 percent gravel.

Lize association (LE).—This association is in long, narrow areas on the lower parts of terraces in the vicinity of Camp Valley. It is about 60 percent Lize stony fine sandy loam, 15 to 30 percent slopes, and 30 percent Lize stony fine sandy loam, 30 to 50 percent slopes. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Badland.

The moderately steep Lize soil does not slope as much as other soils in the mapping unit. It has the profile described as representative of the series. Runoff is medium, and the hazard of erosion is moderate.

The steep Lize soil differs from other soils in the mapping unit by having steeper slopes. It has a profile similar to that of the soil described as representative of the series, but it slopes more than that soil. Runoff is medium or rapid, and the hazard of erosion is moderate or severe.

This association is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 1x1. Not assigned to a range site.

Lize-Tica association (LT).—This association is in large, broad areas on high terraces and mountain faces in the northern part of the survey area. It is about 50 percent Lize stony fine sandy loam, 15 to 30 percent slopes, and 45 percent Tica very stony loam, 15 to 30 percent slopes. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other Lize and Tica soils and some alluvial soil material.

The moderately steep Lize soil differs from other soils in the mapping unit by its position on the terraces at slightly lower elevation. It has the profile described as representative of the series. Runoff is medium, and the hazard of erosion is moderate.

The moderately steep Tica soil differs from other soils in the mapping unit by its position on the mountain slopes and its shallow depth that is less than 20 inches to bedrock. Runoff is medium or rapid, and the hazard of erosion is moderate.

This association is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Lize and Tica parts in dryland capability subclass VII_s; wildlife suitability group 324. Lize part in woodland suitability group 1x1; Tica part in woodland suitability group 2x1. Neither part assigned to a range site.

Met Series

The Met series consists of well-drained soils that are moderately deep to a hardpan. The soils formed in alluvium derived mainly from limestone and reworked old lacustrine sediment. They are on alluvial fans and terraces. Slopes are 0 to 4 percent. The vegetation is shadscale, spiny hopsage, winterfat, horsebrush, galleta, Indian ricegrass, and sand dropseed. Elevation ranges from 4,800 to 5,800 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 49° to 53° F. The frost-free season is 100 to 130 days.

In a representative profile the surface layer is light-gray and pale-brown very fine sandy loam about 4 inches thick. Below this is pale-brown to white very fine sandy loam, loam, and gravelly fine sandy loam about 33 inches thick. These layers are underlain by a white to light-gray, strongly cemented hardpan that has thin discontinuous silica and lime laminae. These laminae, in turn, contain continuous, thin, hard silica laminae that have strata strongly cemented by silica and lime. Below this material is light-gray gravelly loamy fine sand that extends to a depth of 65 inches or more.

Permeability is slow above the the very slowly permeable hardpan in the Met soils. Available water capacity is low. Effective rooting depth is 28 to 40 inches.

These soils are used for grazing and wildlife habitat. Some areas are used for irrigated crops.

Representative profile of Met very fine sandy loam, 0 to 4 percent slopes, in an area of Met-Ursine association; 100 feet east of the SW corner of sec. 3, T. 2 S., R. 67 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, light-gray (10YR 7/2) very fine sandy loam, yellowish brown (10YR 5/4) moist; moderate, thin, platy structure; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots; many fine and very fine vesicular pores; violently effervescent; strongly alkaline; abrupt, smooth boundary.
- A12—2 to 4 inches, pale-brown (10YR 6/3) very fine sandy loam, dark yellowish brown (10YR 4/4) moist; moderate, very fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine roots; many fine and very fine interstitial pores; violently effervescent; strongly alkaline; abrupt, smooth boundary.
- C1—4 to 13 inches, pale-brown (10YR 6/3) very fine sandy loam, dark yellowish-brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine and few medium roots; many fine and very fine tubular pores and many very fine interstitial pores; violently effervescent; strongly alkaline; clear, smooth boundary.
- C2sica—13 to 24 inches, pale-brown (10YR 6/3) loam, yellowish brown (10YR 5/4) moist; massive; very hard, firm, brittle, slightly sticky and slightly plastic; few fine and many very fine roots; few fine tubular pores and common very fine interstitial pores; few vertical cracks contain white (10YR 8/1) silica and lime coats; light gray (10YR 7/2)

moist; violently effervescent; very strongly alkaline; clear, wavy boundary.

C3sica—24 to 31 inches, light-gray (10YR 7/2) loam, pale brown (10YR 6/3) moist; massive, very hard, firm, brittle, nonsticky and nonplastic; weakly cemented; few fine and very fine roots; few fine and very fine tubular pores and few very fine interstitial pores; many very thin, discontinuous, white (10YR 8/2) silica and lime laminae along vertical cracks and at the lower boundary; violently effervescent; common, medium, faint, white (10YR 8/2) lime segregations; very strongly alkaline; abrupt, wavy boundary.

IIC4sica—31 to 37 inches, white (10YR 8/2) gravelly fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; few fine and many very fine interstitial pores; pebbles are thickly silica and lime coated; violently effervescent; very strongly alkaline; abrupt, wavy boundary.

IIC5sica—37 to 51 inches, white (10YR 8/1) strongly silica- and lime-cemented duripan that has few thin ($\frac{1}{8}$ to $\frac{1}{4}$ inch thick), discontinuous, horizontal and diagonal silica and lime laminae, light gray (10YR 7/2) moist; massive; extremely hard, extremely firm; few very fine interstitial pores; violently effervescent; strongly alkaline; abrupt, smooth boundary.

IIIC6sica—51 to 60 inches, light-gray (10YR 7/2), continuous, thin silica-indurated laminae stratified with white (10YR 8/2), strongly silica and lime-cemented strata, yellowish brown (10YR 5/5) and pale brown (10YR 6/3) moist; massive; appearing as thick plates; extremely hard, extremely firm, few fine interstitial pores in strongly cemented part; slightly effervescent in indurated laminae but violently effervescent between laminae; moderately alkaline; clear, smooth boundary.

IIIC7—60 to 69 inches, light-gray (10YR 7/2) gravelly loamy fine sand, yellowish brown (10YR 5/5) moist; massive; hard, firm, nonsticky and nonplastic; common very fine tubular and interstitial pores; pebbles thinly lime coated on underside only; violently effervescent; strongly alkaline.

Five percent of the surface is covered by gravel. The strongly cemented indurated hardpan is at a depth of 28 to 40 inches. The A1 horizons have a combined thickness ranging from 1 to 6 inches. The horizons above the hardpan are stratified very fine sandy loam, loam, and fine sandy loam. They are as much as 65 percent gravel in some strata. Average gravel content ranges from 15 to 35 percent. The strongly cemented hardpan contains discontinuous silica and lime laminae that range in thickness from 1 to 5 millimeters.

Met-Ursine association (MU).—This association is in large areas on old alluvial terraces in the west-central part of the survey area. It is about 50 percent Met very fine sandy loam, 0 to 4 percent slopes, and 35 percent Ursine gravelly loam, 2 to 15 percent slopes. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of Linco and Met soils, some alluvial soil material, and Badland.

Runoff on the Met soils is slow, and the hazard of erosion is slight. Runoff on the Ursine soils is medium, and the hazard of erosion is moderate.

This association is not suitable for irrigated crops. The soils of this association are used mainly for grazing and wildlife habitat. Met part in dryland capability subclass VIIs; range site NV 28-38; irrigated wildlife suitability group 3-43-I; dryland wildlife suitability group 4-43. Ursine part in dryland capability subclass VIIs; range site NV 28-40; dryland wildlife suitability group 4-43. Neither part assigned to a woodland suitability group.

Minu Series

The Minu series consists of well-drained soils that are shallow to a hardpan. These soils formed in alluvium derived mainly from ignimbrite. They are on terrace tops. Slopes are 0 to 8 percent. The terraces in some areas are moderately dissected and in other areas are broad with minimum dissection. The vegetation is Utah juniper, pinon pine, cliffrose, big sagebrush, black sagebrush, and miscellaneous grasses. Elevation ranges from 6,000 to 6,500 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is light brownish-gray stony sandy loam about 3 inches thick. The next layer is brown and very pale-brown gravelly clay loam about 10 inches thick. It is underlain by a very pale brown, strongly cemented gravelly hardpan about 9 inches thick. The next layer is pale-brown very gravelly loamy sand that extends to a depth of 60 inches or more.

Permeability is moderately slow above the very slowly permeable hardpan in the Minu soils. Available water capacity is very low to low. Effective rooting depth is 12 to 18 inches.

The Minu soils are used mainly for grazing and wildlife habitat.

Representative profile of Minu stony sandy loam, 0 to 8 percent slopes, under native vegetation, 1,320 feet north and 660 feet west of the SE. corner of sec. 11, T. 1 N., R. 69 E., Mount Diablo baseline and meridian:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) stony sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thick, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores and common fine vesicular pores; 40 percent gravel; neutral; abrupt, smooth boundary.

B1t—3 to 5 inches, brown (7.5YR 4/2) gravelly light clay loam, dark brown (7.5YR 3/2) moist; moderate fine and very fine subangular blocky structure; soft, very friable, sticky and plastic; many very fine and fine and few coarse roots; many very fine and fine interstitial pores and tubular pores; 25 percent gravel; few thin clay films on ped faces and in pores; neutral; abrupt, smooth boundary.

B2t—5 to 9 inches, brown (7.5YR 5/4) gravelly clay loam, brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and medium roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; 30 percent gravel; continuous thin clay films on ped faces and in pores; mildly alkaline; clear, wavy boundary.

B3tca—9 to 13 inches, very pale brown (10YR 7/3) gravelly light clay loam, brown (10YR 5/3) moist; pockets of brown (7.5YR 5/4 and 4/4) moist; weak, very fine and fine, subangular blocky structure; slightly hard, very friable, sticky and plastic; many fine and medium roots; many very fine and fine interstitial pores; common thin clay films on ped faces and in pores; 40 percent gravel; common $\frac{1}{4}$ - to $\frac{1}{2}$ -inch soft lime concretions; violently effervescent; moderately alkaline; abrupt, wavy boundary.

C1sica—13 to 22 inches, very pale brown (10YR 8/3), strongly cemented gravelly duripan that has pockets of pale-brown (10YR 6/3) sandy loam, pale brown (10YR 6/3) and brown (10YR 4/3) moist; massive; matrix is extremely firm and pockets are very hard and hard, firm, nonsticky and nonplastic; common very fine and fine roots in fracture planes;

common very fine interstitial pores and few very fine tubular pores; several, almost continuous, indurated laminar lenses $\frac{1}{8}$ to $\frac{1}{4}$ inch thick; thin silica coatings in pores and as bridges between sand grains; violently effervescent; many medium and coarse white (10YR 8/2) lime coatings mainly on laminar surfaces; strongly alkaline; gradual, wavy boundary.

IIC2—22 to 60 inches, pale-brown (10YR 6/3) very gravelly loamy sand, brown (10YR 4/3) moist; massive; soft and very friable; very few very fine and fine roots; many fine and very fine interstitial pores; 60 percent gravel; weakly cemented with silica and lime in lenses and pockets; slightly effervescent; strongly alkaline.

About 30 percent of the surface layer is covered by gravel. A few cobbles are on the surface, and the surface cover is 1 percent stones. The silica- and lime-cemented hardpan is at a depth of 12 to 18 inches. The surface soils are gravelly or stony, Class 1 in places. The Bt horizons are about 20 to 35 percent clay and 25 to 35 percent gravel. The B2t horizon is gravelly clay loam or gravelly sandy clay loam. The IIC horizon is massive or single grained and is very gravelly loamy sand, very gravelly loamy coarse sand, or very gravelly sand.

Minu gravelly sandy loam, 2 to 8 percent slopes (MVC).—This soil is in large areas on dissected terraces in the central part of the survey area. It has a profile similar to that described as representative of the series, but it lacks the stoniness, has a thinner subsoil, and has fewer indurated thin silica layers.

Included with this soil in mapping, and making up about 10 percent of the mapped acreage, are areas of other Minu soils, some alluvium, and a soil similar to the Linco soil that is on side slopes.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2d1; not assigned to a range site.

Minu stony sandy loam, 0 to 8 percent slopes (MWC).—This soil is in large areas on dissected terraces in the central part of the survey area. It has the profile described as representative of the series. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Timpahute, Poorma, and other Minu soils.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2d1; not assigned to a range site.

Nevtah Series

The Nevtah series consists of moderately deep, well-drained soils that formed in residuum and alluvium derived mainly from ignimbrite. They are on foothills and mountain faces. Slopes are 4 to 30 percent. The vegetation is big sagebrush, bitterbrush, snowberry, and miscellaneous grasses. Elevation ranges from 7,000 to 9,000 feet. The average annual precipitation is 14 to 20 inches, and the average annual air temperature is 36° to 45° F. The frost-free season is less than 60 days.

In a representative profile the upper part of the surface layer is dark grayish-brown stony loam about 11 inches thick. Below it is dark grayish-brown gravelly loam about 14 inches thick. This layer is underlain by dark-gray weathered ignimbrite that crushes to very gravelly loam. Hard ignimbrite bedrock is at a depth of about 30 inches.

Permeability is moderate in the Nevtah soils. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches.

The Nevtah soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Nevtah stony loam, 4 to 15 percent slopes, in an area of Nevtah-Rock outcrop association, 2,100 feet east of the SW. corner of sec. 6, T. 4 N., R. 71 E., Mount Diablo baseline and meridian:

A11—0 to 11 inches, dark grayish-brown (10YR 4/2) stony loam, very dark brown (10YR 2/2) moist; moderate, medium and coarse, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; slightly acid; clear, smooth boundary.

A12—11 to 25 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate, fine and very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine interstitial pores; 40 percent gravel; neutral; abrupt, smooth boundary.

CR—25 to 30 inches, dark-gray (10YR 4/1) weathered ignimbrite that crushes to very gravelly loam, very dark gray (10YR 3/1) moist; original rock structure visible; slightly hard grading to extremely hard, friable grading to extremely firm, slightly sticky and slightly plastic; common very fine and fine and few medium roots in cracks and decreasing with depth; many fine interstitial pores; neutral.

R—30 inches, hard ignimbrite.

About 20 percent of the surface is covered by gravel. Also a few cobbles are on the surface, and 4 percent of the surface is covered by stones. Bedrock is at a depth ranging from 20 to 40 inches. The lower part of the A horizon is dominantly gravelly loam but is gravelly sandy loam or gravelly fine sandy loam in spots. It is on an average, 40 to 50 percent gravel. Original rock structure is usually visible in the C horizon and grades to hard bedrock.

Nevtah-Rock outcrop association (NR).—This association is in large, broad areas on the side slopes of the highest mountains in the northern part of the survey area. It is about 30 percent Nevtah stony loam, 4 to 15 percent slopes; 30 percent Nevtah very stony loam, 15 to 30 percent slopes; and 20 percent Rock outcrop. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Udel and other Nevtah soils.

Nevtah stony loam, 4 to 15 percent slopes, is less sloping than other soils in the mapping unit, and it also differs from them having Class 1 or 2 stoniness. It has the profile described as representative of the series. Runoff is slow, and the hazard of erosion is slight.

Nevtah very stony loam, 15 to 30 percent slopes, is steeper than the other Nevtah soils and has Class 3 or 4 stoniness. It has a profile similar to that described as representative of the series, but the surface is very stony. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrop is in small areas that are scattered throughout the mapped areas.

This association is not suitable for irrigated crops. The soils are used for grazing, wildlife habitat, and watershed. Nevta stony loam, 4 to 15 percent slopes, and Nevta very stony loam, 15 to 30 percent slopes, in dryland capability subclass VIIIs; range site 28-51; dryland wildlife suitability group 3-41. Rock outcrop in dryland capability subclass VIIIs; not assigned to a range site, wildlife suitability group, or woodland suitability group. Neither of the Nevta soils is assigned to a woodland suitability group.

Nevu Series

The Nevu series consists of well-drained soils that are moderately deep to a hardpan. These soils formed in alluvium that was derived mainly from ignimbrite but was somewhat influenced by limestone. They are on terraces. Slopes are 4 to 15 percent. The vegetation is pinon pine, Utah juniper, brush, and grass. Elevation ranges from 6,500 to 7,000 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 43° to 45° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is grayish-brown gravelly sandy loam about 2 inches thick over dark grayish-brown fine gravelly loam about 9 inches thick. The next layer is grayish-brown and very pale brown gravelly clay loam about 10 inches thick. It is underlain by a very pale brown indurated hardpan about 15 inches thick. The next layer is light brownish-gray gravelly sandy loam that extends to a depth of at least 50 inches.

Permeability is moderately slow above the very slowly permeable hardpan in Nevu soils. Available water capacity is very low. Effective rooting depth is 20 to 27 inches.

The Nevu soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Nevu gravelly sandy loam, 4 to 15 percent slopes, under native vegetation, 675 feet west and 675 feet south of the apparent center of sec. 36, T. 3 N., R. 70 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine and very fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; few fine and very fine vesicular pores and many very fine interstitial pores; neutral; abrupt, smooth boundary.
- A12—2 to 11 inches, dark grayish-brown (10YR 4/2) fine gravelly loam, very dark brown (10YR 2/2) moist; weak, medium and fine, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium and few large roots; common fine and medium interstitial pores; strongly effervescent; moderately alkaline; clear, wavy boundary.
- B2t—11 to 14 inches, grayish-brown (10YR 5/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine and common medium and coarse roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; common thin clay bridges between sand grains, few thin clay films on ped faces and in pores; 25

percent gravel; pebbles coated by lime; violently effervescent; moderately alkaline; clear, wavy boundary.

- B3tca—14 to 21 inches, very pale brown (10YR 7/3) gravelly light clay loam, brown (10YR 5/3) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; common fine and few medium interstitial pores; few moderately thick and common thin clay bridges between sand grains and many thin clay films in pores; 30 percent gravel; common fine and medium white (10YR 8/2) lime mottles; violently effervescent; moderately alkaline; abrupt, wavy boundary.
- C1sicam—21 to 36 inches, very pale brown (10YR 7/3), indurated gravelly duripan that has randomly oriented white (10YR 8/1) lime seams, brown (10YR 4/3) moist; massive; extremely hard, extremely firm; no roots except for a few fine and very fine ones in cracks; very few very fine interstitial pores; few thin brown (10YR 5/3) clay films in pores; many thin very pale brown (10YR 6/3) silica films in pores and as bridges between sand grains; violently effervescent; strongly alkaline; abrupt, smooth boundary.
- C2ca—36 to 50 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, grayish brown (10YR 4/2) moist; massive, hard, friable, nonsticky and nonplastic; practically no roots; many very fine and fine interstitial pores; many fine to coarse, large, distinct white (10YR 8/1) lime masses; violently effervescent; strongly alkaline.

About 30 percent of the surface layer is covered by gravel. The indurated hardpan is at a depth ranging from 20 to 27 inches. The A1 horizon is calcareous in places. The B2t horizon is dominantly gravelly clay loam but is gravelly sandy clay loam or gravelly heavy loam in places. The hardpan is massive but appears as a fine and medium plate because of alternate indurated layers that have weakly or strongly cemented layers. Distance between indurated layers varies.

Nevu gravelly sandy loam, 4 to 15 percent slopes (NSD).—This soil is on dissected terraces in the north-central part of the survey area. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Fanu soils and other Nevu soils.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VIIIs; dryland wildlife suitability group 324; woodland suitability group 101; not assigned to a range site.

Pahranagat Series

The Pahranagat series consists of deep, poorly drained to somewhat poorly drained soils that formed in alluvium derived mainly from transported lacustrine material. They are on flood plains and bottom lands. Slopes are 0 to 2 percent. The vegetation is mostly meadow grasses on virgin areas and some crops in areas of drained soils. Greasewood, rabbitbrush, and big sagebrush also occur in virgin areas of drained soils. Elevation ranges from 4,400 to 5,500 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 49° to 53° F. The frost-free season is 110 to 130 days.

In a representative profile the surface layer is a sandy root mat about 2 inches thick over dark-brown silty clay loam about 10 inches thick. Below it is dark-

brown and very dark grayish-brown clay loam and silty clay loam about 30 inches thick. This material is underlain by stratified dark-brown and very dark grayish-brown sandy loam, silt loam, clay loam, and clay that has occasional fine pebbles. This layer extends to a depth of 60 inches.

Permeability is moderately slow in the Pahrnanagat soils. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Seasonal high water table ranges from 1 to 10 feet below the surface, and flooding is not frequent.

The Pahrnanagat soils are mainly used for grazing, wildlife habitat, meadow hay and pasture, and where drained, for irrigated crops.

Representative profile of Pahrnanagat silty clay loam, under meadow grasses, 1,000 feet west and 1,800 feet north of the SE. corner of sec. 5, T. 2 S., R. 68 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, a root and very fine sandy loam mat that is about 20 percent very fine sandy loam.
- A12—2 to 12 inches, dark-brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; massive; slightly hard, friable, very sticky and plastic; many very fine and fine roots; common fine tubular pores; strongly effervescent; strongly alkaline; clear, smooth boundary.
- C1—12 to 24 inches, dark-brown (10YR 3/3) silty clay loam, dark grayish brown (10YR 4/2) dry; massive; hard, friable, very sticky and plastic; few fine roots; common fine tubular pores; many black (10YR 2/1) mottles, 10 to 20 millimeters thick; strongly effervescent; strongly alkaline; clear, smooth boundary.
- C2—24 to 36 inches, dark-brown (10YR 3/3) clay loam, dark brown (10YR 4/3) dry; massive; hard, firm, very sticky and very plastic; few fine roots, few fine tubular pores; black (10YR 2/1) mottles, few 10 to 15 millimeters thick; violently effervescent; strongly alkaline; clear, smooth boundary.
- C3—36 to 42 inches, very dark grayish-brown (10YR 3/2) heavy clay loam, dark brown (10YR 4/3) dry; massive; hard, firm, very sticky and very plastic; few fine roots; few fine tubular pores; few faint black (10YR 2/1) and light brownish-gray (10YR 6/2) mottles; strongly effervescent; strongly alkaline; clear, smooth boundary.
- C4—42 to 60 inches, stratified very dark grayish-brown (10YR 3/2) and dark-brown (10YR 3/3) sandy loam, silt loam, clay loam, and clay, dark gray (10YR 4/1) and brown (10YR 4/3) dry; massive; firm and friable, sticky and plastic; few fine roots; few fine tubular pores; few to many black (10YR 2/1) mottles; strongly effervescent; mildly alkaline.

The surface root mat is absent in the cultivated drained phases. The A11 horizon is very fine sandy loam, silty clay loam, clay loam, or loam. The A11 horizon is silt loam or fine sandy loam where overwash has occurred. The layers below the A horizon are a series of buried A and C horizons which have textures of silt loam, silty clay loam, and clay loam and contain a few sandy strata in places. In drained phases of this soil, depth to the water table ranges from 3 feet to 10 feet or more. Soils are effervescent to violently effervescent when treated with cold, dilute hydrochloric acid. They are slightly to strongly saline and are alkali affected.

The Pahrnanagat soils mapped in this survey area are slightly cooler, occur at slightly higher elevations, and receive slightly more precipitation than Pahrnanagat soils mapped in other areas. These differences do not affect their use and management.

Pahrnanagat silt loam, drained, strongly saline (Pa).—This level to nearly level soil is in long, narrow areas on flood plains and bottom lands in the northern and

central parts of the Panaca Valley. It has a profile similar to that described as representative of the series, but it has a silt loam surface layer, the next layer is clay or clay loam, and there is less stratification in the substratum. This soil is strongly saline and alkali affected, and it is somewhat poorly drained. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of Geer soils and other Pahrnanagat soils.

The seasonal high water table is below a depth of 30 inches, and some areas of this soil are subject to occasional flooding. Runoff is slow, and the hazard of erosion is slight.

This soil is marginally suitable for the production of selected salt-tolerant irrigated crops. Some alfalfa is being produced where the salt content has been reduced. The soil is used mainly for grazing and wildlife habitat. Dryland capability subclass VIIw; range site NV 28-47; dryland wildlife suitability group 4-24; not assigned to a woodland suitability group.

Pahrnanagat silt loam, strongly saline (Pd).—This level to nearly level soil consists of small, narrow areas on flood plains and bottom lands in the southern part of the Panaca Valley and in Dry Valley. It has a profile similar to that described as representative of the series, but it has a silt loam surface layer, is strongly saline and alkali affected, and is somewhat poorly drained. Included in mapping and making up about 2 percent of the mapped acreage, are areas of other Pahrnanagat soils.

Seasonal high water table is below a depth of 4 feet, and it is subject to occasional flooding. Runoff is slow, and the hazard of erosion is slight.

This soil is marginally suitable for the production of selected salt-tolerant irrigated crops. Some of the soil is used for the production of irrigated pasture. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VIIw; range site NV 28-47; dryland wildlife suitability group 4-24; not assigned to a woodland suitability group.

Pahrnanagat silty clay loam (Pe).—This soil is on small, broad areas on flood plains and bottom lands in the northern end of Panaca Valley (fig. 7). It has the profile described as representative of the series. It is poorly drained. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other Pahrnanagat soils.

Runoff is slow, and the hazard of erosion is slight. Seasonal high water table is at a depth of 1 to 2 feet and is subject to frequent damaging flooding.

This soil is suitable for irrigated crops, if the water table is lowered by the use of drainage ditches and protection is provided from flooding. It is used for the production of wet meadow grasses. Improved irrigated pasture and hay grasses are adapted to this soil. Irrigated capability unit IIIw-60; irrigated wildlife suitability group 3-14-I; not assigned to a range site or woodland suitability group.

Pahrnanagat silty clay loam, drained (Pg).—This level to nearly level soil is in small, narrow areas on flood plains and bottom lands in Panaca Valley and Dry Valley. It has a profile similar to that of the soil described as representative of the series, but it has less stratification above a depth of 40 inches and more strata of sandy loam and loam below a depth of 40 inches than that soil.

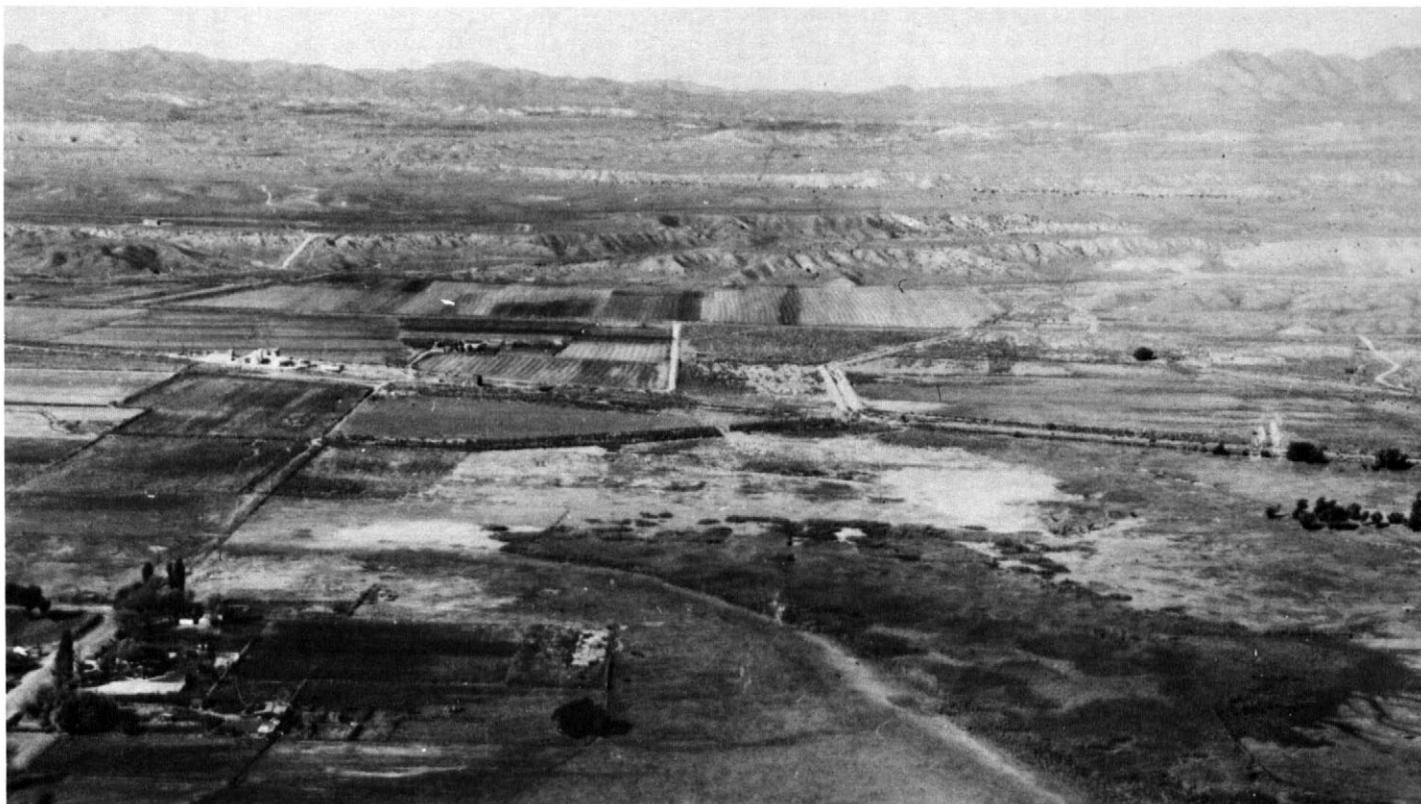


Figure 7.—Pahranagat silty clay loam is in the center. Association 11 is on the terraces in the background.

It is slightly saline. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other Pahranagat soils.

Runoff is slow, and the hazard of erosion is slight. The seasonal high water table is below a depth of 5 feet because of deep channeling. Where channels are shallow the water table is as high as 4 feet in places. This soil is subject to occasional flooding in some areas.

This soil is suitable for irrigated crops. It is used mainly for the production of alfalfa, small grain, and pasture grasses. Areas are also used for grazing and wildlife habitat. Irrigated capability unit IIw-61; irrigated wildlife suitability group 1-14-I; not assigned to a range site or woodland suitability group.

Pamsdel Series

The Pamsdel series consists of well-drained soils that are moderately deep to a hardpan. These soils formed in alluvium derived mainly from limestone and dolomite but influenced somewhat by quartzite. They are on alluvial fans. Slopes are 2 to 8 percent. The vegetation is Utah juniper, cliffrose, big sagebrush, and miscellaneous grasses. Elevation ranges from 5,800 to 6,500 feet. The average annual precipitation is 12 to 16 inches, and the average annual air temperature is 43° to 45° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is about 4 inches of grayish-brown gravelly loam and loam over about 4 inches of brown clay loam that is about 10 per-

cent gravel. The next layer is pinkish-gray clay loam that is about 10 percent gravel and is about 7 inches thick. Below this is light-brown very gravelly clay loam about 6 inches thick. It is underlain by light-gray, continuous, strongly lime cemented gravelly material that extends to a depth of at least 36 inches. This material is capped by a thin indurated silica layer.

Permeability is moderate above the very slowly permeable hardpan in the Pamsdel soils. Available water capacity is low. Effective rooting depth is 20 to 26 inches.

The Pamsdel soils are used mainly for grazing and wildlife habitat.

Representative profile of Pamsdel gravelly loam, under native vegetation, 1,100 feet north and 300 feet east of the SW. corner of sec. 18, T. 1 N., R. 67 E., Mount Diablo baseline and meridian:

- A11—0 to 1 inch, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, thin, platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine vesicular pores; 20 percent gravel; slightly effervescent; moderately alkaline; abrupt, wavy boundary.
- A12—1 to 4 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, thick, platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine vesicular pores; 5 percent gravel; strongly effervescent; moderately alkaline; abrupt, wavy boundary.
- A3—4 to 8 inches, brown (7.5YR 5/2) light clay loam, dark brown (7.5YR 3/2) moist; weak, medium,

prismatic structure parting to moderate, none, sub-angular blocky; slightly hard, friable, sticky and plastic; common very fine and few fine and medium roots; common fine tubular pores; 10 percent gravel; violently effervescent; strongly alkaline; abrupt, wavy boundary.

B21—8 to 15 inches, pinkish-gray (7.5YR 6/2) light clay loam, brown (7.5YR 4/2) moist; weak, medium, prismatic structure parting to moderate, fine, sub-angular blocky; slightly hard, friable, sticky and plastic; common very fine and few fine and medium roots; common fine and very fine tubular pores; 10 percent gravel; violently effervescent; strongly alkaline; abrupt, irregular boundary.

B22—15 to 21 inches, light-brown (7.5YR 5/4) very gravelly light clay loam, brown (7.5YR 4/4) moist; massive; hard, friable, sticky and plastic; few fine and very fine roots; few fine tubular pores; 70 percent gravel, mostly pan fragments; violently effervescent; strongly alkaline; abrupt, smooth boundary.

Ccam—21 to 36 inches, light-gray (10YR 7/2), continuous, very thin (less than 5 millimeters thick), lime-indurated laminae stratified with white (10YR 8/1) gravelly materials that are strongly cemented with lime; light brownish gray (10YR 6/2) and light gray (10YR 7/2) moist; massive; extremely hard, extremely firm; no roots except as a mat on the horizon surface; no pores in laminae but common very fine and few fine interstitial pores in strongly cemented materials; 30 percent limestone and dolomite gravel; violently effervescent; strongly alkaline.

About 20 percent of the surface is covered by gravel and a few cobbles. The lime indurated hardpan is at a depth of 20 to 26 inches. The B horizons are dominantly light clay loam but are loam in some locations. The upper part of the B horizon is as much as 35 percent gravel, and the lower part is 60 to 90 percent. The average gravel content is 35 to 50 percent. The individual laminar subhorizons of the hardpan are as much as 1 inch thick. These are stratified by strongly or weakly cemented lime materials, but nevertheless are hard to extremely hard and friable to extremely firm. Individual discontinuous, very thin (less than 1 millimeter thick) laminae cemented with lime and silica occur in places in the lower part of the hardpan.

Pamsdel gravelly loam, 2 to 8 percent slopes (PMC).

—This soil is in small areas on dissected alluvial fans in the west-central part of the survey area. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Sierocloff and Denmark soils.

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

This soil is not suitable for irrigated crops. It is used for grazing and wildlife habitat. Dryland capability subclass VII₂; dryland wildlife suitability group 334; woodland suitability group 2f1; not assigned to a range site.

Patter Series

The Patter series consists of deep, well-drained soils that formed in alluvium derived mainly from eroding lacustrine sediment. They are on flood plains and alluvial fans. Slopes are 0 to 4 percent. The vegetation is big sagebrush, rabbitbrush, fourwing saltbush, Indian ricegrass, and some scattered Utah juniper. Elevation ranges from 5,200 to 6,000 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 45° to 47° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is pale-brown loam about 5 inches thick. The next layer is pale-

brown very fine sandy loam about 11 inches thick. Below this is pale-brown and light brownish-gray silt loam that has many very pale-brown cylindrical nodules 10 to 15 millimeters in diameter. This layer is about 30 inches thick. It is underlain by pale-brown silt loam that extends to a depth of 60 inches or more.

Permeability is moderate and moderately slow in the Patter soils. Available water capacity is high. Effective rooting depth is 60 inches or more. These soils are subject to occasional flooding. Some units are strongly saline and alkali affected.

The Patter soils are marginally suitable for irrigated crops. They are mainly used for grazing and wildlife habitat.

Representative profile of Patter loam in an area of Patter-Geer association, $\frac{1}{4}$ mile east of the SW. corner of sec. 6, T. 1 N., R. 68 E., Mount Diablo baseline and meridian:

A1—0 to 5 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; strong, medium, platy structure; soft, very friable, nonsticky and nonplastic; common fine roots; common fine vesicular pores; moderately alkaline; abrupt, wavy boundary.

B2—5 to 16 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; common fine tubular pores and many very fine interstitial pores; strongly effervescent; strongly alkaline; abrupt, smooth boundary.

C1sica—16 to 34 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; common very fine roots; common fine tubular pores and many very fine interstitial pores; many very pale brown (10YR 7/3 and 8/3) durinodes 10 to 15 millimeters in diameter; few fine and medium white (10YR 8/2) masses of soft lime; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C2sica—34 to 46 inches, light brownish-gray (10YR 6/2) silt loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; common very fine roots; common fine tubular pores and many very fine interstitial pores; many very pale brown (10YR 7/3 and 8/3) cylindrical durinodes 10 to 15 millimeters in diameter; few fine and medium white (10YR 8/2) masses of soft lime; violently effervescent; moderately alkaline; abrupt, smooth boundary.

C3—46 to 60 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common fine tubular pores and many very fine interstitial pores; violently effervescent; moderately alkaline.

About 3 percent of the surface is covered by gravel. The B2 and C horizons are very fine sandy loam, loam, or silt loam that is about 10 to 18 percent clay. Cylindrical silica and lime-cemented durinodes make up 20 to 50 percent of some horizons between depths of 10 and 40 inches.

Patter-Geer association (PN).—This association is in long, narrow areas on flood plains and short alluvial fans in the east-central part of the survey area. It is about 50 percent Patter loam, 0 to 4 percent slopes, and 35 percent Geer fine sandy loam, 0 to 2 percent slopes.

Included with the association in mapping are areas of Heist soils, which occupy the position immediately below the toe of the terrace side slopes, and areas of other Geer soils. These areas make up about 15 percent of the mapped acreage.

The nearly level to gently sloping Patter soil differs from other soils in the mapping unit by its position on the short alluvial fans. It has the profile described as representative of the Patter series. Runoff is medium, and the hazard of erosion is moderate.

The nearly level Geer soil differs from other soils in the mapping unit by its position on the flood plains. It has a profile similar to that described as representative of the Geer series, but it has a fine sandy loam surface layer. Runoff is slight or medium, and the hazard of erosion is slight or moderate.

Some areas of this association are subject to occasional damaging flooding from high-intensity convection storms.

This association is marginally suitable for irrigated crops. It is used for grazing and wildlife habitat. Patter part in irrigated capability unit IIIe-20; dryland capability subclass VIc; range site NV 28-44; irrigated wildlife suitability group 2-42-I; dryland wildlife suitability group 3-42. Geer part in irrigated capability unit IIc-1; dryland capability subclass VIc; range site NV 28-44; irrigated wildlife suitability group 2-33-I; dryland wildlife suitability group 3-32. Neither part assigned to a woodland suitability group.

Patter-Heist association (PO).—This association is in long, narrow areas on flood plains and short alluvial fans in the west-central part of the survey area. It is about 40 percent Patter silty clay loam, 0 to 2 percent slopes, strongly saline; about 30 percent Heist gravelly sandy loam, 0 to 8 percent slopes; and 20 percent Geer fine sandy loam, 0 to 2 percent slopes. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of other Patter and Geer soils and some alluvial soil material.

The nearly level Patter soil differs from other soils in the mapping unit by its position on the flood plain. It has a profile similar to that described as representative of the Patter series, but it has a silty clay loam surface layer and is strongly saline and alkali affected. Runoff is slow, and the hazard of erosion is slight.

The nearly level to moderately sloping Heist soil differs from other soils in the mapping unit by its position on the short alluvial fans immediately below the toe of the terrace side slopes. Runoff is slow, and the hazard of erosion is moderate.

The nearly level Geer soil differs from other soils in the mapping unit by its position on the flood plain. It has a profile similar to that described as representative of the Geer series, but it has a fine sandy loam surface layer. Runoff is slow or medium, and the hazard of erosion is slight or moderate.

Seasonal high water table is between 5 and 8 feet. The Patter and Geer soils are subject to occasional damaging flooding in some parts of the mapping unit.

Small areas of the association are marginally suitable for irrigated crops. The soils are used mainly for grazing and wildlife habitat. Patter part in dryland capability subclass VIIw; range site NV 28-47; dryland wildlife suitability group 4-24. Heist part in irrigated capability unit IIIe-25; dryland capability subclass VIIs; range site NV 28-44; irrigated wildlife suitability group 2-42-I; dryland wildlife suitability group 3-42. Geer part in irrigated capability unit IIc-1; dryland capability subclass VIc; range site NV 28-44; irrigated wildlife suitability group 2-33-I; dryland

wildlife suitability group 3-32. None of the three parts is assigned to a woodland suitability group.

Patter-Shroe association (PR).—This association is in small areas on alluvial fans and terraces in the southwestern part of the survey area. It is about 65 percent Patter loam, 0 to 4 percent slopes, and about 30 percent Shroe gravelly loam, 2 to 15 percent slopes. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of Acoma soil and some alluvium.

The nearly level to gently sloping Patter soil differs from other soils in the mapping unit by its position on the alluvial fans. Runoff is medium, and the hazard of erosion is moderate.

The gently sloping to strongly sloping Shroe soil differs from other soils in the mapping units by its position on the terraces. It has the profile described as representative of the Shroe series. Runoff is medium or rapid, and the hazard of erosion is moderate or severe.

The Patter soil is marginally suitable for irrigated crops. The Shroe soil is not suitable for irrigated crops. The soils of this association are used for grazing and wildlife habitat. Patter part in irrigated capability unit IIIe-20; dryland capability subclass VIc; range site NV 28-44; irrigated wildlife suitability group 2-42-I; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group. Shroe part in dryland capability subclass VIIs; dryland wildlife suitability group 324; woodland suitability group 1f1; not assigned to a range site.

Pioche Series

The Pioche series consists of shallow, well-drained soils that formed in residuum derived from quartzite. They are on foothills and mountain faces. Slopes are 8 to 30 percent. The vegetation is Utah juniper, pinon pine, cliffrose, big sagebrush, blue grama, needleandthread, and Indian ricegrass. Elevation ranges from 5,500 to 6,500 feet. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 45° to 51° F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is brown extremely stony loam about 1 inch thick. The next layer is brown cobbly clay loam about 3 inches thick. Below this is reddish-brown cobbly clay about 7 inches thick. Bedrock is at a depth of about 11 inches.

Permeability is slow in Pioche soils. Available water capacity is very low. Effective rooting depth is 6 to 15 inches.

The Pioche soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Pioche extremely stony loam, 8 to 30 percent slopes, in an area of Pioche-Rock outcrop complex, 1,300 feet east of the SW. corner of sec. 36, T. 1 N., R. 67 E., Mount Diablo baseline and meridian:

A1—0 to 1 inch, brown (10YR 5/3) extremely stony loam, dark brown (10YR 3/3) moist; weak, thin, platy structure; soft, very friable, nonsticky and nonplastic; common fine roots; 25 percent stones, 30 percent cobbles, and 15 percent gravel; common fine interstitial pores; neutral; abrupt, smooth boundary.

B1t—1 to 4 inches, brown (10YR 5/3) cobbly clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; slightly hard, friable,

sticky and plastic; common fine and medium roots; common fine tubular pores; common thin clay films in pores and few thin clay films on ped faces; 10 percent stones, 10 percent gravel, and 30 percent cobbles; neutral; abrupt, wavy boundary.

B2t—4 to 11 inches, reddish-brown (5YR 5/4) cobbly clay, reddish brown (5YR 4/4) moist; weak, medium, prismatic structure; hard, firm, very sticky and very plastic; common fine and medium roots; common fine and medium tubular pores; continuous thin clay films in pores and on ped faces; 5 percent stones, 10 percent gravel, and 30 percent cobbles; neutral; abrupt, irregular boundary.

R—11 inches, bedrock.

Bedrock is at a depth ranging from 6 to 15 inches. The surface layer ranges from stony to extremely stony. It is generally about 25 percent stones, 30 percent cobbles, and 15 percent gravel. The Bt horizon is 35 to 50 percent cobbles, stones, and gravel and 40 to 50 percent clay. The B2t horizon has weak or moderate, medium, prismatic or strong, subangular blocky structure.

Pioche-Rock outcrop complex (PS).—This complex is in small areas on mountain faces in the west-central part of the survey area. It is about 65 percent Pioche extremely stony loam, 8 to 30 percent slopes, and 25 percent Rock outcrop. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of soils that are similar to the Pioche soil that are more than 20 inches deep over bedrock.

The Pioche soil in this complex is mostly strongly sloping to moderately steep and is under a cover of vegetation. Runoff is medium or rapid, and the hazard of erosion is moderate. The Rock outcrop consists of barren exposures of quartzite.

The Pioche soil and Rock outcrop in this complex are not suitable for irrigated crops. They are used for watershed and wildlife habitat and to a limited extent for grazing. Dryland capability subclass VII_s; Pioche part in woodland suitability group 2x1 and dryland wildlife suitability group 324; not assigned to a range site. Rock outcrop part not assigned to a wildlife suitability group, woodland suitability group, or range site.

Poorma Series

The Poorma series consists of deep, well-drained soils that formed in alluvium derived from ignimbrite that had been influenced somewhat by limestone. They are on narrow flood plains and alluvial fans. Slopes are 0 to 4 percent. The vegetation is big sagebrush, squirreltail, Indian ricegrass, needleandthread, and cheatgrass. Elevation ranges from 5,800 to 6,500 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 44° to 45° F. The frost-free season is 70 to 100 days.

In a representative profile the surface layer is pale-brown very fine sandy loam about 3 inches thick. The next layer is pale-brown silt loam about 14 inches thick. It is underlain by pale-brown silt loam, 60 percent of which is hard, firm, brittle silica and lime cemented durinodes. This layer is about 37 inches thick. Below this is pale-brown very fine sandy loam. This material is about 10 percent hard, firm, brittle silica and lime-cemented durinodes. It extends to a depth of more than 60 inches.

Permeability is moderate in the Poorma soils. Available water capacity is high. Effective rooting depth is 60 inches or more.

The Poorma soils are used mainly for grazing and wildlife habitat.

Representative profile of Poorma very fine sandy loam, 0 to 4 percent slopes, under native vegetation, 75 feet west of the SE. corner of sec. 9, T. 3 N., R. 70 E., Mount Diablo baseline and meridian:

A1—0 to 3 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; weak, thin and medium, platy structure; soft, very friable, non-sticky and nonplastic; very few fine roots; many very fine interstitial pores; violently effervescent; strongly alkaline; abrupt, smooth boundary.

B2—3 to 17 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak, medium, sub-angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine and fine interstitial pores and many fine and few medium tubular pores; violently effervescent; strongly alkaline; clear, smooth boundary.

C1si—17 to 54 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine and fine interstitial pores and common fine tubular pores; few very large cicada channels; 60 percent ½- x 2-inch, hard, firm, brittle durinodes; violently effervescent; strongly alkaline; gradual, smooth boundary.

C2si—54 to 60 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; weak, medium, angular and subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; very few fine and medium roots; few fine tubular pores and many fine interstitial pores; 10 percent ½- x 2-inch, hard, firm, brittle durinodes; violently effervescent; strongly alkaline.

The A and B2 horizons are 13 to 21 inches thick. The texture between 10 and 40 inches is dominantly silt loam or very fine sandy loam, but strata of loam, fine sandy loam, or sandy loam are present in places. The A1 horizon is 0.6 to 1.2 percent organic matter. The Csi horizon is 30 to 70 percent hard or very hard durinodes that are cemented with lime and silica.

Poorma very fine sandy loam, 0 to 4 percent slopes (PTB).—This soil is in small areas on alluvial fans and flood plains in the northern part of the survey area. Included in mapping, and making up about 10 percent of the mapped acreage, are soils similar to Poorma soils.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to occasional damaging flooding in some places where runoff from higher areas is not confined to channels.

This soil is suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Irrigated capability unit IVe-60; dryland capability subclass VIc; range site NV 28-44; irrigated wildlife suitability group 2-33-I; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Poorma Variant

The Poorma variant consists of deep, moderately well drained soils that formed in clayey alluvium derived from ignimbrite and limestone. They are on smooth flood plains. Slopes are 0 to 2 percent. The vegetation is rabbitbrush, greasewood, and inland saltgrass. Elevation ranges from 5,900 to 6,100 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 43° to 45° F. The frost-free season is 50 to 80 days.

In a representative profile the surface layer is pale-

brown silt loam about 3 inches thick. The next layer is pale-brown silt loam that has visible salt concentration and is 3 inches thick. The layer below it is pale-brown clay that has white salt and gypsum crystals in the upper 3 inches. This layer is about 10 percent brittle nodules and is about 25 inches thick. Below it is a layer of pinkish-gray material that has a clay texture and is about 80 percent brittle nodules. This layer is about 13 inches thick. It is underlain by pinkish-gray, light-brown, and brown clay that extends to a depth of 60 inches or more.

Permeability is very slow in the Poorma variant. Available water capacity is high. Effective rooting depth is 60 inches or more. The seasonal high water table varies from 4.5 to 10 feet. The soil is strongly saline and alkali affected.

The Poorma variant soils are used mainly for grazing and wildlife habitat.

Representative profile of Poorma silt loam, clay variant, under native vegetation, 500 feet north and 2,604 feet east of the SW. corner of sec. 29, T. 3 N., R. 70 E., Mount Diablo baseline and meridian:

A1—0 to 3 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; strong, thin, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine and fine interstitial pores and common very fine and fine vesicular pores; many clean sand grains; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1sa—3 to 6 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak, thin, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and common very fine roots; few ½-inch horizontal cicada channels and many very fine and fine interstitial pores; many very fine, distinct, white (10YR 8/1) salt and gypsum crystals; violently effervescent; strongly alkaline; clear, smooth boundary.

IIC2—6 to 31 inches, pale-brown (10YR 6/3) clay, brown (10YR 4/3) moist; moderate, medium, angular and subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine and few fine and medium roots; common very fine and fine interstitial pores and few very fine tubular pores; upper 3 inches have common very fine and fine, distinct, white (10YR 8/1) salt and gypsum crystals; few fine and very fine yellowish-brown (10YR 5/6) stains along root channels; 10 percent brittle cylindrical durinodes; violently effervescent; very strongly alkaline; gradual, smooth boundary.

IIC3sica—31 to 44 inches, pinkish-gray (7.5YR 6/2) clay, brown (7.5YR 4/4) moist; weak, medium and fine, angular and subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; many very fine and few fine tubular pores; 80 percent cylindrical, very firm, brittle durinodes; violently effervescent; very strongly alkaline; smooth boundary.

IIC4—44 to 60 inches, stratified pinkish-gray (7.5YR 6/2) and light-brown (7.5YR 6/4) clay, brown (7.5YR 4/2 and 4/4) moist; weak, medium and fine, subangular blocky structure; very hard, friable, very sticky and very plastic; few very fine roots; many very fine and few fine interstitial and tubular pores; few fine and medium, distinct, very dark gray (10YR 3/1) mottles; violently effervescent; very strongly alkaline.

The A1 horizon has platy structure or is massive in places. The IIC2 horizons have textures of clay or silty clay and contain thin discontinuous strata of loamy fine sand and fine sand in places.

Poorma silt loam, clay variant (PV).—This soil is in

small areas on flood plains in the northern part of the survey area. Included in mapping, and making up about 3 percent of the mapped acreage, are areas of Poorma and Holtle soils.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to infrequent flooding and is strongly saline and alkali affected.

This soil is suitable for the production of only the most salt-tolerant irrigated crops. It is used for grazing and wildlife habitat. Dryland capability subclass VIIw; range site NV 28-47; dryland wildlife suitability group 4-24; not assigned to a woodland suitability group.

Rock Land

Rock land (RO) consists of long, narrow areas on moderately steep to extremely steep canyon faces, mostly in the southern half of the survey area (fig. 8). This unit consists of Rock land, Rock outcrop, rubble land, some alluvium, and very shallow soils, all of which are combined together in no regular pattern. Rock land makes up about 90 percent of the mapped acreage.

The vegetation is sparse and scrubby. It is big sagebrush, Nevada ephedra, squirreltail, needleandthread, scattered bitterbrush, Utah juniper, and pinon pine in those areas where plants will grow.

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

Rock land is not suitable for irrigated crops. It is used mainly for limited grazing, wildlife habitat, and watershed. Dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Rough Broken Land

Rough broken land is land that has been cut so badly by recent gullies that it is nearly barren and the profile arrangement of the soil material has been largely destroyed. Local relief varies in height from a few feet to about 30 feet. The gulying has been in soft ancient lake-bed material. Runoff is rapid, and the hazard of erosion is very severe.

Rough broken land and Badland provide the major source of sediment in the principle drainage system of the Meadow Valley Watershed basin.

Rough broken land has been mapped only in association with the Buster series in the Buster-Rough broken land association (BR).

Royal Series

The Royal series consists of well-drained soils that are shallow to a hardpan. These soils formed in alluvium derived mainly from ignimbrites and lacustrine sediment high in pyroclastic materials. They are on dissected high valley-fill terraces. Slopes are 2 to 15 percent. The vegetation is big sagebrush, black sagebrush, squirreltail, blue grama, Indian ricegrass, and scattered Utah juniper. Elevation ranges from 5,700 to 6,100 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 45° to 50° F. The frost-free season is 100 to 110 days.

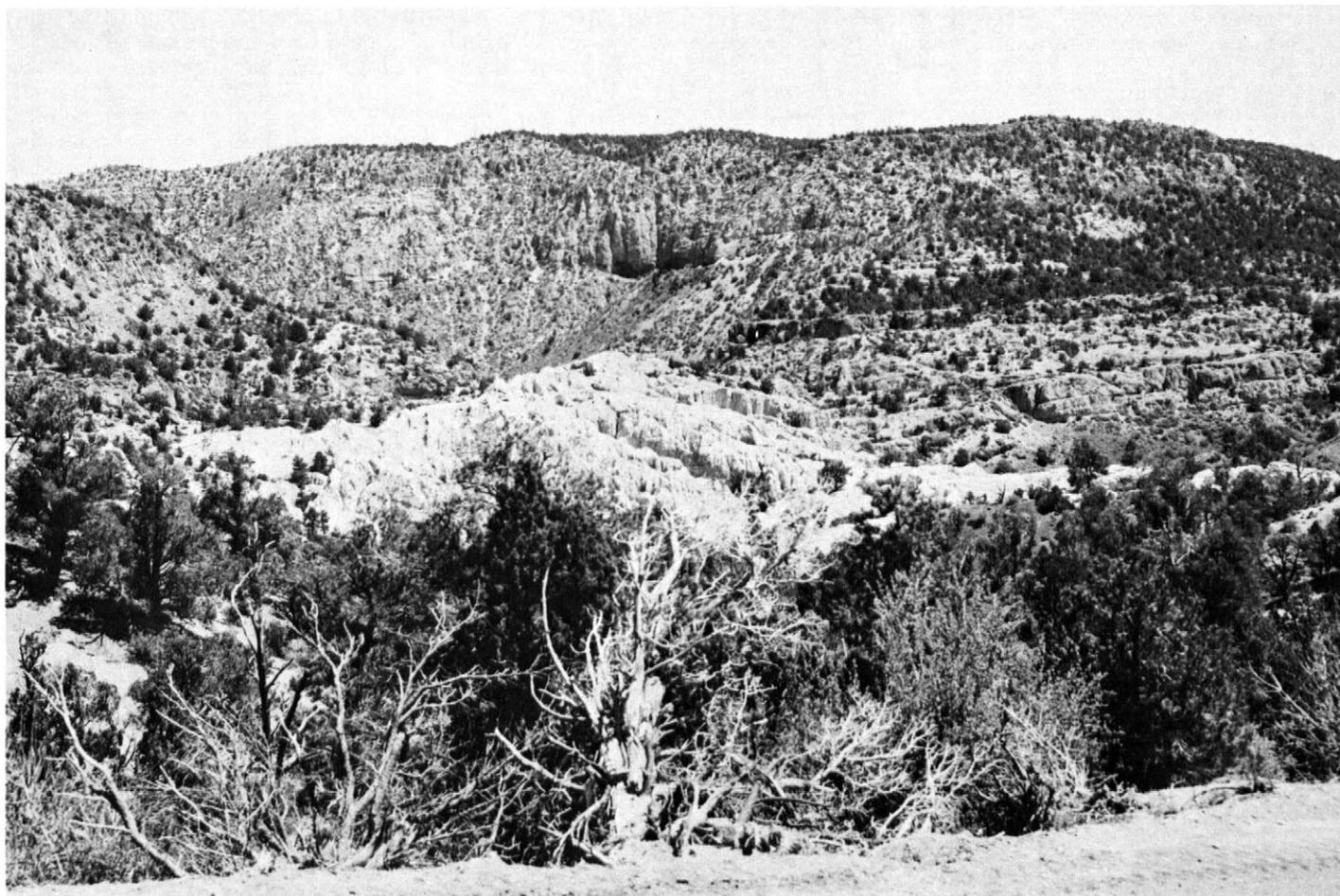


Figure 8.—Scenic area of Rock land near camp sites of Beaver Dam State Park.

In a representative profile the surface layer is pale-brown gravelly loam about 2 inches thick. The next layer is brown gravelly clay loam about 12 inches thick. Below this is a very pale brown indurated hardpan that has continuous silica laminae. The laminae have white lime coatings and are above a strongly cemented hardpan that has pockets and discontinuous strata of weakly cemented and indurated material. The overall hardpan is about 18 inches thick. It is underlain by pale-brown very gravelly loamy sand that has some discontinuous silica and lime laminae and silica and lime coatings on some pebbles. This material extends to a depth of 60 inches or more.

Permeability is moderately slow above the very slowly permeable hardpan in Roval soils. Available water capacity is very low. Effective rooting depth is 10 to 20 inches.

The Roval soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Roval gravelly loam, 2 to 15 percent slopes, under native vegetation, about 9.5 miles NE. of Pioche and approximately 1,200 feet east of the NW corner of sec. 23, T. 2 N., R. 68 E., Mount Diablo baseline and meridian:

A1—0 to 2 inches, pale-brown (10YR 6/3) gravelly loam,

dark brown (10YR 3/3) moist; moderate, thick, platy structure; soft, very friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine and very fine vesicular pores; mildly alkaline; abrupt, smooth boundary.

B2t—2 to 5 inches, brown (10YR 5/3) gravelly clay loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure parting to moderate, medium platy; slightly hard, very friable, sticky and slightly plastic; common fine and very fine roots; many very fine interstitial pores and common fine tubular pores; few thin clay films in pores and on ped faces; mildly alkaline; clear, wavy boundary.

B3tca—5 to 14 inches, brown (10YR 5/3) gravelly clay loam grading gradually to pale-brown (10YR 6/3) very gravelly loam, dark brown grading to brown (10YR 3/3 and 4/3) moist; weak, coarse, prismatic structure; slightly sticky and slightly plastic; common fine and very fine and few medium roots; common very fine and fine interstitial and tubular pores; common thin clay films in pores and few thin clay films on ped faces; gravel, mostly pan fragments; strongly effervescent in the upper part but violently effervescent in the lower part; strongly alkaline; abrupt, wavy boundary.

IIC1sicam—14 to 24 inches, very pale brown (10YR 8/3) indurated duripan containing continuous pale-brown (10YR 6/3) silica laminae that have white (10YR 8/1) lime coatings, pale brown (10YR 6/3) and light gray (10YR 7/2) moist; massive; extremely hard and extremely firm; few root mats along fractures and on the upper laminae; many

very fine and fine and few medium interstitial pores; many thin and moderately thick pendant silica and lime coatings; violently effervescent; strongly alkaline; gradual, wavy boundary.

IIC2sicam—24 to 32 inches, very pale brown (10YR 7/3) strongly cemented duripan that has pockets and discontinuous strata of weakly cemented and indurated materials; many very thin (less than 5 millimeters thick), discontinuous, pale-brown (10YR 6/3) silica laminae and many coarse and very coarse white (10YR 8/1 and 8/2) lime coatings, pale brown (10YR 6/3) moist; massive; extremely hard and hard, extremely firm and firm; many very fine and fine interstitial pores; many thin silica and lime coatings in pores and as bridges between sand grains; violently effervescent; strongly alkaline; clear, smooth boundary.

IIC3sica—32 to 60 inches, pale-brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) moist; several very thin (less than 5 millimeters thick), discontinuous, very pale brown (10YR 7/3) and white (10YR 8/2) silica and lime laminae; silica and lime coatings on some pebbles; massive; hard and very hard, very friable and very firm, non-sticky and nonplastic; strongly effervescent but violently effervescent on laminae; strongly alkaline.

About 25 percent of the surface is covered by gravel. The hardpan is at a depth of 10 to 20 inches. These soils are usually noncalcareous in the upper part, but they are effervescent at the surface in places. The A1 horizon has weak or moderate, medium or thick, platy structure, or it is massive. The upper 7 inches have an average organic-matter content of 1.0 to 2.5 percent. The Bt horizon is 18 to 24 percent clay and 15 to 35 percent gravel, mostly pan fragments. The hardpan has some discontinuous silica laminae that range to as much as 8 millimeters in thickness. They are hard or extremely hard. The hardpan is 12 to 20 inches thick.

Roval gravelly loam, 2 to 15 percent slopes (RRD).—This soil is in large, broad areas on dissected high valley-fill terraces in the central part of the survey area. It has the profile described as representative of the series.

Included with this soil in mapping, and making up about 20 percent of the mapped acreage, are areas of Linco and Acana soils. Some Badland and alluvium are included in the mapped acreage.

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

Roval soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; range site NV 28-45; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Roval-Acana association (RV).—This association is in small narrow bands and broad areas on dissected high valley-fill terraces in the west-central part of the survey area. It is about 55 percent Roval gravelly loam, 2 to 15 percent slopes, and 25 percent Acana gravelly sand loam, 2 to 8 percent slopes. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Geer and Linco soils.

The gently sloping to strongly sloping Roval soil differs from other soils in the mapping unit by its position on the slightly higher parts of the terraces. It has the profile described as representative of the Roval series. Runoff is medium on this soil, and the hazard of erosion is moderate.

The gently sloping to moderately sloping Acana soil differs from other soils in the mapping unit by its position on the slightly lower parts of the terraces where

the landscape is smooth or undulating. It has the profile described as representative of the Acana series.

This association is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Roval part in dryland capability subclass VII_s; range site NV 28-45; dryland wildlife suitability group 3-42. Acana part in dryland capability subclass VII_s; range site NV 28-41; dryland wildlife suitability group 3-42. Neither part assigned to a woodland suitability group.

Satt Series

The Satt series consists of well-drained soils that are moderately deep to a hardpan. These soils formed in alluvium derived mainly from ignimbrite. They are on sides and tops of terraces. Slopes are 4 to 30 percent. The vegetation is pinon pine, Utah juniper, big sagebrush, black sagebrush, bitterbrush, and some miscellaneous grasses. Elevation ranges from 6,800 to 7,500 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 43° to 45° F. The frost-free season is less than 60 days.

In a representative profile the surface layer is light brownish-gray very stony sandy loam about 2 inches thick over dark grayish-brown gravelly sandy clay loam about 5 inches thick. Below this is brown gravelly clay over very gravelly sandy clay and light-brown very gravelly sandy clay loam about 18 inches thick. The next layer is a very pale brown indurated hardpan that has continuous unoriented white lime coatings and is about 28 inches thick. It is underlain by a light yellowish-brown strongly cemented hardpan that has pockets and seams of weakly cemented loamy fine sand. This pan extends to a depth of 60 inches or more.

Permeability is slow above the very slowly permeable hardpan in the Satt soils. Available water capacity is very low. Effective rooting depth is 20 to 30 inches.

The Satt soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Satt very stony sandy loam, 4 to 15 percent slopes, in an area of Basket-Lize association, 2,640 feet east of the SW. corner of sec. 28, T. 5 N., R. 70 E., Mount Diablo baseline and meridian:

A11—0 to 2 inches, light brownish-gray (10YR 6/2) very stony sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and slightly plastic; few very fine roots; few very fine interstitial pores and common fine and very fine vesicular pores; neutral; abrupt, smooth boundary.

A12—2 to 7 inches, dark grayish-brown (10YR 4/2) gravelly sandy clay loam, very dark brown (10YR 2/2) moist; very dark grayish brown (10YR 3/2) rubbed; moderate, very fine, granular structure; slightly hard, friable, slightly sticky and plastic; few medium and common very fine roots; many very fine interstitial pores; few thin clay bridges; neutral; clear, smooth boundary.

B21t—7 to 11 inches, brown (7.5YR 4/2) gravelly clay, dark brown (7.5YR 3/3) moist; moderate, fine and medium, subangular blocky structure; hard, friable, very sticky and very plastic; common very fine and few fine and medium roots; many very fine and fine interstitial pores; many thin clay films on ped faces and continuous thin clay films in pores; neutral; clear, smooth boundary.

B22t—11 to 17 inches, brown (7.5YR 5/4) very gravelly sandy clay, brown (7.5YR 4/4) moist; weak, fine, subangular blocky structure; hard, friable, very sticky and plastic; few medium and common very

fine roots; many very fine and fine interstitial pores; many thin clay films on ped faces; continuous thin clay films in pores, common thin clay bridges between sand grains; neutral; gradual, smooth boundary.

B3t-17—to 25 inches, light-brown (7.5YR 6/4) very gravelly sandy clay loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, sticky and slightly plastic; few fine and medium roots; many very fine and fine interstitial pores; common thin clay films in pores and as bridges between sand grains; mostly noneffervescent but strongly effervescent in a few spots; neutral; abrupt, wavy boundary.

C1sicam—25 to 53 inches, very pale brown (10YR 7/3) indurated duripan that has continuous unoriented white (10YR 8/2) lime coatings and pockets of pale brown (10YR 6/3), brown (10YR 5/3), light gray (10YR 7/2), and brown (10YR 4/3) moist; massive; extremely hard and extremely firm; mat of very fine roots on top and in cracks of the upper part; violently effervescent; moderately alkaline; abrupt, wavy boundary.

C2sicam—53 to 60 inches, light yellowish brown (10YR 6/4) strongly cemented duripan, white (10YR 8/2) and very pale brown (10YR 7/3) coatings; pockets and seams of weakly cemented loamy fine sand; dark yellowish brown (10YR 4/4), light gray (10YR 7/2), and pale brown (10YR 6/3) moist; massive; extremely hard, very firm and brittle; many very fine interstitial pores; thin ($\frac{1}{64}$ to $\frac{1}{8}$ inch thick) discontinuous silica laminae along old fracture planes and common thin silica films as bridges between sand grains; slightly effervescent, but violently effervescent in lime coatings; moderately alkaline.

About 10 percent of the surface is covered by gravel. A few cobbles are on the surface, and the surface cover is 5 percent stones. The hardpan is at a depth of 20 to 30 inches. The A1 horizon has weak, medium to very fine granular or subgranular blocky structure; weak, medium or thick, platy structure; or is massive. The B2t horizon has an overall thickness of 16 to 20 inches. It is dominantly gravelly and very gravelly clay or sandy clay but includes very gravelly heavy clay loam. The B2t horizon is 35 to 50 percent clay and 50 to 70 percent gravel. The laminae of the hardpan are $\frac{1}{64}$ to $\frac{1}{4}$ inch thick. They are at the top of the hardpan and randomly oriented along old fractures. Below the indurated part of the hardpan are strata that are either strongly or weakly cemented with silica.

Satt stony sandy loam, 4 to 15 percent slopes, eroded (SAD2).—This soil is in large, broad areas on dissected upland terraces in the north-central part of the survey area. It has a profile similar to that described as representative of the series, but it has an eroded surface layer about 5 inches thick, and the depth to hardpan is 20 to 25 inches. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of other noneroded Satt soils.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 1f1; not assigned to a range site.

Satt stony fine sandy loam, 2 to 8 percent slopes, eroded (SCC2).—This soil is in small areas on dissected terraces in the northern part of the survey area. It has a profile similar to that described as representative of the series, but it has a stony fine sandy loam surface, is severely eroded, has Class 2 stoniness, and is only 10 to 14 inches deep to an indurated hardpan. This soil is shallower to the indurated hardpan than other Satt

soils mapped in the survey area. This shallowness, however, does not affect its use and management. Included in mapping, and making up about 10 percent of the mapped acreage are areas of Basket and other Satt soils.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 1f1; not assigned to a range site.

Satt association (SD).—This association is in large, broad areas on upland terraces in the northern part of the survey area. It is about 45 percent Satt stony sandy loam, 4 to 15 percent slopes, eroded, and 45 percent Satt extremely stony sandy loam, 15 to 30 percent slopes. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Holtle soils.

The moderately sloping to strongly sloping Satt soil differs from other soils in the mapping unit by its position on the flatter dissected terrace slopes and by its eroded surface layer. It has a profile similar to that described as representative of the series, but it has a 4- to 5-inch stony sandy loam surface layer, and the hardpan is at a depth of 20 to 25 inches. Runoff is medium to rapid, and the hazard of erosion is severe.

The moderately steep Satt soil has steeper slopes than other soils in the mapping unit. It has a profile similar to that described as representative of the series, but its surface layer is extremely stony. Runoff is medium or rapid, and the hazard of erosion is moderate.

This association is not suitable for irrigated crops. It is used mainly for grazing, wildlife habitat, and watershed. Satt stony sandy loam, 4 to 15 percent slopes, eroded, in dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 1f1. Satt extremely stony sandy loam, 15 to 30 percent slopes, in dryland capability subclass VII_s; dryland wildlife suitability group 334; woodland suitability group 1x1. Neither part assigned to a range site.

Seval Series

The Seval series consists of well-drained soils that are moderately deep to a hardpan. These soils formed in alluvium derived mainly from ancient lake terraces. They are on sides of terraces. Slopes are 30 to 50 percent. The vegetation is Utah juniper, cliffrose, big sagebrush, and miscellaneous grasses. Elevation ranges from 5,500 to 6,200 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 49° to 53° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is grayish-brown very gravelly sandy loam about 3 inches thick. Below it is brown gravelly sandy clay loam over light-brown gravelly clay. This material is about 11 inches thick. Below this is light-brown calcareous and brittle gravelly sandy loam about 9 inches thick. It is underlain by a variegated brown, light yellowish-brown, and white indurated hardpan. This pan has a strongly cemented matrix and a thin continuous silica cap. It is about 4 inches thick. A layer of pinkish-gray,

weakly cemented, very gravelly material made up of strata of fine sand, loamy sand, and loam extends to a depth of 60 inches or more.

Permeability is slow above the very slowly permeable hardpan in the Seval soils. Available water capacity is very low. Effective rooting depth is 20 to 28 inches.

The Seval soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Seval very gravelly sandy loam, 30 to 50 percent slopes, under native vegetation, 600 feet north of the SE. corner of sec. 8, T. 1 N., R. 69 E., Mount Diablo baseline and meridian:

A1—0 to 3 inches, grayish-brown (10YR 5/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium and fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine, very fine, and micro roots; many very fine and few fine interstitial pores and a few very fine tubular pores; 50 percent gravel, 20 percent cobbles; neutral; clear, wavy boundary.

B1t—3 to 6 inches, brown (7.5YR 5/2) gravelly sandy clay loam, dark brown (7.5YR 3/2) moist; weak, medium, subangular blocky structure; slightly hard, friable, sticky and very plastic; common fine, very fine, and micro and few medium roots; few very fine tubular pores and many fine interstitial pores; few thin clay films in pores and as bridges between sand grains; 20 percent gravel, 10 percent cobbles; neutral; clear, wavy boundary.

B2t—6 to 14 inches, light-brown (7.5YR 6/4) gravelly clay, brown (7.5YR 4/4) moist; weak, medium, prismatic structure; very hard, firm, very sticky and very plastic; common micro and few fine and very fine roots; few very fine and fine tubular pores and many very fine and fine interstitial pores; many thin clay films in pores; few thin clay films on ped faces, few thin clay bridges between sand grains; 20 percent gravel, 10 percent cobbles; neutral; clear, wavy boundary.

C1sica—14 to 23 inches, light-brown (7.5YR 6/4) gravelly sandy loam, brown (7.5YR 4/4) moist; massive; hard, firm and brittle; few very fine tubular pores and many very fine and fine interstitial pores; common thin clay films coating pebbles and as bridges between sand grains; common, fine, distinct, very pale brown soft lime masses; effervescent in lime masses; moderately alkaline; abrupt, wavy boundary.

C2sicam—23 to 27 inches, variegated brown (10YR 4/3), light yellowish-brown (10YR 6/4), and white (10YR 8/1) indurated duripan that has strongly cemented matrix and thin (1 millimeter thick), light-gray (10YR 7/2), continuous indurated silica cap containing thin (2 millimeters thick), discontinuous, horizontal and oblique indurated silica laminae; massive; extremely hard and very hard, extremely firm and very firm; abrupt, wavy boundary.

IIC3sica—27 to 60 inches, pinkish-gray (7.5YR 7/2), weakly cemented, very gravelly lacustrine material composed of strata of fine sand, loamy sand, and loam; brown (7.5YR 5/2) moist; massive; hard, firm and brittle; many fine and very fine interstitial pores; many silica and lime bridges between sand grains; strongly effervescent, moderately alkaline.

The hardpan is at a depth of 20 to 28 inches. About 50 percent of the surface is covered by gravel, and 20 percent is covered by cobbles. The Bt horizon typically is about 30 percent gravel and cobbles but ranges from 15 to 35 percent. Texture includes clay, sandy clay loam, heavy clay loam, or sandy clay modified by gravel and cobbles.

Seval very gravelly sandy loam, 30 to 50 percent slopes (SEF).—This soil is in small, narrow areas on sides of terraces in the west-central part of the survey area.

Included with this soil in mapping, and making up

about 5 percent of the mapped acreage, are areas of soils similar to Seval soils.

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

This soil is not suitable for irrigated crops. It is used for grazing, wildlife habitat, and watershed. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2d1; not assigned to a range site.

Shroe Series

The Shroe series consists of deep, well-drained soils that formed in alluvium derived from ignimbrites and reworked old lacustrine sediment influenced by pyroclastic materials. They are on gently sloping to moderately steep side slopes and rounded tops of dissected old valley-fill terraces. Slopes are 2 to 30 percent. The vegetation is Utah juniper, big sagebrush, needleand-thread, squirreltail, and scattered pinon pine. Elevation ranges from 5,000 to 6,200 feet. The average annual precipitation is 10 to 14 inches, and the average annual air temperature is 45° to 49° F. The frost-free season is 100 to 130 days.

In a representative profile the surface layer is brown gravelly loam about 2 inches thick over 4 inches of gravelly sandy clay loam that is 20 percent gravel. Below this is 4 inches of brown sandy clay loam, 25 percent of which is fine tuff fragments; and below it is 6 inches of brown gravelly clay, 40 percent of which is fine tuff fragments. The next layer is strong-brown very gravelly sandy clay loam, about 50 percent of which is fine tuff fragments. This layer is about 24 inches thick. It is underlain by light-brown loam that is 10 percent gravel and extends to a depth of 60 inches or more.

Permeability is slow in the Shroe soils. Available water capacity is moderate. Effective rooting depth is 60 inches or more.

The Shroe soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Shroe gravelly loam, 2 to 15 percent slopes, under native vegetation, 1,300 feet south and 1,300 feet east of the NW. corner of sec. 20, T. 5 S., R. 71 E., Mount Diablo baseline and meridian:

A1—0 to 2 inches, brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; massive; soft, friable, slightly sticky and slightly plastic; few very fine roots; common very fine vesicular pores; neutral; abrupt, smooth boundary.

A12—2 to 6 inches, brown (10YR 4/3) gravelly sandy clay loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure; hard, friable, sticky and plastic; common very fine and few fine and micro roots; few fine and very fine tubular pores; 20 percent gravel; neutral; abrupt, smooth boundary.

B1t—6 to 10 inches, brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure; very hard, friable, sticky and plastic; few fine and medium roots; few medium and very fine tubular pores; few thin clay films on ped faces and common thin clay films in pores; 25 percent pebbles, fine tuff fragments; neutral; clear, smooth boundary.

B2t—10 to 16 inches, brown (7.5YR 3/4) gravelly clay, brown (7.5YR 4/4) moist; weak, medium, prismatic structure; very hard, friable, sticky and very plastic; very few fine and few medium roots; few micro and few very fine tubular pores; few thin clay films in pores and on ped faces; 40 per-

cent gravel, fine tuff fragments; neutral; clear, smooth boundary.

- B3t—16 to 40 inches, strong-brown (7.5YR 5/6) very gravelly sandy clay loam, brown (7.5YR 4/4) moist; weak, coarse, prismatic structure; very hard, friable, sticky and plastic; very few fine and few medium roots; few micro and very fine tubular pores; very few thin clay films on ped faces and in pores; 50 percent gravel, fine tuff fragments; neutral; clear, wavy boundary.
- C—40 to 60 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine interstitial pores and very few very fine tubular pores; 10 percent gravel; neutral.

Twenty percent of the surface is covered by gravel. The Bt horizon is sandy clay loam, sandy clay, clay loam, or clay and is 35 to 45 percent clay and 35 to 50 percent gravel and tuff fragments. This horizon typically has a cumulative thickness of 30 to 36 inches but ranges from 20 to 36 inches. The C horizon is 10 to 60 percent gravel.

Shroe gravelly loam, 2 to 15 percent slopes (SGD).—

This soil is in large, broad areas on the dissected sides of terraces in the southeastern part of the survey area. This soil has the profile described as representative of the series. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Decan soils.

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

This soil is not suitable for irrigated crops. It is used for grazing and wildlife habitat. Dryland capability subclass VIs; dryland wildlife suitability group 324; woodland suitability group 1f1; not assigned to a range site.

Shroe-Badland association (SH).—This association is in a large, broad area on the dissected sides of old valley-fill terraces in the southeastern part of the survey area. It is about 50 percent Shroe cobbly sandy clay loam, 15 to 30 percent slopes; 15 percent Shroe gravelly loam, 2 to 15 percent slopes; and 15 percent Badland.

Included with this association in mapping, and making up about 20 percent of the mapped acreage, are areas of soils similar to Shroe soils. Also included is some alluvium.

The moderately steep Shroe soil differs from other soils in the mapping unit by its position in a landscape of steeper, intermediate, and lower slopes. It has a profile similar to that described as representative of the series, but it has a cobbly sandy clay loam surface layer, a gravelly clay loam subsoil, and fine sandy loam underlying material. Runoff is medium or rapid, and the hazard of erosion is moderate or severe.

The gently sloping to strongly sloping Shroe soil differs from other soils in the mapping unit by its position on the upper parts of the terraces where slopes are less than 15 percent. It has the profile described as representative of the series. Slopes are dominantly 8 to 15 percent but include rounded terrace tops where slope is as little as 2 percent. Runoff is medium, and the hazard of erosion is moderate.

Badland is on the severely dissected, narrow, finger-like terrace remnants and terrace side slopes. It is usually barren. Runoff is very rapid, and accelerated erosion is taking place.

This association is not suitable for irrigated crops. It is used for wildlife habitat and limited grazing. Livestock have been excluded from most of this unit. Shroe

parts in dryland capability subclass VIs; dryland wildlife suitability group 324; woodland suitability group 1f1. Badland part in dryland capability subclass VIIIe; not assigned to a wildlife suitability group or woodland suitability group. Neither part assigned to a range site.

Sieroclip Series

The Sieroclip series consists of well-drained soils that are moderately deep to a hardpan. These soils formed in gravelly loamy alluvium derived from limestone and some admixture from reworked lacustrine materials or in loess high in pyroclastic materials. They are on old dissected alluvial fans. Slopes are 2 to 8 percent. The vegetation is black sagebrush, cliffrose, Nevada ephedra, some scattered Utah juniper, and miscellaneous grasses. Elevation ranges from 5,800 to 6,500 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 46° to 50° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is light brownish-gray gravelly sandy loam about 3 inches thick. The next layer is pale-brown light clay loam over gravelly light clay loam. It is about 8 inches thick. Below it is white gravelly loam that is weakly cemented with lime and silica and is about 10 inches thick. Below this is a white hardpan about 5 inches thick. It is strongly cemented with lime and has very thin, discontinuous, horizontal lime and silica laminae. The next layer is a very pale brown, indurated, very gravelly hardpan that is cemented with lime and has many white coatings and seams. It contains several thin, discontinuous, lime and silica laminar strata and is about 7 inches thick. It is underlain by a white to light-gray, strongly cemented, gravelly hardpan that is cemented with lime and extends to a depth of 48 inches or more.

Permeability is moderate above the very slowly permeable hardpan in the Sieroclip soils. Available water capacity is very low. Effective rooting depth is 20 to 30 inches.

The Sieroclip soils are used mainly for grazing and wildlife habitat.

Representative profile of Sieroclip gravelly sandy loam, 2 to 8 percent slopes, under native vegetation, 1,320 feet east and 1,200 feet north of the SW. corner of sec. 5, T. 1 N., R. 67 E., Mount Diablo baseline and meridian:

- A1—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, brown (10YR 4/3) moist; weak, thick, platy structure; soft, very friable, nonsticky and nonplastic; common fine and few very fine roots; common fine vesicular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.
- B21—3 to 6 inches, pale-brown (10YR 6/3) light clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, sticky and slightly plastic; common fine and coarse and few very fine roots; common fine and very fine tubular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.
- B22ca—6 to 11 inches, pale-brown (10YR 6/3) gravelly light clay loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, sticky and slightly plastic; common fine, few very fine, and many coarse roots; many fine and common very fine tubular pores; many pan fragments; violently effervescent; strongly alkaline; abrupt, wavy boundary.

- C1casi—11 to 21 inches, white (10YR 8/1) gravelly loam, very pale brown (10YR 7/3) moist; massive; hard, firm, brittle and slightly plastic; weakly cemented with lime and silica; common fine roots; common very fine interstitial pores; few very thin (1/16 inch or less), discontinuous, randomly oriented lime and silica laminae; many pan fragments; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- C2casim—21 to 26 inches, white (10YR 8/1) hardpan strongly cemented with lime that has very thin (1/16 inch), discontinuous, horizontal lime and silica laminae, pale brown (10YR 6/3) moist; massive; laminae and materials between appear as thick plates; very hard and extremely hard, very firm and extremely firm; common fine and very fine interstitial pores in strongly cemented material and few very fine ones in laminae; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- IIC3casim—26 to 33 inches, very pale brown (10YR 7/3), indurated, very gravelly hardpan cemented with lime; many white (10YR 8/1) coatings and seams and contains several thin (1/8 to 1/4 inch), discontinuous, lime and silica laminar strata, pale brown (10YR 6/3) moist; massive; extremely hard, extremely firm; common very fine interstitial pores; many very thin and thin silica bridges between sand grains; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- IIC4casim—33 to 39 inches, white (10YR 8/2) gravelly hardpan strongly cemented by lime that has thin (1/16 inch or less), discontinuous, lime and silica laminae, very pale brown (10YR 7/3) moist; massive; very hard and extremely hard, very firm and extremely firm; common very fine interstitial pores in strongly cemented materials; violently effervescent; strongly alkaline; clear, wavy boundary.
- IIC5casim—39 to 48 inches, light-gray (10YR 7/2) gravelly hardpan strongly cemented with lime, light yellowish brown (10YR 6/4) moist; massive; very hard and very firm; common very fine interstitial pores; many very thin, discontinuous, randomly oriented, lime and silica laminae and silica bridges between sand grains; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- IIC6ca—48 to 60 inches, very pale brown (10YR 7/3) gravelly loamy sand, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable, non-sticky and nonplastic; many fine interstitial pores; violently effervescent; strongly alkaline.

The lime indurated hardpan is at a depth of 20 to 30 inches. About 40 percent of the surface is covered by gravel. The A1 horizon has weak to strong, thin to thick platy structure or is massive. The B and C horizons are loam, light clay loam, fine sandy loam, sandy loam, or light sandy clay loam and are 50 to 65 percent gravel. Most of the gravel consists of pan fragments. The hardpan is 10 to 30 inches thick and is made up of indurated and strongly cemented layers. It is generally firm but is very hard and very firm in some subhorizons.

Sieroclimb gravelly sandy loam, 2 to 8 percent slopes (SKC).—This soil is on old dissected alluvial fans in the west-central part of the survey area. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of Jarab soils.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; range site NV 28-41; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Slickens

Slickens (SL) is a miscellaneous land type that consists

of a small area of accumulation of fine-textured material separated in ore mill operations. It is in the Caselton area below the old mill site. The mill tailings have been deposited in a dry wash consisting of a series of settling basins. The deposits are shallow to very deep and are generally chemically contaminated. They are nearly barren. Included in mapping is a small area that has been chemically altered by liquids that flow from the settling basins and down the drainageway. Dryland capability subclass VIII_w; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Stampede Series

The Stampede series, as mapped in this area, consists of well-drained soils that are moderately deep to a hardpan. These soils formed in alluvium from mixed sources derived from ignimbrite, tuff, and ancient valley-fill material. They are on alluvial fans. Slopes are 0 to 2 percent. The vegetation is big sagebrush, scattered black sagebrush, and miscellaneous grasses. Elevation ranges from 5,000 to 6,000 feet. The average annual precipitation is 12 to 14 inches, and the average annual air temperature is 46° to 50° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is brown gravelly loam about 7 inches thick. Below it is 17 inches of pale-brown clay loam and clay over pale-brown and light yellowish-brown clay. The next layer is very pale brown clay loam about 5 inches thick. It is underlain by very pale brown loam about 5 inches thick. Under this is very pale brown silica laminae capping white moderately coarse material that is strongly to weakly cemented. This layer contains continuous and discontinuous indurated silica laminae and extends to a depth of 60 inches or more.

Permeability is slow above the very slowly permeable hardpan in Stampede soils. Available water capacity is low.

The Stampede soils are mainly used for grazing and wildlife habitat.

Representative profile of Stampede gravelly loam, 0 to 2 percent slopes, under native vegetation, 100 feet north of the SW. corner of sec. 10, T. 5 S., R. 70 E., Mount Diablo baseline and meridian:

- A11—0 to 3 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few micro and very fine roots; common fine interstitial pores and fine and very fine tubular pores; neutral; abrupt, smooth boundary.
- A12—3 to 7 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, sticky and plastic; common micro and very fine roots; common very fine and fine tubular pores; 15 percent gravel; mildly alkaline; clear, smooth boundary.
- B1t—7 to 10 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate, fine, subangular blocky structure; slightly hard, friable, sticky and plastic; common micro and fine and few medium roots; common very fine and fine tubular pores; few thin clay films in some pores; 10 percent gravel; slightly effervescent; mildly alkaline; abrupt, smooth boundary.
- B21t—10 to 17 inches, pale-brown (10YR 6/3) clay, brown (10YR 4/3) moist; weak, medium, prismatic struc-

ture parting to moderate, fine, subangular blocky; hard, friable, very sticky and very plastic; few micro and very fine roots; few very fine tubular pores; common thin clay films on ped faces; strongly effervescent; mildly alkaline; clear, smooth boundary.

B22t—17 to 24 inches, light yellowish-brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable, very sticky and very plastic; few micro, very fine, and fine roots; few micro tubular pores; common thin clay films on ped faces and in pores; strongly effervescent; mildly alkaline; clear, smooth boundary.

B23—24 to 29 inches, very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; few micro roots; few micro tubular pores; strongly effervescent; moderately alkaline; abrupt, wavy boundary.

C1sica—29 to 34 inches, very pale brown (10YR 8/3) loam, white (10YR 8/2) moist; massive; hard, firm, slightly sticky and slightly plastic; dark yellowish-brown (10YR 4/4) stains on some grains, very few fine roots; few micro tubular pores; violently effervescent; moderately alkaline; abrupt, wavy boundary.

C2sica—34 to 60 inches, very pale brown (10YR 7/3), thin (1 to 5 millimeters thick) silica laminae, pale brown (10YR 6/3) moist, that are capping white (10YR 8/1), pale brown (10YR 7/2) moist, finely stratified strongly and weakly cemented material; material contains fine, continuous and discontinuous, indurated silica laminae; massive but appears as thin plates; violently effervescent; moderately alkaline.

The indurated hardpan is at a depth of 30 to 40 inches. About 20 percent of the surface is covered by gravel. The A horizon has textures of loam or clay loam modified by 10 to 20 percent gravel. The B2t horizon has textures of heavy clay loam and clay.

Stampede soils mapped in this survey area differ from the Stampede soils mapped in other areas by having a slightly higher than average soil temperature, slightly lower elevations, and by having a surface layer that is browner and thinner. These differences have no effect on the use and management of these soils.

Stampede gravelly loam (ST).—This soil is in a small, narrow area on alluvial fans in the southeast corner of the survey area.

Included with this soil in mapping, and making up about 5 percent of the mapped acreage, are areas of Shroe soils and some soils similar to Stampede soil that have indurated silica and lime strata at a depth between 10 and 20 inches.

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

This soil is suitable for irrigated crops where water is available and proper water management is applied. It is used mainly for grazing and wildlife habitat. Irrigated capability subclass IIIs-41; dryland capability subclass VI; range site NV 28-45; irrigated wildlife suitability group 2-41-I; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Swisbob Series

The Swisbob series consists of well-drained soils that are moderately deep to a hardpan. These soils formed in alluvium derived mainly from rhyodacitic ignimbrite. They are on an ancient high terrace. Slopes are 4 to 8 percent. The vegetation is big sagebrush, bitterbrush, needleandthread, squirreltail, and bluegrass. Elevation

ranges from 7,000 to 7,800 feet. The average annual precipitation is 14 to 16 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is less than 60 days.

In a representative profile the surface layer is light brownish-gray very stony loam over dark grayish-brown gravelly light clay loam. It is about 8 inches thick. Below this is brown clay that has continuous dark-brown coatings on ped faces and is about 10 inches thick. Below this is a layer of yellowish-brown clay over a layer of pale brown clay loam. These layers are about 12 inches thick. They are underlain by very pale brown gravel and cobbles strongly cemented by silica and lime over light yellowish-brown cobbly and gravelly sandy loam that extends to a depth of 60 inches or more.

Permeability is very slow in Swisbob soils. Available water capacity is low. Effective rooting depth is 27 to 35 inches.

The Swisbob soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Swisbob very stony loam, 4 to 8 percent slopes, under native vegetation, 2,640 feet east of the SW. corner of sec. 28, T. 5 N., R. 70 E., Mount Diablo baseline and meridian:

A11—0 to 4 inches, light brownish-gray (10YR 6/2) very stony loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; many very fine interstitial and tubular pores; surface has ½-inch gravel pavement; neutral; abrupt, smooth boundary.

A12—4 to 8 inches, dark grayish-brown (10YR 4/2) gravelly light clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine and fine interstitial pores and few fine tubular pores; neutral; abrupt, smooth boundary.

B1t—8 to 11 inches, brown (10YR 4/3) clay that has continuous dark-brown (10YR 3/3) coatings on ped faces, dark brown (7.5YR 3/3) and very dark grayish brown (10YR 3/2) moist; strong, fine and very fine, angular and subangular blocky structure; hard, firm, very sticky and plastic; many fine and few medium roots; many very fine and fine interstitial pores and few fine tubular pores; neutral; abrupt, wavy boundary.

B21t—11 to 18 inches, brown (10YR 4/3) clay that has continuous dark grayish-brown (10YR 4/2) coatings on ped faces; brown (7.5YR 4/4) and brown (10YR 4/3) moist; strong, medium, prismatic structure; very hard, very firm, very sticky and very plastic; few very fine and fine expid roots and very few very fine inped roots; few fine tubular pores; many pressure cutans and few slickensides; continuous thin clay films in pores; neutral; gradual, wavy boundary.

B22t—18 to 24 inches, yellowish-brown (10YR 5/4) clay; many dark grayish-brown (10YR 4/2) coatings and few fine and medium, distinct (10YR 8/2) lime coatings on ped faces; brown (7.5YR 4/4), very dark grayish brown (10YR 3/2), and light brownish gray (10YR 6/2) moist; strong, medium, prismatic structure; very hard, very firm, very sticky and very plastic; few very fine and fine inped tubular pores; continuous pressure cutans; matrix noneffervescent but strongly effervescent on coatings; moderately alkaline; abrupt, wavy boundary.

B3tca—24 to 30 inches, very pale brown (10YR 7/4) and light yellowish-brown (10YR 6/4) clay loam; many, medium and coarse, distinct white (10YR 8/2) lime coatings, light yellowish brown (10YR 6/4), dark yellowish brown (10YR 4/4), and light

brownish gray (10YR 6/2) moist; moderate, medium and fine, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine interstitial pores and few very fine tubular pores; many thin clay films on ped faces and in pores; matrix is strongly effervescent and coatings violently effervescent; moderately alkaline; abrupt, wavy boundary.

C1sicam—30 to 54 inches, very pale brown (10YR 7/3) gravel and cobbles strongly cemented with silica and lime; many, medium to very coarse, distinct white (10YR 8/2) lime coatings, brown (10YR 5/3) and light brownish gray (10YR 6/2) moist; massive; very hard, very firm and brittle; common very fine tubular pores and few very fine and fine interstitial pores; extremely hard and firm, ¼ inch thick almost continuous horizontal silica and lime seams at 3- to 5-inch intervals; many thin silica films in pores and as bridges between sand grains; about 20 percent gravel and 20 percent cobbles; strongly effervescent in matrix but violently effervescent in coatings; moderately alkaline; clear, wavy boundary.

C2—54 to 60 inches, light yellowish-brown (10YR 6/4) cobbly and gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many fine and very fine interstitial pores; few thin clay films in pores and as bridges; slightly effervescent but strongly effervescent where the lime coats the base of gravel and cobbles; moderately alkaline.

The hardpan is at a depth of 27 to 35 inches. About 90 percent of the surface is covered by gravel, and about 3 percent of it is covered by stones. The A1 horizon generally has weak or moderate, very fine to medium, granular, subangular, or angular blocky structure, except for the immediate surface which is usually massive. In places it has weak or moderate, medium or thick, platy structure. The B2t horizon is clay or gravelly clay that is as much as 20 percent gravel. The hardpan consists of alternately strongly and weakly cemented strata ranging in thickness from 1 to 5 inches.

Swisbob very stony loam, 4 to 8 percent slopes (SWC).

—This soil is in large areas on ancient high terraces in the northwestern part of the survey area. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Holtle soils.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; range site NV 28-49; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Tica Series

The Tica series consists of shallow, well-drained soils that formed in residuum weathered from intermediate volcanic rocks. These soils are on rolling foothills and sides of mountains. Slopes are 2 to 70 percent. The vegetation is pinon pine, Utah juniper, mountainmahogany, big sagebrush, low sagebrush, bitterbrush, and miscellaneous grasses. Elevation ranges from 7,000 to 9,400 feet. The average annual precipitation is 14 to 22 inches, and the average annual air temperature is 35° to 45° F. The frost-free season is less than 60 days.

In a representative profile the surface layer is gray very stony loam over a grayish-brown stony loam and is about 5 inches thick. The next layer is brown stony light clay about 8 inches thick. Below it is a layer of light-brown cobbly heavy sandy clay loam about 5 inches thick. Hard rhyodacitic ignimbrite, which is welded tuff, extends to a depth of at least 24 inches.

Permeability is slow in Tica soils. Available water capacity is very low. Effective rooting depth is 10 to 20 inches.

The Tica soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Tica very stony loam, 15 to 30 percent slopes, in an area of Tica-Rock outcrop association, 1,200 feet south and 430 feet west of the N. corner of sec. 20, T. 4 N., R. 68 E., Mount Diablo baseline and meridian:

A11—0 to 1 inch, gray (10YR 5/1) very stony loam, very dark gray (10YR 3/1) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine and few fine interstitial pores; neutral; abrupt, smooth boundary.

A12—1 to 5 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, common fine, and few medium roots; many very fine and few interstitial pores; 30 percent gravel, 2 percent stones, and 5 percent cobbles; neutral; clear, smooth boundary.

B2t—5 to 13 inches, brown (7.5YR 5/4) stony light clay, brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; very hard, friable, very sticky and very plastic; common fine, very fine, and medium roots; many very fine interstitial pores and common very fine tubular pores; many thin clay films on ped faces and in pores; 25 percent gravel and 2 percent stones; neutral; clear, wavy boundary.

B3t—13 to 18 inches, light-brown (7.5YR 6/4) cobbly heavy sandy clay loam, brown (7.5YR 4/4) moist; moderate, medium and coarse, subangular blocky structure; very hard, friable, sticky and plastic; common very fine, fine, and medium roots; common very fine interstitial and tubular pores; many thin and few moderately thick clay films on ped faces and in pores; 40 percent cobbles; neutral; abrupt, smooth boundary.

R—18 to 24 inches, hard ignimbrite (welded tuff).

Bedrock is at a depth of 10 to 20 inches. About 30 percent of the surface is covered by gravel, 15 percent is covered by cobbles, and 3 percent is covered by stones. The A1 horizon has weak or moderate, fine or very fine, granular or subangular blocky structure, but 1 to 2 inches at the surface is either massive or has platy structure. The B2t horizon is clay or heavy clay loam modified by 35 to 50 percent stones, cobbles, and pebbles. A B3t horizon is present in places.

Tica-Nevtah association (TN).—This association is in large, broad areas on mountain faces in the northeastern part of the survey area. It is about 30 percent Tica very stony loam, 15 to 30 percent slopes; 30 percent Nevtah very stony loam, 15 to 30 percent slopes; 30 percent Rock outcrop; and 10 percent Udel and Holtle soils.

The moderately steep Tica soil differs from other soils in the mapping unit by occupying the wooded mountain slopes. It has a clay B2t horizon. It has the profile described as representative of the Tica series. Runoff is medium or rapid, and the hazard of erosion is moderate.

The moderately steep Nevtah soil differs from other soils in the mapping unit by its location on the non-wooded mountain faces. It lacks a B horizon and is slightly shallower to bedrock. It has the profile described as representative of the Nevtah series except for a very stony loam surface layer instead of a stony one.

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

The Rock outcrop consists of volcanic rock. It is in small areas scattered throughout the association.

This association is not suitable for irrigated crops. It is used for grazing, wildlife habitat, and watershed. Tica part in dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2x1; not assigned to a range site. Nevta part in dryland capability subclass VII_s; range site NV 28-51; dryland wildlife suitability group 3-41; not assigned to a woodland suitability group. Rock outcrop part in dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Tica-Rock outcrop association (TR).—This association is in large, broad areas on mountain faces in the north-central part of the survey area. It is about 70 percent Tica very stony loam, 15 to 30 percent slopes, and 25 percent Rock outcrop.

Included with these soils in mapping and making up about 5 percent of the mapped acreage, are areas of Itca soils. Also included are some areas of alluvium.

The moderately steep Tica soil differs from other soils in the mapping unit by its location on the wooded mountain faces. This soil has the profile described as representative of the Tica series.

The Rock outcrop is volcanic rock. It is in small to large areas scattered throughout the Tica soils.

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

This association is not suitable for irrigated crops. It is used for grazing, wildlife habitat, and watershed. Tica part in dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2x1; not assigned to a range site. Rock outcrop part in dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Timpahute Series

The Timpahute series consists of well-drained soils that are moderately deep to a hardpan. These soils formed in loamy alluvium mostly from ignimbrite but containing some material from andesite, basalt, obsidian, and sandstone. They are on smooth, old dissected alluvial fans and terraces. Slopes are 0 to 15 percent. The vegetation is big sagebrush, squirreltail, needleandthread, blue grama, and some scattered Utah juniper. Elevation ranges from 6,000 to 6,300 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 45° to 47° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is pale-brown gravelly loam about 3 inches thick. The next layer is brown clay loam and clay over light-brown clay and is about 22 inches thick. It is underlain by a light-gray indurated gravelly hardpan. This pan, about 17 inches thick, has continuous laminar strata coated by white lime. It contains pockets and strata of loamy sand and sandy loam. It is underlain by light-gray very gravelly and cobbly loamy sand that extends to a depth of 60 inches or more.

Permeability is very slow in Timpahute soils. Avail-

able water capacity is low. Effective rooting depth is 20 to 30 inches.

The Timpahute soils are used mainly for grazing and wildlife habitat.

Representative profile of Timpahute gravelly loam, 0 to 4 percent slopes, under native vegetation, 1,350 feet north and 300 feet west of the SE corner of sec. 25, T. 3 N., R. 68 E., Mount Diablo baseline and meridian:

- A1—0 to 3 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 3/3) moist; moderate, coarse, platy structure; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many medium vesicular pores; gravel pavement on the soil surface; neutral; abrupt, smooth boundary.
- B1t—3 to 10 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate, fine and medium, sub-angular blocky; slightly hard, friable, sticky and plastic; common fine and very fine roots; many very fine and fine interstitial and tubular pores; few thin clay films on ped faces and in pores; neutral; abrupt, smooth boundary.
- B21t—10 to 22 inches, brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate, fine, prismatic structure parting to strong, fine and medium, sub-angular blocky; hard, firm, very sticky and 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; neutral; clear, smooth boundary.
- B22t—22 to 25 inches, light-brown (7.5YR 6/4) light clay, brown (7.5YR 4/4) moist; strong, fine, prismatic structure parting to strong, medium and coarse, subangular blocky; hard, friable, sticky and very plastic; common very fine and few fine roots; common very fine and fine interstitial and tubular pores; many thin and few moderately thick clay films on ped faces and in pores; occasional slickensides; slightly effervescent; few, medium, distinct, pinkish-gray (7.5YR 7/2) lime masses; strongly alkaline; abrupt, smooth boundary.
- C1sicam—25 to 33 inches, light-gray (10YR 7/2) indurated gravelly duripan that has continuous laminar caps coated with white (10YR 8/2) lime, pale brown (10YR 6/3) moist; stratified with light brownish-gray (10YR 6/2), light-gray (10YR 7/2) loamy sand and sandy loam, brown (10YR 3/3) moist; massive but appears as thick plates; roots matted on the silica laminar surfaces; few fine pores; few thin clay films on plate surfaces in upper part of horizon; violently effervescent; strongly alkaline; abrupt, smooth boundary.
- IIC2sicam—33 to 42 inches, light-gray (10YR 7/2) very gravelly duripan of weakly cemented strata and several indurated silica laminae, less than ¼ inch thick and coated with white (10YR 8/2) lime; pale brown (10YR 6/3) moist; massive; few very fine pores; about 60 percent pebbles coated by lime; violently effervescent; strongly alkaline; clear, wavy boundary.
- IIC3—42 to 60 inches, light-gray (10YR 6/3) very gravelly and cobbly loamy sand, pale brown (10YR 6/3) moist; single grained; loose when dry and moist; many very fine and fine and few medium interstitial pores; 50 percent gravel; violently effervescent; strongly alkaline.

About 60 percent of the surface is covered by gravel. The duripan is at a depth that ranges from 20 to 30 inches. The A1 horizon has weak or moderate, platy structure or is massive. The B horizon textures range from clay loam to clay.

Timpahute gravelly loam, 0 to 4 percent slopes (TTB).—This soil is in a large, broad area on moderately dissected terraces in the central part of the survey area.

Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Minu and Patter soils.

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

This soil is not suitable for irrigated crops. It is used for grazing and wildlife habitat. Dryland capability subclass VII_s; range site NV 28-45; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Uana Series

The Uana series consists of well-drained soils that are moderately deep to a hardpan. These soils formed in alluvium derived mainly from ignimbrite and reworked old lacustrine sediment that had a high content of pyroclastic material. They are on rounded and somewhat flattened, strongly dissected, old valley-fill terraces and alluvial fans. Slopes are 2 to 15 percent. The vegetation is Utah juniper, pinon pine, big sagebrush, black sagebrush, bitterbrush, and Indian ricegrass. Elevation ranges from 6,500 to 7,000 feet. The average annual precipitation is 14 to 16 inches, and the average annual air temperature is 41° to 44° F. The frost-free season is 80 to 100 days.

In a representative profile the surface layer is dark grayish-brown gravelly loam over sandy clay loam and is about 3 inches thick. Below this is dark-brown and dark grayish-brown clay about 9 inches thick. Below this is pinkish-gray clay loam about 5 inches thick. It is underlain by white clay loam that is weakly cemented and contains a few discontinuous silica laminae. This layer is about 10 inches thick. Below it is light brownish-gray, very thin, indurated silica laminae capping sandy loam that is weakly to strongly cemented by lime and is about 11 inches thick. Below this is pinkish-gray sandy loam that extends to a depth of more than 60 inches.

Permeability is very slow in Uana soils. Available water capacity is low. Effective rooting depth is 21 to 30 inches.

The Uana soils are used for grazing and wildlife habitat.

Representative profile of Uana gravelly loam, 2 to 15 percent slopes, in an area of Decan-Uana association, 1,340 feet south of the approximate center of sec. 7, T. 3 S., R. 70 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and micro interstitial pores; 15 percent gravel; neutral; abrupt, smooth boundary.
- A12—2 to 3 inches, dark grayish-brown (10YR 4/2) sandy clay loam, dark brown (10YR 3/3) moist; moderate, fine, granular structure; soft, friable, slightly sticky and slightly plastic; few fine roots; many fine interstitial pores; neutral; abrupt, smooth boundary.
- B21t—3 to 9 inches, dark-brown (7.5YR 3/2) clay, very dark gray (10YR 3/1) moist; moderate, medium, prismatic structure; hard, firm, sticky and very plastic; common fine and medium roots; few fine and medium tubular pores; common thin films in pores and on ped faces; neutral; abrupt, smooth boundary.

B22t—9 to 12 inches, dark grayish-brown (10YR 4/2) clay, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure; hard, firm, very sticky and very plastic; common fine and medium roots; few fine and medium tubular pores; many moderately thick clay films in pores and on ped faces; neutral; abrupt, wavy boundary.

B3tca—12 to 17 inches, pinkish-gray (7.5YR 7/2) clay loam, pinkish gray (7.5YR 6/2) moist; weak, medium, prismatic structure; slightly hard, friable, sticky and plastic; many fine and coarse roots; many fine tubular pores; few clay films on ped faces; violently effervescent; moderately alkaline; clear, wavy boundary.

C1sica—17 to 27 inches, white (10YR 8/1) clay loam, light brownish gray (10YR 6/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; few very fine tubular pores; weakly cemented; few discontinuous silica laminae; violently effervescent; strongly alkaline; abrupt, wavy boundary.

IIC2sicam—27 to 38 inches, light brownish-gray (10YR 6/2), very thin (1/32 inch to 1/16 inch thick), indurated silica laminae occurring as capping, brown (10YR 4/3) moist; and few continuous and discontinuous laminae in white (10YR 8/2) and light grayish-brown (10YR 6/2) sandy loam, light gray (10YR 7/2) and brown (10YR 4/2) moist; massive but appearing as thick plates; hard and very hard, very firm, brittle, nonsticky and nonplastic; few fine roots in weakly cemented material between the strongly cemented layers; common fine interstitial pores in weakly cemented material; silica coats on some plates; discontinuously non-effervescent to strongly effervescent; moderately alkaline; clear, smooth boundary.

IIC3—38 to 59 inches, pinkish-gray (7.5YR 6/2) sandy loam, brown (7.5YR 4/4) moist; massive; very hard, very firm, slightly brittle, nonsticky and nonplastic; very few very fine tubular pores; many white (10YR 8/4), 1 to 5 millimeters, fibrous, soft, decomposing tuff fragments; few very thin seams of lime; few large (5 to 10 millimeters) lime masses near lower boundary; mildly alkaline; abrupt, smooth boundary.

IIC4—59 to 65 inches, pinkish-gray (7.5YR 6/2) sandy loam, brown (7.5YR 4/4) moist; massive; hard, very firm, brittle, nonsticky and nonplastic; many white (10YR 8/4), 1 to 8 millimeters, fibrous, soft, decomposing tuff fragments; mildly alkaline.

The hardpan is at a depth of 21 to 30 inches. About 20 percent of the surface is covered by gravel. The average clay content of the Bt horizon is 35 to 45 percent. The hardpan is weakly or strongly cemented. The total thickness of the continuous silica laminae is 0.5 to 1 inch. Individual laminae are 0.5 to 2.0 millimeters thick.

Soils of the Uana series have been mapped only as a component of the Decan-Uana association (DA).

Udel Series

The Udel series consists of very shallow, somewhat excessively drained soils that formed in residuum weathered from rhyodacitic ignimbrite. They are on foothills and sides of mountains. Slopes are 30 to 50 percent. The vegetation is pinon pine, mountain-mahogany, bitterbrush, low sagebrush, needle-and-thread, and bluegrass. Elevation ranges from 7,200 to 9,200 feet. The average annual precipitation is 14 to 20 inches, and the average annual air temperature is 40° to 43° F. The frost-free season is less than 60 days.

In a representative profile 60 percent of the immediate surface is covered by gravel, a few cobbles, and stones. The surface layer is grayish-brown very gravelly sandy loam about 5 inches thick. Below it is light yellowish-brown ignimbrite bedrock.

Permeability is moderately rapid in Udel soils. Available water capacity is very low. Effective rooting depth is less than 10 inches.

The Udel soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Udel very gravelly sandy loam, 30 to 50 percent slopes, in an area of Udel-Rock in alluvium derived mainly from ignimbrite and re-outcrop association, 225 feet south and 225 feet east of the center of sec. 11, T. 5 N., R. 69 E., Mount Diablo baseline and meridian:

- A1—0 to 5 inches, grayish-brown (10YR 5/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine and very fine, granular structure; soft, friable, nonsticky and nonplastic; common fine and very fine and few medium roots; many very fine and fine interstitial pores; neutral; abrupt, smooth boundary.

R—5 inches, light yellowish-brown (10YR 6/4) ignimbrite.

Bedrock is generally at a depth of less than 10 inches. About 60 percent of the surface is covered by gravel and a few cobbles and stones. The A1 horizon is very gravelly fine sandy loam, very gravelly sandy loam, or very gravelly loam. It is 60 to 85 percent gravel, cobbles, and stones.

Udel-Rock outcrop association (UK).—This association is in large areas on high mountain side slopes in the northern part of the survey area. It is about 60 percent Udel very gravelly sandy loam, 30 to 50 percent slopes, and 35 percent Rock outcrop. Included in mapping, and making up about 5 percent of the mapped acreage, are areas of Nevta soils.

The steep Udel soil differs from other soils in the mapping unit by being very gravelly sandy loam that is generally less than 10 inches deep over bedrock. Runoff is rapid, and the hazard of erosion is severe.

The volcanic Rock outcrop is in small to large areas of barren rock. Runoff is rapid, and the hazard of erosion is severe.

This association is not suitable for irrigated crops. It is used for grazing and wildlife habitat. Udel part in dryland capability subclass VII_s; dryland wildlife suitability group 434; woodland suitability group 2d1; not assigned to a range site. Rock outcrop part in dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Umil Series

The Umil series consists of well-drained soils that are shallow to a hardpan. These soils formed in alluvium from rhyodactic ignimbrite and water-deposited tuff. They are on alluvial fans, terraces, and their interfluvial side slopes. Slopes are 2 to 15 percent but range to 50 percent on the interfluvial side slopes. The vegetation is black sagebrush, low rabbitbrush, horsebrush, Sandberg bluegrass, squirreltail, and a few scattered Utah juniper. Elevation ranges from 6,000 to 6,600 feet. The average annual precipitation is 8 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 90 to 100 days.

In a representative profile the surface layer is light brownish-gray gravelly loam about 2 inches thick. The next layer is brown loam over pale-brown gravelly loam and is about 9 inches thick. It is underlain by a very pale brown indurated hardpan that has continuous

silica laminae on the surface and many randomly oriented silica laminae. This pan is about 27 inches thick. Below it is very pale brown gravelly loamy sand that is 25 percent subrounded nodules (1/2 to 2 inches) that are very hard. White lime coating the underside of the pebbles, on the nodules, and in the matrix extends to a depth of 60 inches or more.

Permeability is moderately rapid above the very slowly permeable hardpan in the Umil soils. Available water capacity is very low. Effective rooting depth is 10 to 14 inches.

The Umil soils are used mainly for grazing, wildlife habitat and watershed.

Representative profile of Umil gravelly loam, 2 to 4 percent slopes, under native vegetation, 700 feet south and 530 feet west of the NE. corner of sec. 6, T. 5 N., R. 71 E., Mount Diablo baseline and meridian:

- A1—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly loam, dark brown (10YR 3/3) moist; moderate, fine, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and common fine vesicular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

B2—2 to 7 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak, coarse, prismatic structure parting to weak, medium and fine, subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, common fine, and few medium roots; common very fine and fine interstitial pores and few fine tubular pores; common thin clay film coatings on sand grains and as bridges between sand grains; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

B3ca—7 to 11 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, common fine, and few medium roots; many very fine and fine interstitial pores and few fine tubular pores; few thin clay bridges between sand grains; gravel pan fragments; violently effervescent; moderately alkaline; abrupt, wavy boundary.

C1sicam—11 to 38 inches, very pale brown (10YR 8/3) indurated duripan that has continuous surface and randomly oriented silica laminae, very pale brown (10YR 7/3) moist; many very pale brown (10YR 7/3) and light yellowish-brown (10YR 6/4) silica-coated pores and bridges between sand grains; white almost continuous lime coatings on laminae; massive; extremely hard and extremely firm; few fine and very fine roots in horizontal seams and cracks; many very fine interstitial pores; few 1-inch-thick to 4-inch-thick, strongly cemented, discontinuous strata and pockets; very hard, very firm; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C2sica—38 to 60 inches, very pale brown (10YR 7/3) gravelly loamy sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine and few medium interstitial pores; 25 percent 1/2- to 2-inch subrounded durinodes that are very hard, firm, and brittle; common thin silica films lining pores and bridging sand grains in durinodes; many medium and coarse distinct white (10YR 8/2) lime coatings on gravel bottoms, durinodes, and in matrix; violently effervescent; strongly alkaline.

The duripan is at a depth of 10 to 14 inches. About 50 percent of the surface is covered by gravel. The A1 horizon has weak or moderate, medium or thick, platy structure. The B2t horizon is loam, fine sandy loam, or sandy loam. The hardpan is massive but has numerous laminae giving it a thick platy appearance, and it is 24 to 36 inches thick.

Stratification or pockets of nonindurated material are present in places. C2sica horizon is either weakly cemented or is 20 to 50 percent cylindrical nodules.

Umil gravelly loam, 2 to 4 percent slopes (UMB).—This soil is in a single, large, broad area on alluvial fans and terraces in the northeastern part of the survey area. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Fanu soils.

Runoff is medium, and the hazard of erosion is medium or slight.

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 4-43; not assigned to a woodland suitability group.

Ursine Series

The Ursine series consists of well-drained soils that are shallow to a hardpan. These soils formed in gravelly alluvium derived mainly from limestone that had a minor admixture of quartzite. They are on smooth to convex alluvial fan toe slopes superimposed over lacustrine valley-fill material. Slopes are 2 to 30 percent. The vegetation is black sagebrush, little rabbitbrush, shadscale, cliffrose, Indian ricegrass, galleta, three-awn, needleandthread, Nevada ephedra, blue grama, and scattered Utah juniper. Elevation ranges from 4,800 to 5,800 feet. The average annual precipitation is 8 to 10 inches, and the average annual air temperature is 49° to 53° F. 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 it is light brownish-gray loam and gravelly loam about 6 inches thick. Below this is very pale brown very gravelly loam and gravel (mostly pan fragments). This layer is about 8 inches thick. It is underlain by a white indurated hardpan, consisting of many thin continuous horizontal silica and lime laminae. They are crudely stratified by gravelly loamy sand and gravelly sandy loam that is weakly lime and silica cemented and extends to a depth of 60 inches or more.

Permeability is moderate above the very slowly permeable hardpan in the Ursine soils. Available water capacity is very low. Effective rooting depth is 14 to 20 inches.

The Ursine soils are used for grazing and wildlife habitat.

Representative profile of Ursine gravelly loam, 2 to 15 percent slopes, under native vegetation, 1,200 feet west of the E¹/₄ corner of sec. 18, T. 1 S., R. 68 E., Mount Diablo baseline and meridian:

A1—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly loam, brown (10YR 4/3) moist; weak, thick, platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine vesicular pores; violently effervescent; moderately alkaline; abrupt, smooth boundary.

C1—2 to 4 inches, light brownish-gray (10YR 6/2) loam, brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores; violently effervescent; moderately alkaline; abrupt, smooth boundary.

C2—4 to 8 inches, light brownish-gray (10YR 6/2) grav-

elly loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots; many very fine interstitial pores; gravel, pan fragments; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C3ca—8 to 16 inches, very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots; many very fine interstitial pores; gravel, pan fragments; violently effervescent; strongly alkaline; abrupt, wavy boundary.

C4sicam—16 to 60 inches, white (10YR 8/1 and 8/2) indurated hardpan consisting of many thin (less than 5 millimeters thick), continuous, horizontal silica and lime laminae; crudely stratified by white and light-gray (10YR 8/2 and 7/2) gravelly loamy sand and gravelly sandy loam; weakly lime and silica cemented; light gray, pale brown, and light brownish gray (10YR 7/2, 6/3, and 6/2) moist; massive; extremely hard and hard, extremely firm to friable, nonsticky and nonplastic; few very fine interstitial pores; many silica and lime bridges between sand grains and as coatings on pebbles and sand grains; violently effervescent; very strongly alkaline.

The hardpan is at a depth of 14 to 20 inches. About 25 percent of the surface is covered by gravel and a few cobbles. The material between a depth of 10 inches and the hardpan is loam, silt loam, or very fine sandy loam that averages 35 to 50 percent gravel. The latter consists mostly of pan fragments. Some parts are as much as 70 percent gravel. The hardpan is extremely hard or very hard and very firm except for the laminae. (They are extremely firm.) Individual laminae of the hardpan are 2 to 5 millimeters thick, and the combined laminae total 2 to 8 inches thick. The lesser cemented strata are hard or very hard and firm or friable.

Ursine gravelly loam, 2 to 15 percent slopes (URD).—This soil is in small areas on moderately to strongly dissected alluvial fans in the west-central part of the survey area. This soil has the profile described as representative of the series.

Included with this soil in mapping, and making up about 15 percent of the mapped acreage, are areas of Linco soils. Also included are some areas of Badland.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 4-43; not assigned to a woodland suitability group.

Ursine gravelly loam, 15 to 30 percent slopes (URE).—This soil is in small areas on strongly dissected alluvial fans in the west-central part of the survey area. It has a profile similar to that described as representative of the series, but the soil layers above the hardpan are slightly thinner. Also, this soil has slopes that range from 15 to 30 percent instead of 2 to 15 percent. The average total depth to the hardpan is about 15 inches. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Badland and alluvium.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_e; range NV 28-40; dryland suitability group 4-43; not assigned to a woodland suitability group.

Ursine-Badland association (US).—This association is in large, broad areas on old terraces in the west-central part of the survey area. It is about 60 percent Ursine gravelly loam, 2 to 15 percent slopes, and 20 percent Badland. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Heist, Geer, and Linco soils.

The gently sloping to strongly sloping Ursine soil differs from other soils in the mapping unit by its position on the terrace tops. It has the profile described as representative of the series. Runoff is medium, and the hazard of erosion is moderate.

The Badland is on severely eroded sides of terraces. Runoff is rapid, and the hazard of erosion is severe.

This association is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. The Badland has only scenic or esthetic value. Ursine part in dryland capability subclass VII_s; range site NV 28-40; dryland wildlife suitability group 4-43; not assigned to a woodland suitability group. Badland part in dryland capability subclass VIII_e; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Urtah Series

The Urtah series consists of moderately deep, well-drained soils that formed in residuum and colluvium from limestone or dolomitic limestone. They are on foothills and mountains. Slopes are 30 to 50 percent. The vegetation is pinon pine, big sagebrush, serviceberry, needleandthread, and bluegrass. Elevation ranges from 6,700 to 8,000 feet. The average annual air temperature is 42° to 45° F. The frost-free season is less than 60 days.

In a representative profile the surface layer is dark-gray very stony loam about 13 inches thick. The next layer is light brownish-gray very gravelly loam that has thin white lime coats on the bases of pebbles, mostly in the lower 4 to 5 inches, and is about 17 inches thick. Hard limestone bedrock is at a depth of about 30 inches.

Permeability is moderate in the Urtah soils. Available water capacity is very low. Effective rooting depth is 20 to 40 inches.

The Urtah soils are mainly used for grazing, wildlife habitat, and watershed.

Representative profile of Urtah very stony loam, 30 to 50 percent slopes, in an area of Urtah-Rock outcrop association, 180 feet south of N quarter corner of sec. 13, T. 3 N., R. 70 E., Mount Diablo baseline and meridian:

A1—0 to 13 inches, dark-gray (10YR 4/1) very stony loam, very dark brown (10YR 2/2) moist; weak, fine and very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many fine and medium interstitial pores; ½- to 1-inch gravel mulch on surface; very thin white (10YR 8/2) lime crusts on few pebbles; strongly effervescent; moderately alkaline; clear, smooth boundary.

AC—13 to 30 inches, light brownish-gray (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many fine interstitial pores; thin white (10YR 8/2) lime coats on base of gravel in

lower 4 to 5 inches; violently effervescent; moderately alkaline; abrupt, irregular boundary.
R—30 inches, limestone.

Bedrock is at a depth of 20 to 40 inches. About 60 percent of the surface is covered by gravel, 10 percent is covered by cobbles, and 3 percent is covered by stones. The texture between 10 inches and the bedrock is primarily very gravelly loam or very gravelly light sandy clay loam that is 60 to 80 percent gravel, cobbles, or stones.

Urtah-Rock outcrop association (UT).—This association is in a large area on limestone mountain faces in the east-central part of the survey area. It is about 45 percent Urtah very stony loam, 30 to 50 percent slopes, and 40 percent Rock outcrop. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of soils similar to Urtah soils that are less than 20 inches deep to bedrock.

The steep Urtah soil differs from other soils in the mapping unit by having a very gravelly loam subsoil that extends to consolidated bedrock at a depth of about 30 inches. It has the profile described as representative of the series.

The limestone Rock outcrop is in large and small areas throughout the mapped areas.

Runoff is medium or rapid, and the hazard of erosion is moderate or severe.

This association is not suitable for irrigated crops. It is used mainly for grazing, wildlife habitat, and watershed. Urtah part in dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 1x1; not assigned to a range site. Rock outcrop part in dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group.

Urwil Series

The Urwil series consists of deep, well-drained soils that formed mainly in residuum weathered from rhyodacitic ignimbrite that has minor amounts of alluvium. They are on foothills. Slopes are 2 to 15 percent. The vegetation is pinon pine, Utah juniper, big sagebrush, low sagebrush, bitterbrush, needleandthread, and bluegrass. Elevation ranges from 6,800 to 7,400 feet. The average annual precipitation is 14 to 16 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is less than 60 days.

In a representative profile the surface layer is light brownish-gray stony fine sandy loam over grayish-brown clay loam. It is about 8 inches thick. The next layer is brown gravelly clay that is about 30 percent gravel and is about 9 inches thick. Below this is light brownish-gray gravelly sandy clay that is 40 to 45 percent gravel and extends to a depth of at least 50 inches.

Permeability is slow in the Urwil soils. Available water capacity is low. Effective rooting depth is 60 inches or more.

The Urwil soils are mainly used for grazing, wildlife habitat, and watershed.

Representative profile of Urwil stony fine sandy loam, 2 to 15 percent slopes, under native vegetation, 1,120 feet west and 785 feet north of the SE. corner of sec. 12, T. 3 N., R. 70 E., Mount Diablo baseline and meridian:

- A1—0 to 2 inches, light brownish-gray (10YR 6/2) stony fine sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many fine and medium vesicular pores; 10 percent gravel; neutral; abrupt, smooth boundary.
- A12—2 to 8 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, angular and subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and few medium roots; many very fine and fine interstitial pores; 10 percent gravel; slightly acid; clear, smooth boundary.
- B2t—8 to 17 inches, brown (10YR 5/3) gravelly clay, dark brown (10YR 3/3) moist; strong, medium and coarse, angular blocky structure; hard, friable, very sticky and very plastic; common fine and medium and few coarse roots; many very fine interstitial pores and common very fine tubular pores; continuous thin clay films on ped faces and many thin and few moderately thick clay films in pores; 30 percent gravel; neutral; gradual, wavy boundary.
- B31t—17 to 24 inches, light brownish-gray (10YR 6/2) gravelly sandy clay, dark grayish brown (10YR 4/2) moist; massive; hard, friable, very sticky and very plastic; few fine and very fine roots; many very fine and few fine interstitial pores and common very fine tubular pores; common thin clay films in pores and as bridges between sand grains; 40 percent gravel; neutral; gradual, wavy boundary.
- B32t—24 to 50 inches, light brownish-gray (10YR 6/2) gravelly sandy clay, dark grayish brown (10YR 4/2) moist; massive; very hard, friable, very sticky and very plastic; few fine and very fine roots; many very fine and few fine interstitial pores and common very fine tubular pores; common thin clay films in pores and as bridges between sand grains; 45 percent gravel; rock structure visible in place; neutral.

The hard bedrock is at a depth of 48 inches to more than 60 inches. About 10 percent of the surface is covered by gravel, and about 3 percent of it is covered by stones. Also, a few cobbles are on the surface. The A horizon has weak or moderate, fine or medium, subangular blocky, angular blocky, or granular structure, or it is massive. The B2t horizon is primarily gravelly clay but is gravelly sandy clay or gravelly clay loam in places. It is 20 to 45 percent gravel, cobbles, and stones, which are mostly weathered parent rock.

Urwil stony fine sandy loam, 2 to 15 percent slopes (UWD).—This soil is in large areas on foothills in the northeastern part of the survey area. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of volcanic Rock outcrop.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VIs; dryland wildlife suitability group 324; woodland suitability group 1f1; not assigned to a range site.

Usine Series

The Usine series consists of deep, excessively drained soils that formed in alluvium derived mainly from limestone and ignimbrite. They are on sides of terraces. Slopes are 8 to 30 percent. The vegetation is black sagebrush and cheatgrass. Elevation ranges from 5,800 to 6,600 feet. The average annual precipitation is 8 to 12 inches, and the average annual air

temperature is 44° to 45° F. The frost-free season is 60 to 80 days.

In a representative profile the surface layer is light brownish-gray cobbly sandy loam about 4 inches thick. The next layer is very pale brown gravelly very fine sandy loam about 5 inches thick. Below this is very pale brown very gravelly loamy sand that has thin white lime coatings on the underside of the pebbles and is about 6 inches thick. It is underlain by very pale brown very gravelly sand that extends to a depth of 60 inches or more.

Permeability is very rapid in the Usine soils. Available water capacity is very low. Effective rooting depth is 60 inches or more.

The Usine soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Usine cobbly sandy loam, 8 to 30 percent slopes, in an area of Holsine-Usine association, 920 feet south and 670 feet east of the NW. corner of sec. 28, T. 3 N., R. 70 E., Mount Diablo baseline and meridian:

- A1—0 to 4 inches, light brownish-gray (10YR 6/2) cobbly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; many very fine and fine interstitial pores; 40 percent gravel and pebbles; violently effervescent; moderately alkaline; clear, smooth boundary.
- C1—4 to 9 inches, very pale brown (10YR 7/3) gravelly very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; many very fine and fine interstitial pores; 30 percent gravel and cobbles; violently effervescent; moderately alkaline; clear, wavy boundary.
- IIC2ca—9 to 15 inches, very pale brown (10YR 7/3) very gravelly loamy sand, brown (10YR 5/3) moist; single grained; very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine and fine and common medium interstitial pores; all pebbles have thin white (10YR 8/2) lime coats on bottoms and some are completely coated; violently effervescent; strongly alkaline; clear, wavy boundary.
- IIC3—15 to 60 inches, very pale brown (10YR 7/3) very gravelly sand, brown (10YR 5/3) moist; single grained; loose, very few very fine roots; many very fine and fine and few medium interstitial pores; few pebbles in upper part have white (10YR 8/2) lime coated undersides; slightly effervescent; moderately alkaline.

About 30 percent of the surface is covered by gravel and about 20 percent by cobbles. The soil is violently or strongly effervescent. The A1 horizon is massive or has weak, medium or thick; platy structure. The C horizon contains strata of very gravelly loamy sand, coarse sand, or loamy coarse sand. The content of gravel and cobbles ranges from 75 to 90 percent.

The Usine soils have been mapped only as a component of the Holsine-Usine association (HN).

Vicu Series

The Vicu series consists of deep, well-drained soils that formed in alluvium derived from rhyodacitic ignimbrite. They are on old terraces. Slopes are 2 to 8 percent. The vegetation is pinon pine, Utah juniper, big sagebrush, bitterbrush, and miscellaneous grasses. Elevation ranges from 6,000 to 6,500 feet. The average annual precipitation is 10 to 12 inches, and the average

annual air temperature is 44° to 45° F. The frost-free season is 80 to 100 days.

In a representative profile the surface layer is grayish-brown stony sandy loam over dark grayish-brown gravelly sandy loam and is about 8 inches thick. The next layer is brown gravelly and cobbly sandy clay over very gravelly sandy clay and is about 21 inches thick. Below this is brown very gravelly coarse sandy loam over very gravelly loamy sand and is about 15 inches thick. It is underlain by a white strongly cemented, very gravelly hardpan that has many discontinuous, randomly oriented, thin silica laminae and extends to a depth of 60 inches or more.

Permeability is slow above the very slowly permeable hardpan in the Vicu soils. Available water capacity is very low. Effective rooting depth is 40 to 50 inches.

The Vicu soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Vicu stony sandy loam, 2 to 8 percent slopes, under native vegetation, approximately N quarter corner of sec. 36, T. 6 N., R. 69 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) stony sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine and common fine vesicular pores and many fine and few medium interstitial pores; many clean sand grains; neutral; abrupt, smooth boundary.
- A12—2 to 8 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; weak, fine and medium, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, common fine, and few medium roots; many very fine and fine interstitial pores and few fine tubular pores; neutral; abrupt, wavy boundary.
- IIB21t—8 to 22 inches, brown (7.5YR 5/4) gravelly sandy clay that has brown (7.5YR 4/4) coatings, brown (7.5YR 4/4) moist; massive; hard, friable, very sticky and very plastic; few very fine, fine, medium, and coarse roots; many very fine interstitial pores and few very fine and fine tubular pores; common fine and few moderately thick clay bridges between sand grains and in pores; 50 percent gravel and cobbles; neutral; clear, smooth boundary.
- IIB22t—22 to 29 inches, brown (7.5YR 5/4) very gravelly sandy clay, brown (7.5YR 4/4) moist; massive; hard, friable, very sticky and very plastic; few very fine, fine, and medium roots; many very fine interstitial pores and few very fine tubular pores; many thin and few moderately thick clay bridges between sand grains and coatings on pebbles and many thin clay films in pores; neutral; clear, smooth boundary.
- IIB31t—29 to 35 inches, brown (7.5YR 5/4) very gravelly coarse sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine interstitial pores; common thin and few moderately thick clay coatings and bridges between sand grains; neutral; clear, smooth boundary.
- IIB32tea—35 to 44 inches, brown (7.5YR 5/4) very gravelly loamy sand, brown (7.5YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, common fine, and few medium roots; many very fine and fine interstitial pores; common thin clay coatings on the base of gravel and few thin clay bridges between sand grains; few thin white (10YR 8/2) lime coatings on base of gravel in lower part of horizon; strongly effervescent; moderately alkaline; abrupt, wavy boundary.

IICsicam—44 to 60 inches, white (10YR 8/2), strongly cemented, very gravelly hardpan that has many discontinuous, randomly oriented, thin (1/64 to 1/8 inch thick) silica laminae, light gray (10YR 7/2) moist; massive; extremely hard and very firm; few very fine interstitial pores in strongly cemented material and many very fine and fine interstitial pores in other parts; horizon contains many pockets and strata of weakly cemented, slightly hard, friable, and brittle materials; violently effervescent; moderately alkaline.

The hardpan is at a depth of 40 to 50 inches. About 20 percent of the surface is covered by gravel and 2 to 3 percent of it by stones. The cumulative thickness of the Bt horizons is 30 to 46 inches. The B2t horizon is sandy clay or clay and occasionally clay loam. The content of gravel, cobbles, and stones ranges from 40 to 75 percent and averages 55 to 70 percent. The hardpan is extremely hard or very hard, and very firm or firm.

Vicu stony sandy loam, 2 to 8 percent slopes (VCC).—This soil is in a large, broad area on high alluvial terraces and fans. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Tica and Umil soils.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing and wildlife habitat. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 1f1; not assigned to a range site.

Vil Series

The Vil series consists of well-drained soils that are shallow to a hardpan. These soils formed in gravelly loamy alluvium derived mainly from ignimbrites. They are on dissected alluvial fans. Slopes are 2 to 8 percent. The vegetation is Utah juniper, pinon pine, black sagebrush, big sagebrush, squirreltail, and Indian ricegrass. Elevation ranges from 6,000 to 6,500 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 100 to 110 days.

In a representative profile the surface layer is grayish-brown gravelly loam about 3 inches thick. The next layer is grayish-brown gravelly loam about 4 inches thick over brown gravelly heavy sandy clay loam that has a thin lime coating on the undersides of pebbles and is about 5 inches thick. Below this is white, weakly cemented gravelly loam about 5 inches thick. Next is a white, strongly cemented hardpan about 5 inches thick. Below this layer is white gravelly loamy sand about 10 inches thick. Next is a white, strongly cemented hardpan about 16 inches thick. This pan is underlain by light-gray very coarse sand that is very gravelly and extends to a depth of 60 inches or more.

Permeability is moderately slow above the very slowly permeable hardpan in the Vil soils. Available water capacity is very low. Effective rooting depth is 15 to 20 inches.

The Vil soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Vil gravelly loam, 2 to 8 percent slopes, under native vegetation, 660 feet north

and 660 feet west of the SE. corner of sec. 2, T. 2 S., R. 69 E., Mount Diablo baseline and meridian:

- A1—0 to 3 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and common medium vesicular pores and many fine and very fine tubular pores; mildly alkaline; clear, smooth boundary.
- B1—3 to 7 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) moist; moderate, fine, granular structure; slightly hard, friable, sticky and plastic; many fine and very fine and common medium roots; many fine and very fine interstitial and tubular pores; mildly alkaline; clear, smooth boundary.
- B2t—7 to 12 inches, brown (10YR 4/3) gravelly heavy sandy clay loam, dark brown (10YR 3/4) moist; massive; hard, friable, very sticky and very plastic; many fine and very fine and common medium and coarse roots; many micro, very fine, and fine and few medium tubular pores; few thin clay bridges between sand grains and coatings on sand grains; noneffervescent in upper part but strongly effervescent in lower part; pebbles have thin lime coatings on undersides; mildly alkaline; clear, wavy boundary.
- C1sica—12 to 17 inches, white (10YR 8/2) gravelly loam, very pale brown (10YR 7/3) moist; massive; hard, firm, slightly sticky and slightly plastic; weakly silica and lime cemented; many fine and few fine roots; many very fine and few fine tubular pores; very thin ($\frac{1}{16}$ inch or less), discontinuous silica laminae that fracture easily; few tongues of B2t material in fractures and seams; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- C2sica—17 to 22 inches, white (10YR 8/1) strongly cemented hardpan that has many very pale brown (10YR 7/3), continuous, horizontal, $\frac{1}{16}$ inch to $\frac{1}{8}$ inch, indurated silica laminae; light gray (10YR 7/2) moist; massive but appearing as thick plates; extremely hard and extremely firm; many very fine and fine roots matted on plate surfaces; few very fine and fine tubular pores and many micro interstitial pores; many very thin silica laminae lining tubular pores and common very thin silica bridges between sand grains; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- C3sica—22 to 32 inches, white (10YR 8/2) gravelly loamy sand that is mostly weakly silica and lime cemented but contains pockets that are strongly cemented and that has many very thin ($\frac{1}{16}$ inch or less), very pale brown (10YR 7/3), continuous horizontal and discontinuous diagonal indurated silica laminae; light gray (10YR 7/2) and pale brown (10YR 6/3) moist; massive; hard and extremely hard, firm and extremely firm, nonsticky and nonplastic; few fine and very fine roots, mostly matted on indurated laminae surfaces; many very fine and micro and few fine interstitial pores; gravel and cobbles thickly silica and lime coated; violently effervescent; strongly alkaline; gradual, wavy boundary.
- IIC4sica—32 to 48 inches, white (10YR 8/2), strongly cemented hardpan that has few very thin ($\frac{1}{16}$ inch or less) continuous indurated silica laminae, light gray (10YR 7/2) moist; massive; very hard and extremely hard, very firm and extremely firm; few fine and very fine roots; many very fine and micro and few fine interstitial pores; upper and lower part of horizon are more strongly cemented than midsection; pebbles thickly silica and lime coated; violently effervescent; strongly alkaline; abrupt, wavy boundary.
- IIC5—48 to 60 inches, light-gray (10YR 7/2) very gravelly very coarse sand, yellowish brown (10YR 5/4) moist; single grained; loose; many fine and very fine roots; many fine and very fine interstitial pores; slightly effervescent with some pebbles hav-

ing thin lime and silica coatings; strongly alkaline; abrupt, smooth boundary.

The hardpan is at a depth of 15 to 20 inches. About 30 percent of the surface is covered by gravel. Also, a few cobbles are on the surface. The B2t horizon is noneffervescent to strongly effervescent and is dominantly sandy clay loam. It is light clay loam or heavy loam in places and is modified by 15 to 35 percent gravel and cobbles. This horizon is massive or has weak or moderate, fine or medium, prismatic or subangular blocky structure. The hardpan contains strata of variably cemented material ranging from indurated to weakly cemented. The continuous silica laminae are as much as 5 millimeters thick. The gross thickness of the hardpan is 20 to 40 inches and includes as much as 20 inches of weakly cemented materials in places.

Vil gravelly loam, 2 to 8 percent slopes (VGC).—This soil is in a large area on high dissected terraces in the central part of the survey area.

Included with this soil in mapping, and making up about 5 percent of the mapped acreage, are areas of Acana soil. Also included are some areas of alluvial soil material.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing, wildlife habitat, and watershed. Dryland capability subclass VII_s; dryland wildlife suitability group 324; woodland suitability group 2d1; not assigned to a range site.

Wilpar Series

The Wilpar series consists of deep, well-drained soils that formed in residuum that has minor amounts of colluvium weathered from rhyodacitic ignimbrite. They are on mountain faces. Slopes are 30 to 50 percent. The vegetation is pinon pine, Utah juniper, mountain-mahogany, big sagebrush, and miscellaneous grasses. Elevation ranges from 6,800 to 7,800 feet. The average annual precipitation is 14 to 16 inches, and the average annual air temperature is 42° to 43° F. The frost-free season is less than 60 days.

In a representative profile the surface layer is grayish-brown very stony sandy loam over a dark grayish-brown gravelly heavy sandy loam. It is about 5 inches thick. Below this is brown gravelly sandy clay over gravelly clay. These layers are about 11 inches thick. The next layer is light-brown very gravelly clay that is 70 percent gravel and cobbles and is about 10 inches thick. The layer below it is pale-brown very gravelly sandy clay that is over light yellowish-brown very gravelly sandy clay loam. This material is about 75 percent weathered coarse fragments and is about 32 inches thick. It is underlain by white and light-gray very gravelly coarse sandy clay loam that has highly weathered ignimbrite bedrock with the original rock structure. The layer extends to a depth of 60 inches or more.

Permeability is slow in the Wilpar soils. Available water capacity is low. Effective rooting depth is 60 inches or more.

The Wilpar soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Wilpar very stony sandy loam, 30 to 50 percent slopes, under native vegetation,

1,300 feet north, and 1,700 feet east of the south quarter corner of sec. 8, T. 5 N., R. 68 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) very stony sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and slightly plastic; few very fine roots; many very fine and fine interstitial pores; neutral; abrupt, smooth boundary.
- A12—2 to 5 inches, dark grayish-brown (10YR 4/2) gravelly heavy sandy loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine interstitial pores; neutral; clear, wavy boundary.
- B1t—5 to 10 inches, brown (7.5YR 4/3) gravelly sandy clay, dark brown (10YR 3/3) moist; moderate, medium and fine, subangular blocky structure; slightly hard, very friable, very sticky and very plastic; many very fine, common fine, and few medium roots; common very fine interstitial pores and few very fine tubular pores; common moderately thick clay bridges between sand grains; 40 percent gravel and cobbles; neutral; clear, wavy boundary.
- B21t—10 to 16 inches, brown (7.5YR 5/4) gravelly clay, brown (7.5YR 4/4) moist; weak, medium and coarse, subangular blocky structure; hard, friable, very sticky and very plastic; many very fine and few fine and medium roots; many very fine and fine interstitial pores and few very fine tubular pores; many thin and few moderately thick clay bridges between sand grains and continuous moderately thick clay films in pores; 40 percent gravel and cobbles; neutral; clear, wavy boundary.
- B22t—16 to 26 inches, light-brown (7.5YR 6/4) gravelly clay that has brown (7.5YR 5/4) clay films, brown (7.5YR 5/4) moist; massive; very hard, friable, very sticky and very plastic; many very fine and few fine and medium roots; many very fine interstitial pores and few very fine and fine tubular pores; few thin and many moderately thick clay bridges between sand grains and coatings in pores; 70 percent gravel and cobbles; neutral; abrupt, wavy boundary.
- B31t—26 to 43 inches, pale-brown (10YR 6/3) very gravelly sandy clay, brown (7.5YR 5/4) moist; massive; very hard, friable, very sticky and very plastic; many very fine and few fine and medium roots; many very fine interstitial pores and few very fine and fine tubular pores; common thin and moderately thick strong-brown (7.5YR 5/6) clay bridges between sand grains; 75 percent gravel and cobbles; neutral; abrupt, wavy boundary.
- B32t—43 to 58 inches, light yellowish-brown (10YR 6/4) very gravelly sandy clay loam, brown (7.5YR 5/4) moist; massive; hard, friable, sticky and plastic; few very fine and fine roots; many very fine and fine tubular pores; common thin and few moderately thick clay bridges between sand grains; 75 percent gravel and cobbles; neutral; gradual, wavy boundary.
- C—58 to 60 inches, white (10YR 8/1) and light-gray (10YR 7/2) very gravelly coarse sandy clay loam, light gray (10YR 7/1) and very pale brown (10YR 7/3) moist; massive; hard, friable, sticky and plastic; few medium roots; common very fine interstitial pores; highly weathered ignimbrite bedrock that has original rock structure; common, thin yellowish-brown (10YR 5/6) clay films coating pebbles; mildly alkaline.

The bedrock is at a depth of 52 to 68 inches. About 20 percent of the surface is covered by gravel, and 5 percent is covered by stones. Also, a few cobbles are on the surface. The Bt horizon has cumulative thickness of 40 to 56 inches. The upper 20 inches of the Bt horizon is 35 to 50 percent

clay. There are 40 to 50 percent gravel cobbles to a depth of about 18 inches and 50 to 75 percent below a depth of 18 inches. The B2t horizon is dominantly gravelly clay but is heavy clay loam or sandy clay modified by gravel and cobbles in some places.

Wilpar very stony sandy loam, 30 to 50 percent slopes (WMF).—This soil is in a large area on mountain faces in the north-central part of the survey area.

Included with this soil in mapping, and making up about 20 percent of the mapped acreage, are areas of Tica and Hamtah soils. Also included are some areas where volcanic rock crops out.

Runoff is medium or rapid, and the hazard of erosion is moderate or severe.

This soil is not suitable for irrigated crops. It is used for grazing, wildlife habitat, and watershed. Dryland capability subclass VII_s; dryland wildlife suitability group 334; woodland suitability group 2x1; not assigned to a range site.

Winu Series

The Winu series consists of moderately deep, well-drained soils that formed in residuum weathered from rhyodacitic ignimbrite. They are on mountain faces. Slopes are 15 to 75 percent. The vegetation is low sagebrush, big sagebrush, bitterbrush, serviceberry, mountainmahogany, manzanita, and various grasses. Elevation ranges from 7,600 to 9,200 feet. The average annual precipitation is 14 to 20 inches, and the average annual air temperature is 40° to 43° F. The frost-free season is 40 to 50 days.

In a representative profile the surface layer is dark-gray very stony loam over very dark grayish-brown gravelly clay loam about 9 inches thick. The next layer is brown gravelly heavy clay loam about 13 inches thick. The next layer is light-brown sandy loam about 11 inches thick. Below this is brown loam about 5 inches thick resting on pinkish-gray hard bedrock at a depth of 38 inches.

Permeability is moderately slow in the Winu soils. Available water capacity is very low. Effective rooting depth is 24 to 40 inches.

The Winu soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Winu very stony loam, 15 to 30 percent slopes, in an area of Winu-Rock outcrop association, 600 feet south and 600 feet west of the NE. corner of sec. 3, T. 4 N., R. 68 E., Mount Diablo baseline and meridian:

- A11—0 to 2 inches, dark-gray (10YR 4/1) very stony loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to moderate very fine granular; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; neutral; clear, smooth boundary.
- A12—2 to 9 inches, very dark grayish-brown (10YR 3/2) gravelly clay loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine, common fine, and few medium roots; many very fine and fine and common medium tubular pores; neutral; clear, smooth boundary.
- B2t—9 to 22 inches, brown (7.5YR 4/2) gravelly heavy clay loam, speckled by brown (7.5YR 5/3), very

dark brown (7.5YR 2/2) moist; strong, medium and fine, subangular blocky structure; hard, friable, very sticky and plastic; many very fine, common fine, and few medium and coarse roots; many very fine and fine interstitial and tubular pores; many thin clay films on ped faces and continuous thin clay films in pores; many, medium and coarse, black (10YR 2/1) pieces of charcoal and charcoal stains; slightly acid; gradual, irregular boundary.

B31t—22 to 33 inches, light-brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; many, medium, faint pink (7.5YR 8/4) spots; massive; slightly hard, very friable, sticky and slightly plastic; many very fine and few fine roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; common thin clay films as bridges between sand grains and in pores; slightly acid; abrupt, wavy boundary.

B32t—33 to 38 inches, brown (7.5YR 5/4) loam, strong brown (7.5YR 4/6) moist; massive; hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores and common very fine tubular pores; common thin clay bridges between sand grains; ½- to 1-inch thick diagonal band of gray (10YR 5/1) material; slightly acid; abrupt, wavy boundary.

R—38 inches, pinkish-gray (7.5YR 7/2) bedrock that has brown (7.5YR 5/4) clay films in cracks.

The hard bedrock is at a depth of 24 to 40 inches. About 20 percent of the surface is covered by gravel, and about 10 percent of it is covered by stones. Also, a few cobbles are on the surface. The thickness of the Bt horizon is 18 to 29 inches. Its upper 20 inches is 20 to 30 percent clay and 15 to 35 percent gravel and cobbles. The B2t horizon is gravelly clay loam or gravelly sandy clay loam that is 20 to 50 percent gravel and some cobbles.

Winu extremely stony loam, 50 to 75 percent slopes (WNG).—This soil is in large, broad areas on very steep mountain faces in the north-central part of the survey area. It has a profile similar to that described as representative of the series, but the surface is extremely stony, and this soil has very steep slopes. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Udel soils and other Winu soils. Also included are some areas of Rock outcrop.

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

This soil is not suitable for irrigated crops. It is used mainly for grazing, wildlife habitat, and watershed. Dryland capability subclass VIIIs; range site NV 28-50; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Winu-Rock outcrop association (WR).—This association is in large, broad areas on mountain faces in the north-central part of the survey area. It is about 30 percent Winu very stony loam, 15 to 30 percent slopes; 30 percent Winu extremely stony loam, 30 to 50 percent slopes; and 20 percent Rock outcrop. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Nevta, Udel, and Winz soils.

The moderately steep Winu soil differs from other soils in the mapping unit by its position on the less sloping landscape in the survey area. It has the profile described as representative of the series. Runoff is medium, and the hazard of erosion is moderate.

The steep Winu soil differs from other soils in the mapping unit by its position on the steeper landscape. It has a profile similar to that described as representa-

tive of the series, but it is extremely stony. Runoff is rapid, and the hazard of erosion is severe.

The Rock outcrop is scattered throughout in small and large areas.

This association is not suitable for irrigated crops. It is used for grazing, wildlife habitat, and watershed. Winu very stony loam, 15 to 30 percent slopes, and Winu extremely stony loam, 30 to 50 percent slopes, in dryland capability subclass VIIIs; range site NV 28-50; dryland wildlife suitability group 3-42. Rock outcrop in dryland capability subclass VIIIs; not assigned to a range site, wildlife suitability group, or woodland suitability group. Neither of the Winu parts assigned to a woodland suitability group.

Winz Series

The Winz series consists of deep, well-drained soils that formed in colluvium and residuum weathered from rhyodacitic ignimbrite. They are on mountain faces. Slopes are 30 to 75 percent. The vegetation is balsam white fir, Douglas-fir, manzanita, serviceberry, various grasses, and a few scattered ponderosa pine. Elevation ranges from 7,800 to 9,200 feet. The average annual precipitation is 16 to 24 inches, and the average annual air temperature is 38° to 41° F. The frost-free season is 40 to 50 days.

In a representative profile a 4-inch layer of very dark brown duff is on the surface. The surface layer is light brownish-gray very stony sandy loam about 5 inches thick. The next layer is light-gray very gravelly coarse sandy loam that is about 70 percent coarse fragments and is about 18 inches thick. Below this is light-gray very gravelly clay that is about 85 percent coarse fragments and is about 13 inches thick. The next layer is light-gray extremely cobbly clay that is about 95 percent coarse fragments. It extends to a depth of at least 60 inches.

Permeability is moderately slow in the Winz soils. Available water capacity is very low to low. Effective rooting depth is 54 inches or more.

The Winz soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Winz very stony sandy loam, 30 to 50 percent slopes, in an area of Winz association, at the approximate NW. corner of sec. 22, T. 5 N., R. 68 E., Mount Diablo baseline and meridian:

O1—4 inches to 0, very dark brown (7.5YR 2/2) duff layer of mahogany leaves, black (7.5YR 2/0) moist; massive; soft and very friable; slightly acid; abrupt, smooth boundary.

A1—0 to 5 inches, light brownish-gray (10YR 6/2) very stony sandy loam that has many medium and coarse faint grayish-brown (10YR 5/2) stains, dark grayish brown (10YR 3/2) moist; weak, fine and medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and many fine, medium, and coarse roots; many fine and very fine and few medium interstitial pores; slightly acid; gradual, wavy boundary.

A2—5 to 23 inches, light-gray (10YR 7/1) very gravelly coarse sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; many fine and very fine and few medium and coarse roots; many very fine and fine interstitial pores and common fine and few medium tubular pores; 70 percent gravel, cobbles,

and stones; slightly acid; gradual, irregular boundary.

- B21t—23 to 36 inches, light-gray (10YR 7/2) very gravelly clay, brownish gray (10YR 6/2) moist; massive; slightly hard, very friable, very sticky and very plastic; many very fine, common fine, and few medium and coarse roots; many very fine and fine interstitial pores and few fine and medium tubular pores; many moderately thick and few thick light yellowish-brown (10YR 6/2) clay coatings on pebbles and few thin clay bridges between sand grains; 85 percent gravel, cobbles, and stones; slightly acid; gradual, irregular boundary.
- B22t—36 to 60 inches, light-gray (10YR 7/2) extremely cobbly clay, light brownish gray (10YR 6/2) and brown (10YR 4/3) moist; massive; slightly hard, very friable, very sticky and very plastic; many fine, common medium, and few very fine and coarse roots; many very coarse tubular pores; many moderately thick and few thick and thin light yellowish-brown (10YR 6/4) clay coatings on pebbles; 95 percent gravel, cobbles, and stones; slightly acid.

The depth of soil is 65 inches or more. The A1 horizon has weak, very fine to medium, subangular blocky or granular structure. The lower boundary of the A2 horizon is clear or gradual. The B2t horizon is clay modified by 75 to 90 percent gravel, cobbles, and stones. It has thin, medium, or thick continuous clay film coatings on most of the pebbles, cobbles, and stones.

Winz association (WS).—This association is in small, scattered areas on high mountains in the north-central part of the survey area. It is about 45 percent Winz very stony sandy loam, 30 to 50 percent slopes, and 45 percent Winz extremely stony sandy loam, 50 to 75 percent slopes. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of Rock outcrop.

The steep Winz soil differs from other soils in the mapping unit by its position on the less steep slopes. It has the profile described as representative of the series. Runoff is medium, and the hazard of erosion is moderate.

The very steep Winz soil differs from other soils in the mapping unit by its position on the steeper slopes. It has a profile similar to that described as representative of the series except for an extremely stony surface layer. Runoff is rapid, and the hazard of erosion is severe.

This association is not suitable for irrigated crops. It is used mainly for grazing, wildlife habitat, and watershed. Dryland capability subclass VII_s; dryland wildlife suitability group 324. Not assigned to a range site or woodland suitability group.

Zoate Series

The Zoate series consists of shallow, well-drained soils that formed in residuum weathered mainly from volcanic rock, but they have been influenced somewhat by pyroclastic materials. They are on foothill faces and mountains. Slopes are 4 to 50 percent. The vegetation is black sagebrush, big sagebrush, squirreltail, needleandthread, and some scattered Utah juniper. Elevation ranges from 5,000 to 6,200 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 49° to 53° F. The frost-free season is 100 to 120 days.

In a representative profile the surface layer is

grayish-brown cobbly loam about 2 inches thick. The next layer is brown gravelly heavy clay loam about 3 inches thick. Below it is gravelly clay over gravelly heavy clay loam that is about 30 to 40 percent gravel and is about 8 inches thick. It is underlain by light-gray indurated silica laminae capping white strongly cemented material that is about 1 inch thick and rests on volcanic bedrock at a depth of 14 inches.

Permeability is slow in Zoate soils. Available water capacity is very low to low. Effective rooting depth is 13 to 20 inches.

The Zoate soils are used mainly for grazing, wildlife habitat, and watershed.

Representative profile of Zoate cobbly loam, 15 to 50 percent slopes, in an area of Zoate-Rock outcrop association, 1,300 feet west of the NE. corner of sec. 35, T. 1 S., R. 68 E., Mount Diablo baseline and meridian:

- A1—0 to 2 inches, grayish-brown (10YR 5/2) cobbly loam, dark brown (10YR 3/3) moist; weak, medium, platy structure; soft, very friable, slightly sticky and slightly plastic; common fine interstitial pores; 20 percent cobbles and 20 percent gravel; neutral; abrupt, smooth boundary.
- B1—2 to 5 inches, brown (10YR 5/3) gravelly heavy clay loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky; slightly hard, friable, very sticky and very plastic; common fine roots; common fine tubular pores; 20 percent gravel; violently effervescent pendants on underside of pebbles; mildly alkaline; abrupt, wavy boundary.
- B21t—5 to 8 inches, brown (10YR 4/3) gravelly clay, dark brown (10YR 3/3) moist; weak, medium, prismatic structure; slightly hard, friable, very sticky and very plastic; common fine and many medium roots; common fine tubular pores; few thin clay films on ped faces; 35 percent gravel; mildly alkaline; abrupt, wavy boundary.
- B22t—8 to 13 inches, brown (10YR 4/3) gravelly heavy clay loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to strong, fine, subangular blocky; slightly hard, friable, very sticky and plastic; common fine roots; common fine tubular pores; common thin clay films on ped faces and in pores; 40 percent gravel; mildly alkaline; abrupt, irregular boundary.
- Csicam—13 to 14 inches, thin ($\frac{1}{8}$ to $\frac{1}{16}$ inch), light-gray (10YR 7/1), indurated silica laminae capping white (10YR 8/1), strongly cemented material which is light gray (10YR 7/2) moist.
- R—14 inches, bedrock.

Bedrock is at a depth of 13 to 20 inches. About 20 percent of the surface is covered by gravel, and 30 percent is covered by cobbles. Also, few stones are on the surface. The B2t horizon is clay loam or clay that is 35 to 45 percent clay and 35 to 50 percent gravel and cobbles. The duripan ranges from thin, indurated silica laminae capping a few inches of strongly cemented materials to thin, indurated silica laminae capping bedrock.

Zoate cobbly loam, 15 to 50 percent slopes (ZOF).—This soil is in large, broad and small, narrow areas on foothill and mountain slopes in the central part of the survey area. It has the profile described as representative of the series. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Kyler soils, soils similar to Zoate soils, and Rock outcrop.

Runoff is medium or rapid, and the hazard of erosion is moderate or severe.

This soil is not suitable for irrigated crops. It is used mainly for grazing, wildlife habitat, and watershed. Dryland capability subclass VII_e; range site NV

28-42; dryland wildlife suitability group 3-42; not assigned to a woodland suitability group.

Zoate-Rock outcrop association (ZR).—This association is in large, broad areas on foothills and mountain faces in the southwestern part of the survey area. It is about 40 percent Zoate stony loam, 15 to 50 percent slopes; 20 percent Zoate cobbly loam, 4 to 15 percent slopes; and 30 percent Rock outcrop. Included in mapping, and making up about 10 percent of the mapped acreage, are areas of soils similar to the Zoate soils.

The moderately steep to steep Zoate soil differs from other soils in the mapping unit by its position in areas of steeper landscape. It has a profile similar to that described as representative of the series, but it is 3 to 5 inches shallower to bedrock and has Class 2 and 3 stoniness. Runoff is rapid, and the hazard of erosion is severe.

The moderately sloping to strongly sloping Zoate soil differs from other soils in the mapping unit by its position in areas of less sloping landscape. It has the profile described as representative of the series, but is as much as 20 inches deep to bedrock. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrop is in small areas scattered throughout both Zoate parts of the association.

This association is not suitable for irrigated crops. It is used mainly for grazing, wildlife habitat, and watershed. Zoate stony loam, 15 to 50 percent slopes, in dryland capability subclass VII_s; range site NV 28-42; dryland wildlife suitability group 3-42. Zoate cobbly loam, 4 to 15 percent slopes, part in dryland capability subclass VII_s; range site NV 28-42; dryland wildlife suitability group 4-43. Rock outcrop part in dryland capability subclass VIII_s; not assigned to a range site, wildlife suitability group, or woodland suitability group. Neither Zoate part assigned to a woodland suitability group.

Use and Management of the Soils

In this section the use and management of soils in the survey area are discussed, and the system of capability classification used by the Soil Conservation Service is explained. The soils are then placed into capability groups, and the general management for each group is discussed. Estimated average yield per acre is given for selected arable soils under one level of management. Management of range, wildlife habitat, and woodland is discussed in this section, and engineering interpretations are given. Use of the soils for recreational development also is discussed.

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 landforming that would change slope, depth, or other characteristics of the soils; does not

take into consideration possible but unlikely major reclamation projects; and does not apply to 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.

The soils of the Meadow Valley Area have limitations because of drainage, concentrations of soluble salts, flooding, and other factors related to temporary uses. These limitations are considered in the capability grouping. Also considered is the irrigation needed by cultivated crops and pasture crops in the survey area because of insufficient rainfall.

In the capability system, the kinds of soils are grouped at three levels: the capability class, subclass, and unit. All soils that are irrigated or suitable for irrigation in the survey area are in capability units. Those that are not suitable for irrigated crops, but are used for trees and range, are not in capability units. These soils are in capability subclasses only, and information about their use and management is given in the sections on woodland and range. The capability class, subclass, and unit are explained 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 Meadow Valley 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 not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in the Meadow Valley Area.)
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter *e*, *w*, *s*, or *c*, to the class numeral, for example, II_w. 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 corrected or improved by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, stony, slowly permeable, or salty (in some salty soils the salts can be removed or reduced); and *c* 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 or no limitations. Class V can contain, at most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely to pasture, range, wildlife habitat, and 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, IIw-1 or IIc-1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability subclasses and units

In the following pages the capability subclasses and units in the Meadow Valley Area are described, and suggestions for the use and management of the soils are given. Descriptions for each subclass and unit include the general characteristics of the soils in the subclass and unit, the suitability of these soils for crops, and management appropriate for the soils. The capability subclass and unit designations for each soil in the survey area can be found in the section "Descriptions of the Soils" or in the "Guide to Mapping Units" at the back of this publication.

IRRIGATED CAPABILITY UNIT IIw-61

This capability unit consists of moderately well drained, very deep, nearly level, slightly saline soils that have a medium-textured surface layer and a stratified, medium-textured and moderately coarse textured subsoil and substratum. Slopes range from 0 to 2 percent. Yearly precipitation is 8 to 12 inches, and the frost-free season is 100 to 130 days.

Permeability is moderate and moderately slow. Runoff is slow. The hazard of accelerated erosion is slight. Available water capacity is moderate to very high. Effective rooting depth is 60 inches. In some areas the seasonal high water table fluctuates and is at as shallow a depth as 4 feet. The soils are subject to infrequent flow in some areas.

The soils of this unit are used for producing alfalfa, grazing, and wildlife habitat. They are suitable for all climatically adapted crops. These soils are limited for

deep-rooted crops by the fluctuating high water table.

Adequate water management helps prevent a high water table. Good management that includes land smoothing or leveling is needed on the soils of this unit to facilitate surface irrigation. Fertilization is necessary to maintain a reasonable level of crop production. The use of green manure, crop residues, and other organic matter helps develop and maintain favorable soil structure, tilth, and the water infiltration rate.

IRRIGATED CAPABILITY UNIT IIc-1

This capability unit consists of well-drained, very deep, nearly level soils that have a medium-textured and moderately coarse textured surface layer and a stratified, medium-textured and moderately coarse textured subsoil and substratum. Slopes range from 0 to 2 percent. Precipitation is 8 to 12 inches, and the frost-free season is 100 to 130 days.

Permeability is moderate. Runoff is slow to medium. The hazard of accelerated erosion is slight. Available water capacity is moderate to high. Effective rooting depth is 60 inches. Seasonal high water table is below a depth of 10 feet. In a few small areas, soils of this capability unit are subject to occasional flooding.

The soils of this unit are used mainly for production of alfalfa and for grazing. They are potentially suitable for alfalfa, grain, pasture grasses, and all other climatically adapted crops when irrigation water is made available.

Good management that includes land smoothing or leveling, proper water management, and fertilization is needed.

IRRIGATED CAPABILITY UNIT IIIe-20

This capability unit consists of well-drained, very deep, nearly level to gently sloping soils that have a medium-textured surface layer, subsoil, and substratum. Slopes range from 0 to 4 percent. Precipitation is 8 to 10 inches, and the frost-free season is 100 to 110 days.

Permeability is moderate. Runoff is slow and medium. The hazard of accelerated erosion is slight to moderate. Available water capacity is high. Effective rooting depth is 60 inches.

The soils of this unit are used mainly for grazing and wildlife habitat. They are potentially suitable for climatically adapted crops.

Good management that includes a fertilization program adequate to maintain the desired crop production level and controlled irrigation on the steeper slopes to reduce soil erosion is needed.

IRRIGATED CAPABILITY UNIT IIIe-25

This capability unit consists of well-drained, moderately deep to very deep, nearly level to moderately sloping soils that mostly have a medium-textured and moderately coarse textured, gravelly surface layer and a moderately coarse textured to moderately fine textured gravelly or gravel-free subsoil. The shallower soils are underlain by a silica-lime cemented hardpan. Slopes range from 0 to 8 percent. Precipitation is 8 to 12 inches, and the frost-free season is 100 to 130 days.

Permeability is slow to moderately rapid above the cemented hardpan. Runoff is slow to medium. The

hazard of accelerated erosion is slight to moderate. Available water capacity is low. Effective rooting depth is 20 inches to more than 60 inches.

The soils of this unit are used mainly for grazing and wildlife habitat. They are marginally suitable for irrigated crops if water is available. These soils are limited for most crops by low available water capacity and, where slopes are steeper, by the hazard of erosion.

Good management that includes land smoothing or leveling, cross-slope cultivation, and contour or sprinkler irrigation is needed on the soils of this unit, especially where slopes are steeper. Leveling cuts need to be kept to a minimum on the moderately deep soils. The use of green manure, crop residues, and other organic matter helps maintain favorable soil structure and tilth. Crops respond to applications of fertilizer, especially fertilizer that contains nitrogen.

IRRIGATED CAPABILITY UNIT IIIw-123

This capability unit consists of somewhat poorly drained, very deep, nearly level soils that have a sandy loam overwash and silty clay loam surface layer and moderately fine textured subsoil and substratum containing thin, medium and moderately coarse, discontinuous strata. Slopes range from 0 to 2 percent. Precipitation is 10 to 12 inches, and the frost-free season is 80 to 100 days.

Permeability is slow. Runoff is slow. The hazard of accelerated erosion is slight. Available water capacity is high to very high. Effective rooting depth is 60 inches. Seasonal high water table is at a depth of 5 feet to more than 6 feet. These soils are subject to infrequent flooding in places. Some areas have been drained by entrenchment of the creek channel.

The soils of this unit are used mainly for production of alfalfa and meadow grasses. They are potentially suitable for irrigated crops, including alfalfa, small grain, and grass pasture.

Good management that includes irrigation water management and drainage is needed on the soils of this unit. Maintenance of the existing channels is necessary to keep the water table at its present level. If this channel were to be back filled or dammed, a subsurface drainage system would be required.

IRRIGATED CAPABILITY UNIT IIIw-60

This capability unit consists of poorly drained, very deep, nearly level soils that are medium textured and moderately fine textured throughout. Some soils are weakly cemented by silica in part of the subsoil. Slopes range from 0 to 2 percent. Precipitation is 8 to 10 inches, and the frost-free season is 110 to 130 days.

Permeability is moderately slow. Runoff is slow. The hazard of accelerated erosion is slight. Available water capacity is high to very high. Effective rooting depth is 60 inches. Seasonal high water table rises to 1 to 2 feet. These soils are subject to frequent flooding. Some areas in virgin condition are salt and alkali affected.

The soils in this unit are used mainly for irrigated grass pasture in the cultivated areas and livestock grazing in the virgin areas. They are potentially suitable for most cultivated crops tolerant of a high ground-water table.

Good management is needed on soils of this unit. A

drainageway system is necessary to lower the ground-water table and maintain it at a constant level. Excess amounts of salts can be lessened when the water table has been lowered.

IRRIGATED CAPABILITY UNIT IIIs-41

This capability unit consists of well-drained, moderately deep, nearly level soils that have a gravelly, medium-textured surface layer; a moderately fine textured and fine textured subsoil; and an underlying strongly cemented hardpan. Slopes range from 0 to 2 percent. Yearly precipitation is 12 to 14 inches, and the frost-free season is 100 to 110 days.

Permeability is slow above the hardpan. Runoff is slow and medium. The hazard of accelerated erosion is slight. Available water capacity is low. Effective rooting depth is 28 to 35 inches.

The soils in this unit are used mainly for grazing and for wildlife habitat. They are suitable for range seeding and marginally suitable for irrigated crops.

Good management is needed on the soils of this unit to maintain or improve adequate plant cover. Good management that includes land smoothing or leveling is needed to facilitate irrigation water management, but must be limited because of the depth of soil. Sprinkler irrigation is well suited in areas of irregular slopes. The use of green manure and other plant residues helps improve and maintain soil structure, tilth, and permeability.

IRRIGATED CAPABILITY UNIT IIIs-45

This capability unit consists of well-drained, very deep soils that have a moderately coarse textured surface layer; a stratified, medium-textured and moderately coarse textured subsoil; and a stratified, medium-textured to coarse-textured substratum containing coarse fragments below a depth of 20 inches. Slopes range from 0 to 2 percent. Yearly precipitation is 8 to 12 inches, and the frost-free season is 80 to 130 days.

Permeability is moderate. Runoff is slow. The hazard of accelerated erosion is slight to moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches.

The soils in this unit are used mainly for grazing and wildlife habitat. They are potentially suitable for the production of irrigated crops if water becomes available.

Good management is needed on the soils of this unit to maintain or improve the present vegetative cover. Good management that includes land smoothing or leveling is needed to facilitate irrigation water management, but must be limited so as not to expose the underlying gravelly materials. The use of green manure and other crop residues helps improve and maintain soil structure, tilth, and permeability.

IRRIGATED CAPABILITY UNIT IIIs-115

This capability unit consists of well-drained, very deep, nearly level soils that have a medium-textured surface layer; a medium-textured and moderately fine textured subsoil; and a stratified, medium-textured and coarse-textured substratum that is weakly cemented with silica in the upper part. Slopes range from 0 to 2

percent. Precipitation is 10 to 12 inches, and the frost-free season is 80 to 100 days.

Permeability is slow. Runoff is slow. The hazard of accelerated erosion is slight. Available water capacity is moderate. Effective rooting depth is 60 inches.

The soils in this unit are used mainly for grazing and wildlife habitat. They are suitable for range seeding and marginally suitable for irrigated crops if irrigation water becomes available.

Good management that includes land smoothing or leveling to facilitate irrigation and irrigation water management to maintain adequate soil moisture for plant growth is needed on the soils of this unit. The use of green manure or other crop residues helps maintain favorable soil structure, tilth, plant nutrients, and infiltration rates.

IRRIGATED CAPABILITY UNIT IV_e-60

This capability unit consists of well-drained, very deep, nearly level to moderately sloping soils that have a medium-textured and moderately coarse textured surface layer and a medium-textured and moderately coarse textured subsoil and substratum containing some hard nodules. Slopes range from 0 to 8 percent. Precipitation is 8 to 12 inches, and the frost-free season is 40 to 100 days.

Permeability is moderate. Runoff is slow to medium. The hazard of accelerated erosion is slight to moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches.

The soils in this unit are used mainly for grazing and wildlife habitat. They are potentially suitable for irrigated pasture and grass hay.

Good management that includes land smoothing and leveling, crop selection, and controlled water application are needed to minimize erosion on soils of this unit that have steeper slopes.

IRRIGATED CAPABILITY UNIT IV_w-123

This capability unit consists of very poorly drained and poorly drained, very deep, nearly level soils that have a peat and moderately fine textured surface layer; a fine-textured and moderately fine textured subsoil; and a fine-textured substratum. Slopes range from 0 to 2 percent. Precipitation is 10 to 12 inches, and the frost-free season is 50 to 80 days.

Permeability is slow. Runoff is slow. The hazard of accelerated erosion is slight. Available water capacity is high to very high. Effective rooting depth is 60 inches. Seasonal high water table rises to 0 to 1.5 feet.

The soils in this unit are used mainly for irrigated grass meadows and hayland. They are potentially suitable for grass, hay, and pasture.

Good management, which includes irrigation water management, is needed on the soils of this unit. If the ground-water table is to be maintained at a lower level, a subsurface drainageway system is necessary. The concave, cross-sectional surface topography would facilitate drainage.

Included in this unit because of small area is the Four Star loam, 0 to 4 percent slopes. It is mostly moderately coarse textured, has a lower available water capacity, and in some places is moderately deep to rock.

DRYLAND CAPABILITY SUBCLASS VI_b

This capability subclass consists of well-drained, moderately deep to very deep, nearly level to moderately steep soils that have a gravelly, mostly cobbly or stony, moderately coarse textured to moderately fine textured surface layer. Some of the soils included are gravel free or have a loamy sand surface layer. Some of these soils are underlain by a silica and lime cemented hardpan or bedrock. Slopes range from 0 to 30 percent. Precipitation is 10 to 16 inches, and the frost-free season is 80 to 130 days.

Permeability is slow. Runoff is slow to rapid. The hazard of accelerated erosion is slight to severe. Available water capacity is low to moderate. Effective rooting depth is 28 inches to more than 60 inches.

The soils of this capability subclass are used mainly for grazing, wildlife habitat, and watershed.

Maintenance of an adequate plant cover is needed on the soils of this subclass. If the plant cover is depleted, the soils of this subclass can be seeded to adapted species.

DRYLAND CAPABILITY SUBCLASS VI_c

This capability subclass consists of well-drained, nearly level to moderately sloping soils that have a medium textured and moderately coarse textured surface layer, which is gravelly in places. Slopes range from 0 to 8 percent. Yearly precipitation is 8 to 12 inches, and the frost-free season is 40 to 130 days.

Permeability is moderate. Runoff is slow to medium. The hazard of accelerated erosion is slight to moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches.

The soils of this capability subclass are used mainly for grazing and wildlife habitat.

Good management is needed on the soils of this subclass to maintain or improve the vegetative stand. Many areas of these soils are suitable for range seeding if the native vegetation is depleted. Proper seedbed preparation and plant species selection is necessary because of the relatively low amount of annual precipitation.

DRYLAND CAPABILITY SUBCLASS VII_b

This capability subclass consists of well-drained, shallow to very deep, moderately steep and steep soils that have a gravelly or cobbly, moderately fine textured to moderately coarse textured surface layer. The shallower soils are underlain by strongly cemented or indurated silica and lime hardpans. Slopes range from 15 to 50 percent. Precipitation is 8 to 16 inches, and the frost-free season is 80 to 130 days.

Permeability is moderate to slow above the hardpan. Runoff is medium to rapid. The hazard of accelerated erosion is moderate to severe. Available water capacity is very low to moderate. Effective rooting depth is 14 to 60 inches.

The soils of this capability subclass are used mainly for grazing, wildlife habitat, and watershed.

Proper construction of roads and trails and proper management to maintain adequate vegetative cover to minimize erosion are needed on the soils of this subclass.

DRYLAND CAPABILITY SUBCLASS VII_w

This capability subclass consists of moderately well drained and somewhat poorly drained, very deep, nearly level and gently sloping soils that have a medium-textured and moderately fine textured surface layer and that are strongly saline and alkali affected. Slopes range from 0 to 2 percent. Yearly precipitation is 8 to 12 inches, and the frost-free season is 50 to 130 days.

Permeability is mostly very slow and slow but ranges to moderate. Runoff is slow. The hazard of accelerated erosion is slight. Available water capacity is high to very high. Effective rooting depth is 60 inches. The seasonal high water table is below a depth of 4 to 10 feet. Some areas are subject to occasional flooding.

The soils of this capability subclass are used mainly for grazing and wildlife habitat. They are not suitable for range seeding because of their saline and alkaline conditions.

Continuing or permanent limitations to the use of these soils are salt and alkali content, the high water table, and slow and very slow permeability. Good management is needed to maintain plant cover on these soils.

DRYLAND CAPABILITY SUBCLASS VII_s

This capability subclass consists of well-drained, very shallow to very deep, nearly level to very steep soils that have a gravelly, very gravelly, cobbly, stony, very stony, or extremely stony, moderately coarse textured to moderately fine textured surface layer. In places, however, the surface layer is not gravelly. The shallower soils are underlain by a silica-lime cemented hardpan or by bedrock. Slopes range from 0 to 75 percent. Precipitation is 8 to 24 inches, and the frost-free season is 40 to 130 days.

Permeability is moderately rapid to slow above the hardpan or bedrock. Runoff is slow to rapid. The hazard of accelerated erosion is slight to very severe. Available water capacity is very low to high. Effective rooting depth is 10 to more than 60 inches.

The soils of this capability subclass are used mainly for grazing, wildlife habitat, and watershed. The stony surface layer, low or very low available water capacity, or slope make them unsuitable for range seeding. They are limited for other uses by these characteristics and also by sparse rainfall in summer.

Good management is needed on the soils of this subclass to maintain or improve existing native plant cover and to minimize erosion. Roads and trails need to be properly constructed to minimize runoff and reduce possible soil losses through erosion.

DRYLAND CAPABILITY SUBCLASS VIII_s

This capability subclass consists of barren or nearly barren, highly variable soil material that exists mostly as severely eroded faces of alluvial terraces. Slopes range from steep to extremely steep except for the severely gullied land, which generally has gentle slopes. Yearly precipitation is 8 to 14 inches, and the frost-free season is 80 to 130 days. Runoff is very rapid. The hazard of erosion is very severe.

The soil material in this capability subclass has no value for irrigated crops. Its use is limited to esthetic purposes and limited wildlife habitat.

DRYLAND CAPABILITY SUBCLASS VIII_w

This capability subclass consists of land areas that are in drainageways and on their contiguous flood plains. It is mostly gravelly to very gravelly and cobbly, moderately coarse textured and coarse textured materials, but also contains gravelly and gravel-free, medium-textured material. Most of this subclass is subject to very frequent flooding. These areas are subjected to almost annual flooding. Also included are impounded mineral byproducts from processing mined ore and soil material that has been altered chemically by milling liquid wastes. These areas are devoid of vegetation.

The soils of this capability subclass are used mainly for wildlife habitat or have no use.

DRYLAND CAPABILITY SUBCLASS VIII_s

This capability subclass consists of barren exposures of bedrock and randomly mixed, very shallow or shallow soils over bedrock and associated rubble land occupying moderately steep to extremely steep canyon faces, hillsides, and mountainsides.

Runoff is rapid or very rapid. The hazard of erosion is severe.

The soils of this capability subclass are used mainly for wildlife habitat or esthetic purposes.

Estimated yields

Table 6 lists average yields per acre that can be expected under a moderately high level of management from selected soils in the survey area. In the Meadow Valley Area, this level of management is used in most of the cultivated fields but not in areas producing meadow vegetation. The estimates are based on data compiled by the Soil Conservation Service and the Cooperative Extension Service and on information obtained from some of the ranchers of the survey area.

Several important limitations should be kept in mind when using table 6.

1. The yield figures are estimates.
2. The estimates are of average yields that may be expected over a period of years. The yield in any given year may be higher or lower than this average, depending upon variations in the supply of irrigation water and in the length of the growing season.
3. Variations in yields exist among areas of the same soil.
4. Past management of a soil affects its response to new management practices.
5. New crop varieties and improved farming practices are likely to affect future yields.

Pasture yields indicated in table 6 are for improved varieties most suited to the soil type.

Use of the Soils for Range⁵

Range is land on which the climax, or natural potential, plant community is dominated by grasses, grasslike plants, forbs, and shrubs. Range is used pri-

⁵ By LENARD D. SMITH, district conservationist, with assistance from HARLAN G. ARNOLD and A. DEAN CHAMRAD, range conservationists.

TABLE 6.—Estimated average yields per acre of principal crops on selected irrigated soils

| Soil | Alfalfa | Wheat | Barley | Improved pasture | Native meadow hay |
|--|---------|-------|--------|------------------|-------------------|
| | Tons | Tons | Tons | AUM ¹ | Tons |
| Bicondoa sandy loam..... | 4.25 | | 1.5 | 12 | 1 |
| Bicondoa silty clay loam, drained..... | 4.5 | | 1.75 | 13 | 1.25 |
| Bicondoa complex | | | | | |
| Bicondoa silty clay loam, 0 to 2 percent slopes ² | | | | | 1.5 |
| Bicondoa peat, 0 to 2 percent slopes ² | | | | | 1 |
| Geer silt loam..... | 5 | 1.75 | 2 | 12 | |
| Geer silt loam, slightly saline..... | 4.5 | 1.75 | 1.75 | 13 | |
| Geer silt loam, strongly saline..... | | | 1 | 10 | |
| Geer silt loam, wet..... | | | 1.75 | 10 | 1.5 |
| Holtle loam, 0 to 8 percent slopes ³ | | 1.75 | 1.75 | 10 | |
| Pahrnanagat silt loam, drained, strongly saline..... | | | 1 | 12 | |
| Pahrnanagat silt loam, strongly saline..... | | | | | .75 |
| Pahrnanagat silty clay loam..... | | | | 12 | 1 |
| Pahrnanagat silty clay loam, drained..... | 5.5 | 2 | 2 | 14 | |
| Patter loam, 0 to 4 percent slopes ⁴ | 4 | 1.5 | 1.75 | 11 | |

¹ AUM = Animal unit month. The number of animals that can graze 1 acre for 1 month during the irrigation season without damage to the pasture.

² Part of the Bicondoa complex only.

³ Crop estimates are only for those soils that have slopes of 4 percent or less.

⁴ Part of the Patter-Gear association only.

marily for grazing by domestic livestock and wild herbivores. Properly managed range, however, also provides other benefits to society, including various wildlife habitat components, recreation, watershed, ground-water recharge, historic and cultural sites, natural areas, esthetic beauty, and clean air and water.

Range management is the science and art of manipulating range ecosystems to obtain optimum, sustained production of forage for livestock and wildlife, as well as other range products and values, while perpetuating the basic range resources.

Soils used for range have been grouped into range sites based upon climax or potential plant communities.

Range sites and condition classes

A range site is a distinctive kind of range that differs from other kinds of range in its potential to produce plants. It is a product of all the environmental factors including soil, temperature, precipitation, insulation, natural biotic influences, and any others that are responsible for its development.

Range condition is the present state of vegetation of a range site in relation to the climax or potential plant community for that site. The higher range condition classes reflect a plant species composition more similar to that of the original plant community than do the lower condition classes. Four range condition classes are recognized, based upon the percent by weight of the present vegetation that is climax for the site: *excellent*—76 to 100 percent of climax vegetation present; *good*—51 to 75 percent; *fair*—26 to 50 percent; and *poor*—0 to 25 percent. How a range has been managed in the past is reflected by its present vegetation.

Knowledge of the important range sites on a given land area and the range condition class of each site enables the land user to determine if that range is producing the optimum kinds and amounts of vegetation

for specific management objectives. He can then develop a sound management plan to meet his objectives.

Each range site in the Area is named and described briefly in terms of general soil characteristics influencing plant growth, general climate and topographic setting, and approximate climax, or potential, plant community. These include dominant aspect, major species composition, total annual yield, and major changes occurring in the plant community with deterioration. Significant management implications are briefly discussed where applicable, and soil taxonomic units comprising each site are listed.

The range site each soil of the survey area is in can be learned by referring to that soil in the section "Descriptions of the Soils" or the "Guide to Mapping Units" at the back of this survey.

RANGE SITE NV 28-37, DESERT GRAVELLY FANS

This site consists of soils on short alluvial fans. Elevation ranges from 4,400 to 5,200 feet. The average annual precipitation is 8 to 9 inches. Precipitation occurs throughout the year, but mostly late in summer and from midwinter to early in spring. The least amount of precipitation falls in May and June. Precipitation in July through September is 3 to 4 inches and usually occurs during high-intensity convection storms. The average annual air temperature is 48° to 52° F. The frost-free season is 110 to 130 days.

The soils in this site are well drained. They have a light brownish-gray, gravelly, moderately coarse textured surface layer and a very pale brown, very gravelly, stratified moderately coarse textured and coarse textured subsoil. Slopes range from 2 to 8 percent.

Permeability is moderately rapid. Runoff is slow to medium. The hazard of erosion is slight to moderate. Available water capacity is low.

The dominant vegetation on this site is Indian ricegrass, black sagebrush, and some other shrubs and grasses. The approximate composition, by weight, of the potential plant community is 10 to 15 percent Indian ricegrass, 5 to 15 percent black sagebrush, 0 to 15 percent winterfat, 5 to 10 percent galleta, 3 to 8 percent bud sagebrush, 3 to 6 percent sand dropseed, 1 to 5 percent perennial forbs, 1 to 5 percent squirreltail, 0 to 5 percent low rabbitbrush, 0 to 5 percent Nevada ephedra, 0 to 5 percent fourwing saltbush, 1 to 4 percent needleandthread, 1 to 3 percent annual forbs, 0 to 3 percent desert barberry, 1 to 2 percent spiny hopsage, and 0 to 2 percent blue grama.

As range condition deteriorates, black sagebrush, winterfat, low rabbitbrush, needleandthread, and blue grama increase, and fluffgrass, halogeton, and Russian-thistle invade the site. When this site is in poor condition, black sagebrush, low rabbitbrush, Russian-thistle, and other annuals dominate.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 350 pounds per acre in favorable years and 100 pounds in unfavorable years. Annuals make up about one-third of the yield increase in favorable years.

This site is not suitable for range seeding because of inadequate precipitation and the low available water capacity of the soils. A suitable system of grazing management is necessary to improve and maintain good range condition.

RANGE SITE NV 28-38, DESERT SHALLOW TERRACES

This site consists of soils on terraces. Slopes are 0 to 4 percent. Elevation ranges from 4,800 to 5,800 feet. The average annual precipitation is 7 to 8 inches. Some precipitation falls throughout the year, mostly late in summer and in midwinter to early in spring. The least amount falls in May and June. Precipitation in July through September is 3 to 4 inches and usually occurs during high-intensity convection storms. The average annual air temperature is 49° to 53° F. The frost-free season is 100 to 130 days.

The soils in this site are well drained. They have a light-gray to pale-brown, medium-textured surface layer and a pale-brown and light-gray, medium-textured subsoil that grades to a white, gravelly, moderately coarse textured material. A white and light-gray, silica-lime cemented hardpan is at a depth of about 28 to 40 inches.

Permeability is very slow in the soils of this site. Runoff is slow to medium. The hazard of erosion is slight. Available water capacity is low.

The dominant vegetation on this site is shadscale, bud sagebrush, fourwing saltbush, and other shrubs and Indian ricegrass, sand dropseed, and galleta. The approximate composition, by weight, of the potential plant community is 0 to 2 percent blue grama, 3 to 8 percent galleta, 2 to 6 percent squirreltail, 5 to 10 percent Indian ricegrass, 4 to 8 percent needleandthread, 5 to 10 percent sand dropseed, 2 to 8 percent perennial forbs, 10 to 30 percent shadscale, 10 to 15 percent fourwing saltbush, 10 to 20 percent bud sagebrush, 5 to 10 percent spiny hopsage, 1 to 5 percent Nevada ephedra, 5 to 15 percent winterfat, 1 to 5 percent

low rabbitbrush, and 2 to 10 percent annual grasses and forbs.

As range condition deteriorates, blue grama, galleta, bud sagebrush, spiny hopsage, and winterfat decrease, and Indian ricegrass, squirreltail, and sand dropseed initially increase and then decrease. With continued deterioration shadscale, low rabbitbrush, and annuals increase, and horsebrush, Russian-thistle, and broom snakeweed invade the site. When the site is in poor condition, low rabbitbrush, snakeweed, Russian-thistle, and other annuals dominate.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 350 pounds per acre in favorable years and 125 pounds in unfavorable years.

This site is not suitable for range seeding because of inadequate precipitation and the low available water capacity of the soils. A suitable system of grazing management is necessary to improve and maintain good range condition.

RANGE SITE NV 28-39, SEMIDESERT LIMESTONE HILLS

This site consists of soils on low mountain faces. Slopes are 15 to 30 percent. Elevation ranges from 5,200 to 6,200 feet. The average annual precipitation is 8 to 12 inches. Precipitation falls during late summer and midwinter to early in spring. The least amount falls in May and June. The average annual air temperature is 45° to 50° F. The frost-free season is 80 to 130 days.

The soils in this site are well drained. They have a pale-brown cobbly, medium-textured surface layer and a pinkish-gray medium-textured subsoil. Hard bedrock is at a depth of 6 to 15 inches.

Permeability is moderate in the soils of this site. Runoff is medium or rapid. The hazard of erosion is severe. Available water capacity is very low.

The dominant vegetation on this site is cliffrose, black sagebrush, galleta, Indian ricegrass, blue grama, needleandthread, and Sandberg bluegrass. The approximate composition, by weight, of the potential plant community is 10 to 15 percent galleta, 1 to 5 percent blue grama, 10 to 15 percent Indian ricegrass, 1 to 5 percent needleandthread, 2 to 4 percent Sandberg bluegrass, 5 to 8 percent squirreltail, 3 to 7 percent perennial forbs, 5 to 10 percent cliffrose, 1 to 5 percent annual forbs and grasses, 15 to 20 percent black sagebrush, 3 to 5 percent fourwing saltbush, 0 to 5 percent pinon pine and Utah juniper, 1 to 3 percent winterfat, and 10 to 15 percent other shrubs.

As range condition deteriorates, black sagebrush, squirreltail, annuals, and Utah juniper increase and broom snakeweed and annuals invade. When the site is in poor condition, black sagebrush and Utah juniper dominate the plant community in places.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 500 pounds per acre in favorable years and 275 pounds in unfavorable years.

This site has shallow soils, steep slopes, and stoniness that preclude brush management or range seeding as management practices. A system of grazing management designed to improve and maintain desirable

range condition is the most practical management activity that can be applied to this site.

RANGE SITE NV 28-40, SEMIDESERT LIMY TERRACES

This site consists of dissected terraces and alluvial fans. Slopes are 2 to 30 percent. Elevation ranges from 4,800 to 6,500 feet. The average annual precipitation is 8 to 12 inches. Some precipitation falls throughout the year, usually during late summer and midwinter to early spring, with the least amount during May and June. Precipitation in July through September is 3 to 4 inches and occurs during high-intensity convection storms. The average annual air temperature is 45° to 53° F. The frost-free season is 100 to 130 days.

The soils in this site are well drained. They have a light brownish-gray, brown, and light-brown gravelly, medium-textured and moderately coarse textured surface layer and a brown to very pale brown gravelly, medium-textured and moderately fine textured subsoil. Underlying layers are silica- and lime-cemented hardpans. Some of the soils lack the cemented hardpan and are very deep.

Permeability is moderately slow to moderately rapid above the hardpan. Runoff is slow to rapid depending on slope, which ranges from 2 to 30 percent. The hazard of erosion is slight to severe. The available water capacity is very low to moderate.

The dominant vegetation on this site is black sagebrush and galleta and often scattered Utah juniper trees. The approximate composition, by weight, of the potential plant community is 0 to 5 percent Great Basin wildrye, 10 to 15 percent galleta, 6 to 10 percent Indian ricegrass, 1 to 5 percent sand dropseed, 1 to 5 percent scarlet globemallow and other perennial forbs, 10 to 25 percent black sagebrush, 3 to 8 percent Nevada ephedra, 1 to 5 percent fourwing saltbush, 5 to 10 percent low rabbitbrush, 1 to 5 percent winterfat, 1 to 10 percent bitterbrush, 5 to 8 percent blue grama, 1 to 5 percent squirreltail, 6 to 10 percent needleandthread, and 1 to 10 percent annual grasses and forbs.

As range condition deteriorates, black sagebrush, low rabbitbrush, juniper, annuals, and broom snakeweed increase and invade. When the site is in poor condition, black sagebrush, low rabbitbrush, Russian-thistle or broom snakeweed, or both, dominate.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 600 pounds per acre in favorable years and 200 pounds in unfavorable years. During favorable years about a third of the increase in yield is from annual forbs and grasses.

This site is generally not suitable for range seeding because of the droughty nature of the soils. Contour furrows or pitting may be used to retard runoff and erosion. A system of grazing management is essential to improve and maintain desirable range conditions on this site.

RANGE SITE NV 28-41, SEMIDESERT SHALLOW TERRACES

This site consists of soils on terraces. Slopes are 2 to 15 percent. Elevation ranges from 5,800 to 6,600 feet. The average annual precipitation is 8 to 12 inches. Some precipitation falls throughout the year, usually late in summer and in midwinter to early in spring

and in June. Precipitation in July through September is 3 to 4 inches and usually occurs during high-intensity convection storms. The average annual air temperature is 42° to 50° F. The frost-free season is 60 to 110 days.

The soils in this site are well drained. They have a light brownish-gray, calcareous, gravelly, medium textured and moderately coarse textured surface layer; a pale-brown, gravelly or gravel-free, medium textured or moderately fine textured subsoil about 8 inches thick; and white, brittle, gravelly, medium-textured material 10 inches thick over an indurated silica- and lime-cemented hardpan.

Permeability is moderate to moderately rapid above a very slowly permeable hardpan. Runoff is medium and slow. The hazard of erosion is slight to moderate. The available water capacity is very low.

The dominant vegetation on this site is black sagebrush, galleta, and Indian ricegrass with occasional Utah juniper and gambel oak at the higher elevations. The approximate composition, by weight, of the potential plant community is 5 to 10 percent Great Basin wildrye; 6 to 12 percent galleta; 6 to 10 percent Indian ricegrass; 5 to 10 percent needleandthread; 2 to 4 percent squirreltail; 10 to 15 percent black sagebrush; 1 to 5 percent Nevada ephedra; 0 to 5 percent Utah juniper, pinon pine, and gambel oak; 2 to 5 percent low rabbitbrush; 2 to 7 percent perennial forbs; 3 to 7 percent bluebunch wheatgrass; 2 to 5 percent Sandberg bluegrass; 4 to 8 percent blue grama; 2 to 4 percent winterfat; 2 to 4 percent spiny hopsage; 1 to 3 percent bitterbrush; 1 to 5 percent fourwing saltbush; and 2 to 10 percent other shrubs.

As range condition deteriorates, basin wildrye, bluebunch wheatgrass, blue grama, winterfat, and spiny hopsage decrease while black sagebrush, Douglas rabbitbrush, wolfberry, Russian-thistle, and other annuals increase or invade.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 700 pounds per acre in favorable years and 300 pounds in unfavorable years.

This site is suitable for seeding. Brush management may be desirable when the site is in poor to fair condition. A system of grazing management is essential to improve and maintain a desirable range condition.

RANGE SITE NV 28-42, SEMIDESERT BASALT HILL

This site consists of soils on mountains. Slopes are 4 to 50 percent. Elevation ranges from 5,000 to 6,200 feet. The average annual precipitation is 10 to 12 inches. Some precipitation falls throughout the year, mostly late in summer and in midwinter to early spring. The least amount falls in May and June. Precipitation in July through September is 3 to 4 inches and usually falls during high-intensity convection storms. The average annual air temperature is 49° to 53° F. The frost-free season is 100 to 120 days.

The soils in this site are well drained. They have a grayish-brown to brown, slightly plastic, cobbly, medium-textured surface layer and a gravelly, fine-textured subsoil. This is underlain by a silica- and lime-cemented hardpan over bedrock at depths of 13 to 20 inches.

Permeability is slow in the soils of this site. Runoff

is slow to rapid. The hazard of erosion is moderate to severe. The available water capacity is very low to low.

The dominant vegetation on this site is black sagebrush and galleta. Big sagebrush may replace black sagebrush in microsites of more favorable moisture. Occasional Utah juniper and mountainmahogany may occur at higher elevations. The approximate composition, by weight, of the potential plant community is 8 to 20 percent galleta, 0 to 15 percent blue grama, 5 to 10 percent Indian ricegrass, 0 to 10 percent sand dropseed, 1 to 10 percent needleandthread, 5 to 10 percent squirreltail, 20 to 35 percent black sagebrush or big sagebrush, 5 to 10 percent Nevada ephedra, 5 to 10 percent cliffrose, 0 to 5 percent low rabbitbrush, 1 to 10 percent perennial forbs, 1 to 5 percent annual forbs, and 1 to 3 percent Sandberg bluegrass.

As range condition deteriorates, blue grama and galleta decrease, while low rabbitbrush, Indian ricegrass, sand dropseed, and annual forbs increase. With severe deterioration cacti and annual forbs or grasses may invade and dominate the plant community.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 600 pounds per acre in favorable years and 300 pounds in unfavorable years.

This soil is not suitable for range seeding because of excessive stoniness, low available water capacity, and steep slopes. Brush management is a desirable practice on poor and fair condition ranges if sufficient remnants of desirable grasses are present to provide a practical response. A system of grazing management designed to improve or maintain desirable range condition is essential and possibly the only other feasible management that can be applied to this site.

RANGE SITE NV 28-44, SEMIDESERT LOAMY FLOOD PLAIN

This site consists of soils on alluvial fans, terraces, and flood plains. Slopes are 0 to 8 percent. Elevation ranges from 5,000 to 7,800 feet. The average annual precipitation is 8 to 12 inches. The soils receive extra moisture from runoff from higher lying soils. Some precipitation falls throughout the year, mostly late in summer and in midwinter to early spring. The least amount falls in May and June. Precipitation in July through September is 3 to 4 inches and usually occurs during high-intensity convection storms. The average annual air temperature is 45° to 52° F. The frost-free season is 100 to 130 days.

The soils in this site are well drained. They have a brown, light-brown, and light brownish-gray gravelly or gravel-free, medium textured and moderately coarse textured surface layer. The subsoil is brown to very pale brown and grayish-brown gravelly or gravel-free, moderately coarse textured to moderately fine textured material which extends to a depth of 60 inches. Some soils are underlain by coarse-textured materials.

Permeability is moderate in the soils of this site. Runoff is medium and slow. The hazard of erosion is slight or moderate. The available water capacity is low to high.

The dominant vegetation on this site is big sagebrush and Great Basin wildrye associated with western wheatgrass, alkali sacaton and Indian ricegrass. The

approximate composition, by weight, of the potential plant community is 5 to 20 percent western wheatgrass, 5 to 10 percent galleta, 5 to 20 percent Indian ricegrass, 3 to 8 percent sand dropseed, 10 to 20 percent Great Basin wildrye, 0 to 5 percent rabbitbrush, 0 to 5 percent Nevada ephedra, 0 to 5 percent blue grama, 2 to 5 percent squirreltail, 5 to 15 percent big sagebrush, 1 to 5 percent perennial forbs, 1 to 5 percent annual forbs and grasses, and 1 to 5 percent alkali sacaton.

As range condition deteriorates, big sagebrush and rabbitbrush increase while Russian-thistle, horsebrush, and greasewood invade. When the site is severely deteriorated, rabbitbrush and Russian thistle dominate.

When this range site is in excellent condition, the total annual yield of air-dry herbage is about 1,800 pounds per acre in favorable years and 700 pounds in unfavorable years.

This site is suitable for range seeding and brush management, and a good response can be expected because of its position. It receives extra moisture as runoff from the surrounding area. Brush management is a desirable practice without range seeding on poor and fair condition ranges if sufficient remnant of desirable grasses are present to provide a practical response. Contour furrows and diversions should be considered in conjunction with brush management and range seedings to retard runoff and erosion. The position and characteristics of this site with respect to the availability of runoff water is such that good response can be expected from water spreading.

RANGE SITE NV 28-45, SEMIDESERT LOAMY SLOPE

This site consists of soils on terraces and alluvial fans. Slopes are 0 to 15 percent. Elevation ranges from 5,500 to 6,100 feet. The average annual precipitation is 8 to 12 inches. Some precipitation falls throughout the year, mostly late in summer and in midwinter to early in spring. The least amount falls in May and June. Precipitation in July through September is 3 to 4 inches and usually occurs during high-intensity convection storms. The average annual air temperature is 45° to 53° F. The frost-free season is 80 to 130 days.

The soils in this site are well drained. They have a pale-brown to reddish-brown gravelly and gravel-free, medium textured and moderately fine textured surface layer and a light-brown to reddish-brown gravelly or gravel-free, medium-textured to fine-textured subsoil. The underlying layer is a continuous or discontinuous lime and silica hardpan of varying thickness.

Permeability is slow to moderate above the very slowly permeable hardpan in the soils of this site. Runoff is slow to medium. The hazard of erosion is slight to moderate. The available water capacity is low to moderate.

The dominant vegetation on this site is big sagebrush and mixed grasses. The approximate composition, by weight, of the potential plant community is 5 to 7 percent galleta, 5 to 8 percent Indian ricegrass, 2 to 10 percent needleandthread, 0 to 5 percent sand dropseed, 6 to 8 percent bluebunch wheatgrass, 5 to 10 percent blue grama, 4 to 6 percent Sandberg bluegrass, 2 to 5 percent squirreltail, 10 to 25 percent big sagebrush, 1 to 3 percent low rabbitbrush, 5 to 8 percent Nevada ephedra, 3 to 5 percent winterfat, 4 to 6 percent spiny

hopsage, 3 to 6 percent fourwing saltbush, and 2 to 7 percent other shrubs.

As range condition deteriorates, big sagebrush, low rabbitbrush, galleta, and blue grama increase, and rabbitbrush, cheatgrass, and other annuals invade. With severe deterioration, big sagebrush and cheatgrass may dominate.

When this range site is in excellent condition, the total annual yield of air-dry herbage is about 800 pounds per acre in favorable years and 350 pounds in unfavorable years.

These soils are suitable for mechanical brush management and range seeding, but only fair response can be expected because of unreliable spring moisture conditions. Brush management without seeding is a desirable practice on poor and fair condition ranges, if sufficient remnants of desirable grasses are present to provide a practical response. Contour furrows, pitting, and diversions may be considered in conjunction with brush management and range seedings to retard runoff. A system of grazing management designed to improve or maintain a desirable range condition is desirable in places.

RANGE SITE NV 28-46, SEMIDESERT LOAMY PLAIN

This site consists of soils on terraces. Slopes are 0 to 8 percent. Elevation ranges from 6,000 to 6,600 feet. The average annual precipitation is 10 to 12 inches. Some precipitation falls throughout the year, mostly late in summer and in midwinter to early spring. The least amount falls in May and June. The average annual air temperature is 42° to 45° F. The frost-free season is 80 to 100 days.

The soils in this site are well drained. They have a light brownish-gray moderately coarse textured surface layer, a brown over very pale brown moderately fine textured subsoil, and a medium-textured and gravelly coarse-textured substratum.

Permeability is moderately slow in the soils of this site. Runoff is slow to medium. The hazard of erosion is slight to moderate. Available water capacity is low to moderate and comes mostly from precipitation.

The dominant vegetation on this site is a grass-shrub complex that has big sagebrush and bluebunch wheatgrass. The approximate composition, by weight, of the potential plant community is 3 to 5 percent Sandberg bluegrass, 6 to 10 percent bluebunch wheatgrass, 5 to 8 percent Indian ricegrass, 4 to 8 percent needleandthread, 5 to 10 percent blue grama, 2 to 5 percent squirreltail, 0 to 3 percent three-awn, 10 to 35 percent big sagebrush, 1 to 3 percent low rabbitbrush, 1 to 3 percent bitterbrush, 2 to 5 percent winterfat, and 4 to 8 percent Nevada ephedra.

As range condition deteriorates, blue grama, squirreltail, and big sagebrush increase, and Russian-thistle and other annuals invade. With severe deterioration, big sagebrush may dominate the plant community.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 1,000 pounds per acre in favorable years and 500 pounds in unfavorable years.

The site is suitable for mechanical brush management and range seeding. Brush management without seeding is a desirable practice on poor and fair con-

dition ranges if sufficient remnants of desirable grasses are present to provide a practical response.

RANGE SITE NV 28-47, SEMIDESERT SALINE FLOOD PLAIN

This site consists of soils on flood plains. Slopes are 0 to 4 percent. Elevation ranges from 5,200 to 6,400 feet. The average annual precipitation is 8 to 10 inches. The seasonal water table influences plant growth more than the natural precipitation does. Most of the precipitation falls in midwinter to early in spring; the least amount falls in May and June. The average annual air temperature is 44° to 47° F. The frost-free season is 40 to 110 days.

The soils in this site are moderately well drained and somewhat poorly drained. They have a light-brown and pale-brown medium-textured and moderately fine textured surface layer and a brown, pale-brown, and pinkish-gray, saline and alkali affected, moderately fine textured and fine textured subsoil that extends to a depth of 60 inches or more.

Permeability is slow to moderate in the soils of the site. Runoff is slow to medium. The hazard of erosion is slight to moderate. A few channels caused by high-intensity floods are present. The available water capacity is high. Seasonal high water table is 4 to 6 feet. Saline salts are present in moderate and strong concentrations at a depth of 30 inches.

The dominant vegetation on this site is Great Basin wildrye and alkali sacaton. The approximate composition, by weight, of the potential plant community is 20 to 50 percent Great Basin wildrye, 20 to 50 percent alkali sacaton, 1 to 15 percent inland saltgrass, 1 to 5 percent rushes, 1 to 5 percent sedges, 5 to 15 percent rabbitbrush, 0 to 5 percent greasewood, 0 to 5 percent wolfberry, 0 to 3 percent fourwing saltbush, 1 to 8 percent perennial forbs, and 0 to 5 percent annual grasses.

As range condition deteriorates, rabbitbrush, greasewood, and inland saltgrass increase, and Russian-thistle and halogeton invade. When the site is severely deteriorated, rabbitbrush and greasewood may dominate.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 1,000 pounds per acre in favorable years and 500 pounds in unfavorable years.

This site is not suitable for range seeding because of the salinity. Brush management is a desirable practice on poor and fair condition ranges if sufficient remnants of desirable grasses are present to provide a practical response. The position and characteristics of these soils with respect to the availability of runoff water are such that desirable vegetative response can be expected from water spreading.

RANGE SITE NV 28-49, UPLAND LOAMY

This site consists of soils on terraces. Slopes are 4 to 8 percent. Elevation ranges from 7,000 to 7,800 feet. The average annual precipitation is 12 to 16 inches. Most of the precipitation falls as snow in winter. Summer precipitation is 4 to 6 inches. The average annual air temperature is 42° to 45° F. The frost-free season is 60 to 110 days.

The soils in this site are well drained. They have a

dense gravel cover over a very stony, light brownish-gray, medium-textured surface layer. The next layer is dark grayish-brown, gravelly, moderately fine textured material about 8 inches thick. The subsoil is stratified, dark-brown, yellowish-brown, and very pale brown, hard and very hard, fine textured and moderately fine textured material about 22 inches thick. The underlying layer is a strongly cemented hardpan.

Permeability is very slow in the soils of this site. Runoff is medium. The hazard of erosion is slight to moderate. The available water capacity is low.

The dominant vegetation on this site is bluebunch wheatgrass and big sagebrush. The approximate composition, by weight, of the potential plant community is 10 to 30 percent bluebunch wheatgrass, 4 to 10 percent Thurber needlegrass, 1 to 3 percent Sandberg bluegrass, 5 to 10 percent Great Basin wildrye, 10 to 20 percent big sagebrush, 10 to 15 percent bitterbrush, 2 to 5 percent serviceberry, 0 to 5 percent snowberry, 0 to 5 percent low rabbitbrush, 0 to 5 percent Utah juniper, 0 to 2 percent gambel oak, 6 to 14 percent perennial forbs, 2 to 5 percent needleandthread, 5 to 8 percent Nevada bluegrass, and 2 to 6 percent long-tongue muttongrass.

As range condition deteriorates, Great Basin wildrye, bluebunch, and western wheatgrass decrease; big sagebrush and rabbitbrush increase; and annual grasses and forbs increase or invade. When the site is in poor condition, big sagebrush may dominate.

When this range site is in excellent condition, the total annual yield of air-dry herbage is about 1,000 pounds per acre in favorable years and 600 pounds in unfavorable years.

Brush management is a desirable practice on poor and fair condition ranges if sufficient remnants of desirable grasses are present to provide a practical response. Stoniness precludes mechanical brush management or drill seeding. A system of grazing management designed to improve and maintain desirable range condition is very important to the management of this site.

RANGE SITE NV 28-50, MOUNTAIN LOAMY

This site consists of soils on steep mountain and foothill faces. Slopes are 15 to 75 percent. Elevation ranges from 7,200 to 9,200 feet. The average annual precipitation is 14 to 20 inches. Most of the precipitation falls in winter as snow. The average annual air temperature is 40° to 43° F. The frost-free season is 40 to 50 days.

The soils in this site are well drained. They have a dark-gray and dark grayish-brown, gravelly to extremely stony, medium-textured and moderately fine textured surface layer that is 9 to 20 inches thick. The subsoil is white, pinkish-gray, light-brown, and brown gravelly and very gravelly, medium-textured to fine-textured over weathered bedrock at depths of about 30 inches or deeper.

Permeability is slow to moderately slow in the soils of this site. Runoff is medium to rapid. The hazard of erosion is slight to severe. The available water capacity is low to moderate.

The dominant vegetation on this site is Great Basin wildrye, bluebunch wheatgrass, big sagebrush, and

other mixed shrubs. The approximate composition, by weight, of the potential plant community is 15 to 30 percent bluebunch wheatgrass, 5 to 15 percent Thurber needlegrass, 15 to 25 percent Nevada bluegrass, 0 to 20 percent Great Basin wildrye, 0 to 5 percent chokecherry, 5 to 15 percent big sagebrush, 5 to 10 percent bitterbrush, 5 to 10 percent serviceberry, 5 to 15 percent snowberry, 0 to 5 percent mountainmahogany, 4 to 15 percent perennial forbs, 3 to 4 percent pinon pine, 2 to 4 percent Utah juniper, 2 to 3 percent gambel oak, 2 to 8 percent ponderosa pine, and 1 to 15 percent annual forbs and grasses.

As range condition deteriorates, Great Basin wildrye and bluebunch wheatgrass decrease; big sagebrush and serviceberry increase; and rabbitbrush, cheatgrass, and other annuals invade. When the site is in poor condition, big sagebrush, serviceberry, and annuals may dominate.

When this range site is in excellent condition, the total annual yield of air-dry herbage is about 1,100 pounds per acre in favorable years and 700 pounds in unfavorable years.

This site is not suitable for range seeding because of excessive runoff and high hazard of erosion on the steep slopes. A system of grazing management designed to improve and maintain desirable range condition is the most practical management that can be applied to this site.

On mountain tops, ridges, and upper side slopes, all species of this range site are dwarfed because of shallower soil depths and severe weather conditions. Under these conditions, low sagebrush, bluebunch wheatgrass, and bluegrasses dominate, and yield would be somewhat lower than that for the rest of the site.

RANGE SITE NV 28-51, MOUNTAIN SHALLOW LOAMY

This site consists of soils on mountain slopes. Slopes are 4 to 30 percent. Elevation ranges from 7,000 to 9,000 feet. The average annual precipitation is 14 to 20 inches. Most precipitation falls in winter. Summer precipitation is 5 to 7 inches and usually occurs during intense convection storms. The average annual air temperature is 36° to 45° F. The frost-free season is 40 to 60 days.

The soils of this site are well drained. They have a grayish-brown, stony and very stony, medium-textured surface layer about 25 inches thick over highly weathered bedrock.

Permeability is moderate in the soils of this site. Runoff is slow to medium. The hazard of erosion is slight to moderate. The available water capacity is very low to low.

The dominant vegetation on this site is low sagebrush and bluebunch wheatgrass. The approximate composition, by weight, of the potential plant community is 10 to 30 percent bluebunch wheatgrass, 10 to 20 percent Thurber needlegrass, 0 to 5 percent Indian ricegrass, 5 to 15 percent Great Basin wildrye, 0 to 5 percent Sandberg bluegrass, 5 to 10 percent Nevada bluegrass, 10 to 30 percent low sagebrush, 3 to 10 percent snowberry, 1 to 5 percent serviceberry, 8 to 12 percent bitterbrush, 4 to 9 percent annual grasses and forbs, 5 to 20 percent mountainmahogany, 1 to 4 percent pinon pine, 1 to 3 percent Utah juniper, 1 to 3

percent gambel oak, and 1 to 10 percent ponderosa pine.

As range condition deteriorates, low sagebrush, snowberry, serviceberry, and annuals increase, and low rabbitbrush invades. When the site is in poor condition, low sagebrush, low rabbitbrush, and annuals may dominate.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 450 pounds in unfavorable years.

RANGE SITE NV 28-52, UPLAND LIMESTONE HILLS

This site consists of soils on mountain faces. Slopes are 30 to 50 percent. Elevation ranges from 6,000 to 7,200 feet. The average annual precipitation is 12 to 16 inches. Precipitation falls throughout the year, usually late in summer and in midwinter to early in spring. The least amount falls in May and June. The average annual air temperature is 45° to 50° F. The frost-free season is 80 to 120 days.

The soils in this site are well drained. They have a pale-brown, stony, medium-textured surface layer and a pinkish-gray, cobbly and gravelly, medium-textured subsoil over limestone at a depth of 6 to 15 inches.

Permeability is moderate in the soils of this site. Runoff is medium and rapid. The hazard of erosion is severe. Available water capacity is very low.

The dominant vegetation on this site is cliffrose, black sagebrush, and galleta. The approximate composition, by weight, of the potential plant community is 2 to 7 percent blue grama, 10 to 15 percent galleta, 1 to 5 percent Sandberg bluegrass, 2 to 4 percent Nevada bluegrass, 3 to 6 percent Thurber needlegrass, 2 to 4 percent needleandthread, 2 to 5 percent squirrel-tail, 3 to 10 percent bluebunch wheatgrass, 15 to 30 percent cliffrose, 3 to 5 percent bitterbrush, 5 to 10 percent mountainmahogany, 6 to 15 percent other shrubs, 5 to 15 percent pinon pine, 0 to 4 percent gambel oak, 10 to 15 percent Utah juniper, 1 to 2 percent springtipped tongueflower, 1 to 3 percent annual forbs and grasses, and 1 to 10 percent perennial forbs.

As range condition deteriorates, black sagebrush, cliffrose, pinon pine, and Utah juniper increase, and broom snakeweed, low rabbitbrush, and annuals invade. When the site is in poor condition, black sagebrush, low rabbitbrush, and Utah juniper may dominate.

When this site is in excellent condition, the total annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 350 pounds in unfavorable years.

This site has shallow soils, steep slopes, and stoniness that preclude brush management or range seeding as management practices. A system of grazing management designed to improve and maintain desirable range condition is essential and the most practical management that can be applied to these soils.

Use of the Soils for Wildlife Habitat

The wildlife population of any area depends upon the availability of food, cover, and water in a suitable combination. Habitats are created, improved, or maintained by establishing desirable vegetation and developing water supplies in suitable places.

Soils directly influence the kinds and amounts of vegetation and the amounts of water available, and in this way indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the productivity of wildlife habitat are: thickness of the soil useful to crops, surface texture, available water capacity to a depth of 40 inches, wetness, surface stoniness or rockiness, flood hazard, slope, and permeability of the soil to air and water.

In table 7 the soils of the Meadow Valley Area are rated for producing seven elements of wildlife habitat and four groups or kinds of wildlife. The ratings indicate relative suitability for various elements.

A rating of *good* means that the element of wildlife habitat and habitats generally are easily created, improved, and maintained. Few or no limitations affect management in this category, and satisfactory results are expected when the soil is used for the prescribed purpose.

A rating of *fair* means the element of wildlife habitat and habitats can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequently attention may be required for satisfactory results.

A rating of *poor* means that limitations for the designated use are rather severe. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of *very poor* means that limitations to the establishment of elements of wildlife habitat are very severe and that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitats on soils in this category.

The significance of each subheading in table 7 under "Elements of Wildlife Habitat" and "Kinds of Wildlife" is given in the following paragraphs.

Habitat elements.—Each soil is rated according to its suitability for producing various kinds of plants and other elements that make up a wildlife habitat. The ratings take into account mainly the characteristics of the soil and closely related natural factors of the environment. They do not take into account climate, present use of the soil, or present distribution of wildlife and people. For this reason selection of a site for development as a habitat for wildlife requires inspection at the site.

Grain and seed crops are grain-producing or seed-producing annual plants such as wheat, barley, corn, sorghums, and millet that provide food and cover for wildlife.

Grasses and legumes are domestic grasses and legumes that are established by planting and which furnish food and cover for wildlife. The grasses include species such as brome grass, orchardgrass, timothy, and wheatgrass. Legumes include species such as alfalfa, sweetclover, vetch, and other clovers.

Wild herbaceous upland plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Such species as bluegrass, cheatgrass, dropseed, fescue, grama, ricegrass, bluebunch, wheatgrass, Great Basin and wildrye, buckwheat, and milk vetch are included.

Coniferous woody plants are cone-bearing trees and shrubs that are used mainly as cover but may furnish

food in the form of browse, seeds, or fruitlike cones. They most generally grow in their natural environment but may be planted and managed. Such species as Utah juniper, pinon pine, chokecherry, cliffrose, and ornamentals are included.

Shrubs include those perennial shrubby type plants that most generally grow in their natural environment but may be planted and managed. They produce buds, twigs, bark, and foliage used as food and cover, and they provide shade for some species of wildlife. They include mountainmahogany, bitterbrush, serviceberry, snowberry, and various sagebrush species.

Wetland food and cover plants are annual and perennial wild herbaceous plants that grow on moist to wet sites. Submersed or floating aquatics are not included. These plants furnish food or cover mostly for wetland wildlife. They include such plants as wild millet, spike rush, cattail, and pondweed. The habitat is developed by dikes and water control structures. Water is manipulated to allow planting, production, and harvest of the desirable plants.

Shallow-water developments are impoundments or excavations for controlling water to create habitat mainly for waterfowl. They may be designed so that they can be drained, planted, and flooded or can be permanent impoundments to grow submersed aquatics. Both fresh water and brackish water situations are included.

Kinds of wildlife.—Table 7 rates the soil according to its suitability as habitat for the four kinds of wildlife in the survey area. These are open land, woodland, wetland, and rangeland. These ratings are related to the ratings made for the elements of habitat. For example, soils that are rated very poor for shallow-water developments are rated very poor for wetland wildlife.

Open-land wildlife consists of birds and mammals that normally live in the cropland, meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadow larks, field sparrows, cottontail rabbits, and foxes are typical examples of openland wildlife.

Woodland wildlife consists of birds and mammals that normally live in wooded areas consisting mainly of coniferous trees and shrubs. Jays, woodpeckers, deer, antelope, sheep, and squirrels are typical examples of woodland wildlife. Soils rated for woodland wildlife are not rated for rangeland.

Wetland wildlife are birds and mammals that normally live in wet areas, marshes, and swamps. Ducks, geese, rails, shore birds, herons, mink, beaver, and muskrat are typical examples of wetland wildlife.

Rangeland wildlife are birds and mammals that normally live in grass and shrub type dryland areas. Crows, eagles, lizards, small birds, deer, antelope, chicken, sage grouse, coyote, and rodents are typical examples of range wildlife. Soils rated for range wildlife are not rated for woodland wildlife.

Each wildlife suitability group has been assigned a number representing its relative suitability rating for various kinds of wildlife. A letter "I" following the group number is used to indicate the soils included in the group are either irrigated or have a potential for irrigation if water is made available. The wildlife suitability group each soil of the survey area is in can

be learned by referring to that soil in the section "Descriptions of the Soils" or in the "Guide to Mapping Units" at the back of this survey.

WILDLIFE SUITABILITY GROUP 1-14-1

This group consists of moderately well drained soils that have a moderately fine textured surface layer and a stratified, medium textured and moderately coarse textured subsoil. Slopes are 0 to 2 percent. Elevation ranges from 4,300 to 5,000 feet. Annual precipitation is 8 to 10 inches. The average annual air temperature is 46° to 53° F. The frost-free season is 110 to 130 days.

Permeability is slow to moderately slow in the soils of this group. Runoff is slow. The hazard of erosion is slight. Available water capacity is high to very high. The effective rooting depth is 60 inches. A seasonal high water table is at a depth below 10 feet.

Some of the soils in this group differ from most others in that they have a surface layer of silt loam and a weakly cemented hardpan of silica. Also, they are not so stratified. Some other soils differ in that they have a subsoil that is not so coarse and a water table at a depth of 1 to 3 feet.

The soils of this group are mostly in alfalfa, grain crops, and pasture grasses. In some areas the vegetation is mostly meadow grasses, and in others it is greasewood, rabbitbrush, and some big sagebrush.

WILDLIFE SUITABILITY GROUP 2-23-1

This group consists of moderately well drained soils that have a moderately fine textured surface layer. The subsoil is fine textured and moderately fine textured. The substratum is stratified and is medium textured and moderately fine textured. Slopes are 0 to 2 percent. Elevation ranges from 5,500 to 6,000 feet. Annual precipitation is 10 to 12 inches. The average annual air temperature is 42° to 45° F. The frost-free season is 80 to 100 days.

Permeability is slow in the soils of this group. Runoff is slow. The hazard of erosion is slight. Available water capacity is high. The effective rooting depth is 60 inches. The seasonal high water table is below a depth of 5 feet.

Some of the soils in this group differ from most in that they have a sandy loam surface layer over highly stratified, moderately coarse textured, medium textured, moderately fine textured, and fine textured layers.

The soils of this group are mostly in alfalfa and pasture grasses. Some areas not under cultivation have a vegetative cover of big sagebrush, low rabbitbrush, and miscellaneous grasses.

WILDLIFE SUITABILITY GROUP 2-32-1

This group consists of well-drained soils that have a moderately coarse textured surface layer and a medium textured and moderately coarse textured subsoil and substratum. Some soils have a lime-cemented hardpan at a depth of 26 to 36 inches. Slopes are 0 to 8 percent. Elevation ranges from 4,400 to 6,100 feet. Annual precipitation is 8 to 12 inches. The average annual air temperature is 45° to 52° F. The frost-free season is 100 to 130 days.

TABLE 7.—*Suitability of the*
[Absence of data indicates

| Soil series and map symbols | Elements of wildlife habitat | | | | |
|---|---|---|--|--|--|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Coniferous woody plants | Shrubs |
| Acana: ACC, AE For Ursine part of AE see Ursine series. | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Fair ----- |
| Acoma: AGD ----- | Very poor ----- | Very poor ----- | Fair ----- | Good ----- | Good ----- |
| Alluvial Land: AL ----- | Very poor ----- | Very poor ----- | Fair ----- | Poor ----- | Fair ----- |
| Aned: ANC ----- | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Good ----- |
| Badland: BA, BB, BD2 For Bit part of BB, see Bit series. For Buster and Holsine parts of BD2, see Buster and Holsine series. | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- |
| Basket: BKF, BL For Lize and Satt parts of BL, see Lize and Satt series. | Very poor ----- | Very poor ----- | Fair ----- | Good ----- | Good ----- |
| Bicondoa: Bm, Bn ----- | Fair ----- | Fair ----- | Good ----- | Good ----- | Good ----- |
| Bo ----- | Very poor in silty clay loam part, poor in peat part. | Fair in silty clay loam part, very poor in peat part. | Good in silty clay loam part, poor in peat part. | Good in silty clay loam part, poor in peat part. | Fair in silty clay loam part, poor in peat part. |
| Bit Mapped only in association with Badland. | Very poor where not irrigated, poor where irrigated. | Very poor where not irrigated, fair where irrigated. | Fair ----- | Fair ----- | Good ----- |
| Buster: Buster parts of BD2 and HN. | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Poor ----- |
| BR For Rough broken part of BR, see Rough Broken land. | Very poor where not irrigated, fair where irrigated. | Very poor where not irrigated, fair where irrigated. | Fair ----- | Fair ----- | Good ----- |
| Cath: CAC ----- | Very poor where not irrigated, fair where irrigated. | Very poor, fair -- | Fair ----- | Fair ----- | Good ----- |
| Cedaran: CD, CE For Decan part of CD and Rock outcrop part of CE, see Decan series and Rock outcrop. | Very poor ----- | Very poor ----- | Good ----- | Fair ----- | Fair ----- |
| Cedaran part of IO ----- | Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Fair ----- |
| Cliffdown: CG For Geer part of CG, see Geer series. | Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Fair ----- |
| Decan: DA For Uana part of DA, see Uana series. | Very poor ----- | Very poor ----- | Good ----- | Good ----- | Good ----- |

soils for wildlife habitat

rating not made]

| Elements of wildlife habitat—Continued | | Kinds of wildlife | | | |
|--|----------------------------|---|-------------------------|---|---|
| Wetland food and cover plants | Shallow-water developments | Open land | Woodland | Wetland | Rangeland |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Fair. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Very poor ----- | |
| Fair ----- | Fair ----- | Poor ----- | ----- | Fair ----- | Fair. |
| Very poor ----- | Very poor ----- | Poor ----- | Poor ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor. |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ¹ ----- | Very poor ----- | |
| Fair ----- | Fair ----- | Fair ¹ ----- | ----- | Fair ----- | Good. |
| Good in silty clay loam part, fair in peat part. | Good ----- | Fair in silty clay loam part, very poor in peat part. | ----- | Good in silty clay loam part, fair ¹ in peat part. | Fair ¹ in silty clay loam part, poor in peat part. |
| Very poor ----- | Very poor ----- | Poor where not irrigated, fair where irrigated. | ----- | Poor ----- | Fair. ¹ |
| Very poor ----- | Very poor ----- | Poor ² ----- | ----- | Very poor ----- | Poor. ¹ |
| Very poor ----- | Very poor ----- | Poor ² , fair ----- | Poor ¹ ----- | Very poor ----- | Fair. ² |
| Very poor ----- | Very poor ----- | Poor, fair ----- | ----- | Very poor ----- | Fair. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | Poor ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Very poor ----- | Poor ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Poor. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | Poor ----- | Very poor ----- | ----- |

TABLE 7.—Suitability of the

| Soil series and map symbols | Elements of wildlife habitat | | | | |
|--|--|--|-------------------------------|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Coniferous woody plants | Shrubs |
| Decathon: DCC, DED, DEE ----- For Basket part of DCC and DEE, see Basket series. | Very poor ----- | Very poor ----- | Fair ----- | Good ----- | Fair ----- |
| Deerlodge: DG, DH ----- For Ursine part of DH, see Ursine series. | Very poor where not irrigated, poor where irrigated. | Very poor where not irrigated, poor where irrigated. | Fair ----- | Good in gravelly sandy loam part, fair in gravelly loam part. | Good in gravelly sandy loam part, fair in gravelly loam part. |
| Denmark: DMD, DN ----- | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Fair ----- |
| Fanu: FAC ----- | Very poor ----- | Very poor ----- | Good ----- | Good ----- | Good ----- |
| Fourstar ----- Mapped only in association with Holtle series. | Very poor ----- | Very poor ----- | Poor ----- | Very poor ----- | Poor ----- |
| Geer: Gf, Gg, GE, GM ----- For Heist part of GM, see Heist series. | Poor ----- | Very poor ----- | Poor ----- | Poor ----- | Fair ----- |
| Gh ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- |
| Gk ----- | Very poor ----- | Poor ----- | Fair ----- | Poor ----- | Poor ----- |
| Hamtah: HA, HC ----- For Tica part of HA and Udel and Rock outcrops of HC, see Tica and Udel series and Rock outcrop. | Very poor ----- | Very poor ----- | Good ----- | Fair ----- | Good ----- |
| Heist: HDC, HEC ----- | Very poor where not irrigated, fair where irrigated. | Very poor where not irrigated, poor where irrigated. | Fair ----- | Fair ----- | Good ----- |
| Holsine: HN ----- For Usine and Buster parts of HN, see Usine series and Buster series. | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Good ----- |
| Holtle: HOC, HR ----- For Fourstar part of HR, see Fourstar series. | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Good ----- |
| Homestake: HSC, HTC ----- | Very poor ----- | Very poor ----- | Good ----- | Good ----- | Good ----- |
| Itea: IND, IO, IR ----- For Rock outcrop part of IR, see Rock outcrop. For Cedaran part of IO, see Cedaran series. | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Fair ----- |
| Jarab: JCD ----- | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Good ----- |
| Kyler: KO ----- | Very poor ----- | Very poor ----- | Poor ----- | Very poor ----- | Poor ----- |
| KR ----- For Rock outcrop parts KO and KR, see Rock outcrop. | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Good ----- |

soils for wildlife habitat—Continued

| Elements of wildlife habitat—Continued | | Kinds of wildlife | | | |
|--|----------------------------|---|-------------------------|-------------------------|--|
| Wetland food and cover plants | Shallow-water developments | Open land | Woodland | Wetland | Rangeland |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Poor where not irrigated, fair where irrigated. | ----- | Very poor ----- | Fair ¹ , poor where inclusions. |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Fair. |
| Poor ----- | Very poor ----- | Fair ----- | ----- | Very poor ----- | Good. |
| Good ----- | Very poor ----- | Very poor ----- | ----- | Poor ¹ ----- | Poor. |
| Poor ----- | Poor ----- | Fair ----- | ----- | Very poor ----- | Fair. |
| Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor. |
| Fair ----- | Fair ----- | Poor ¹ ----- | ----- | Good ----- | Poor. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Good. |
| Very poor ----- | Very poor ----- | Fair ----- | ----- | Very poor ----- | Fair. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Fair. ¹ |
| Poor ----- | Very poor ----- | Fair ² ----- | ----- | Very poor ----- | Fair. ¹ |
| Poor ----- | Very poor ----- | Poor ----- | Fair ¹ ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ² ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Very poor ----- | Fair ² ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Very poor ----- | ----- | Very poor ----- | Poor. |
| Very poor ----- | Very poor ----- | Very poor ¹ ----- | Fair ¹ ----- | Very poor ----- | ----- |

TABLE 7.—Suitability of the

| Soil series and map symbols | Elements of wildlife habitat | | | | |
|---|------------------------------|---------------------|-------------------------------|-------------------------|-----------------|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Coniferous woody plants | Shrubs |
| Lien: LAB ----- | Very poor ----- | Very poor ----- | Poor ----- | Poor ----- | Poor ----- |
| Linco: LC, LD ----- For Acana part of LC and Badland part of LD, see Acana series and Badland. | Very poor ----- | Very poor ----- | Poor ----- | Very poor ----- | Poor ----- |
| Lize: LE, LT ----- For Tica part of LT, see Tica series. | Very poor ----- | Very poor ----- | Good ----- | Good ----- | Fair ----- |
| Met: MU ----- For Ursine part of MU, see Ursine series. | Very poor ----- | Very poor ----- | Poor ----- | Poor ----- | Poor ----- |
| Minu: MVC ----- | Very poor ----- | Very poor ----- | Fair ----- | Good ----- | Good ----- |
| MWC ----- | Very poor ----- | Very poor ----- | Fair ----- | Good ----- | Good ----- |
| Nevtah: NR ----- For Rock outcrop part of NR, see Rock outcrop. | Very poor ----- | Very poor ----- | Good ----- | Poor ----- | Good ----- |
| Nevu: NSD ----- | Very poor ----- | Very poor ----- | Fair ----- | Good ----- | Good ----- |
| Pahranagat: Pa, Pd ----- | Poor ----- | Poor ----- | Very poor ----- | Very poor ----- | Very poor ----- |
| Pe ----- | Good ----- | Good ----- | Fair ----- | Poor ----- | Fair ----- |
| Pg ----- | Good ----- | Good ----- | Poor ----- | Very poor ----- | Very poor ----- |
| Pamsdel: PMC ----- | Very poor ----- | Very poor ----- | Fair ----- | Good ----- | Good ----- |
| Patter: PN, PR ----- For Geer part of PN and Shroe part of PR, see Geer and Shroe series. | Poor ----- | Poor ----- | Fair ----- | Fair ----- | Good ----- |
| PO ----- For Geer and Heist parts of PO, see Geer and Heist series. | Very poor ----- | Very poor ----- | Poor ----- | Very poor ----- | Fair ----- |
| Pioche: PS ----- For Rock outcrop of PS, see Rock outcrop. | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Good ----- |
| Poorma: PTB ----- | Very poor ----- | Very poor ----- | Fair ----- | Good ----- | Good ----- |
| Poorma clay variant: PV ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- |
| Rock land: RO ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- |
| Rock outcrop. Too variable for valid ratings. Mapped only in association or complex with Cedarán, Itca, Kyler, Nevtah, Pioche, Tica, Udel, Urtah, Winu, and Zoate soils. | | | | | |

soils for wildlife habitat—Continued

| Elements of wildlife habitat—Continued | | Kinds of wildlife | | | |
|--|----------------------------|------------------------------|-------------------------|-----------------|-------------------------|
| Wetland food and cover plants | Shallow-water developments | Open land | Woodland | Wetland | Rangeland |
| Very poor ----- | Very poor ----- | Very poor ¹ ----- | Poor ² ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Poor. |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Poor. |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Good. |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ² ----- | Poor ----- | ----- |
| Good ----- | Good ----- | Poor ----- | ----- | Good ----- | Very poor. |
| Fair ----- | Fair ----- | Good ----- | ----- | Fair ----- | Very poor. |
| Good ----- | Good ----- | Fair ----- | ----- | Good ----- | Fair. |
| Very poor ----- | Very poor ----- | Poor ----- | Poor ----- | Very poor ----- | ----- |
| Poor ----- | Very poor ----- | Fair ----- | ----- | Very poor ----- | Fair. |
| Fair ----- | Very poor ----- | Poor ----- | ----- | Poor ----- | Very poor. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ² ----- | Very poor ----- | ----- |
| Very poor ----- | Very poor ----- | Poor ¹ ----- | ----- | Very poor ----- | Fair. ¹ |
| Fair ----- | Fair ----- | Poor ----- | ----- | Fair ----- | Very poor. |
| Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | ----- |

TABLE 7.—Suitability of the

| Soil series and map symbols | Elements of wildlife habitat | | | | |
|--|------------------------------|---------------------|-------------------------------|-------------------------|-----------|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Coniferous woody plants | Shrubs |
| Rough broken land Mapped only in association with Buster soil. | Very poor | Very poor | Fair | Fair | Good |
| Roval: RRD, RV For Acana part of RV, see Acana series. | Very poor | Very poor | Fair | Fair | Good |
| Satt: SAD2, SCC2, SD | Poor | Very poor | Good | Good | Good |
| Seval: SEF | Very poor | Very poor | Fair | Fair | Good |
| Shroe: | | | | | |
| SGD | Very poor | Very poor | Fair | Fair | Good |
| SH | Poor | Poor | Fair | Fair | Good |
| Sieroclip: SKC | Very poor | Very poor | Fair | Fair | Good |
| Slickens: SL | Very poor | Very poor | Very poor | Very poor | Very poor |
| Stampede: ST | Poor | Poor | Fair | Fair | Good |
| Swisbob: SWC | Very poor | Very poor | Fair | Poor | Good |
| Tica: TN, TR For Nevtah part of TN and Rock outcrop part of TR, see Nevtah series and Rock outcrop. | Very poor | Very poor | Fair | Fair | Fair |
| Timpahute: TTB | Very poor | Very poor | Fair | Fair | Good |
| Uana Mapped only in association with Decan series. | Very poor | Very poor | Good | Good | Good |
| Udel: UK For Rock outcrop part of UK, see Rock outcrop. | Very poor | Very poor | Poor | Poor | Poor |
| Umil: UMB | Very poor | Very poor | Fair | Poor | Good |
| Ursine: URD, URE, US For Badland part of US, see Badland. | Very poor | Very poor | Poor | Very poor | Poor |
| Urtah: UT For Rock outcrop part of UT, see Rock outcrop. | Very poor | Very poor | Fair | Fair | Good |
| Urwil: UWD | Poor | Poor | Fair | Fair | Good |
| Usine Mapped only in association with Holsine soil. | Very poor | Very poor | Poor | Poor | Poor |
| Vicu: VCC | Very poor | Very poor | Fair | Fair | Good |
| Vil: VGC | Very poor | Very poor | Fair | Fair | Good |
| Wilpar: WMF | Very poor | Very poor | Fair | Fair | Fair |
| Winu: WNG, WR For Rock outcrop part of WR, see Rock outcrop. | Very poor | Very poor | Fair | Poor | Good |

soils for wildlife habitat—Continued

| Elements of wildlife habitat—Continued | | Kinds of wildlife | | | |
|--|----------------------------|-------------------------|---|-----------------|--------------------|
| Wetland food and cover plants | Shallow-water developments | Open land | Woodland | Wetland | Rangeland |
| Very poor ----- | Very poor ----- | Poor ----- | | Very poor ----- | Fair. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | | Very poor ----- | Fair. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | Poor where slopes are 15 to 30 percent. | Very poor ----- | |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ² ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Poor ----- | | Very poor ----- | Fair. ¹ |
| Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor ----- | Very poor. |
| Poor ----- | Very poor ----- | Fair ----- | | Very poor ----- | Fair. |
| Very poor ----- | Very poor ----- | Poor ----- | | Very poor ----- | Fair. ¹ |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ² ----- | Very poor ----- | |
| Poor ----- | Very poor ----- | Fair ----- | | Very poor ----- | Fair. |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Very poor ----- | Poor ----- | Very poor ----- | |
| Poor ----- | Very poor ----- | Very poor ----- | | Very poor ----- | Poor. |
| Very poor ----- | Very poor ----- | Very poor ----- | | Very poor ----- | Poor. |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ² ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Poor ¹ ----- | Fair ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Poor ----- | | Very poor ----- | Poor. |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ² ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Poor ----- | Fair ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Poor ----- | Poor ----- | Very poor ----- | |
| Very poor ----- | Very poor ----- | Poor ----- | | Very poor ----- | Fair. |

TABLE 7.—Suitability of the

| Soil series and map symbols | Elements of wildlife habitat | | | | |
|--|------------------------------|---------------------|-------------------------------|-------------------------|------------|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Coniferous woody plants | Shrubs |
| Winz: WS ----- | Very poor ----- | Very poor ----- | Fair ----- | Fair ----- | Fair ----- |
| Zoate: ZOF, ZR ----- For Rock outcrop part of ZR, see Rock outcrop. | Very poor ----- | Very poor ----- | Fair ----- | Poor ----- | Fair ----- |

¹ Borderline to next higher rating.

Permeability is moderate in the soils of this group. Runoff is slow to medium. The hazard of erosion is slight. Available water capacity is low to moderate. Effective rooting depth is 26 to 60 inches. Both soils are subject to occasional flooding.

The primary vegetation on soils in this group is big sagebrush. Also, scattered greasewood grows in places.

WILDLIFE SUITABILITY GROUP 2-33-1

This group consists of well drained and moderately well drained soils that have a medium textured and moderately coarse textured surface layer and a stratified, medium textured and moderately coarse textured subsoil and substratum. Some soils have coarse textured material in the substratum. Slopes are 0 to 2 percent. Elevation ranges from 4,400 to 6,100 feet. Annual precipitation is 8 to 12 inches. The average annual air temperature is 46° to 52° F. The frost-free season is 100 to 130 days.

Permeability is moderate in the soils of this group. Runoff is moderate to slow. The hazard of erosion is medium to slight. Available water capacity is low to moderate. The seasonal high water table is at a depth of 4 feet in some areas. All soils are subject to occasional flooding in some areas.

Some of the soils in this group differ from others in that they have an average annual air temperature of 44° to 45° F and a frost-free season of 80 to 100 days.

The nonirrigated soils of this group are mostly in big sagebrush, shadscale, horsebrush, saltbush, rabbitbrush, Indian ricegrass, needleandthread, and galata. The cultivated crops are limited to alfalfa.

WILDLIFE SUITABILITY GROUP 2-42-1

This group consists of well-drained soils that have a medium textured and moderately coarse textured surface layer which is gravelly or gravel free in some areas. Subsurface soils are fine textured to moderately coarse textured and gravelly in some areas. The substratum is moderately textured to fine textured material and is gravelly in some areas. Some soils have hardpans at a depth of about 23 inches. Slopes are 0 to 8 percent. The elevation ranges from 5,000 to 7,800 feet. Annual precipitation is 8 to 14 inches. The aver-

age annual air temperature is 43° to 53° F. The frost-free season is 40 to 120 days.

Permeability is slow to moderately rapid in the soils of this group. Runoff is slow to medium. The hazard of erosion is slight to moderate. Available water capacity is low to high. Effective rooting depth is 23 to 60 inches.

Some of the soils of this group are mostly in big sagebrush, rabbitbrush, Indian ricegrass, fourwing saltbush, squirreltail, needleandthread, blue grama, and bluestem wheatgrass. In some places the vegetation is scattered black sagebrush.

WILDLIFE SUITABILITY GROUP 3-14-1

This group consists of moderately well drained soils that have a medium-textured surface layer and a stratified, moderately fine textured subsoil and substratum. Slopes are 0 to 2 percent. Elevation ranges from 4,200 to 5,000 feet. Annual precipitation is 8 to 10 inches. The average annual air temperature is 49° to 53° F. The frost-free season is 110 to 130 days.

Permeability is slow in the soils of this group. Runoff is slow. The hazard of erosion is slight. Available water capacity is very high. Effective rooting depth is 60 inches. The seasonal high water table is at a depth of 4 to 5 feet.

Some of the soils in this group differ from others in that they are strongly saline soils and have a water table which rises occasionally to 30 inches.

Most areas of soil in this group have not been cultivated. The soils support greasewood and rabbitbrush. Some of the soils also support meadow grasses.

WILDLIFE SUITABILITY GROUP 3-24-1

This group consists of moderately well drained soils that have a medium textured and moderately fine textured surface layer and a moderately fine textured and fine textured subsoil and substratum. Slopes are 0 to 4 percent. The elevation ranges from 5,500 to 6,200 feet. Annual precipitation is 8 to 12 inches. The average annual air temperature is 43° to 47° F. The frost-free season is 40 to 110 days.

Permeability is slow to very slow in the soils of this group. Runoff is slow to moderate. The hazard of erosion is slight. Available water capacity is moderate to high. Effective rooting depth is 60 inches. The sea-

soils for wildlife habitat—Continued

| Elements of wildlife habitat—Continued | | Kinds of wildlife | | | |
|--|----------------------------|-------------------|----------|-----------------|-----------|
| Wetland food and cover plants | Shallow-water developments | Open land | Woodland | Wetland | Rangeland |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Fair. |
| Very poor ----- | Very poor ----- | Poor ----- | ----- | Very poor ----- | Fair. |

^a Borderline to next lower rating.

sonal high water table is at a depth of 4.5 to 6 feet. All soils are subject to occasional flooding.

Some of the soils in this group differ from others in that they lack fine textured and moderately fine textured material and are moderately permeable.

The soils of this group are mostly in rabbitbrush, greasewood, fourwing saltbush, and inland saltgrass.

WILDLIFE SUITABILITY GROUP 3-43-I

This group consists of well-drained to somewhat excessively drained soils that have a medium textured to moderately coarse textured surface layer and a medium textured and moderately coarse textured subsoil and substratum. Some soils have a silica- and lime-cemented hardpan beginning at a depth of 28 to 40 inches. Slopes are 0 to 8 percent. The elevation ranges from 5,800 to 6,800 feet. Annual precipitation is 8 to 10 inches. The average annual air temperature is 48° to 53° F. The frost-free season is 100 to 130 days.

Permeability is moderately rapid to slow. Where a hardpan is present, the material is very slowly permeable. Runoff is slow to medium. The hazard of erosion is slight to moderate. Available water capacity is low. Effective rooting depth is 28 to 60 inches.

Some of the soils in this group differ from others in that they have a moderately fine textured subsoil and a silica and lime cemented hardpan beginning at a depth of 20 to 28 inches.

The soils of this group are mostly in black sagebrush, big sagebrush, cliffrose, Nevada ephedra, Indian ricegrass, galleta, needleandthread, sand dropseed, scattered Utah juniper, fourwing saltbush, Fremont mahonia, shadscale, spiny hopsage, winterfat, and horsebrush.

WILDLIFE SUITABILITY GROUP 4-11-I

This group consists of poorly drained soils that have a moderately fine textured and medium textured surface layer and a stratified, fine textured and moderately fine textured subsoil and substratum. Slopes are 0 to 2 percent. Elevation ranges from 5,900 to 6,200 feet. Annual precipitation is 10 to 12 inches. The average annual air temperature is 42° to 45° F. The frost-free season is 50 to 88 days.

Permeability is slow in the soils of this group, and

runoff is slow. The hazard of erosion is slight. Available water capacity is moderate to high. Effective rooting depth is 60 inches. Seasonal high water table is at a depth of 1 to 1½ feet.

Some soils in this group differ from others in that they have a peat surface layer. Also, some soils have a loam surface layer; a stratified, medium-textured and moderately coarse textured subsoil and substratum; and an effective rooting depth of 48 to 60 inches.

The soils in this group are mostly in meadow grasses.

WILDLIFE SUITABILITY GROUP 4-24

This group consists of moderately well drained soils that have a medium-textured and moderately fine textured surface layer and a moderately fine textured and fine textured subsoil and substratum. Slopes are 0 to 4 percent. Elevation ranges from 5,500 to 6,200 feet. Annual precipitation is 8 to 12 inches. The average annual air temperature is 43° to 47° F. The frost-free season is 40 to 110 days.

Permeability is slow to very slow in the soils of this group. Runoff is slow to moderate. The hazard of erosion is slight. Available water capacity is low. The effective rooting depth is 48 to 60 inches. The seasonal high water table is at a depth of 4.5 to 6 feet. The soils are subject to occasional flooding in some areas.

Some of the soils of this group differ from others in that they are medium textured throughout.

The soils of this group are mostly in rabbitbrush, greasewood, fourwing saltbush, and inland saltgrass.

WILDLIFE SUITABILITY GROUP 3-32

This group consists of well-drained soils that have a medium-textured and moderately coarse textured surface layer and a medium-textured and moderately coarse textured subsoil and substratum. Some soils have a lime-cemented hardpan at a depth of 26 to 36 inches. Slopes are 0 to 8 percent. Elevation ranges from 4,400 to 6,100 feet. Annual precipitation is 8 to 12 inches. The average annual air temperature is 45° to 52° F. The frost-free season is 100 to 130 days.

Permeability is moderate in the soils of this group. The soils that have a hardpan are very slowly permeable. Runoff is slow. The hazard of erosion is slight.

Available water capacity is low to moderate. Effective rooting depth is 26 to 60 inches. These soils are subject to occasional flooding in some areas.

The soils of this group are mostly in big sagebrush, scattered greasewood, and miscellaneous grasses. Some areas are being used for the production of alfalfa.

WILDLIFE SUITABILITY GROUP 3-33

This group consists of well drained and moderately well drained soils that have a medium-textured and moderately coarse textured surface layer and a medium-textured and moderately coarse textured subsoil and substratum. Some soils contain coarse strata below a depth of 20 inches, and some have surface layers and subsoils that are slightly saline. Slopes are 0 to 2 percent. Elevation ranges from 4,400 to 6,100 feet. Annual precipitation is 8 to 12 inches. The average annual air temperature is 46° to 52° F. The frost-free season is 110 to 130 days.

Permeability is moderate in the soils of this group. Runoff is slow. The hazard of accelerated erosion is slight. Available water capacity is low. Effective rooting depth is 60 inches. Seasonal high water table is at a depth of 4 feet in some soils. Some soils are subject to occasional flooding.

The soils that have a moderately coarse textured surface layer are in big sagebrush, Indian ricegrass, and needleandthread. The soils that have a medium-textured surface layer are used for the production of alfalfa and livestock forage. The soils of this group are in shadschale, winterfat, horsebrush, fourwing saltbush, Nevada ephedra, low rabbitbrush, galleta, and Indian ricegrass.

WILDLIFE SUITABILITY GROUP 3-41

This group consists of well-drained soils that have a stony and very stony, medium-textured and moderately fine textured surface layer; a gravelly, medium-textured, moderately fine textured, and fine textured subsoil; and a very gravelly, moderately fine textured substratum. Slopes are 15 to 50 percent. Elevation ranges from 7,000 to 9,500 feet. Annual precipitation is 14 to 20 inches. The average annual air temperature is 40° to 43° F. The frost-free season is 45 to 80 days.

Permeability is moderately slow to medium in the soils of this group. The hazard of erosion is slight to severe. Available water capacity is low to moderate. Effective rooting depth is 20 to 60 inches.

The soils of this group are mostly in big sagebrush, bitterbrush, snowberry, serviceberry, scattered pinon pine, mountainmahogany, bluebunch wheatgrass, squirreltail, and Thurber needlegrass.

WILDLIFE SUITABILITY GROUP 3-42

This group consists of well-drained soils that have a medium-textured and moderately coarse textured surface layer. The surface layer generally has varying amounts of gravel, cobbles, and stones. The subsoil is fine-textured to moderately coarse textured and generally has varying amounts of gravel. The substratum in a hardpan that is cemented with silica or lime, or both, or is medium-textured to moderately coarse textured material that generally has varying amounts of

gravel. Slopes are 0 to 75 percent. Elevation ranges from 4,800 to 9,200 feet. Annual precipitation is 8 to 20 inches. The average annual air temperature is 40° to 50° F. The frost-free season is 45 to 130 days.

Permeability is very slow to rapid in the soils of this group. Runoff is slow to rapid. The hazard of erosion is slight to very severe. Available water capacity is low to moderate. The effective rooting depth is 10 to 60 inches.

Some of the soils in this group differ from others in that they are more droughty because of a combination of slope, texture, and precipitation pattern. Also, some soils are excessively drained and are coarser in texture than others.

The soils of this group are mostly in big sagebrush, low rabbitbrush, black sagebrush, Nevada ephedra, cliffrose, Utah juniper, squirreltail, needleandthread, Indian ricegrass, galleta, three-awn, blue grama, fourwing saltbush, low sagebrush, bitterbrush, and pinon pine. Some scattered serviceberry, mountainmahogany, manzanita, Great Basin wildrye, bluestem wheatgrass, and bluegrasses also are present.

WILDLIFE SUITABILITY GROUP 4-41

This group consists of well-drained soils that have a medium-textured surface layer; a medium textured and moderately fine textured subsoil; and a stratified, moderately fine textured, medium-textured, and moderately coarse textured substratum. Slopes are 0 to 8 percent. Elevation ranges from 5,800 to 6,800 feet. Annual precipitation is 8 to 12 inches. The average annual air temperature is 42° to 45° F. The frost-free season lasts 70 to 80 days.

Permeability is moderate in the soils of this group. Runoff is slow to medium. The hazard of erosion is slight to moderate. Available water capacity is low. Effective rooting depth is 60 inches.

The soils of this group are mostly in big sagebrush, bluestem wheatgrass, squirreltail, Indian ricegrass, scattered bitterbrush, and cliffrose.

WILDLIFE SUITABILITY GROUP 4-43

This group consists of well-drained soils that have a gravelly, stony, or cobbly, medium-textured or moderately coarse textured surface layer and a gravelly or cobbly medium-textured or moderately coarse textured subsoil. Some soils in this group have a gravelly moderately coarse textured subsoil. The other soils are 6 to 40 inches deep to a silica- and lime-cemented hardpan or hard bedrock. Slopes are 0 to 50 percent. Elevation ranges from 4,400 to 7,200 feet. Annual precipitation is 8 to 14 inches. The average annual air temperature is 43° to 53° F. The frost-free season is 80 to 130 days.

Permeability is slow to moderately rapid in the soils of this group. Runoff is slow to rapid. The hazard of erosion is slight to severe. Available water capacity is low. Effective rooting depth is 6 to 60 inches.

The soils of this group are mostly in shadscale, black sagebrush, rabbitbrush, horsebrush, hopsage, white-sage, galleta, Indian ricegrass, needleandthread, squirreltail, scattered juniper, cliffrose, desert mahonia, and big sagebrush.

WILDLIFE SUITABILITY GROUP 324

This group consists of well-drained soils that have a moderately fine textured to moderately coarse textured surface layer modified by gravel, cobbles, and stones in varying amounts. The subsoil is mostly fine textured and moderately fine textured and is modified by varying amounts of gravel, cobbles, and stones. The substratum is a silica-cemented, lime-cemented, or both, hardpan or is coarse textured to fine textured and is modified by varying amounts of gravel. Slopes are 2 to 75 percent. Elevation ranges from 5,000 to 9,300 feet. Annual precipitation is 8 to 24 inches. The average annual air temperature is 35° to 53° F. The frost-free season is 40 to 130 days. Permeability is very slow to moderate. Runoff is slow to rapid. The hazard of erosion is slight to very severe. Available water capacity is low to high. Effective rooting depth is 6 to 60 inches.

Some soils in this group differ from others in that their subsoil is less than 35 percent coarse fragments. The substratum of some soils contains a few coarse fragments, and other soils are underlain by hard rock.

The soils of this group are mostly in pinon pine, Utah juniper, big sagebrush, cliffrose, bitterbrush, black sagebrush, low rabbitbrush, low sagebrush, serviceberry, mountainmahogany, manzanita, balsam white fir, squirreltail, needleandthread, Indian ricegrass, galleta, and blue grama.

WILDLIFE SUITABILITY GROUP 334

This group consists of well drained and excessively well drained soils that have a medium-textured and moderately coarse textured surface layer which is modified by varying amounts of gravel, cobbles, and stones. The subsoil is fine-textured to medium-textured material that in places lacks coarse fragments or is modified by varying amounts of gravel or cobbles. The substratum generally has silica- and lime-cemented hardpans, but in places they are not cemented. Slopes are 0 to 75 percent. Elevation ranges from 5,500 to 7,500 feet. Annual precipitation is 10 to 16 inches. The average annual air temperature is 42° to 51° F. The frost-free season is 60 to 110 days.

Permeability is slow to moderate in the soils of this group. Runoff is slow to rapid. The hazard of erosion is slight to very severe. Available water capacity is low. The effective rooting depth is 10 to 60 inches.

Some of the soils in this group differ from others in that they receive 8 to 12 inches of annual precipitation, very rapid permeability, and generally coarser textures throughout. Moderately coarse textured to moderately fine textured soils are usually modified by varying amounts of gravel.

The soils of this group are mostly in Utah juniper, pinon pine, big sagebrush, cliffrose, black sagebrush, rabbitbrush, Nevada ephedra, snowberry, currant, mountainmahogany, squirreltail, needleandthread, Indian ricegrass, galleta, three-awn, and blue grama.

WILDLIFE SUITABILITY GROUP 434

This group consists of well-drained to somewhat excessively drained soils that have a gravelly and stony, medium-textured and moderately coarse textured surface layer; a gravelly, moderately coarse textured,

moderately fine textured, and fine textured subsoil; and a gravelly, moderately fine textured and fine textured substratum. Most soils are underlain by hard rock. Some have a silica- and lime-cemented hardpan at a depth of 6 to 12 inches. Slopes are 2 to 50 percent. Elevation ranges from 5,800 to 9,200 feet. Precipitation is 8 to 20 inches. The average annual air temperature is 40° to 45° F. The frost-free season is 50 to 100 days.

Permeability is slow to moderately rapid in the soils of this group. Runoff is slow to rapid. The hazard of erosion is slight to very severe. Available water capacity is low to moderate. Effective rooting depth is 6 to 20 inches.

The soils of this group are mostly in pinon pine, Utah juniper, big sagebrush, black sagebrush, low sagebrush, snowberry, bitterbrush, mountainmahogany, Indian ricegrass, needleandthread, and bluegrasses.

Use of the Soils as Woodland

Tree species of the Area have limited commercial value for wood products because of the trees grown. Young pinon pine are harvested for Christmas trees, while alder trees are harvested for firewood or pine nuts. Utah junipers are harvested for fenceposts. No saw logs are harvested.

The soils of the Area have been placed in woodland suitability groups to assist owners in planning the use of their soils for wood crops. Each group consists of soils that are suited to the same kinds of trees, that need about the same management where the vegetation on them is similar, and that have the same potential production.

Each group is identified by a three-part symbol such as 1x1, 2f1, or 2d1. The potential productivity of the soils in the group is indicated by the first number in the symbol. In this survey area only two ratings are used: 1, high, and 2, moderate. These ratings are based on field determination of the average site index. Site index of a given soil in the case of pinon pine-Utah juniper is the basal area in square feet that the entire stand of trees for 4.5 feet in height attain when the stand averages 5 inches in diameter at one foot in a natural, essentially unmanaged stand (fig. 9). The site index can be converted into approximate expected growth and yield per acre and expressed in cords.

In the survey area conversion of average site index into volumetric growth and yield is based on research of the indicator forest-type pinon pine and Utah juniper. The site index was determined for each major kind of wooded soil. It was based on field measurements of existing stands growing on identified soils. Because field measurements of site index were not feasible for every kind of soil, information about key soils and tree species was projected to similar soils as needed. Such projections are estimates and range from a low of 50 on the poorest site to a maximum of 250 on the best sites.

The second part of the symbol identifying a woodland suitability group is a small letter. In this survey *x*, *f*, *c*, *d*, and *o* are used. Except for *o*, the small letter indicates an important soil property that imposes a hazard or limitation in managing the soils or the

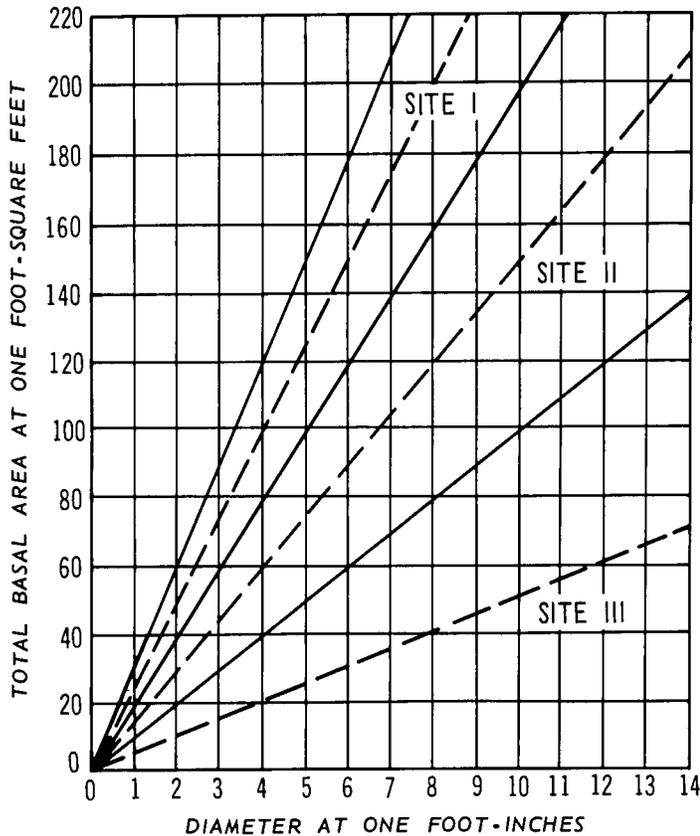


Figure 9.—Basal area curves for pinon-juniper. Basal area is attained when the diameter of the tree at a height of 1 foot averages 5 inches (outside bark) for a stand more than 4.5 feet in height.

group for trees. The letter *o* indicates that the soils have few limitations that restrict their use for trees. The letter *x* indicates stoniness or rockiness that causes restrictions or limitations. The letter *f* indicates soils with restrictions or limitations because of a large amount of coarse fragments, over 2 millimeters and less than 10 inches in diameter, in the profile. The letter *c* indicates soils having restrictions or limitations because of the kind and amount of clay in the upper part of the soil profile. The letter *d* indicates a restriction or limitation because of a restricted rooting depth.

The last part of the symbol is another number and differentiates woodland suitability groups that have identical first and second parts in their identifying symbol. In this survey area, because the woodland is so limited, only one last letter is used.

Each woodland suitability group in the survey area is rated for various management hazards or limitations. These ratings are good, fair, and poor for accessibility. For equipment limitations, seedling mortality, plant competition, and windthrow hazard, ratings are given as *slight*, *moderate*, and *severe*. These are described in the following paragraphs.

Accessibility of the area to off-road movement of vehicles other than harvesting equipment depends upon surface gradient and such soil characteristics as texture, stoniness, cropping out of rocks, and the like.

Good accessibility means few or no limitations. *Fair* means moderate limitations; most off-road vehicles can traverse the area, but with some difficulty. *Poor* means severe limitations. Most off-road vehicles can either traverse the area with great difficulty or they cannot traverse it at all.

Equipment limitations depend on soil characteristics that restrict or prohibit the use of harvesting equipment either seasonally or continually. *Slight* means no restriction on the kind of equipment or the time of year it is used. *Moderate* means that use of equipment is restricted for three months of the year or less. *Severe* means that special equipment is needed and that its use is severely restricted for more than three months of the year.

Seedling mortality refers to mortality naturally occurring on planted tree seedlings as influenced by kind of soil or topographic conditions when plant competition is assumed not to be a factor. *Slight* means a loss of 0 to 25 percent, *moderate* means a loss of 25 to 50 percent, and *severe* means a loss of more than 50 percent of the seedlings. It is assumed that seed supplies are adequate.

Plant competition is the degree to which undesirable plants invade openings in the tree canopy. Considered in the ratings are available water capacity, fertility, drainage, and degree of erosion. *Slight* means that plant competition does not prevent adequate natural regeneration and early growth or interfere with seedling development. *Moderate* means that competition delays natural or artificial establishment and growth rate, but it does not prevent the development of fully stocked normal stands. *Severe* means that competition prevents adequate natural or artificial regeneration unless the site is prepared properly and maintenance practices such as burning, spraying, disking, or girdling are applied.

Windthrow hazard depends on the soil characteristics that enable trees to resist being blown down by wind. *Slight* means that most trees withstand the wind, *moderate* means that some trees are expected to blow down during excessive wetness and high wind, and *severe* means that many trees are expected to blow down during periods when the soil is wet and winds are moderate or high.

The woodland suitability group each soil of the survey area is in can be learned by referring to that soil in the section "Descriptions of the Soils" or the "Guide to Mapping Units" at the back of this survey.

WOODLAND SUITABILITY GROUP 1x1

The soils in this group are well drained. They have a neutral to moderately alkaline, stony to extremely stony, medium textured to moderately coarse textured surface layer. The material in the subsoil is neutral to strongly alkaline, gravelly and very gravelly, and medium textured to fine textured. Depth to bedrock or a hardpan ranges from 7 to more than 60 inches. These soils are on terrace tops, mountain faces, and terrace sides. Elevation ranges from 6,000 to 8,000 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 40° to 51° F. The frost-free season is 70 to 110 days. Precipitation falls

mostly in fall, winter, and early in spring. It is not significant late in spring and early in summer.

Permeability is slow to moderate in the soils of this group. Runoff is medium to rapid. The hazard of erosion is slight to severe. Available water capacity is very low to moderate.

Pinon pine and Utah juniper in existing stands in this group are mostly of mixed age. The canopy cover ranges from about 30 to 70 percent. Soils of the group are in Suitability Class 1 and have a site index of 100 to 150.

The soil areas of the group are generally fair to poor in accessibility. Equipment limitations are moderate to severe because of stones, slope, and winter snows. Mortality of tree seedlings is slight to moderate, and plant competition is slight. Susceptibility of trees to windthrow is slight to moderate. Some loss is incurred through pests and disease. Forest tree species have little value for commercial timber products. Under proper forest management, production of Christmas trees is good, and production of fenceposts is fair to good. In about 1 or 2 years in 10, production of pine nuts is good. Stands of pinon pine trees are considered fair for fireplace wood.

In areas where grazing has not been excessive and the tree canopy is about 30 to 70 percent, the understory vegetation consists of bluegrass, bluebunch wheatgrass, Indian ricegrass, needlegrass, bitterbrush, big sagebrush, serviceberry, and snowberry. Productivity of the understory ranges from about 50 pounds of air-dry herbage per acre under a canopy cover of 70 percent to about 100 pounds under a cover of 30 percent. The understory is mostly heavily grazed by cattle and wildlife. Prolonged excessive grazing results in an understory of big sagebrush, snowberry, squirrel-tail, and bluegrass.

WOODLAND SUITABILITY GROUP 111

The soils in this group are well drained. They have a neutral, gravelly or stony, moderately coarse textured to moderately fine textured surface layer. The subsoil is neutral, gravelly, cobbly, moderately fine textured and fine textured material. Depth to a hardpan ranges from 25 to more than 60 inches. The soils are on foothills and terraces. Elevation ranges from 5,000 to 7,500 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 42° to 49° F. The frost-free season is 70 to 130 days. Precipitation falls mostly in fall, winter, and spring. The amount that falls in summer is insignificant.

Permeability is slow in the soils of this group. Runoff is slow to rapid. The hazard of erosion is slight to very severe. Available water capacity is very low to moderate.

Pinon pine and Utah juniper in existing stands in this group are mostly of mixed age. The canopy cover ranges from about 30 to 70 percent. Soils of this group are in Suitability Class 1 and have a site index of 140 to 250.

The soil areas of this group generally have good accessibility. Equipment limitations are moderate to severe because of winter snows which persist two to four months of the year depending upon location with

the survey area. Mortality of tree seedlings is moderate to severe, and plant competition is slight. Susceptibility of trees to windthrow is slight to moderate. Some loss is incurred through pests and disease. Under proper forest management, production of pinon Christmas trees is good. Stands of pinon pine trees are considered fair value for fireplace wood, and the Utah juniper trees have fair potential for posts.

In areas where grazing has not been excessive and the tree canopy is about 30 to 70 percent, the understory vegetation consists of blue grama, needleandthread, Indian ricegrass, bitterbrush, and big sagebrush. Productivity of the understory ranges from about 25 pounds of air-dry herbage per acre under a canopy cover of 70 percent to about 50 pounds under a canopy cover of 30 percent. The understory is most heavily grazed by cattle and wildlife. Prolonged excessive grazing results in an understory of big sagebrush, low rabbitbrush, wild buckwheat, and squirrel-tail.

WOODLAND SUITABILITY GROUP 112

The soils in this group are well drained. They have a neutral to slightly acid, gravelly or nongravelly, moderately coarse textured to moderately fine textured surface layer. The subsoil is neutral to moderately alkaline, gravelly and nongravelly, moderately fine textured and fine textured material. Depth to the hardpan ranges from 18 to more than 60 inches. These soils are on terraces or alluvial fans. Elevation ranges from 5,000 to 7,000 feet. The average annual precipitation is 8 to 16 inches, and the average annual air temperature is 41° to 50° F. The frost-free season is 80 to 120 days. Precipitation falls mostly in fall, winter, and spring. The amount that falls in summer is insignificant. Permeability is very slow and moderately slow in the soils of this group. Runoff is slow or medium. The hazard of erosion is slight to moderate. Available water capacity is very low to low.

Pinon pine and Utah juniper in existing stands in this group are mostly mature and are located above mature juniper and mixed-age pinon pine. The canopy cover ranges from about 30 to 50 percent. Soils of the group are in Suitability Class 1 and site index of 100 to 155.

The soil areas of the group generally have good accessibility. Equipment limitations are moderate because of snow. Mortality of tree seedlings is moderate. Plant competition and susceptibility of trees to windthrow are both slight to moderate. Some loss is incurred through pests and disease. Under proper forest management, production of Christmas trees is fair to good, and production of fenceposts is good. Stands of pinon pine trees are considered fair to poor for fireplace wood.

In areas where grazing has not been excessive and the tree canopy is about 30 to 50 percent, the understory vegetation consists of blue grama, Thurber needlegrass, bluegrass, Indian ricegrass, bitterbrush, and big sagebrush. Productivity of the understory ranges from about 50 pounds of air-dry herbage per acre under a canopy cover of 50 percent to about 75 pounds under 30 percent. The understory is mostly moderately grazed by cattle and wildlife. Prolonged excessive

grazing results in an understory of wild buckwheat, big sagebrush, squirreltail, and low rabbitbrush.

WOODLAND SUITABILITY GROUP 101

Nevu gravelly sandy loam, 4 to 15 percent slopes, is the only soil in this group. It is well drained. It has a neutral to moderately alkaline, gravelly, moderately coarse textured surface layer. The subsoil is moderately alkaline, gravelly, and moderately fine textured. Depth to hardpan is about 21 inches. This soil is on terrace tops. Elevation ranges from 6,500 to 7,000 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 43° to 45° F. The frost-free season is 100 to 110 days. Precipitation falls mostly in fall, winter, and spring. It is not significant in summer.

Permeability is moderately slow in this soil. Runoff is medium. The hazard of erosion is moderate. Available water capacity is low.

Pinon pine and Utah juniper in existing stands in this group are mostly of mixed age. The canopy cover ranges from about 30 to 70 percent. Soils of the group are in Suitability Class 1 and have a site index of 110 to 130.

The soil areas of the group are generally good to fair in accessibility. Equipment limitations are moderate because of snow. Mortality of tree seedlings is slight. Plant competition and susceptibility of trees to windthrow are both slight to moderate. Some loss is incurred through pests and disease. Under proper management, production of Christmas trees is fair. Even under good management, however, production of fenceposts is poor. In about 1 or 2 years in 10, production of pine nuts is good. Stands of pinon pine trees are considered fair for fireplace wood.

In areas where grazing has not been excessive and the tree canopy is about 30 to 70 percent, the understory vegetation consists of bitterbrush, black sagebrush, bluegrass, Thurber needlegrass, and squirreltail. Productivity of the understory ranges from about 50 pounds of air-dry herbage per acre under a canopy cover of 70 percent to about 100 pounds under a 30 percent canopy. The understory is mostly heavily grazed by cattle and wildlife. Prolonged excessive grazing results in an understory of black sagebrush, squirreltail, and bitterbrush.

WOODLAND SUITABILITY GROUP 201

The soils in this group are well drained. They have a neutral, stony and extremely stony, medium textured and moderately fine textured surface layer. The subsoil is neutral, gravelly and cobbly, moderately fine textured and fine textured. Depth to a hardpan ranges from 11 to more than 60 inches. They are on mountain faces. Elevation ranges from 5,500 to 9,400 feet. The average annual precipitation is 10 to 22 inches, and the average annual air temperature is 35° to 51° F. The frost-free season is 60 to 120 days. Precipitation falls mostly in fall, winter, and spring. It is not significant in summer.

Permeability is slow in the soils of this group. Runoff is medium to rapid. The hazard of erosion is slight to severe. Available water capacity is very low to moderate.

Pinon pine and Utah juniper in existing stands in this group are mostly of mixed age. The canopy cover ranges from about 30 to 70 percent. Soils of the group are in Suitability Class 2 and have a site index of 50 to 100.

The soil areas of the group are generally poor in accessibility. Equipment limitations are moderate to severe depending upon location, stoniness, slope, and amount of snow. Mortality of tree seedlings is slight to moderate, and plant competition is moderate. Susceptibility of trees to windthrow is slight to moderate. Some loss is incurred because of pests and disease. Under proper management, the production of Christmas trees is good. The production of fenceposts is poor, however, even under good management. In about 1 or 2 years in 10, production of pine nuts is good. Stands of pinon pine trees are considered moderate for fireplace wood.

In areas where grazing has not been excessive and the tree canopy is about 30 to 70 percent, the understory vegetation consists of blue grasses, bluebunch wheatgrass, blue grama, Indian ricegrass, low sagebrush, big sagebrush, bitterbrush, and snowberry. Productivity of the understory ranges from about 100 pounds of air-dry herbage per acre under a canopy cover of 70 percent to about 200 pounds under 30 percent. The understory is mostly moderately heavily grazed by cattle and wildlife. Prolonged excessive grazing results in an understory of blue grasses, Indian ricegrass, squirreltail, and big sagebrush or low sagebrush.

WOODLAND SUITABILITY GROUP 211

The soils in this group are well drained. They have a neutral, gravelly, very gravelly, or cobbly, medium-textured or moderately fine textured surface layer. The subsoil is neutral to moderately alkaline, gravelly, very gravelly, cobbly, or very cobbly. It is moderately coarse textured to fine textured. These soils are mostly deep, but some are strongly cemented with lime at a depth of about 21 inches. They are on mountain faces, terrace tops, and terrace side slopes. Elevation ranges from 5,000 to 7,500 feet. The average annual precipitation is 10 to 16 inches, and the average annual air temperature is 40° to 49° F. The frost-free season is 100 to 130 days. Precipitation falls mostly in fall, winter, and spring. The amount that falls in summer is not significant.

Permeability is slow to moderate in the soils of this group. Runoff is medium to rapid. The hazard of erosion is slight to severe. Available water capacity is very low to moderate.

Pinon pine and Utah juniper in existing stands in this group are mostly of mixed age. The canopy cover ranges from about 30 to 70 percent. Soils of the group are in Suitability Class 2 and have a site index of 80 to 100.

The soil areas of the group are generally fair in accessibility. Equipment limitations are slight to moderate because of slope and snow. Mortality of tree seedlings, plant competition, and susceptibility of trees to windthrow are all also slight to moderate. Some loss is incurred because of pests and disease. Under proper forest management, production of Christmas trees is good to fair, and production of fenceposts poor to fair.

WOODLAND SUITABILITY GROUP 2o1

In about 1 or 2 years in 10, production of pine nuts is good. Stands of pinon pine trees are considered fair for fireplace wood.

In areas where grazing has not been excessive and the tree canopy is about 30 to 70 percent, the understory vegetation consists of bluegrass, Thurber needlegrass, blue grama, Indian ricegrass, bitterbrush, big sagebrush, and black sagebrush. Productivity of the understory ranges from about 100 pounds of air-dry herbage per acre under a canopy cover of 70 percent to about 200 pounds under a cover of 30 percent. The understory is mostly heavily grazed by cattle and wildlife. Prolonged excessive grazing results in an understory of big sagebrush or black sagebrush, low rabbitbrush, squirreltail, and remnants of other grasses.

WOODLAND SUITABILITY GROUP 2d1

The soils in this group are well drained. They have a neutral to strongly alkaline, gravelly, very gravelly, cobbly, and stony, moderately fine textured surface layer. The subsoil is neutral to moderately alkaline and gravelly and very gravelly. It is moderately coarse textured to fine textured. Depth to bedrock ranges from 5 to 18 inches, and depth to hardpan ranges from 8 to 23 inches. These soils are on mountain faces, foothills, and high terraces. Elevation ranges from 5,500 to 9,200 feet. The average annual precipitation is 8 to 20 inches, and the average annual air temperature is 41° to 53° F. The frost-free season is 50 to 110 days. Precipitation falls mostly in fall, winter, and spring. The amount of precipitation is insignificant in summer.

Permeability is moderately rapid to slow in the soils of this group. Runoff is slow to rapid. The hazard of erosion is slight to severe. Available water capacity is very low to low.

Pinon pine and Utah juniper in existing stands in this group are mostly of mixed age. The canopy cover ranges from about 30 to 60 percent. Soils of this group are in Suitability Class 2 and have a site index of 50 to 80.

The soil areas of the group are generally fair in accessibility. Equipment limitations are slight to moderate because of slope and snow. Mortality of tree seedlings is slight to moderate, and plant competition is slight. The susceptibility of trees to windthrow is slight to moderate. Some loss is incurred through pests and disease. Under proper forest management, production of Christmas trees and fenceposts is fair. In about 1 or 2 years in 10, production of pine nuts is good. Stands of pinon trees are considered fair for fireplace wood.

In areas where grazing has not been excessive and the tree canopy is about 30 to 60 percent, the understory vegetation consists of blue grasses, Thurber needlegrasses, bluebunch wheatgrass, low sagebrush or big sagebrush, snowberry, bitterbrush, mountainmahogany, and serviceberry. Productivity of the understory ranges from about 100 pounds of air-dry herbage per acre under a canopy cover of 60 percent to about 200 pounds under 30 percent. The understory is moderately heavily grazed by cattle and wildlife. Prolonged excessive grazing results in an understory of big sagebrush or low sagebrush, snowberry, mountainmahogany, squirreltail, and bluegrass.

The soils in this group are well drained. They have a neutral to mildly alkaline, gravelly, moderately coarse textured and medium textured surface layer. The subsoil is mildly alkaline and moderately alkaline. It is gravelly and nongravelly and is medium textured. Depth to the hardpan is about 27 inches in some soils. These soils are on terraces. Elevation ranges from 6,000 to 6,600 feet. The average annual precipitation is 10 to 12 inches, and the average annual air temperature is 42° to 45° F. The frost-free season is 80 to 100 days. Precipitation falls mostly in fall, winter, and spring. The amount that falls in summer is insignificant.

Permeability is slow in the soils of this group. Runoff is slow and medium. The hazard of erosion is slight to moderate. Available water capacity is low to moderate.

Utah juniper and pinon pine in existing stands in this group are mostly of mixed age. The canopy cover ranges from about 30 to 50 percent. Soils of the group are in Suitability Class 2 and have a site index of 50 to 80.

The soil areas of the group are generally good to fair in accessibility. Equipment limitations are slight to moderate because of snow. Mortality of tree seedlings is slight to moderate, and plant competition is slight. The susceptibility of trees to windthrow is slight to moderate. Some loss is incurred because of pests and disease. Forest tree species have little value for commercial timber products. Under proper forest management, production of Christmas trees is fair, and production of fenceposts is fair to poor. In about 1 or 2 years in 10, production of pine nuts is good.

In areas where grazing has not been excessive and the tree canopy is about 30 to 50 percent, the understory vegetation consists of bluegrass, blue grama, needlegrass, sand dropseed, bluebunch wheatgrass, black sagebrush, and bitterbrush. Productivity of the understory ranges from about 150 pounds of air-dry herbage per acre under a canopy cover of 50 percent to about 250 pounds under a cover of 30 percent. The understory is heavily grazed by cattle and wildlife. Prolonged excessive grazing results in an understory of black sagebrush, squirreltail, blue grama, Indian ricegrass, and bluegrass.

Engineering Uses of the Soils

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built that have properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures of the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 8 and 9, which show respectively, several estimated soil properties significant to engineering and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 8 and 9, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering work, especially work that involves heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many 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 of the terms used in this soil survey have special meaning to soil scientists but are not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering soil classification systems

Two systems of classifying soils are in general use among engineers. Most highway engineers classify soil materials according to the system used by the American Association of State Highway Officials (AASHO) (1). This system is based on grain-size distribution, liquid limit, plasticity index, and field performance of soils in highways. In the AASHO system, soil materials are classified in seven principal groups. The groups range from A-1, which consists of gravelly soils having high bearing strength (the best soils for road subgrade), to A-7, which consists of clayey soils having low strength when wet (the poorest soils for road subgrade). Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. Within each group, the relative engineering value of a soil is indicated by group index numbers that range from 0 for the best material to 20 for the poorest. AASHO classification

without group index numbers is given in table 8 for all soils mapped in the survey area.

Some engineers prefer to use the Unified classification system established by the Corps of Engineers, U.S. Army (6). It is used by Soil Conservation Service engineers, Department of Defense, and others. This system classifies soils according to particle-size distribution, plasticity, liquid limit, and organic matter. In this system the soils are identified as coarse grained (eight classes), fine grained (six classes), and highly organic (one class). The symbols used to identify coarse-grained material are GW, GP, GM, GC, SW, SP, SM, and SC; those used to identify fine-grained material are ML, CL, OL, MH, CH, and OH; and the symbol used to identify highly organic material is Pt. Soils on the borderline between two classifications are given a joint classification, for example, CL-ML.

The system of classification used by the U.S. Department of Agriculture is primarily for agricultural use, but the textural classification is also important in engineering. In this system soils are classified according to the proportions of the different sizes of mineral particles.

USDA textural classification is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 8. These estimates are made for typical soil profiles by layers sufficiently different to have different significances for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 8.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 8 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Liquid limit and plasticity index indicate the effects of water on the strength and consistence of the soil material. As the moisture content of 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 changes from the semi-

solid to plastic state. The liquid limit is the moisture content at which the soil material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 8.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 8 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

The available water capacity is the amount of capillary water held in a soil in a form that plants can use readily.

Reaction refers to the degree of acidity or alkalinity of a soil. The pH value and relative terms used to describe reaction are defined in the Glossary.

Salinity is indicated by the electrical conductivity of saturated soil extract, which is expressed in millimhos per centimeter at 25° C. It affects the suitability of a soil for crops, the stability of a soil when used as construction material, and the corrosivity of a soil to other materials.

Shrink-swell potential indicates the volume change to be expected with a change in moisture content. The shrinking and swelling of soils can cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to structures constructed in, on, or with such materials.

Frost action potential indicates the susceptibility to formation of ice lenses within the soil during periods of freezing temperatures. These lenses cause the soil to expand and lift upward. The combination of soil heaving and accumulation of excess moisture in the soil as the ice thaws results in loss of soil strength. Estimates of potential frost action are made of bare soils not covered with insulating vegetation or snow. Under these conditions, the most severe frost action is likely to occur.

Corrosivity, as used in table 8, pertains to potential soil-induced chemical action that dissolves or weakens untreated steel or concrete. Rate of corrosion of untreated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations

The estimated interpretations in table 9 are based on the engineering properties of soils shown in table 8, on test data for soils in the survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the Area. In table 8

ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage of cropland and pasture, irrigation, ponds and reservoirs, embankments, and terraces and diversions. For these particular uses, table 9 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties generally favorable for the rated use, or in other words, limitations that are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance. For some uses, the rating of severe is divided to obtain ratings of severe and very severe. *Very severe* means one or more soil properties so unfavorable for a particular use that overcoming the limitations is most difficult and costly and commonly not practical for the rated use.

Soil suitability is rated by the terms *good*, *fair*, and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 9.

Septic-tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, slope, and, if the floor needs to be leveled, depth to bedrock. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 9, are not more than three stories high and are supported by foundation

TABLE 8.—Estimated soil properties

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions, if present, for referring to other series that appear in the first column of this table. Absence of data indicates that

| Soil series and map symbols | Depth to— | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|--|----------------------|---------------------------|--|---|--------------------------------------|---------------------------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| *Acana: ACC, AE ----- For Ursine part of AE, see Ursine series. | ³ 1.0-1.5 | >5 | 0-3 3-10 10-17 17-24 24-60 | Gravelly sandy loam --- Sandy clay loam ----- Gravelly loamy sand --- Silica-cemented hardpan. Gravelly loamy sand --- | SM SC SM, SP-SM SP-SM or SM | A-1 A-2 A-2 A-1 | 0 0 0 0-5 |
| Acoma: AGD ----- | >5 | >5 | 0-4 4-30 30-60 | Gravelly sandy loam --- Gravelly sandy clay --- Very gravelly sandy clay loam. | SM SC GC, GP-GC | A-2 or A-4 A-6, A-7 A-2 | 0 0 0 |
| Alluvial land: AL. Too variable for valid estimates. | | | | | | | |
| Aned: ANC ----- | ³ 1.0-1.5 | >5 | 0-4 4-18 18-30 | Sandy loam and loam -- Clay loam ----- Silica cemented hardpan. | SM CL | A-2 or A-4 A-6 | 0 0 |
| *Badland: BA, BB, BD2. Too variable for valid estimates. For Bit part of BB, see Bit series. For Buster and Holsine parts of BD2, see Buster and Holsine series. | | | | | | | |
| *Basket: BKF, BL ----- For Lize and Satt parts of BL, see Lize and Satt series. | >5 | >5 | 0-4 4-17 17-27 27-39 39-60 | Gravelly fine sandy loam and gravelly sandy loam. Very gravelly sandy clay loam. Gravelly sandy loam --- Very gravelly coarse sand. Gravelly sandy loam --- | SM GC GM GP SM or GM | A-2 A-2 A-1 A-1 A-1 | 0-5 0-5 0-5 0-5 0-5 |
| Bicondoa: Bm ----- | >5 | ⁴ 4-6 | 0-9 9-60 | Sandy loam ----- Stratified silt loam, silty clay loam, clay loam, and sandy loam. | SM CL or CH | A-2 or A-4 A-7 | 0 0 |
| Bn ----- | >5 | ⁶ 6-10 | 0-60 | Stratified silt loam, silty clay loam, clay loam, and clay. | CL or CH | A-7 | 0 |
| Bo ^a ----- | >5 | ⁴ 0-1.5 | 0-60 | Stratified silty clay, silty clay loam, and clay. | CL or CH | A-7 | 0 |
| Bit ----- Mapped only in complex with Badland. | ³ 2.0-3.0 | >5 | 0-6 6-24 24-34 34-46 46-60 | Fine sandy loam ----- Very fine sandy loam -- Gravelly loam ----- Stratified, indurated to weakly silica-lime cemented hardpan. Sandy loam ----- | SM ML, CL-ML SM SM | A-7 A-4 A-4 A-2 or A-4 | 0 0 0 0 |

significant to engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the the soil is too variable to rate or that no estimate was made. The symbol > means more than; the symbol < means less than]

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasti- city index | Permea- bility | Available water capacity | Reaction | Salin- ity ¹ | Shrink- swell potential | Frost- action potential | Corrosiv- ity to un- treated steel or concrete |
|--|-----------------------|------------------------|--------------------------|--------------|--------------------------|-------------------|--------------------------------|----------|----------------------------|-------------------------------|-------------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| 80-85 | 55-65 | 35-45 | 15-25 | 15-20 | ³ NP | 2.0-6.0 | 0.08-0.10 | 7.4-8.4 | <2 | Low----- | High----- | High. |
| 85-90 | 60-70 | 45-55 | 20-35 | 25-35 | 10-20 | 0.2-0.6 | 0.16-0.18 | 7.9-9.0 | <2 | Moderate-- | High----- | High. |
| 70-80 | 50-75 | 30-40 | 10-20 | 10-20 | NP | 6.0-20.0 | 0.05-0.07 | 8.5->9.0 | <2 | Low----- | Low----- | High. |
| 70-80 | 45-55 | 30-40 | 10-20 | 10-15 | NP | 6.0-20.0 | 0.04-0.05 | 8.5-<9.0 | <2 | Low----- | Low----- | High. |
| 85-95 | 75-85 | 50-60 | 25-40 | 15-25 | NP | 2.0-6.0 | 0.07-0.10 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 70-90 | 50-75 | 45-65 | 35-45 | 35-45 | 25-30 | 0.06-0.2 | 0.12-0.15 | 6.6-7.8 | <2 | High----- | Moderate-- | High. |
| 40-60 | 20-45 | 25-35 | 10-20 | 25-35 | 15-20 | 0.0-0.6 | 0.06-0.08 | 7.4-8.4 | <2 | Moderate-- | Moderate-- | High. |
| 95-100 | 90-95 | 55-65 | 30-45 | 20-30 | NP-5 | 0.6-2.0 | 0.13-0.15 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 95-100 | 90-95 | 75-85 | 60-70 | 30-40 | 15-20 | 0.2-0.6 | 0.17-0.19 | 6.6-7.3 | <2 | Moderate-- | High----- | High. |
| 70-80 | 60-70 | 45-55 | 25-35 | 20-30 | NP | 2.0-6.0 | 0.07-0.09 | 6.6-7.3 | <2 | Low----- | Moderate-- | High. |
| 45-55 | 20-35 | 15-30 | 10-20 | 30-40 | 10-20 | 0.6-2.0 | 0.06-0.09 | 6.6-7.3 | <2 | Low----- | Moderate-- | High. |
| 50-60 | 40-50 | 20-30 | 10-20 | 15-25 | NP | 2.0-6.0 | 0.07-0.09 | 6.6-7.3 | <2 | Low----- | Moderate-- | High. |
| 35-45 | 25-35 | 10-20 | 0-5 | 10-15 | NP | 6.0-20 | 0.04-0.05 | 8.5-9.0 | <2 | Low----- | Low----- | High. |
| 55-65 | 50-60 | 30-40 | 15-25 | 20-30 | NP | 2.0-6.0 | 0.07-0.09 | 8.5-9.0 | <2 | Low----- | Moderate-- | High. |
| 100 | 100 | 60-70 | 30-40 | 25-35 | NP-5 | 0.6-2.0 | 0.12-0.14 | 7.9-8.4 | <2 | Low----- | High----- | High. |
| 100 | 100 | 85-95 | 70-80 | 40-55 | 25-35 | 0.06-0.2 | 0.17-0.18 | 6.6-8.4 | <2 | Moderate-- | High----- | High. |
| 100 | 95-100 | 85-95 | 80-90 | 40-55 | 25-35 | 0.06-0.2 | 0.17-0.18 | 6.6-8.4 | <2 | Moderate-- | High----- | High. |
| 100 | 95-100 | 85-95 | 80-90 | 40-55 | 25-40 | 0.06-0.2 | 0.17-0.18 | 6.6-7.8 | <2 | Moderate-- | High----- | High. |
| 100 | 95-100 | 70-80 | 40-50 | 25-35 | NP | 2.0-6.0 | 0.10-0.13 | 8.5-9.0 | <2 | Low----- | High----- | High. |
| 100 | 95-100 | 85-95 | 55-65 | 25-35 | 5-10 | 0.6-2.0 | 0.13-0.15 | 8.5-9.0 | <2 | Low----- | High----- | High. |
| 80-90 | 60-70 | 50-60 | 35-45 | 25-35 | NP | 0.6-2.0 | 0.08-0.12 | 9.0 | <2 | Low----- | High----- | High. |
| 100 | 95-100 | 60-70 | 30-40 | 25-35 | NP | 2.0-6.0 | 0.10-0.13 | 8.5-9.0 | 2-4 | Low----- | High----- | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to— | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|---|--------------------|---------------------------|--|--|----------------------------------|---------------------------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| Buster: BR ----- Rough broken land part of BR too variable for valid estimates. | >5 | >5 | 0-3 3-22 22-32 32-60 | Fine sandy loam ----- Sandy clay loam ----- Weakly cemented loam ----- Gravelly loamy coarse sand. | SM SC or CL ML SM | A-4 A-6 or A-7 A-4 A-1 | 0 0 0 0 |
| Cath: CAC ----- | >5 | >5 | 0-3 3-20 20-26 26-60 | Gravelly loam ----- Clay loam and gravelly clay loam. Very gravelly sandy clay loam. Weakly cemented very gravelly loamy sand and very gravelly sandy loam. | SM CL GC GM | A-4 A-6 A-2 A-1 | 0 0 0 0 |
| *Cedaran: CD, CE ----- For Decan part of CD, see Decan series. Rock outcrop part of CE too variable for valid estimates. | 1.0-1.5 | >5 | 0-3 3-18 18 | Cobbly loam ----- Gravelly clay loam ----- Hard tuff bedrock. | ML or CL- ML SC | A-4 A-2, A-6 or A-7 | 25-35 10-20 |
| *Cliffdown: CG ----- For Geer part of CG, see Geer series. | >5 | >5 | 0-12 12-60 | Gravelly sandy loam ----- Stratified very gravelly sandy loam and loamy sand. | SM SM | A-1 A-1 | 0 0 |
| *Decan: DA ----- For Uana part, see Uana series. | 2.0-3.0 2.0-3.0 | >5 | 0-3 3-17 17-23 23-30 | Gravelly clay loam and clay loam. Clay ----- Loam ----- Silica-cemented hardpan stratified with sandy loam. | CL or ML CL or CH ML | A-6 or A-7 A-7 A-4 | 0 0 0 |
| *Decathon: DCC, DED, DEE. For Basket part of DED and DEE, see Basket series. | 2.0-3.0 | >5 | 0-4 4-20 20-27 27-38 38-60 | Gravelly loam ----- Clay loam, gravelly sandy clay loam, and loam. Gravelly sandy loam ----- Silica-cemented hardpan. Very gravelly loamy sand. | SC SC SC or SM-SC GP-GM | A-6 A-6 or A-7 A-2 A-1 | 0 0 0 0 |
| *Deerlodge: DG, DH ----- For Ursine part of DH, see Ursine series. | 1.5-2.5 | >5 | 0-3 3-23 23-30 | Gravelly sandy loam ----- Sandy clay loam and gravelly sandy clay loam. Silica and lime cemented hardpan. | SM SC | A-1 or A-2 A-2 | 0-5 0 |
| *Denmark: DMD, DN. For Linco part of DN, see Linco series. | 1.0-1.5 | >5 | 0-20 20-40 40-60 | Gravelly loam ----- Silica-and-lime cemented hardpan. Very gravelly fine sandy loam. | SM or SM-SC GM | A-4 A-1 | 0-20 0 |

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasticity index | Permeability | Available water capacity | Reaction | Salinity ¹ | Shrink-swell potential | Frost-action potential | Corrosivity to untreated steel or concrete |
|--|-----------------|------------------|--------------------|--------------|------------------|--------------|--------------------------|----------|-----------------------|------------------------|------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| 95-100 | 90-100 | 60-80 | 40-50 | 25-35 | NP | 2.0-6.0 | 0.10-0.13 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 100 | 95-100 | 75-90 | 35-55 | 35-45 | 20-30 | 0.2-0.6 | 0.17-0.18 | 6.6-8.4 | <2 | Moderate- | High----- | High. |
| 95-100 | 85-95 | 75-85 | 55-65 | 25-35 | NP | 0.2-0.6 | 0.12-0.15 | 8.5-9.0 | <2 | Low----- | High----- | High. |
| 70-80 | 60-70 | 25-35 | 10-20 | 15-25 | NP | 6.0-20 | 0.05-0.07 | 7.9-8.4 | <2 | Low----- | Low----- | High. |
| 95-100 | 75-85 | 65-75 | 40-50 | 30-40 | 5-10 | 0.6-2.0 | 0.10-0.13 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 85-95 | 75-85 | 65-80 | 50-60 | 30-40 | 10-20 | 0.06-0.2 | 0.13-0.15 | 7.4-7.8 | <2 | Moderate- | High----- | High. |
| 40-50 | 35-45 | 30-40 | 20-30 | 30-40 | 10-20 | 0.2-0.6 | 0.06-0.08 | 7.9-8.4 | <2 | Low----- | Moderate- | High. |
| 40-50 | 30-40 | 15-25 | 10-15 | 15-25 | NP | 0.2-0.6 | 0.05-0.07 | 8.5-9.0 | 2-4 | Low----- | Low----- | High. |
| 80-90 | 75-85 | 65-75 | 50-60 | 25-35 | 5-10 | 2.0-6.0 | 0.08-0.10 | 6.6-7.3 | <2 | Low----- | High----- | Moderate. |
| 70-80 | 50-60 | 45-55 | 30-40 | 35-45 | 15-25 | 0.2-0.6 | 0.12-0.14 | 6.6-7.3 | <2 | Moderate- | High----- | Moderate. |
| 75-85 | 55-65 | 30-40 | 15-25 | 20-30 | NP | 2.0-6.0 | 0.07-0.10 | 7.9-9.0 | <2 | Low----- | Moderate- | High. |
| 60-70 | 45-55 | 25-35 | 10-20 | 15-25 | NP | 2.0-6.0 | 0.05-0.07 | 8.5-9.0 | <2 | Low----- | Moderate- | High. |
| 85-95 | 75-85 | 70-80 | 50-60 | 35-45 | 10-20 | 0.2-0.6 | 0.13-0.16 | 6.1-6.5 | <2 | Moderate- | High----- | Moderate. |
| 95-100 | 85-95 | 75-85 | 65-75 | 45-55 | 25-35 | 0.06-0.2 | 0.15-0.17 | 6.1-7.3 | <2 | High----- | High----- | High. |
| 95-100 | 85-95 | 70-80 | 50-60 | 30-40 | 5-10 | 0.6-2.0 | 0.13-0.15 | 6.6-7.8 | <2 | Low----- | High----- | High. |
| 75-85 | 60-70 | 50-60 | 35-45 | 30-40 | 10-15 | 0.6-2.0 | 0.10-0.13 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 85-95 | 75-85 | 65-75 | 40-50 | 35-45 | 15-20 | 0.2-0.6 | 0.15-0.17 | 7.4-8.4 | <2 | Moderate- | High----- | High. |
| 80-90 | 65-75 | 55-65 | 25-35 | 20-30 | 5-15 | 2.0-6.0 | 0.09-0.11 | 7.9-8.4 | <2 | Low----- | High----- | High. |
| 35-45 | 25-35 | 10-20 | 5-10 | 10-20 | NP | 6.0-20 | 0.04-0.06 | 7.9-9.0 | <2 | Low----- | Low----- | High. |
| 80-90 | 65-75 | 40-50 | 20-30 | 20-30 | NP | 2.0-6.0 | 0.07-0.10 | 7.4-7.8 | <2 | Low----- | Moderate- | High. |
| 80-90 | 60-70 | 50-60 | 25-35 | 35-45 | 20-30 | 0.2-0.6 | 0.10-0.13 | 7.4-8.4 | <2 | Moderate- | Moderate- | High. |
| 70-80 | 60-70 | 50-65 | 35-45 | 25-35 | 5-10 | 2.0-6.0 | 0.10-0.13 | 8.5-9.0 | <2 | Low----- | High----- | High. |
| 35-45 | 25-35 | 20-25 | 10-15 | 20-30 | NP | 6.0-20 | 0.05-0.07 | 8.5->9.0 | <2 | Low----- | Low----- | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to— | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|---|--------------------|---------------------------|--------------------|--|-----------------|------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| Fanu: FAC ----- | >5 | >5 | 0-9 | Gravelly fine sandy loam. | SM or SC- SM | A-2 | 0 |
| | | | 9-27 | Loam and sandy clay loam. | SC or CL | A-6 | 0 |
| | | | 27-60 | Stratified sandy clay loam and sandy loam. | SC or SM- SC | A-2 or A-6 | 0 |
| Four Star ----- Mapped only in association with Holte series. | >5 | * 1-2 | 0-13 | Stratified gravelly coarse sandy loam, sandy loam, and silty clay loam. | ML or CL- ML | A-4 | 0 |
| | | | 13-60 | Stratified fine sandy loam, gravelly loam, silt loam, coarse sandy loam, and sand. | ML | A-4 or A-5 | 0 |
| Geer: GE ----- | * >5 | >5 | 0-32 | Fine sandy loam, stratified sandy loam, and loam. | SM | A-4 | 0 |
| | | | 32-60 | Stratified sandy loam, loamy sand, loam, and gravelly coarse sand. | SM or SP- SM | A-1 | 0-5 |
| *Gf, GM ----- For Heist part of GM, see Heist series. | >5 | * 4-6 | 0-12 | Silt loam ----- | ML | A-4 or A-5 | 0 |
| | | | 12-60 | Stratified silt loam, loam, very fine sandy loam, and loamy sand. | ML | A-4 or A-5 | 0 |
| Gg, Gh ----- | >5 | * 2-5 | 0-12 | Silt loam ----- | ML | A-4 or A-5 | 0 |
| | | | 12-60 | Stratified silt loam, loam, very fine sandy loam, and loamy sand. | ML | A-4 or A-5 | 0 |
| Gk ----- | >5 | * 2-5 | 0-12 | Silt loam ----- | ML | A-4 or A-5 | 0 |
| | | | 12-60 | Stratified silt loam, loam, very fine sandy loam, and loamy sand. | ML | A-4 or A-5 | 0 |
| *Hamtah: HA, HC ----- For Tica part of HA and Udel part of HC, see Tica and Udel series. Rock outcrop part of HC too variable for valid estimates. | * 5-6.5 | >5 | 0-10 | Very stony clay loam --- | SC | A-6 | 25-35 |
| | | | 10-21 | Gravelly clay loam ----- | GC | A-6 | 0-5 |
| | | | 21-41 | Gravelly and very gravelly clay. | GC | A-7 | 0-5 |
| | | | 41-60 | Very gravelly clay loam. | GC | A-2 | 0-5 |
| Heist: HDC ----- | >5 | >5 | 0-35 | Gravelly sandy loam --- | SM | A-1 or A-2 | 0 |
| | | | 35-60 | Sandy loam ----- | SM | A-2 | 0 |
| HEC ----- | >5 | >5 | 0-30 | Gravelly sandy loam --- | SM | A-1 or A-2 | 0 |
| | | | 30-60 | Gravelly loamy sand --- | SM or SP- SM | A-1 | 0 |
| *Holsine: HN ----- For Usine and Buster parts of HN, see Usine and Buster series. | >5 | >5 | * 0-12 | Gravelly and very gravelly coarse sandy loam. | SM or SP- SM | A-1 | 0-1 |
| | | | 12-60 | Very fine sandy loam --- | SM or ML | A-4 | 0 |

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasti- city index | Permea- bility | Available water capacity | Reaction | Salin- ity ¹ | Shrink- swell potential | Frost- action potential | Corrosiv- ity to un- treated steel or concrete |
|---|-----------------------|------------------------|--------------------------|-----------------|--------------------------|---------------------------------------|---|----------------------|----------------------------|-------------------------------|-------------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| 90-100 | 65-75 | 45-55 | 25-35 | 25-35 | 5-10 | <i>Inches per hour</i> 2.0-6.0 | <i>Inches per inch of soil</i> 0.08-0.10 | <i>pH</i> 7.4-7.8 | <2 | Low----- | High----- | High. |
| 100 | 95-100 | 75-85 | 45-55 | 25-35 | 10-20 | 0.6-2.0 | 0.15-0.18 | 7.9-8.4 | <2 | Moderate- | High----- | High. |
| 100 | 95-100 | 65-75 | 30-40 | 25-35 | 5-15 | 0.6-2.0 | 0.13-0.15 | 7.9-8.4 | <2 | Moderate- | High----- | High. |
| 95-100 | 80-90 | 70-80 | 50-60 | 25-35 | 5-10 | 0.6-2.0 | 0.12-0.14 | 6.1-7.3 | <2 | Moderate- | High----- | High. |
| 95-100 | 85-95 | 60-70 | 50-60 | 35-45 | 5-10 | 0.6-2.0 | 0.12-0.14 | 6.1-7.3 | <2 | Low----- | High----- | High. |
| 100 | 90-100 | 65-80 | 35-50 | 25-35 | NP-5 | 2.0-6.0 | 0.10-0.13 | 7.4-8.4 | 2-4 | Low----- | High----- | High. |
| 80-90 | 65-75 | 30-40 | 10-20 | 15-25 | NP | 2.0-6.0 | 0.07-0.09 | 7.9-8.4 | 2-4 | Low----- | Moderate- | High. |
| 100 | 100 | 90-100 | 75-85 | 35-45 | 5-10 | 0.6-2.0 | 0.14-0.17 | 7.9-9.0 | 2-4 | Low----- | High----- | High. |
| 100 | 100 | 80-90 | 55-65 | 35-45 | 5-10 | 0.6-2.0 | 0.12-0.14 | 7.9->9.0 | 2-4 | Low----- | High----- | High. |
| 100 | 100 | 90-100 | 75-85 | 35-45 | 5-10 | 0.6-2.0 | 0.14-0.17 | 7.9-9.0 | 4-16 | Low----- | High----- | High. |
| 100 | 100 | 80-90 | 55-65 | 35-45 | 5-10 | 0.6-2.0 | 0.12-0.14 | 7.9->9.0 | 4-16 | Low----- | High----- | High. |
| 100 | 100 | 90-100 | 75-85 | 35-45 | 5-10 | 0.6-2.0 | 0.14-0.17 | 7.9-9.0 | 0-16 | Low----- | High----- | High. |
| 100 | 100 | 80-90 | 55-65 | 35-45 | 5-10 | 0.6-2.0 | 0.12-0.14 | 7.9->9.0 | 2-8 | Low----- | High----- | High. |
| 70-80 | 60-70 | 55-65 | 35-45 | 30-40 | 15-25 | 0.2-0.6 | 0.03-0.15 | 6.1-7.3 | <2 | Moderate- | High----- | High. |
| 60-70 | 50-60 | 45-55 | 35-45 | 30-40 | 15-25 | 0.2-0.6 | 0.10-0.13 | 6.1-7.3 | <2 | Moderate- | High----- | High. |
| 50-60 | 45-55 | 40-50 | 35-45 | 40-50 | 20-30 | 0.06-0.2 | 0.10-0.13 | 6.1-7.3 | <2 | High----- | Moderate- | High. |
| 50-60 | 40-50 | 35-45 | 25-35 | 30-40 | 15-25 | 0.2-0.6 | 0.08-0.10 | 6.6-7.3 | <2 | Moderate- | Moderate- | High. |
| 75-85 | 65-75 | 40-50 | 20-30 | 20-30 | NP | 2.0-6.0 | 0.07-0.10 | 7.9-9.0 | <2 | Low----- | Moderate- | High. |
| 85-95 | 75-85 | 45-55 | 25-35 | 20-30 | NP | 2.0-6.0 | 0.10-0.13 | 7.9-9.0 | <2 | Low----- | Moderate- | High. |
| 75-85 | 65-75 | 40-50 | 20-30 | 20-30 | NP | 2.0-6.0 | 0.07-0.10 | 8.5-9.0 | <2 | Low----- | Moderate- | High. |
| 70-80 | 60-70 | 35-45 | 10-20 | 15-25 | NP | 2.0-6.0 | 0.05-0.07 | 8.5-9.0 | <2 | Low----- | Moderate- | High. |
| 65-75 | 35-45 | 20-30 | 10-15 | 15-20 | NP-5 | 2.0-6.0 | 0.05-0.07 | 7.9-8.4 | <2 | Low----- | Low----- | High. |
| 85-95 | 80-90 | 70-80 | 45-55 | 30-40 | NP-5 | 0.6-0.2 | 0.14-0.17 | 7.9-9.0 | <2 | Low----- | High----- | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to— | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|--|----------------------|---------------------------|-------------------------------|--|------------------------------------|---------------------------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| *Holtle: HOC, HR ----- For Four Star part of HR, see Four Star series. | >5 | ⁶ >5 | 0-28 28-60 | Loam ----- Silt loam ----- | ML ML | A-4 A-4 or A-5 | 0 0 |
| Homestake: HSC, HTC -- | >5 | >5 | 0-6 6-20 20-41 41-60 | Gravelly sandy loam and gravelly sandy clay loam. Gravelly and very gravelly clay loam and clay. Very cobbly and gravelly sandy clay loam. Very cobbly and gravelly loamy sand. | SC SC SC SM | A-2 A-2 or A-6 A-2 A-1 | 5-35 0-5 50-60 50-60 |
| *Itca: IND, IO, IR ----- For Cedar part of IO, see Cedar series. Rock outcrop part of IR too variable for valid estimates. | ⁷ 1.0-1.5 | >5 | 0-5 5-14 14 | Stony loam and gravelly clay loam. Gravelly clay ----- Volcanic bedrock. | CL GC | A-6 A-2, A-6 or A-7 | 25-35 10-15 |
| Jarab: JCD ----- | ⁸ 1.0-1.5 | >5 | 0-5 5-10 10-35 | Cobbly loam and gravelly loam. Gravelly clay loam ----- Silica-lime cemented hardpan. | GC-GM, GC, SC-SM or SC GC | A-4 A-6 | 30-40 0-5 |
| *Kyler: KO, KR ----- For Kyler moderately deep variant part of KR, see Kyler moderately deep variant. Rock outcrop parts of KO and KR too variable for valid estimates. | 0.5-1.5 | >5 | 0-7 7 | Cobbly loam and gravelly loam. Limestone bedrock. | SC or SC-SM | A-4 | 30-40 |
| Kyler moderately deep variant. Mapped only in association with KR. | 2-4 | >5 | 0-11 11-43 | Very stony loam and gravelly loam. Very gravelly loam ----- | SC or SC-SM GC or GC-GM | A-4 A-1 or A-2 | 20-30 0-5 |
| Lien: LAB ----- | ⁸ 0.5-1 | >5 | 0-8 8-24 24-60 | Gravelly and very gravelly fine sandy loam. Silica-lime cemented hardpan. Weakly cemented loamy fine sand. | SM SM | A-2 A-2 | 0 0 |

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasti- city index | Permea- bility | Available water capacity | Reaction | Salin- ity ¹ | Shrink- swell potential | Frost- action potential | Corrosiv- ity to un- treated steel or concrete |
|---|-----------------------|------------------------|--------------------------|-----------------|--------------------------|--------------------|--------------------------------|--------------------|----------------------------|-------------------------------|-------------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| 95-100 100 | 95-100 95-100 | 80-90 85-95 | 60-70 65-85 | 25-35 35-45 | NP-5 5-10 | 0.6-2.0 0.6-2.0 | 0.12-0.15 0.15-0.18 | 6.6-7.3 7.9-8.4 | <2 <2 | Low----- Low----- | High----- High----- | High. High. |
| 70-80 | 60-70 | 50-60 | 25-35 | 25-35 | 10-20 | 0.2-0.6 | 0.08-0.10 | 6.6-7.3 | <2 | Moderate- | Moderate- | High. |
| 50-60 | 40-50 | 35-45 | 30-40 | 30-40 | 15-25 | 0.06-0.2 | 0.06-0.08 | 6.6-7.3 | <2 | Moderate- | Moderate- | High. |
| 65-75 | 55-65 | 45-55 | 20-30 | 25-35 | 10-20 | 0.2-0.6 | 0.08-0.10 | 7.9-8.4 | <2 | Moderate- | Moderate- | High. |
| 65-75 | 60-70 | 30-40 | 10-20 | 15-25 | NP | 6.0-20 | 0.06-0.08 | 8.5-9.0 | <2 | Low----- | Moderate- | High. |
| 75-85 | 70-80 | 60-70 | 50-60 | 25-35 | 10-20 | 0.2-0.6 | 0.10-0.13 | 6.1-7.3 | <2 | Moderate- | High----- | High. |
| 50-60 | 45-55 | 40-55 | 30-40 | 30-40 | 15-20 | 0.06-0.2 | 0.10-0.13 | 6.6-7.3 | <2 | Moderate- | Moderate- | High. |
| 65-75 | 60-70 | 55-65 | 35-45 | 20-30 | 5-10 | 0.6-2.0 | 0.07-0.09 | 7.9-9.0 | <2 | Low----- | High----- | High. |
| 60-70 | 50-60 | 45-55 | 35-45 | 30-40 | 10-20 | 0.2-0.6 | 0.08-0.10 | 7.9-9.0 | <2 | Moderate- | High----- | High. |
| 70-80 | 60-70 | 55-65 | 35-45 | 20-30 | 5-10 | 0.6-2.0 | 0.07-0.09 | 7.9-9.0 | <2 | Low----- | High----- | High. |
| 70-80 | 60-70 | 55-65 | 35-45 | 20-30 | 5-10 | 0.6-2.0 | 0.07-0.09 | 7.9-9.0 | <2 | Low----- | High----- | High. |
| 40-50 | 30-40 | 25-35 | 20-30 | 20-30 | 5-10 | 0.6-2.0 | 0.05-0.06 | 8.5-9.0 | <2 | Low----- | Moderate- | High. |
| 65-75 | 60-70 | 40-50 | 25-30 | 20-25 | NP | 2.0-6.0 | 0.05-0.06 | 7.9-8.4 | <2 | Low----- | Moderate- | High. |
| 90-100 | 90-100 | 60-70 | 20-30 | 15-25 | NP | 6.0-20 | 0.08-0.10 | 8.5-9.0 | 2-4 | Low----- | Moderate- | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to— | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|--|----------------------|---------------------------|--|---|---|---------------------------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| *Linco: LC, LD ----- For Acana part of LC, see Acana series. Badland part of LD too variable to estimate. | >5 | >5 | 0-8 8-60 | Gravelly sandy loam and gravelly loam. Gravelly fine sandy loam. | SM SM | A-2 A-2 | 0-5 0 |
| *Lize: LE, LT ----- For Tica part of LT, see Tica series. | >5 | >5 | 0-7 7-35 35-60 | Stony fine sandy loam and gravelly loam. Gravelly clay loam ---- Gravelly sandy loam --- | SM GC GM-SM | A-2, A-4 A-6 or A-7 A-2 | 5-20 0 0 |
| *Met: MU ----- For Ursine part of MU, see Ursine series. | ^a 2.0-3.0 | >5 | 0-13 13-31 31-37 37-60 60-69 | Very fine sandy loam --- Loam ----- Gravelly fine sandy loam. Silica-lime cemented hardpan. Gravelly loamy fine sand. | SM or ML ML GM or SM SP-SM or SM | A-4 A-4 A-1 A-1 | 0 0 0 0 |
| *Minu: MVC ----- | ^a 1.0-1.5 | >5 | 0-12 12-18 18-28 28-53 53-60 | Gravelly sandy loam and gravelly loam. Sandy clay loam ----- Silica-cemented hardpan. Stratified very gravelly loamy sand and sandy loam. Sandy clay loam ----- | GM or SM SC GP-GM SC | A-4 A-2 A-1 A-2 or A-6 | 0-1 0 0 0 |
| MWC ----- | ^a 1.0-1.5 | >5 | 0-3 3-13 13-22 22-60 | Stony sandy loam ----- Gravelly clay loam ---- Silica-cemented hardpan. Very gravelly loamy sand. | GM SC GP-GM | A-1 A-2 A-1 | 10-20 0-2 0 |
| Nevtah: NR ----- Rock outcrop part of NR too variable for valid estimates. | ^r 1.5-3.5 | >5 | 0-11 11-25 25-30 30 | Stony loam ----- Gravelly loam ----- Weathered tuff bedrock. Hard tuff bedrock. | SM-SC or SC GM-GC or GC | A-4 A-2 | 5-20 0 |
| Nevu: NSD ----- | ^a 1.5-2.3 | >5 | 0-11 11-21 21-36 36-50 | Gravelly sandy loam and gravelly loam. Gravelly clay loam ---- Silica-lime cemented hardpan. Gravelly sandy loam --- | SM-SC or SC SC SM | A-2 or A-4 A-2 or A-6 A-1 | 0 0 0 |
| Pahranagat: Pa ----- | >5 | 2.5-4.0 | 0-42 42-60 | Stratified silt loam, clay loam, and silty clay loam. Stratified silt loam, clay loam, and clay. | CL CL | A-6 A-7 | 0 0 |

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasticity index | Permeability | Available water capacity | Reaction | Salinity ¹ | Shrink-swell potential | Frost-action potential | Corrosivity to untreated steel or concrete |
|--|-----------------|------------------|--------------------|--------------|------------------|------------------------|--------------------------------|-----------|-----------------------|------------------------|------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| | | | | | | <i>Inches per hour</i> | <i>Inches per inch of soil</i> | <i>pH</i> | | | | |
| 75-85 | 60-70 | 45-55 | 25-35 | 20-30 | NP | 0.6-2.0 | 0.07-0.10 | 7.9-8.4 | <2 | Low----- | Moderate- | High. |
| 75-85 | 55-65 | 35-45 | 20-30 | 20-30 | NP | 0.6-2.0 | 0.07-0.10 | 8.5-9.0 | 2-4 | Low----- | Moderate- | High. |
| 70-80 | 55-65 | 45-55 | 30-40 | 20-30 | NP-5 | 0.6-2.0 | 0.06-0.10 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 60-70 | 50-60 | 45-55 | 35-45 | 35-45 | 15-25 | 0.2-0.6 | 0.10-0.13 | 6.6-7.3 | <2 | Moderate- | High----- | High. |
| 60-70 | 50-60 | 30-40 | 15-25 | 20-30 | 5-10 | 2.0-6.0 | 0.05-0.06 | 7.4-8.4 | <2 | Low----- | Moderate- | High. |
| 95-100 | 90-100 | 75-85 | 45-55 | 25-35 | NP-5 | 0.6-2.0 | 0.13-0.15 | 8.5-9.0 | <2 | Low----- | High----- | High. |
| 95-100 | 85-95 | 70-80 | 50-60 | 30-40 | 5-10 | 0.06-0.2 | 0.13-0.15 | >9.0 | 4-8 | Low----- | High----- | High. |
| 55-65 | 40-50 | 25-35 | 15-25 | 20-30 | NP-5 | 2.0-6.0 | 0.07-0.08 | >9.0 | 4-16 | Low----- | High----- | High. |
| 55-65 | 40-50 | 20-30 | 5-15 | 15-25 | NP | 6.0-20 | 0.05-0.06 | 8.5-9.0 | 8-16 | Low----- | Low----- | High. |
| 65-75 | 60-70 | 50-60 | 35-45 | 25-35 | NP-5 | 0.6-2.0 | 0.08-0.10 | 6.6-7.3 | <2 | Low----- | Moderate- | High. |
| 70-80 | 60-70 | 45-55 | 25-35 | 30-40 | 15-25 | 0.2-0.6 | 0.10-0.13 | 7.4-8.4 | <2 | Moderate- | High----- | High. |
| 30-40 | 25-35 | 15-25 | 5-10 | 10-20 | NP | 6.0-20 | 0.05-0.06 | 7.9-9.0 | <2 | Low----- | Low----- | High. |
| 85-95 | 75-85 | 60-70 | 30-40 | 30-40 | 15-25 | 0.06-0.2 | 0.17-0.19 | 7.9-9.0 | <2 | Moderate- | High----- | High. |
| 50-60 | 45-55 | 25-35 | 15-20 | 20-30 | NP-5 | 2.0-6.0 | 0.05-0.06 | 6.6-7.3 | <2 | Low----- | Moderate- | High. |
| 70-80 | 60-70 | 45-55 | 25-35 | 30-40 | 20-30 | 0.2-0.6 | 0.10-0.13 | 7.4-8.4 | <2 | Moderate- | Moderate- | High. |
| 40-50 | 30-40 | 15-25 | 5-10 | 10-20 | NP | 6.0-20 | 0.05-0.06 | 8.5-9.0 | <2 | Low----- | Low----- | High. |
| 70-80 | 60-70 | 50-60 | 35-45 | 20-30 | 5-10 | 0.6-2.0 | 0.10-0.13 | 6.1-7.3 | <2 | Low----- | High----- | Moderate. |
| 50-60 | 40-50 | 35-45 | 25-35 | 20-30 | 5-10 | 0.6-2.0 | 0.07-0.10 | 6.1-7.3 | <2 | Low----- | Moderate- | Moderate. |
| 65-75 | 55-75 | 45-55 | 30-40 | 20-30 | 5-10 | 0.6-2.0 | 0.07-0.10 | 6.6-8.4 | <2 | Low----- | High----- | High. |
| 65-75 | 50-60 | 45-55 | 30-40 | 25-35 | 10-20 | 0.2-0.6 | 0.10-0.13 | 7.9-8.4 | <2 | Moderate- | High----- | High. |
| 60-70 | 55-65 | 30-40 | 15-25 | 20-30 | NP | 2.0-6.0 | 0.06-0.08 | 7.9-9.0 | <2 | Low----- | Moderate- | High. |
| 100 | 100 | 90-100 | 75-85 | 30-40 | 20-30 | 0.2-0.6 | 0.16-0.18 | 7.9-9.0 | >16 | Moderate- | High----- | High. |
| 100 | 100 | 90-100 | 75-85 | 40-50 | 25-35 | 0.2-0.6 | 0.16-0.18 | 7.9-8.4 | 8-16 | Moderate- | High----- | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to— | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|---|--------------------|---------------------------|--------------------|--|-----------------|------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| Pahranagat—Con. Pd ----- | >5 | 4-5 | 0-42 | Stratified silt loam, clay loam, and silty clay loam. | CL | A-6 | 0 |
| | | | 42-60 | Stratified silt loam, clay loam, and clay. | CL | A-7 | 0 |
| Pe ----- | >5 | * 1-2 | 0-42 | Silty clay loam and clay loam. | CL | A-6 or A-7 | 0 |
| | | | 42-60 | Stratified silt loam, clay loam, clay, and sandy loam. | CL | A-6 or A-7 | 0 |
| Pg ----- | >5 | 4-5 | 0-42 | Stratified silt loam, clay loam, and silty clay loam. | CL | A-6 | 0 |
| | | | 42-60 | Stratified silt loam, clay loam, and clay. | CL | A-7 | 0 |
| Pamsdel: PMC ----- | * 1.5-2.5 | 5 | 0-4 | Loam ----- | ML or CL- ML | A-4 | 0-5 |
| | | | 4-15 | Clay loam ----- | CL | A-7 | 0 |
| | | | 15-21 | Very gravelly clay loam. | SC | A-2 | 0 |
| | | | 21-36 | Lime cemented hardpan. | | | |
| *Patter: PN, PR ----- | >5 | 5 | 0-16 | Loam and very fine sandy loam. | ML | A-4 | 0 |
| For Geer part of PN, see Geer series. For Shroe part of PR, see Shroe series. | | | 16-60 | Silt loam ----- | ML | A-4 | 0 |
| PO ----- | >5 | * 5-8 | 0-37 | Silty clay loam and light clay loam. | ML or CL | A-6 | 0 |
| For Heist and Geer parts of PO, see Heist and Geer series. | | | 37-60 | Silt loam ----- | ML | A-4 | 0 |
| *Pioche: PS ----- | * 0.5-1.5 | 5 | 0-4 | Extremely stony loam and cobbly clay loam. | CL | A-6 | 60-70 |
| Rock outcrop part too variable for valid estimates. | | | 4-11 | Cobbly clay ----- | CL or CH | A-7 | 40-50 |
| | | | 11 | Hard quartzite. | | | |
| Poorma: PTB ----- | >5 | 5 | 0-60 | Very fine sandy loam and silt loam. | ML | A-4 | 0 |
| Poorma clay variant: PV. | >5 | 4.5->5 | 0-6 | Silt loam ----- | CL-ML or CL | A-4 | 0 |
| | | | 6-60 | Clay ----- | CL or CH | A-7 | 0 |
| Rock land: RO ----- | | | | | | | |
| Too variable for valid estimates. | | | | | | | |
| Rock outcrop: Too variable for valid estimates. Mapped only in association or complex with Cedar, Itca, Kyler, Nevtah, Pioche, Tica, Udel, Urtah, Winu, and Zoate soils. | | | | | | | |

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasticity index | Permeability | Available water capacity | Reaction | Salinity ¹ | Shrink-swell potential | Frost-action potential | Corrosivity to untreated steel or concrete |
|--|-----------------|------------------|--------------------|----------------|------------------|-----------------------------------|---|----------------------|-----------------------|------------------------|------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| 100 | 100 | 90-100 | 75-85 | 30-40 | 20-30 | <i>Inches per hour</i> 0.2-0.6 | <i>Inches per inch of soil</i> 0.16-0.18 | <i>pH</i> 7.9-9.0 | >16 | Moderate | High | High. |
| 100 | 100 | 90-100 | 75-85 | 40-50 | 25-35 | 0.2-0.6 | 0.16-0.18 | 7.9-8.4 | 8-16 | Moderate | High | High. |
| 100 | 100 | 95-100 | 85-95 | 35-45 | 20-30 | 0.2-0.6 | 0.16-0.18 | 8.5-9.0 | 2-4 | Moderate | High | High. |
| 100 | 100 | 90-100 | 70-80 | 35-45 | 15-25 | 0.2-0.6 | 0.16-0.18 | 7.9-8.4 | 2-4 | Moderate | High | High. |
| 100 | 100 | 90-100 | 75-85 | 30-40 | 20-30 | 0.2-0.6 | 0.16-0.18 | 7.9-9.0 | 4-8 | Moderate | High | High. |
| 100 | 100 | 90-100 | 75-85 | 40-50 | 25-35 | 0.2-0.6 | 0.16-0.18 | 7.9-8.4 | 4-8 | Moderate | High | High. |
| 85-95 | 80-90 | 70-80 | 50-60 | 25-35 | 5-10 | 0.6-2.0 | 0.12-0.14 | 7.9-8.4 | <2 | Low | High | High. |
| 90-95 60-70 | 85-95 30-40 | 75-85 25-35 | 60-70 20-30 | 40-50 35-45 | 15-25 15-25 | 0.6-2.0 0.6-2.0 | 0.15-0.18 0.08-0.10 | 7.9-8.4 8.5-9.0 | <2 <2 | Moderate Moderate | High Moderate | High High. |
| 100 | 95-100 | 80-90 | 50-60 | 20-30 | NP-5 | 0.6-2.0 | 0.16-0.18 | 7.9-9.0 | 2-4 | Low | High | High. |
| 100 | 95-100 | 85-95 | 75-85 | 25-35 | NP-5 | 0.6-2.0 | 0.16-0.18 | 7.9-9.0 | 2-4 | Low | High | High. |
| 100 | 100 | 85-95 | 65-75 | 30-40 | 10-15 | 0.2-0.6 | 0.16-0.18 | 7.9-9.0 | 8-16 | Moderate | High | High. |
| 100 | 95-100 | 85-95 | 75-85 | 25-35 | NP-5 | 0.6-2.0 | 0.16-0.18 | 7.9-9.0 | 4-8 | Low | High | High. |
| 75-85 | 70-80 | 65-75 | 50-60 | 30-40 | 15-25 | 0.2-0.6 | 0.05-0.07 | 6.6-7.3 | 2 | Moderate | Moderate | High. |
| 85-95 | 80-90 | 75-85 | 65-75 | 45-55 | 25-35 | 0.06-0.2 | 0.05-0.07 | 6.6-8.4 | <2 | High | Moderate | High. |
| 95-100 | 90-100 | 85-95 | 70-80 | 20-30 | NP-5 | 0.6-0.2 | 0.16-0.18 | 8.5-9.9 | 2-4 | Low | High | High. |
| 100 | 95-100 | 85-95 | 70-80 | 20-30 | 5-10 | 0.6-2.0 | 0.16-0.18 | 7.9-9.0 | >16 | Low | High | High. |
| 100 | 100 | 90-100 | 75-85 | 45-55 | 25-35 | <0.06 | 0.13-0.15 | 8.5-9.0 | 4-16 | High | Moderate | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to— | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|---|----------------------|---------------------------|--|---|--|--|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| Rough broken land. Too variable for valid estimates. Mapped only in association with Buster soil. | | | | | | | |
| *Roval: RRD, RV ----- For Acana part of RV, see Acana series. | ^a 1.0-1.5 | >5 | 0-14 14-32 32-60 | Gravelly loam and gravelly clay loam. Silica-lime cemented hardpan. Very gravelly loamy sand. | SC or SM-SC SM or SP-SM | A-4 A-1 | 0-5 0-5 |
| Satt: SAD2, SCC2, SD --- | ^a 1.5-2.5 | >5 | 0-2 2-25 25-60 | Stony sandy loam ----- Gravelly sandy clay loam, gravelly clay, very gravelly sandy clay, and very gravelly sandy clay loam. Silica-cemented hardpan. | SM GC | A-2 A-6 or A-7 | 5-30 0-5 |
| Seval: SEF ----- | ^a 1.5-2.5 | >5 | 0-3 3-14 14-23 23-27 27-60 | Very gravelly sandy loam. Gravelly sandy clay loam and gravelly clay. Gravelly sandy loam -- Silica-cemented hardpan. Stratified very gravelly sand, very gravelly fine sand, and very gravelly loam. | SC or SM-SC CL SM, SC or SM-SC GP-GM or SP-SM | A-1 or A-2 A-6 or A-7 A-2 A-1 | 20-30 10-15 0-5 0-5 |
| Shroe: SGD, SH ----- Badland part of SH too variable for valid estimates. | >5 | >5 | 0-10 10-16 16-40 40-60 | Gravelly sandy clay loam. Gravelly clay ----- Very gravelly sandy clay loam. Loam ----- | SC SC or CL GC or GP-GC ML | A-2 A-7 A-2 A-4 | 0-25 0-5 0-5 0 |
| Sieroclipf: SKC ----- | ^a 1.5-2.5 | >5 | 0-3 3-11 11-21 21-48 48-60 | Gravelly sandy loam --- Clay loam and gravelly clay loam. Gravelly loam ----- Silica-lime cemented hardpan. Gravelly loamy sand --- | SM SC SM or SM-SC SM or SP-SM | A-1 or A-2 A-6 A-4 A-1 | 0-5 0-5 0-5 0-5 |
| Slickens: SL. Too variable for valid estimates. | | | | | | | |

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasti- city index | Permea- bility | Available water capacity | Reaction | Salin- ity ¹ | Shrink- swell potential | Frost- action potential | Corrosiv- ity to un- treated steel or concrete |
|---|-----------------------|------------------------|--------------------------|-----------------|--------------------------|----------------------------|------------------------------------|--------------------|----------------------------|-------------------------------|-------------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| | | | | | | <i>Inches per hour</i> | <i>Inches per inch of soil</i> | <i>pH</i> | | | | |
| 70-80 | 60-70 | 55-65 | 40-50 | 20-30 | 5-10 | 0.2-0.6 | 0.10-0.12 | 6.6-7.8 | <2 | Moderate | High | High. |
| 55-65 | 40-50 | 25-35 | 10-20 | 10-20 | NP | 6.0-20 | 0.05-0.06 | 8.5-9.0 | <2 | Low | Low | High. |
| 85-95 60-70 | 75-85 45-55 | 50-60 40-50 | 25-35 35-45 | 20-30 35-45 | NP-5 20-30 | 2.0-6.0 0.06-0.2 | 0.06-0.08 0.08-0.10 | 6.6-7.3 6.6-7.3 | <2 <2 | Low Moderate | Moderate Moderate | High. High. |
| 60-70 | 35-45 | 20-30 | 10-20 | 20-30 | 5-10 | 2.0-6.0 | 0.05-0.06 | 6.6-7.3 | <2 | Low | Low | High. |
| 75-85 | 65-75 | 55-65 | 50-60 | 35-45 | 10-20 | 0.06-0.2 | 0.10-0.12 | 7.4-8.4 | <2 | Moderate | Moderate | High. |
| 75-85 | 60-70 | 35-45 | 20-30 | 20-30 | 5-10 | 2.0-6.0 | 0.07-0.10 | 7.9-9.0 | <2 | Low | Moderate | High. |
| 50-60 | 25-35 | 10-20 | 5-10 | 10-20 | NP | 6.0-20 | 0.05-0.06 | 7.9-8.4 | <2 | Low | Low | High. |
| 75-85 | 65-75 | 50-60 | 25-35 | 30-40 | 10-20 | 0.2-0.6 | 0.10-0.13 | 6.6-7.3 | <2 | Moderate | High | High. |
| 75-85 30-40 | 60-70 25-35 | 55-65 20-30 | 45-55 10-20 | 40-50 30-40 | 25-35 10-20 | 0.06-0.2 0.2-0.6 | 0.10-0.13 0.06-0.08 | 6.6-7.3 6.6-7.3 | <2 <2 | High Low | Moderate Low | High. High. |
| 90-100 | 80-90 | 70-80 | 50-60 | 30-40 | 5-10 | 0.6-0.2 | 0.13-0.15 | 6.6-7.3 | <2 | Low | High | High. |
| 75-85 | 65-75 | 40-50 | 20-30 | 20-30 | NP-5 | 2.0-6.0 | 0.07-0.10 | 7.9-8.4 | <2 | Low | High | High. |
| 70-80 | 55-65 | 50-60 | 40-50 | 30-40 | 10-20 | 0.6-2.0 | 0.13-0.16 | 7.9-9.0 | <2 | Moderate | High | High. |
| 70-80 | 60-70 | 50-60 | 35-45 | 25-35 | 5-10 | 0.6-2.0 | 0.13-0.16 | 8.5-9.0 | <2 | Low | High | High. |
| 60-70 | 50-60 | 25-35 | 10-15 | 10-20 | NP | 6.0-20 | 0.05-0.07 | 8.5-9.0 | 2-8 | Low | Low | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to— | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|---|--------------------|---------------------------|--------------------|---|-------------|------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| Stampede: ST ----- | ° 2.0-3.0 | >5 | 0-7 | Gravelly loam ----- | SM or SM-SC | A-4 | 0-5 |
| | | | 7-29 | Clay loam and clay ---- | CL or CH | A-7 | 0-5 |
| | | | 29-34 | Loam ----- | ML or CL-ML | A-4 | 0-5 |
| | | | 34-60 | Silica-cemented hardpan. | | | |
| Swisbob: SWC ----- | ° 2.0-3.0 | >5 | 0-8 | Very stony loam and gravelly clay loam. | SC | A-6 | 10-20 |
| | | | 8-24 | Clay ----- | CH | A-7 | 0 |
| | | | 24-30 | Clay loam ----- | CL | A-6 | 0 |
| | | | 30-54 | Silica-cemented hardpan. | | | |
| | | | 54-60 | Cobbly and gravelly sandy loam. | SM | A-1 | 20-30 |
| *Tica: TN, TR ----- For Nevtah part of TN, see Nevtah series. Rock outcrop part of TN and TR too variable for valid estimates. | ° 1.0-1.5 | >5 | 0-5 | Stony and very stony loam. | SM or SM-SC | A-4 | 15-30 |
| | | | 5-18 | Stony clay and cobbly sandy clay loam. | CL or CH | A-7 | 5-50 |
| | | | 18 | Welded tuff bedrock. | | | |
| Timpahute: TTB ----- | ° 1.5-2.5 | >5 | 0-3 | Gravelly loam ----- | SM or SM-SC | A-2 or A-6 | 0-5 |
| | | | 3-10 | Clay loam ----- | CL | A-6 | 0 |
| | | | 10-25 | Clay ----- | CH | A-7 | 0 |
| | | | 25-42 | Silica-lime cemented hardpan. | | | |
| | | | 42-60 | Very gravelly and cobbly loamy sand. | GP-GM | A-1 | 15-25 |
| Uana: Mapped only in association with Decan series in unit DA. | ° 1.5-2.5 | >5 | 0-3 | Gravelly loam and sandy clay loam. | SC | A-2 or A-6 | 0 |
| | | | 3-12 | Clay ----- | CL or CH | A-7 | 0 |
| | | | 12-27 | Clay loam ----- | CL | A-6 | 0 |
| | | | 27-38 | Silica-lime cemented hardpan. | | | |
| | | | 38-65 | Sandy loam ----- | SM | A-2 | 0 |
| Udel: UK ----- Rock outcrop part of UK too variable for valid estimates. | ° 0.5-1.0 | >5 | 0-5 | Very gravelly sandy loam. | GM or GP-GM | A-1 | 0-10 |
| | | | 5 | Rhyodacite bedrock. | | | |
| Umil: UMB ----- | ° 1.0-1.5 | 5 | 0-11 | Loam and gravelly loam. | ML or CL-ML | A-4 | 0-5 |
| | | | 11-38 | Silica-lime cemented hardpan. | | | |
| | | | 38-60 | Gravelly loamy sand -- | SM | A-1 | 0-5 |
| Ursine: URD, URE, US -- Badland part of US too variable for valid estimates. | ° 1.0-1.5 | 5 | 0-8 | Gravelly loam and loam. | SM or GM | A-4 | 0 |
| | | | 8-16 | Very gravelly loam ---- | GM | A-2 or A-1 | 0 |
| | | | 16-60 | Silica-lime cemented hardpan. | | | |

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasti- city index | Permea- bility | Available water capacity | Reaction | Salini- ty ¹ | Shrink- swell potential | Frost- potential | Corrosiv- ity to un- treated steel or concrete |
|---|-----------------------|------------------------|--------------------------|-----------------|--------------------------|-------------------|--------------------------------|----------|----------------------------|-------------------------------|---------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| 75-85 | 60-70 | 50-60 | 35-45 | 25-35 | 5-10 | 0.6-2.0 | 0.10-0.12 | 6.6-7.8 | <2 | Low----- | High----- | High. |
| 100 | 95-100 | 85-95 | 70-80 | 45-55 | 30-40 | 0.06-0.2 | 0.15-0.17 | 6.6-7.8 | <2 | High----- | Moderate- | High. |
| 90-100 | 85-95 | 70-80 | 50-60 | 25-35 | 5-10 | 0.6-0.2 | 0.13-0.15 | 7.9-8.4 | <2 | Low----- | High----- | High. |
| 60-70 | 55-65 | 45-55 | 35-45 | 25-35 | 10-15 | 0.2-0.6 | 0.07-0.10 | 6.6-7.3 | <2 | Moderate- | High----- | High. |
| 100 | 90-100 | 80-90 | 70-80 | 50-60 | 30-40 | <0.06 | 0.13-0.15 | 6.6-8.4 | <2 | High----- | Moderate- | High. |
| 100 | 90-100 | 80-90 | 60-70 | 30-40 | 20-30 | 0.2-0.6 | 0.15-0.17 | 7.9-8.4 | <2 | Moderate- | High----- | High. |
| 65-75 | 55-65 | 35-45 | 15-25 | 20-30 | NP-5 | 2.0-6.0 | 0.07-0.10 | 7.9-8.4 | <2 | Low----- | Moderate- | High. |
| 65-75 | 55-65 | 45-55 | 35-45 | 25-35 | 5-10 | 0.6-2.0 | 0.07-0.10 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 95-100 | 85-95 | 75-85 | 65-75 | 45-55 | 25-35 | 0.06-0.2 | 0.10-0.13 | 6.6-7.3 | <2 | High----- | Moderate- | High. |
| 60-70 | 55-65 | 45-55 | 30-40 | 25-35 | 5-10 | 0.6-2.0 | 0.06-0.08 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 95-100 | 90-100 | 80-90 | 60-70 | 30-40 | 20-30 | 0.2-0.6 | 0.15-0.18 | 6.6-7.3 | <2 | Moderate- | High----- | High. |
| 95-100 | 95-100 | 85-95 | 70-80 | 50-60 | 35-45 | <0.06 | 0.13-0.16 | 7.3-9.0 | <2 | High----- | Moderate- | High. |
| 40-50 | 30-40 | 15-25 | 5-10 | 10-20 | NP | 6.0-20 | 0.05-0.08 | 7.9-9.0 | <2 | Low----- | Low----- | High. |
| 85-95 | 70-80 | 55-65 | 30-40 | 20-30 | 10-20 | 0.6-0.2 | 0.09-0.12 | 6.6-7.3 | <2 | Moderate- | High----- | High. |
| 100 | 95-100 | 85-95 | 70-80 | 45-55 | 30-40 | <0.06 | 0.15-0.17 | 6.6-7.3 | <2 | High----- | Moderate- | High. |
| 100 | 95-100 | 85-95 | 65-75 | 30-40 | 15-25 | 0.06-0.2 | 0.15-0.18 | 6.6-8.5 | <2 | Moderate- | High----- | High. |
| 100 | 95-100 | 55-65 | 25-35 | 20-30 | NP-5 | 2.0-6.0 | 0.12-0.15 | 8.5-9.0 | <2 | Low----- | High----- | High. |
| 40-50 | 25-35 | 15-25 | 10-15 | 15-25 | NP | 2.0-6.0 | 0.12-0.06 | 6.1-7.3 | <2 | Low----- | Low----- | Moderate. |
| 80-90 | 70-80 | 60-70 | 50-60 | 25-35 | 5-10 | 2.0-6.0 | 0.13-0.15 | 7.9-8.4 | <2 | Low----- | High----- | High. |
| 75-85 | 65-75 | 35-45 | 15-25 | 15-25 | NP | 6.0-20 | 0.06-0.08 | 8.5-9.0 | 2-8 | Low----- | Low----- | High. |
| 65-75 | 55-65 | 45-55 | 35-45 | 20-30 | NP-5 | 0.6-2.0 | 0.13-0.15 | 7.9-9.0 | <2 | Low----- | High----- | High. |
| 50-60 | 30-40 | 25-35 | 20-30 | 20-30 | NP | 2.0-6.0 | 0.06-0.08 | 8.5-9.0 | 2-4 | Low----- | Moderate- | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to — | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|--|--------------------|---------------------------|--|--|--|---------------------------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| Urtah: UT ----- Rock outcrop part of UT too variable for valid estimates. | * 1.5-3.5 | 5 | 0-30 30 | Very stony loam and very gravelly loam. Limestone bedrock. | GM | A-1 | 10-35 |
| Urwil: UWD ----- | * 4.0-5.0 | 5 | 0-2 2-8 8-50 | Stony fine sandy loam --- Clay loam ----- Gravelly clay and gravelly sandy clay. | SM CL SC or GC | A-4 A-6 or A-7 A-2 | 5-15 0-5 0-5 |
| Usine: Mapped only in association with Holsine and Buster soils in unit HN. | 5 | 5 | 0-9 9-15 15-60 | Cobbly and gravelly sandy loam and gravelly very fine sandy loam. Very gravelly loamy sand. Very gravelly sand ---- | SM GM or GP- GM GP | A-2 or A-1 A-1 A-1 | 15-20 5-10 5-10 |
| Vicu: VCC ----- | * 3.3-4.2 | >5 | 0-8 8-29 29-44 44-60 | Stony and gravelly sandy loam. Gravelly and cobbly sandy clay and very gravelly sandy clay. Very gravelly coarse sandy loam and very gravelly loamy sand. Silica-lime cemented hardpan. | SM GC GP-GM | A-1 A-2 A-1 | 5-10 5-10 0-5 |
| Vil: VGC ----- | * 1.0-1.5 | >5 | 0-7 7-12 12-17 17-48 48-60 | Gravelly loam ----- Gravelly sandy clay loam. Gravelly loam ----- Silica-lime cemented hardpan. Very gravelly very coarse sand. | GC or GM- GC GM-GC or GC GP-GM or SP-SM | A-4 A-6 A-2 or A-4 A-1 | 5-15 5-10 5-10 5-10 |
| Wilpar: WMF ----- | * 4.3-5.0 | >5 | 0-5 5-26 26-60 | Very stony sandy loam and gravelly sandy loam. Gravelly sandy clay, and gravelly and cobbly clay. Very gravelly sandy clay, and very gravelly sandy clay loam. | SM SC or CL SC | A-2 A-7 A-2 | 10-25 5-15 5-10 |
| Winu: WNG, WR ----- Rock outcrop part of WR too variable for valid estimates. | * 2.0-3.3 | >5 | 0-2 2-22 22-33 33-38 38 | Very stony loam ----- Gravelly clay loam ---- Sandy loam ----- Loam ----- Fractured rhyodacite bedrock. | SC or SM- SC GC SC or SM- SC ML, CL or CL-ML | A-4 A-6 A-2 A-4 | 10-30 0-5 0-5 0-5 |

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasti- city index | Permea- bility | Available water capacity | Reaction | Salin- ity ¹ | Shrink- swell potential | Frost- action potential | Corrosiv- ity to un- treated steel or concrete |
|---|-----------------------|------------------------|--------------------------|-----------------|--------------------------|---------------------------------------|---|----------------------|----------------------------|-------------------------------|-------------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| 30-40 | 25-35 | 20-30 | 15-20 | 20-30 | NP | <i>Inches per hour</i> 0.6-2.0 | <i>Inches per inch of soil</i> 0.05-0.07 | <i>pH</i> 7.9-8.4 | <2 | Low----- | Moderate_ | High. |
| 85-95 | 75-85 | 60-70 | 35-45 | 25-35 | NP | 2.0-6.0 | 0.13-0.15 | 6.1-7.3 | <2 | Low----- | High----- | High. |
| 85-95 | 80-90 | 75-85 | 55-65 | 35-45 | 20-30 | 0.2-0.6 | 0.15-0.19 | 6.1-7.3 | <2 | High----- | High----- | High. |
| 60-70 | 50-60 | 40-50 | 25-35 | 45-50 | 25-35 | 0.06-0.2 | 0.10-0.13 | 6.1-7.3 | <2 | High----- | Moderate_ | High. |
| 70-80 | 60-70 | 40-50 | 20-30 | 20-30 | NP | 2.0-6.0 | 0.06-0.08 | 7.9-8.4 | <2 | Low----- | High----- | High. |
| 40-50 | 35-45 | 25-35 | 10-15 | NP | NP | 6.0-20 | 0.05-0.06 | 8.5-9.0 | <2 | Low----- | Low----- | High. |
| 30-40 | 20-30 | 10-20 | 0-5 | NP | NP | >20 | 0.04-0.05 | 7.9-9.0 | <2 | Low----- | Low----- | High. |
| 60-70 | 55-65 | 35-45 | 15-25 | 20-30 | NP-5 | 2.0-6.0 | 0.06-0.08 | 6.6-7.3 | <2 | Low----- | Moderate_ | High. |
| 45-55 | 35-45 | 30-40 | 15-25 | 35-45 | 20-30 | 0.06-0.2 | 0.07-0.10 | 6.6-7.3 | <2 | Moderate_ | Moderate_ | High. |
| 40-50 | 25-35 | 15-25 | 5-10 | 15-25 | NP | 6.0-20 | 0.05-0.06 | 6.6-8.4 | <2 | Low----- | Low----- | High. |
| 60-70 | 55-65 | 45-55 | 35-45 | 20-30 | 5-10 | 0.6-2.0 | 0.08-0.12 | 7.4-7.8 | <2 | Low----- | High----- | High. |
| 60-70 | 55-65 | 45-55 | 35-45 | 25-35 | 15-20 | 0.2-0.6 | 0.10-0.13 | 7.4-7.8 | <2 | Moderate_ | High----- | High. |
| 50-60 | 40-50 | 30-40 | 30-40 | 20-30 | 5-10 | 0.6-2.0 | 0.08-0.12 | 8.5-9.0 | <2 | Low----- | High----- | High. |
| 50-60 | 45-55 | 20-30 | 5-10 | 10-15 | NP | >20 | 0.05-0.06 | 8.5-9.0 | <2 | Low----- | Low----- | High. |
| 80-90 | 60-70 | 35-45 | 15-25 | 20-30 | NP-5 | 2.0-6.0 | 0.08-0.12 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 70-80 | 60-70 | 55-65 | 45-55 | 40-50 | 25-35 | 0.06-0.2 | 0.12-0.14 | 6.6-7.3 | <2 | High----- | Moderate_ | High. |
| 60-70 | 30-40 | 25-30 | 10-20 | 30-40 | 15-25 | 0.06-0.2 | 0.07-0.10 | 6.6-7.3 | <2 | Moderate_ | Moderate_ | High. |
| 70-80 | 65-75 | 55-65 | 40-50 | 20-30 | 5-10 | 0.6-2.0 | 0.08-0.10 | 6.1-7.3 | <2 | Low----- | High----- | High. |
| 60-70 | 55-65 | 50-60 | 40-50 | 30-40 | 15-25 | 0.2-0.6 | 0.10-0.13 | 6.1-7.3 | <2 | Moderate_ | High----- | High. |
| 95-100 | 80-90 | 50-60 | 25-35 | 20-30 | 5-10 | 2.0-6.0 | 0.12-0.14 | 6.1-6.5 | <2 | Low----- | High----- | High. |
| 95-100 | 80-90 | 70-80 | 50-60 | 25-35 | 5-10 | 0.6-2.0 | 0.14-0.17 | 6.1-6.5 | <2 | Low----- | High----- | High. |

TABLE 8.—Estimated soil properties

| Soil series and map symbols | Depth to — | | Depth from surface | Classification | | | Coarse fraction greater than 3 inches |
|---|--------------------|---------------------------|--------------------------|--|----------------|-------------------|---------------------------------------|
| | Hardpan or bedrock | Seasonal high water table | | USDA texture | Unified | AASHO | |
| | <i>Feet</i> | <i>Feet</i> | <i>Inches</i> | | | | <i>Percent</i> |
| Winz: WS ----- | >5 | >5 | 4-0 0-5 5-23 | Duff ----- Very stony sandy loam. | Pt SM GM | A-8 A-1 A-1 | 10-30 5-10 |
| | | | 23-60 | Very gravelly coarse sandy loam. Very gravelly and cobbly clay, and extreme cobbly, gravelly and stony clay. | GC | A-2 | 25-50 |
| Zoate: ZOF, ZR ----- Rock outcrop part of ZR too variable for valid estimates. | 1.0-1.5 | >5 | 0-2 2-8 8-13 13 | Cobbly loam ----- Gravelly clay loam and gravelly clay. Silica-lime cemented hardpan. Volcanic bedrock. | SM GC | A-2 or A-4 A-6 | 20-40 0-5 |

¹ EC x 10³, 25° C.

² Hardpan rippable with light equipment.

³ NP = nonplastic.

⁴ Frequently flooded for brief periods.

⁵ Occasionally flooded for brief periods.

footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 9 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. Reliable predictions can be made to a depth of 10 to 15 feet for some soils, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 9, have an all-weather surface expected to carry automobile traffic the entire year. They have a subgrade of under-

lying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel

significant to engineering—Continued

| Percentage less than 3 inches passing sieve— | | | | Liquid limit | Plasticity index | Permeability | Available water capacity | Reaction | Salinity ¹ | Shrink-swell potential | Frost-action potential | Corrosivity to untreated steel or concrete |
|--|-----------------|------------------|--------------------|--------------|------------------|------------------------|--------------------------------|-----------|-----------------------|------------------------|------------------------|--|
| No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | | | |
| | | | | | | <i>Inches per hour</i> | <i>Inches per inch of soil</i> | <i>pH</i> | | | | |
| 60-70 | 50-60 | 30-40 | 15-25 | 20-30 | NP | 2.0-6.0 | 0.06-0.08 | 6.1-6.5 | <2 | Low----- | Moderate- | Moderate. |
| 40-50 | 30-40 | 20-25 | 10-15 | 20-30 | NP | 2.0-6.0 | 0.05-0.07 | 6.1-6.5 | <2 | Low----- | Low----- | Moderate. |
| 40-50 | 30-40 | 25-35 | 20-30 | 40-50 | 20-30 | 0.2-0.6 | 0.08-0.10 | 6.1-6.5 | <2 | Moderate- | Low----- | Moderate. |
| 65-75 | 55-65 | 50-60 | 30-40 | 20-30 | NP-5 | 0.6-2.0 | 0.08-0.10 | 6.6-7.3 | <2 | Low----- | High----- | High. |
| 60-70 | 50-60 | 45-55 | 40-50 | 30-40 | 15-25 | 0.06-0.2 | 0.10-0.12 | 7.4-7.8 | <2 | Moderate- | Moderate- | High. |

⁶ Bicondoa peat part of Bo has a peat (organic) surface 6 to 10 inches thick.

⁷ Hard bedrock.

⁸ Hardpan not rippable with light equipment.

⁹ Rippable bedrock.

generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials. Also, they do not indicate quality of the deposit.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that resists seepage and piping and has favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage of cropland and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope, stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of

soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; need for drainage; and depth to water table or bedrock.

Soil hydrologic groups

Information about runoff is essential to flood control planning. The major soils of the United States have been placed in four hydrologic groups. These groups are based on intake of water at the end of long duration storms, after prior wetting and opportunity for swelling, with consideration of the protective effects of vegetation. The criteria for the four groups are as follows:

Group A consists of soils that have a high infiltration rate even when thoroughly wetted and are chiefly deep, well drained to excessively well drained sand, gravel, or both. Such soils have a high rate of water transmission and a low runoff potential. (No soils of the survey area are in this group.)

Group B consists of soils that have a moderate infiltration rate when thoroughly wetted and are chiefly moderately deep to deep, moderately well drained to well drained, and moderately fine textured to moderately coarse textured. Such soils have a moderate rate of water transmission. In this group are Cliff-down, Fanu, Four Star, Geer, Heist, Holsine, Holtle, Patter, Poorma, and Usine soils.

TABLE 9.—Engineering

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|--|---|---|---|--|---|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| *Acana: ACC, AE ----- For Ursine part of AE, see Ursine series. | Slight ----- | Severe: cemented pan at a depth of less than 20 inches. | Severe: rippable pan at a depth of less than 20 inches. | Moderate: rippable pan at a depth of less than 20 inches. | Severe: rippable pan at a depth of less than 20 inches over rapidly permeable material. | Slight ----- |
| Acoma: AGD ----- | Severe: slow permeability. | Moderate where slopes are 2 to 8 percent, severe where 8 to 15 percent. | Severe: very gravelly texture. | Severe; high shrink-swell potential. | Moderate: very gravelly sandy clay loam texture. ² | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent. |
| Alluvial land: AL. Too variable for valid estimates. | | | | | | |
| Aned: ANC ----- | Severe: cemented pan at a depth of less than 20 inches. | Severe: cemented pan at a depth of less than 20 inches. | Severe: cemented rippable pan at a depth of less than 20 inches. | Moderate: cemented rippable pan at a depth of less than 20 inches. | Severe: cemented rippable pan at a depth of less than 20 inches. | Slight ----- |
| *Badland: BA, BB, BD2. Too variable for valid estimates. For Buster and Holsine parts of BD2, see Buster and Holsine series. For Bit part of BB see Bit series. | | | | | | |
| *Basket: BKF, BL ----- For Lize and Satt parts of BL, see Lize and Satt series. | Severe: slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent. |
| Bicondoa: Bm ----- | Severe: flooded; slowly permeable; water table at a depth of 4 to 6 feet. | Severe: flooded; water table at a depth of 4 to 6 feet. | Moderate: flooded; water table at a depth of 4 to 6 feet. | Severe: flooded; mostly CL or CH material. | Severe: flooded; water table at a depth of 4 to 6 feet. | Severe: flooded. |

interpretations

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the that appear in the first column of this table]

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|--|--|--|--|---|---|---|--|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Poor: mostly gravelly loamy sand. | Moderate: rippable pan at a depth of less than 20 inches. | Poor: high frost action above pan; rippable pan at a depth of less than 20 inches. | Fair: SP-SM or SM material below a depth of 24 inches. | Unsuitable: mostly SP-SM or SM material. | Slopes are 0 to 8 percent; high seepage potential. | High permeability; high susceptibility to piping. | Features generally not applicable. | Features generally not applicable. |
| Fair: gravelly sandy clay and very gravelly sandy clay loam. | Moderate: SC material has more than 30 percent fines; some A-6 and A-7 material. | Poor: high shrink-swell potential. | Unsuitable-- | Unsuitable-- | Slopes are 2 to 15 percent. | Low compacted permeability; high shrink-swell potential. | Features generally not applicable. | Features generally not applicable. |
| Poor: clay loam over rippable cemented pan at a depth of less than 20 inches. | Severe: A-6 material. | Poor: rippable pan at a depth of less than 20 inches. | Unsuitable-- | Unsuitable-- | Slopes are 2 to 8 percent; underlying material is pervious in places. | Medium shear strength; high shrink-swell potential. | Features generally not applicable. | Features generally not applicable. |
| Poor: slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent. | Poor: slopes are 30 to 50 percent. | Poor: stratified SM, GP-GM material. | Poor: stratified SM, GP-GM material. | Slopes are 30 to 50 percent; high seepage potential. | High permeability. | Features generally not applicable. | Features generally not applicable. |
| Fair: mostly clay loam, silty clay loam. | Severe: flooded; high potential frost action. | Poor: mostly A-7 material with PI more than 15; high potential frost action. | Unsuitable-- | Unsuitable-- | Seasonal water table at a depth of 4 to 6 feet. | Mostly CL or CH material; high compressibility; low shear strength. | Seasonal water table at a depth of 4 to 6 feet; slowly permeable. | Flooded; seasonal water table at a depth of 4 to 6 feet; slowly permeable. |

TABLE 9.—Engineering

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|--|---|---|--|--|--|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| Bicondoa (con.) Bn ----- | Severe: flooded; slowly permeable. | Severe: flooded. | Moderate: flooded; mostly clay loam and silty clay loam. | Severe: flooded; CL or CH material. | Severe: flooded; mostly clay loam and silty clay loam. | Severe: flooded. |
| Bo ----- | Severe: flooded; slowly permeable; seasonal water table at a depth of 0 to 1.5 feet. | Severe: flooded; seasonal water table at a depth of 0 to 1.5 feet. | Severe: seasonal water table at a depth of 0 to 1.5 feet. | Severe: flooded; seasonal water table at a depth of 0 to 1.5 feet; mostly CL or CH material. | Severe: flooded; seasonal water table at a depth of 0 to 1.5 feet. | Severe: flooded; seasonal water table at a depth of 0 to 1.5 feet. |
| Bit ----- Mapped only in association with Badland. | Severe: cemented pan at a depth of more than 40 inches. | Severe: cemented pan at a depth of more than 40 inches; previous material at a depth of 0 to 34 inches. | Moderate: rippable cemented pan at a depth of more than 40 inches. | Slight: rippable cemented pan at a depth of more than 40 inches. | Severe: rippable cemented pan underlain by pervious materials. | Slight----- |
| Buster: BR ----- Rough broken land part of BR too variable for valid estimates. | Severe: moderately slow permeability. | Severe: rapid permeability below a depth of 30 inches. | Moderate: gravelly loamy coarse sand at a depth of 30 to 60 inches. | Slight ----- | Severe: pervious material below a depth of 30 to 60 inches. | Slight----- |
| Cath: CAC ----- | Severe: moderately slow permeability. | Moderate where slopes are 2 to 8 percent.* | Severe: very gravelly material below a depth of 20 inches. | Slight ----- | Severe: very gravelly material below a depth of 20 inches. | Slight----- |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|--|---|---|--|--|---|--|--|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Fair: mostly clay loam and silty clay loam. | Severe: mostly CL or CH material; high potential frost action. | Poor: mostly A-7 material with PI more than 15; high potential frost action. | Unsuitable-- | Unsuitable-- | Seasonal water table at a depth of 6 to 10 feet. | Mostly CL or CH material; high compressibility; low shear strength. | Slowly permeable. | Flooded; slowly permeable. |
| Severe: poor and very poorly drained. | Severe: flooded; seasonal water table at a depth of 0 to 1.5 feet. | Poor: seasonal water table at a depth of 0 to 1.5 feet; mostly A-7 material with PI more than 15. | Unsuitable-- | Unsuitable-- | Seasonal water table at a depth of 0 to 1.5 feet. | Mostly CL or CH material; seasonal water table at a depth of 0 to 1.5 feet; low shear strength. | Seasonal water table at a depth of 0 to 1.5 feet; slowly permeable. | Flooded; seasonal water table at a depth of 0 to 1.5 feet; slowly permeable. |
| Fair: mostly fine sandy loam, very fine sandy loam, and gravelly loam over rippable cemented pan at a depth of more than 40 inches. | Severe: mostly ML, CL, and SM material; high potential frost action. | Poor: mostly A-4 material; high potential for frost action. | Unsuitable-- | Unsuitable-- | Slopes are 0 to 8 percent; pervious material. | Mostly CL, ML and SM material; medium compacted permeability and shear strength; high susceptibility to piping. | Cemented pan at a depth of less than 40 inches; slopes are 0 to 8 percent. | Cemented pan; slopes are 0 to 8 percent. |
| Fair: mostly sandy clay loam and loam in the upper 30 inches. | Severe: A-4, A-6, and A-7 material; high frost action. | Poor: A-4, A-6, and A-7 material; high frost action. | Poor: SM material below a depth of 30 inches. | Unsuitable-- | Pervious material at a depth of 30 to 60 inches. | Medium shear strength; medium to low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Fair: mostly clay loam, gravelly clay loam, and very gravelly clay loam in upper 24 inches. | Severe: A-6 material with PI more than 15; high frost action above a depth of 20 inches. | Severe: above a depth of 20 inches high frost action slight; below a depth of 20 inches A-1 material. | Unsuitable-- | Poor: GC and GM material below a depth of 20 inches. | Pervious material below a depth of 20 inches; slopes are 2 to 8 percent. | Medium shear strength; medium compacted permeability. | Slopes are 2 to 8 percent. | Slopes are 2 to 8 percent; moderately low available water capacity. |

TABLE 9.—*Engineering*

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|---|---|---|---|--|---|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| *Cedaran: CD, CE ----- For Decan part of CD see Decan series. Rock outcrop part of CE too variable for valid estimates. | Severe: bedrock at a depth of less than 20 inches. | Severe: bedrock at a depth of less than 20 inches. | Severe: bedrock at a depth of less than 20 inches. | Severe: bedrock at a depth of less than 20 inches. | Severe: bedrock at a depth of less than 20 inches. | Moderate where slopes are 4 to 15 percent, severe where 15 to 30 percent. |
| *Cliffdown: CG ----- For Geer part of CG, see Geer series. | Slight ⁴ ----- | Severe: permeability more than 2.0 inches per hour. | Severe: very gravelly sandy loam and loamy sand dominant to depth of 60 inches. | Slight ----- | Severe: permeability more than 2.0 inches per hour. | Slight ----- |
| *Decan: DA ----- For Uana part of DA, see Uana series. | Severe: slowly permeable. | Moderate where slopes are 2 to 8 percent, severe where 8 to 15 percent. | Moderate: rippable cemented pan at a depth of less than 40 inches. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent. | Moderate: rippable cemented pan at a depth of less than 60 inches. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent. |
| *Decathon: DCC, DED, DEE ----- For Basket part of DED and DEE, see Basket series. | Severe: cemented pan at a depth of 24 to 36 inches. | Severe: cemented pan at a depth of 24 to 36 inches. | Moderate: rippable cemented pan at a depth of 24 to 36 inches. | Moderate: rippable cemented pan at a depth of 24 to 36 inches. | Severe: pervious material below a depth of 36 inches. | Slight ----- |
| *Deerlodge: DG, DH ----- For Ursine part of DH, see Ursine series. | Severe: cemented pan at a depth of 20 to 30 inches. | Severe: cemented pan at a depth of 20 to 30 inches. | Moderate: rippable cemented pan at a depth of 20 to 30 inches. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent. | Moderate: rippable cemented pan at a depth of 20 to 30 inches. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|---|---|--|--|--|---|------------------------------------|------------------------------------|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Poor: bedrock at a depth of less than 20 inches. | Severe: A-6 and A-7 material; bedrock at a depth of less than 20 inches. | Poor: bedrock at a depth of less than 20 inches. | Unsuitable-- | Unsuitable-- | Bedrock at a depth of less than 20 inches; slopes are 4 to 30 percent. | Bedrock at a depth of less than 20 inches; slopes are 4 to 30 percent. | Features generally not applicable. | Features generally not applicable. |
| Poor: very gravelly sandy loam and loamy sand dominant to a depth of 60 inches. | Slight----- | Good----- | Poor: mostly SM material. | Poor: mostly SM material. | Pervious material; slopes are 2 to 8 percent. | Medium shear strength and compacted permeability; high susceptibility to piping. | Features generally not applicable. | Features generally not applicable. |
| Poor: mostly clay in upper 20 inches. | Severe: mostly CL or CH material; high shrink-swell-potential. | Poor: mostly A-6 and A-7 material; rippable cemented pan at a depth of 20 to 40 inches. | Unsuitable: mostly CL or CH and ML material with cemented pan at a depth of 20 to 40 inches. | Unsuitable: mostly CL or CH and ML material with cemented pan at a depth of 20 to 40 inches. | Slopes are 2 to 15 percent. | Mostly CL or CH material; low shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Fair: mostly sandy clay loam textures in upper 24 inches. | Moderate: mostly A-6 or A-7 material with more than 30 percent fines; rippable cemented pan at a depth of 24 to 36 inches; good below a depth of 38 inches. | Fair: GP-GM material below a depth of 40 inches. | Fair: GP-GM material below a depth of 40 inches. | Fair: GP-GM material below a depth of 40 inches. | Slopes are 2 to 8 percent. ^a | Medium shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Fair: mostly sandy clay loam textures in upper 24 inches. | Moderate: mostly A-2 material; moderate shrink-swell and frost action. | Fair: about 24 inches of A-2 material over rippable cemented pan. | Unsuitable-- | Unsuitable-- | Slopes are 2 to 15 percent. | SM and SC material over rippable cemented pan; medium shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|--|--|---|--------------|---|--|---|---|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Poor: less than 20 inches of material available above cemented pan. | Severe: cemented pan at a depth of less than 20 inches. | Poor: non-rippable cemented pan at a depth of less than 20 inches. | Unsuitable-- | Unsuitable-- | Nonrippable cemented pan at a depth of less than 20 inches; slopes are 2 to 15 percent. | Mostly SM or SC material above a cemented pan at a depth of less than 20 inches; medium to low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Good----- | Severe: mostly A-2 or A-6 material; high frost action. | Severe: mostly A-2 or A-6 material; high frost action. | Unsuitable-- | Unsuitable-- | Slopes are 0 to 8 percent. | Mostly SC or CL material; low compacted permeability; medium to low shear strength. | Slopes are 0 to 8 percent. | Slopes are 0 to 8 percent. |
| Poor: water table at a depth of 1 to 2 feet. | Severe: flooded; water table at a depth of 1 to 2 feet; high frost action. | Severe ----- | Unsuitable-- | Unsuitable-- | Water table at a depth of 1 to 2 feet; slopes are 0 to 4 percent. | Mostly ML or CL material; medium to high susceptibility to piping; medium to low shear strength. | Flooded; water table at a depth of 1 to 2 feet; moderately slow permeability. | Flooded; water table at a depth of 1 to 2 feet. |
| Good----- | Severe: flooded; high frost action; mostly A-4 material to a depth of 32 inches. | Poor: mostly A-4 to a depth of 32 inches; high frost action. | Poor: SM material with less than 20 percent fines below a depth of 30 inches. | Unsuitable-- | Moderately permeable. | Mostly SM material; medium to high susceptibility to piping; medium shear strength. | Flooded ----- | Flooded. |
| Good----- | Severe: flooded; high frost action; mostly A-4 or A-5 material. | Poor: mostly A-4 or A-5 material to a depth of 60 inches; high frost action. | Unsuitable-- | Unsuitable-- | Moderately permeable. | Mostly ML material; high susceptibility to piping; medium to low shear strength; medium compressibility. | ----- | Occasionally flooded. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|--|--|--|--------------|--|--|--|--|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Good for G _g and G _h , fair for G _k , water table at a depth of 2 to 4 feet. | Severe: flooded; high frost action. | Poor: mostly A-4 or A-5 material to a depth of 60 inches; high frost action. | Unsuitable-- | Unsuitable-- | Moderately permeable. | Mostly ML material; high susceptibility to piping; medium to low shear strength; medium compressibility. | Saline; G _g and G _h water table at a depth of 4 to 6 feet, G _k water table at a depth of 2 to 4 feet. | Flooded; seasonal water table; saline. |
| Poor where slopes are 30 to 50 percent; very gravelly textures. | Severe where slopes are 30 to 50 percent. | Poor where slopes are 30 to 50 percent; large stones. | Unsuitable-- | Unsuitable-- | Slopes are 30 to 50 percent. | Mostly SC and GC material; low compacted permeability; slopes are 30 to 50 percent. | Features generally not applicable. | Features generally not applicable. |
| Good----- | Moderate: moderate frost action; mostly A-2 or A-1 material. | Moderate: moderate frost action; mostly A-2 or A-1 material. | Poor: mostly SM material that extends to a depth of 60 inches. | Unsuitable-- | Pervious material; slopes are 0 to 8 percent. | Mostly SM material; medium shear strength; medium compacted permeability; medium to high susceptibility to piping. | Slopes are 0 to 8 percent. | Slopes are 0 to 8 percent; rapid intake. |
| Good----- | Severe: A-4 material; high frost action. | Poor: A-4 material; high frost action. | Unsuitable-- | Unsuitable-- | Moderately permeable; slopes are 0 to 8 percent. | Mostly SM or ML material; medium to low shear strength; medium to high susceptibility to piping. | Features generally not applicable. | Features generally not applicable. |
| Good----- | Severe: A-4 material; high frost action. | Poor: A-4 material; high frost action. | Unsuitable-- | Unsuitable-- | Moderately permeable; slopes are 0 to 8 percent. | Mostly ML material; medium to low shear strength; high piping hazard; medium compressibility. | Flooded; slopes are 0 to 8 percent. | Flooded; slopes are 0 to 8 percent. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|---|--|---|--------------|---|---|------------------------------------|------------------------------------|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Fair: gravelly and very gravelly textures; large stones in HTC. | Moderate: SC material; moderate shrink-swell; large stones in HTC. | Fair: SC material; moderate shrink-swell; large stones in HTC. | Poor: SM material that has 10 to 20 percent fines below a depth of 40 inches. | Unsuitable-- | Slopes are 2 to 8 percent; large stones in HTC. | Mostly SC material; medium shear strength; low compacted permeability; low piping hazard. | Features generally not applicable. | Features generally not applicable. |
| Poor: bedrock at a depth of less than 20 inches. | Severe: bedrock at a depth of less than 20 inches. | Poor: bedrock at a depth of less than 20 inches. | Unsuitable-- | Unsuitable-- | Bedrock at a depth of less than 20 inches; slopes are 2 to 50 percent. | Bedrock at a depth of less than 20 inches. | Features generally not applicable. | Features generally not applicable. |
| Poor: cemented pan at a depth of less than 20 inches. | Severe: cemented pan at a depth of less than 20 inches. | Poor: cemented pan at a depth of less than 20 inches. | Unsuitable-- | Unsuitable-- | Cemented pan at a depth of less than 20 inches; slopes are 2 to 15 percent. | Cemented pan at a depth of less than 20 inches. | Features generally not applicable. | Features generally not applicable. |
| Poor: bedrock at a depth of less than 20 inches; slopes are 15 to 50 percent. | Severe: bedrock at a depth of less than 20 inches; slopes are 15 to 50 percent. | Poor: bedrock at a depth of less than 20 inches. | Unsuitable-- | Unsuitable-- | Bedrock at a depth of less than 20 inches; slopes are 15 to 50 percent. | Less than 20 inches of SC material on bedrock. | Features generally not applicable. | Features generally not applicable. |
| Poor where slopes are 50 to 70 percent. | Severe where slopes are 50 to 70 percent. | Poor where slopes are 50 to 70 percent. | Unsuitable-- | Unsuitable-- | Slopes are 50 to 70 percent. | Bedrock at a depth of 2 to 4 feet; slopes are 50 to 70 percent. | Features generally not applicable. | Features generally not applicable. |
| Poor: GM or SM material less than 20 inches thick. | Severe: cemented pan at a depth of less than 20 inches. | Poor: GM or SM material less than 20 inches thick. | Unsuitable-- | Unsuitable-- | Cemented pan at a depth of less than 20 inches; slopes are 2 to 4 percent. | GM or SM material less than 20 inches thick on cemented pan. | Features generally not applicable. | Features generally not applicable. |

TABLE 9.—Engineering

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|---|--|--|--|--|--|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| *Linco: LC, LD ----- For Acana part of LC, see Acana series. Badland part of LD too variable for valid estimates. | Moderate permeability 0.6 to 2.0 inches per hour; moderate where slopes are 4 to 15 percent, severe where 15 to 30 percent. | Moderate permeability 0.6 to 2.0 inches per hour. | Moderate: gravelly textures; severe where slopes are 15 to 30 percent. | Slight where slopes are 4 to 8 percent, moderate where 8 to 15 percent, severe where 15 to 30 percent. | Slight where slopes are 4 to 15 percent, moderate where 15 to 25 percent, severe where 25 to 30 percent. | Slight where slopes are 4 to 8 percent, moderate where 8 to 15 percent, severe where 15 to 30 percent. |
| *Lize: LE, LT ----- For Tica part of LT, see Tica series. | Severe where slopes are 15 to 50 percent. | Severe where slopes are 15 to 50 percent. | Severe where slopes are 15 to 50 percent. | Severe where slopes are 15 to 50 percent. | Severe where slopes are 15 to 50 percent. | Severe where slopes are 15 to 50 percent. |
| *Met: MU ----- For Ursine part, see Ursine series. | Severe: cemented pan at a depth of 20 to 40 inches. | Severe: cemented pan at a depth of 20 to 40 inches. | Moderate: rippable cemented pan at a depth of 20 to 40 inches. | Moderate: ML material; low shear strength; rippable cemented pan at a depth of 20 to 40 inches. | Severe: rippable cemented pan at a depth of 20 to 40 inches. | Slight----- |
| Minu: MVC, MWC ----- | Severe: cemented pan at a depth of less than 20 inches. | Severe: cemented pan at a depth of less than 20 inches. | Severe: rippable cemented pan at a depth of less than 20 inches. | Moderate: rippable cemented pan at a depth of less than 20 inches. | Severe: rippable cemented pan at a depth of less than 20 inches. | Slight----- |
| Nevtah: NR ----- Rock outcrop part too variable for valid estimates. | Severe: bedrock at a depth of less than 40 inches. | Severe: bedrock at a depth of less than 40 inches; large stones. | Severe: bedrock at a depth of less than 40 inches. | Severe: 20 percent Rock outcrop. | Severe: bedrock at a depth of less than 40 inches; 20 percent Rock outcrop. | Slight where slopes are 4 to 8 percent, moderate where 8 to 15 percent, severe where 15 to 30 percent. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|--|--|--|---|---|---|---|--|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Good where slopes are 4 to 8 percent, fair where 8 to 15 percent, poor where 15 to 30 percent. | Moderate where slopes are 4 to 15 percent, severe where 15 to 30 percent; moderate frost action. | Moderate where slopes are 4 to 15 percent, severe where 15 to 30 percent; moderate frost action. | Poor: mostly SM material that has 20 to 30 percent fines. | Unsuitable-- | Pervious material; slopes are 4 to 30 percent. | SM material; medium shear strength; compacted permeability; medium to high piping hazard. | Features generally not applicable. | Features generally not applicable. |
| Poor where slopes are 15 to 50 percent. | Severe where slopes are 15 to 50 percent. | Fair where slopes are 15 to 25 percent, poor where 25 to 50 percent. | Poor: GM-SM material at a depth of 35 to 60 inches. | Poor: GM-SM material at a depth of 35 to 60 inches. | Slopes are 15 to 50 percent. | Mostly GC or SC, and GM-SM material; high shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Fair: 20 to 40 inches of good material. | Severe: A-4 material; high frost action. | Poor: 20 to 40 inches of mostly A-4 material; high frost action. | Unsuitable-- | Unsuitable-- | Pervious material at a depth of 20 to 40 inches; slopes are 0 to 4 percent. | Mostly ML material; medium to low shear strength; high piping hazard. | Cemented pan at a depth of 20 to 40 inches. | Cemented pan at a depth of 20 to 40 inches; slopes are 0 to 4 percent; saline subsoil. |
| Poor: mostly gravelly sandy loam, gravelly loam, and sandy clay loam less than 20 inches thick. | Moderate: rippable cemented pan at a depth of less than 20 inches; moderate frost action. | Good: mostly A-1 and A-2 material; cemented pan easily excavated. | MVC unsuitable; MWC fair and GP-GM material at a depth of 22 to 60 inches. | Unsuitable-- | Cemented pan at a depth of less than 20 inches; slopes are 2 to 8 percent. | Mostly SC, GM and SP-SM material; high shear strength; medium to low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Fair where slopes are 4 to 15 percent that have limited thickness of good material, poor where slopes are 15 to 30 percent. | Severe: 20 percent Rock outcrop. | Poor: 20 percent Rock outcrop; bedrock at a depth of 20 to 40 inches. | Unsuitable-- | Unsuitable-- | Bedrock at a depth of 20 to 40 inches; slopes are 4 to 30 percent. | Bedrock at a depth of 20 to 30 inches; mostly SM-SC or SC, and GM-GC or GC material; high shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |

TABLE 9.—Engineering

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|---|---|---|---|---|---|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| Nevu: NSD ----- | Severe: cemented pan at a depth of 20 to 40 inches. | Severe: cemented pan at a depth of 20 to 40 inches. | Severe: cemented pan at a depth of 20 to 40 inches. | Moderate: cemented pan at a depth of 20 to 40 inches. | Severe: cemented pan at a depth of 20 to 40 inches. | Slight where slopes are 4 to 8 percent, moderate where 8 to 15 percent. |
| Pahranagat: Pa, Pd, Pg ----- | Severe: flooded; water table at a depth of 2.5 to 5 feet. | Severe: flooded; water table at a depth of 2.5 to 5 feet. | Severe: flooded; water table at a depth of 2.5 to 5 feet. | Severe: flooded. | Severe: flooded; water table at a depth of 2.5 to 5 feet. | Severe: flooded; water table at a depth of 2.5 to 5 feet. |
| Pe ----- | Severe: flooded; water table at a depth of 1 to 2 feet. | Severe: flooded; water table at a depth of 1 to 2 feet. | Severe: flooded; water table at a depth of 1 to 2 feet. | Severe: flooded; water table at a depth of 1 to 2 feet. | Severe: flooded; water table at a depth of 1 to 2 feet. | Severe: flooded; water table at a depth of 1 to 2 feet. |
| Pamsdel: PMC ----- | Severe: cemented pan at a depth of 20 to 30 inches. | Severe: cemented pan at a depth of 20 to 30 inches. | Severe: cemented pan at a depth of 20 to 30 inches. | Moderate: cemented pan at a depth of 20 to 30 inches. | Severe: cemented pan at a depth of 20 to 30 inches. | Slight----- |
| *Patter: PN, PR, PO ----- For Geer part of PN, Shroe part of PR, and Heist and Geer parts of PO, see Geer, Shroe, and Heist series. | Severe: flooded. | Severe: flooded. | Severe: flooded. | Severe: flooded. | Severe: flooded. | Severe: flooded. |
| Pioche: PS ----- Rock outcrop part of PS too variable for valid estimates. | Severe: bedrock at a depth of less than 20 inches; extremely stony. | Severe: bedrock at a depth of less than 20 inches; extremely stony; slopes are 8 to 30 percent. | Severe: bedrock at a depth of less than 20 inches; extremely stony. | Severe: bedrock at a depth of less than 20 inches; extremely stony. | Severe: bedrock at a depth of less than 20 inches; extremely stony. | Moderate where slopes are 8 to 15 percent; severe where 15 to 30 percent. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|--|---|---|--------------|--------------|---|--|--|--|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Fair: 20 to 40 inches of gravelly sandy loam, gravelly loam, and gravelly clay loam. | Severe: high frost action. | Poor: A-2, A-4, and A-6 material less than 36 inches thick. | Unsuitable-- | Unsuitable-- | Cemented pan at a depth of 20 to 40 inches; slopes are 4 to 15 percent. | Cemented pan at a depth of 20 to 40 inches; mostly SM-SC and SC material; medium to high shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Fair: silt loam, silty clay loam, and clay loam textures. | Severe: flooded; high frost action; CL material that has PI more than 15. | Poor: high frost action; CL material that has PI more than 15. | Unsuitable-- | Unsuitable-- | Seasonal water table at a depth of 2.5 to 5 feet. | Mostly CL material; saline; medium to low shear strength; high piping hazard. | Water table at a depth of 2.5 to 5.0 feet; saline; slowly permeable. | Water table at a depth of 2.5 to 5.0 feet; saline; slowly permeable. |
| Poor: water table at a depth of 1 to 2 feet. | Severe: flooded; water table at a depth of 1 to 2 feet; CL material that has PI more than 15. | Poor: water table at a depth of 1 to 2 feet; high frost action; CL material that has PI more than 15. | Unsuitable-- | Unsuitable-- | Seasonal water table at a depth of 1 to 2 feet. | Mostly CL material; medium to low shear strength; high piping hazard. | Water table at a depth of 1 to 2 feet; slowly permeable. | Water table at a depth of 1 to 2 feet; slowly permeable. |
| Fair: clay loam and very gravelly clay loam textures. | Severe: high frost action; CL material that has PI more than 15. | Poor: CL and GC or SC material less than 30 inches thick. | Unsuitable-- | Unsuitable-- | Cemented pan at a depth of 20 to 30 inches; slopes are 2 to 8 percent. | Limited thickness of CL and GC or SC material. | Features generally not applicable. | Features generally not applicable. |
| Good----- | Severe: flooded; mostly A-4 material; high frost action. | Poor: mostly A-4 material; high frost action. | Unsuitable-- | Unsuitable-- | Moderately permeable; slopes are 0 to 4 percent. | ML material; low shear strength; high piping hazard. | Flooded; slopes are 0 to 4 percent. | Flooded; slopes are 0 to 4 percent; PO saline. |
| Poor: bedrock at a depth of less than 20 inches; extremely stony. | Severe: bedrock at a depth of less than 20 inches. | Poor: bedrock at a depth of less than 20 inches. | Unsuitable-- | Unsuitable-- | Bedrock at a depth of less than 20 inches; slopes are 8 to 30 percent. | Bedrock at a depth of 20 inches; less than extremely stony. | Features generally not applicable. | Features generally not applicable. |

TABLE 9.—Engineering

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|---|---|---|---|--|--|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| Poorma: PTB ----- | Severe: flooded. | Severe: flooded. | Severe: flooded. | Severe: flooded. | Severe: flooded. | Severe: flooded. |
| Poorma clay variant: PV ----- | Severe: flooded; very slowly permeable. | Slight ----- | Severe: flooded; clay. | Severe: flooded; CL or CH material; high shrink-swell. | Severe: flooded; clay; water table at a depth of 4.5 to 10 feet. | Severe: flooded. |
| Rock land: RO. Too variable for valid estimates. | | | | | | |
| Rock outcrop. Too variable for valid estimates. Mapped only in complexes and associations with Cedar, Itca, Kyler, Nevtah, Pioche, Tica, Udel, Urtah, Winu, and Zoate soils. | | | | | | |
| Rough broken land. Too variable for valid estimates. Mapped only in association with Buster soil. | | | | | | |
| *Roval: RRD, RV ----- For Acana part of RV, see Acana series. | Severe: cemented pan at a depth of less than 20 inches. | Severe: cemented pan at a depth of less than 20 inches. | Severe: cemented pan at a depth of less than 20 inches. | Severe: cemented pan at a depth of less than 20 inches. | Severe: cemented pan at a depth of less than 20 inches. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent. |
| Satt: SAD2, SCC2, SD ----- | Severe: cemented pan at a depth of 20 to 30 inches. | Severe: cemented pan at a depth of 20 to 30 inches. | Severe: cemented pan at a depth of 20 to 30 inches. | Moderate: cemented pan at a depth of 20 to 30 inches; moderate where slopes are 2 to 15 percent, severe where 15 to 30 percent. | Severe: cemented pan at a depth of 20 to 30 inches. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent, severe where 15 to 30 percent. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|--|--|--|--|--------------|---|--|------------------------------------|-------------------------------------|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Good ----- | Severe: mostly A-4 material; high frost action. | Poor: mostly A-4 material; high frost action. | Unsuitable-- | Unsuitable-- | Moderately permeable; slopes are 0 to 4 percent. | ML material; low shear strength; high piping hazard. | Flooded ---- | Flooded; slopes are 0 to 4 percent. |
| Poor: clay. | Severe: A-7 material; high shrink-swell. | Poor: mostly A-7 material; high shrink-swell. | Unsuitable-- | Unsuitable-- | Very slowly permeable. | CL or CH material; saline; medium to low shear strength; high compressibility. | Very slowly permeable; saline. | Flooded; very slowly permeable. |
| Poor: less than 20 inches of gravelly loam and gravelly clay loam. | Severe: cemented pan at a depth of less than 20 inches. | Poor: cemented pan at a depth of less than 20 inches; good below a depth of 32 inches. | Poor: SM material at a depth of 32 to 60 inches. | Unsuitable-- | Cemented pan at a depth of less than 20 inches; slopes are 2 to 15 percent. | Cemented pan at a depth of less than 20 inches. | Features generally not applicable. | Features generally not applicable. |
| Fair: gravelly sandy clay loam and gravelly clay; 20 to 30 inches thick; fair where slopes are 2 to 15 percent, poor where 15 to 30 percent. | Moderate: cemented pan at a depth of 20 to 30 inches; moderate where slopes are 2 to 15 percent, severe where 15 to 30 percent slopes. | Poor: cemented pan at a depth of 20 to 30 inches. | Unsuitable-- | Unsuitable-- | Cemented pan at a depth of 20 to 30 inches; slopes are 2 to 30 percent. | About 20 to 30 inches of GC material; medium shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |

TABLE 9.—Engineering

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|--|--|--|--|--|--|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| Seval: SEF ----- | Severe: cemented pan at a depth of 20 to 30 inches; slopes are 30 to 50 percent. | Severe: cemented pan at a depth of 20 to 30 inches; slopes are 30 to 50 percent. | Severe: cemented pan at a depth of 20 to 30 inches; slopes are 30 to 50 percent. | Severe where slopes are 30 to 50 percent. | Severe: cemented pan at a depth of 20 to 30 inches; slopes are 30 to 50 percent. | Severe where slopes are 30 to 50 percent. |
| Shroe: SGD, SH ----- Badland part of SH too variable for valid estimates. | Severe: slow permeability; where slopes are 2 to 15 percent; severe where slopes are 15 to 30 percent. | Moderate where slopes are 2 to 8 percent, severe where 8 to 30 percent. | Severe: gravelly clay and very gravelly sandy clay loam textures. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent, severe where 15 to 30 percent. | Moderate: 2 to 25 percent gravelly clay and very gravelly sandy clay loam; severe where slopes are 25 to 30 percent. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent, severe where 15 to 30 percent. |
| Sieroclipf: SKC ----- | Severe: cemented pan at a depth of 20 to 30 inches. | Severe: cemented pan at a depth of 20 to 30 inches. | Moderate: rippable pan at a depth of 20 to 30 inches. | Slight: rippable pan at a depth of 20 to 30 inches. | Severe: rippable pan at a depth of 20 to 30 inches; rapidly permeable below a depth of 30 inches. | Slight----- |
| Slickens: SL Too variable for valid estimates. | | | | | | |
| Stampede: ST ----- | Severe: cemented pan at a depth of 24 to 36 inches; slowly permeable. | Slight----- | Severe: cemented pan at a depth of 24 to 36 inches; clay textures. | Severe: CH or CL material; high shrink-swell. | Severe: cemented pan at a depth of 24 to 36 inches; clay textures. | Slight----- |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|--|--|--|--|--|--|---|---|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Poor: cemented pan at a depth of 20 to 30 inches; slopes are 30 to 50 percent. | Severe: cemented pan at a depth of 20 to 30 inches; slopes are 30 to 50 percent. | Poor: cemented pan at a depth of 20 to 30 inches. | Fair: GP-GM or SP-SM material at a depth of 27 to 60 inches. | Fair: GP-GM or SP-SM material at a depth of 27 to 60 inches. | Cemented pan at a depth of 20 to 30 inches; 30 to 50 percent slopes. | About 20 to 30 inches of CL, SM, SC or SM-SC material; medium to low shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Fair: gravelly clay and very gravelly sandy clay loam textures: fair where slopes are 2 to 15 percent, poor where 15 to 30 percent. | Moderate frost action; moderate where slopes are 2 to 15 percent, severe where 15 to 30 percent. | Fair: mostly A-2 and A-7 material; fair where slopes are 2 to 25 percent, poor where 25 to 30 percent. | Unsuitable-- | Unsuitable-- | Slopes are 2 to 30 percent. | Mostly SC, CL, and ML material; medium to low shear strength; piping hazard. | Features generally not applicable. | Features generally not applicable. |
| Fair: 20 to 30 inches of clay loam, gravelly clay loam, and gravelly loam. | Severe: rippable pan at a depth of 20 to 30 inches; high frost action. | Poor: A-6 and A-4 material; rippable pan at a depth of 20 to 30 inches; high frost action. | Poor: SM material at a depth of 48 to 60 inches. | Unsuitable-- | Cemented pan at a depth of 20 to 30 inches; slopes are 2 to 8 percent. | Mostly SM, SC, or SM-SC material; medium shear strength; medium piping hazard. | Features generally not applicable. | Features generally not applicable. |
| Poor: clay textured material 24 to 36 inches thick; cemented pan at a depth of 24 to 36 inches. | Severe: mostly A-4 or A-7 material; high shrink-swell. | Poor: cemented pan at a depth of 24 to 36 inches; mostly A-4 or A-7 material. | Unsuitable-- | Unsuitable-- | Cemented pan at a depth of 24 to 36 inches; slowly permeable. | Mostly CL or CH material; medium to low shear strength; high compressibility; high shrink-swell. | Cemented pan at a depth of 24 to 36 inches; slowly permeable. | Cemented pan at a depth of 24 to 36 inches; slowly permeable. |

TABLE 9.—Engineering

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|---|---|---|---|--|---|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| Swisbob: SWC ----- | Severe: cemented pan at a depth of 24 to 36 inches; very slowly permeable. | Severe: cemented pan at a depth of 24 to 36 inches; very stony. | Severe: cemented pan at a depth of 24 to 36 inches; clay textures. | Severe: CH and CL material; high shrink-swell | Severe: cemented pan at a depth of 24 to 36 inches; clay and clay loam textures. | Slight----- |
| *Tica: TN, TR ----- For Nevtah part of TN, see Nevtah series. Rock outcrop parts of TN and TR too variable for valid estimates. | Severe: bedrock at a depth of less than 20 inches; slopes are 15 to 30 percent. | Severe: bedrock at a depth of less than 20 inches; slopes are 15 to 30 percent. | Severe: bedrock at a depth of less than 20 inches; slopes are 15 to 30 percent. | Severe: bedrock at a depth of less than 20 inches; slopes are 15 to 30 percent. | Severe: bedrock at a depth of less than 20 inches; slopes are 15 to 30 percent. | Severe slopes are 15 to 30 percent. |
| Timpahute: TT8 ----- | Severe: cemented pan at a depth of 20 to 30 inches; very slowly permeable. | Severe: cemented pan at a depth of 20 to 30 inches. | Severe: cemented pan at a depth of 20 to 30 inches. | Severe: CH material; high shrink-swell. | Severe: cemented pan at a depth of 20 to 30 inches; clay and clay loam. | Slight----- |
| Uana ----- Mapped only in association with Decan soils. | Severe: cemented pan at a depth of 20 to 30 inches; slowly permeable. | Severe: cemented pan at a depth of 20 to 30 inches. | Moderate: rippable cemented pan at a depth of 20 to 30 inches. | Moderate: mostly CL material; moderate shrink-swell. | Moderate: rippable cemented pan at a depth of 20 to 30 inches; clay loam. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent. |
| *Udel: UK ----- Rock outcrop part too variable for valid estimates. | Severe: bedrock at a depth of less than 10 inches; slopes are 30 to 50 percent. | Severe: bedrock at a depth of less than 10 inches; slopes are 30 to 50 percent. | Severe: bedrock at a depth of less than 10 inches; slopes are 30 to 50 percent. | Severe: bedrock at a depth of less than 10 inches; slopes are 30 to 50 percent. | Severe: bedrock at a depth of less than 10 inches; slopes are 30 to 50 percent. | Severe where slopes are 30 to 50 percent. |

interpretations—Continued

| Degree and kind of soil Sanitary land fill ¹ | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|---|--|--|---|---|---|------------------------------------|------------------------------------|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Poor: clay and clay loam textures. | Severe: A-6 and A-7 material; high shrink-swell. | Poor: mostly A-6 and A-7 material; high shrink-swell. | Poor: SM material that has 15 to 25 percent fines at a depth of 50 to 60 inches. | Unsuitable... | Cemented pan at a depth of 24 to 36 inches; very slowly permeable; slopes are 4 to 8 percent. | Mostly CL and CH material; medium to low shear strength; high compressibility. | Features generally not applicable. | Features generally not applicable. |
| Poor: bedrock at a depth of less than 20 inches. | Severe: bedrock at a depth of less than 20 inches; slopes are 15 to 30 percent. | Poor: bedrock at a depth of less than 20 inches. | Unsuitable... | Unsuitable... | Bedrock at a depth of less than 20 inches; slopes are 15 to 30 percent. | Bedrock at a depth of less than 20 inches. | Features generally not applicable. | Features generally not applicable. |
| Poor: cemented pan at a depth of 20 to 30 inches; clay and clay loam. | Severe: A-6 and A-7 material; high shrink-swell. | Poor: cemented pan at a depth of 20 to 30 inches; A-6 and A-7 material; high shrink-swell. | Unsuitable... | Fair: GP-GM material at a depth of 42 to 60 inches. | Cemented pan at a depth of 20 to 30 inches; slopes are 0 to 4 percent. | Mostly CL and CH material; medium to low shear strength; high compressibility. | Features generally not applicable. | Features generally not applicable. |
| Fair: rippable pan at a depth of 20 to 30 inches; mostly clay loam. | Severe: mostly A-6 and A-7 material; high frost action. | Poor: rippable cemented pan at a depth of 20 to 30 inches; mostly A-6 and A-7 material; high frost action. | Poor: SM material that has 25 to 35 percent fines at a depth of 38 to 65 inches. | Unsuitable... | Cemented pan at a depth of 20 to 30 inches; slopes are 2 to 15 percent. | Mostly CL material that has rippable cemented pan at a depth of 20 to 30 inches; medium shear strength; medium piping hazard. | Features generally not applicable. | Features generally not applicable. |
| Poor: bedrock at a depth of less than 10 inches; slopes are 30 to 50 percent. | Severe: bedrock at a depth of less than 10 inches; slopes are 30 to 50 percent. | Unsuitable... | Unsuitable... | Unsuitable... | Bedrock at a depth of less than 10 inches; slopes are 30 to 50 percent. | Bedrock at a depth of less than 10 inches. | Features generally not applicable. | Features generally not applicable. |

TABLE 9.—*Engineering*

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|--|---|---|---|---|--|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| Umil: UMB ----- | Severe: cemented pan at a depth of 10 to 14 inches. | Severe: cemented pan at a depth of 10 to 14 inches. | Severe: cemented pan at a depth of 10 to 14 inches. | Severe: cemented pan at a depth of 10 to 14 inches. | Severe: cemented pan at a depth of 10 to 14 inches. | Slight----- |
| Ursine: URD, URE, US ----- Badland part of US too variable for valid estimates. | Severe: cemented pan at a depth of 14 to 20 inches. | Severe: cemented pan at a depth of 14 to 20 inches. | Moderate: rippable pan at a depth of 14 to 20 inches; moderate where slopes are 2 to 15 percent, severe where 15 to 30 percent. | Moderate: rippable pan at a depth of 14 to 20 inches; moderate where slopes are 2 to 15 percent, severe where 15 to 30 percent. | Moderate: rippable pan at a depth of 14 to 20 inches; moderate where slopes are 2 to 25 percent, severe where 25 to 30 percent. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent, severe where 15 to 30 percent. |
| Urtah: UT ----- Rock outcrop part too variable for valid estimate. | Severe: bedrock at a depth of 20 to 40 inches; slopes are 30 to 50 percent. | Severe: bedrock at a depth of 20 to 40 inches; slopes are 30 to 50 percent. | Severe: bedrock at a depth of 20 to 40 inches; slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent; 40 percent rock outcrop. | Severe: bedrock at a depth of 20 to 40 inches; slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent. |
| Urwil: UWD ----- | Severe: slowly permeable. | Moderate: stony material; moderate where slopes are 2 to 8 percent, severe where 8 to 15 percent. | Severe: gravelly clay and sandy clay. | Severe: SC material; high shrink-swell. | Moderate: rippable bedrock between 4 and 5 feet; gravelly sandy clay. | Slight where slopes are 2 to 8 percent, moderate where 8 to 15 percent. |
| Usine ----- Mapped only in association with Holsine soil. | Moderate where slopes are 8 to 15 percent, severe where 15 to 30 percent. ⁴ | Severe: slopes are 8 to 30 percent; very rapid permeability. | Severe: very gravelly. | Moderate where slopes are 8 to 15 percent, severe where 15 to 30 percent. | Severe: very gravelly textures; very rapid permeability. | Severe: very rapid permeability. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|---|--|--|--------------|---|--|------------------------------------|------------------------------------|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Poor: cemented pan at a depth of 10 to 14 inches. | Severe: cemented pan at a depth of 10 to 14 inches. | Poor: cemented pan at a depth of 10 to 14 inches. | Poor: SM material that has 15 to 25 percent fines at a depth of 38 to 60 inches. | Unsuitable-- | Cemented pan at a depth of 10 to 14 inches; slopes are 2 to 4 percent. | Cemented pan at a depth of 10 to 14 inches. | Features generally not applicable. | Features generally not applicable. |
| Poor: cemented pan at a depth of 14 to 20 inches. | Moderate: rippable pan at a depth of 14 to 20 inches; moderate where slopes are 2 to 15 percent, severe where 15 to 30 percent. | Poor: rippable pan at a depth of 14 to 20 inches; mostly GM material. | Unsuitable-- | Unsuitable-- | Cemented pan at a depth of 14 to 20 inches; slopes are 2 to 30 percent. | Rippable cemented pan at a depth of 14 to 20 inches; mostly GM material; medium shear strength; medium compacted permeability; medium piping hazard. | Features generally not applicable. | Features generally not applicable. |
| Poor: slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent; 40 percent rock outcrop. | Poor: bedrock at a depth of 20 to 40 inches; slopes are 30 to 50 percent. | Unsuitable-- | Unsuitable-- | Bedrock at a depth of 20 to 40 inches; slopes are 30 to 50 percent. | Slopes are 30 to 50 percent; 20 to 40 inches of 40 percent rock outcrop. | Features generally not applicable. | Features generally not applicable. |
| Moderate: gravelly sandy clay; large stones. | Severe: A-2 material; high shrink-swell. | Fair: mostly A-2 material; high shrink-swell. | Unsuitable-- | Unsuitable-- | Slopes are 2 to 15 percent. | Mostly SC material; medium shear strength; high shrink-swell. | Features generally not applicable. | Features generally not applicable. |
| Poor: mostly very gravelly sand. | Moderate where slopes are 8 to 15 percent, severe where 15 to 30 percent. | Good where slopes are 8 to 15 percent, fair where 15 to 25 percent, poor where 25 to 30 percent. | Good----- | Good----- | Slopes are 8 to 30 percent; pervious material. | Mostly GP material; high shear strength; high compacted permeability. | Features generally not applicable. | Features generally not applicable. |

TABLE 9.—*Engineering*

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|--|---|---|---|--|--|--------------------------------------|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| Vicu: VCC ----- | Severe: cemented pan at a depth of 40 to 50 inches. | Severe: rapidly permeable above cemented pan at a depth of 40 to 50 inches. | Moderate: cemented pan at a depth of 40 to 50 inches; gravelly and very gravelly. | Moderate: SC material; moderate shrink-swell. | Severe: rapidly permeable above cemented pan at a depth of 40 to 50 inches. | Slight----- |
| Vil: VGC ----- | Severe: cemented pan at a depth of 15 to 20 inches. | Severe: cemented pan at a depth of 15 to 20 inches. | Moderate: rippable cemented pan at a depth of 15 to 20 inches; gravelly. | Moderate: rippable cemented pan at a depth of 15 to 20 inches; large stones. | Moderate: rippable cemented pan at a depth of 15 to 20 inches; large stones. | Slight----- |
| Wilpar: WMF ----- | Severe: slopes are 30 to 50 percent; slowly permeable. | Severe: slopes are 30 to 50 percent. | Severe: slopes are 30 to 50 percent; gravelly and very gravelly clay. | Severe: slopes are 30 to 50 percent; high shrink-swell. | Severe: slopes are 30 to 50 percent; gravelly and very gravelly clay textures. | Severe: slopes are 30 to 50 percent. |
| Winu: WNG, WR ----- Rock outcrop part of WR too variable for valid estimates. | Severe: bedrock at a depth of 24 to 40 inches; slopes are 15 to 75 percent. | Severe: bedrock at a depth of 24 to 40 inches; slopes are 15 to 75 percent. | Severe: bedrock at a depth of 24 to 40 inches; slopes are 15 to 75 percent. | Severe: slopes are 15 to 75 percent. | Severe: bedrock at a depth of 24 to 40 inches. | Severe: slopes are 15 to 75 percent. |
| Winz: WS ----- | Severe: slopes are 30 to 70 percent. | Severe: slopes are 30 to 75 percent. | Severe: slopes are 30 to 75 percent; very gravelly and cobbly. | Severe: slopes are 30 to 75 percent. | Severe: slopes are 30 to 75 percent; very gravelly and cobbly. | Severe: slopes are 30 to 75 percent. |

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|--|---|--|--|--|--|------------------------------------|------------------------------------|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Poor: mostly very gravelly material. | Moderate: moderate shrink-swell. | Good: cemented pan at a depth of 40 to 50 inches; mostly A-2 and A-4 material | Unsuitable-- | Unsuitable-- | Slopes are 2 to 8 percent; rapidly permeable above cemented pan at a depth of 40 to 50 inches. | About 3 to 4 feet of SC and GP material; high shear strength; medium compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Severe: gravelly loam and gravelly sandy clay loam less than 20 inches thick. | Moderate: rippable cemented pan at a depth of 15 to 20 inches. | Poor: rippable cemented pan at a depth of 15 to 20 inches. | Fair: GP-GM or SP-SM material that is 5 to 10 percent fines at a depth of 48 to 60 inches. | Fair: GP-GM or SP-SM material that is 5 to 10 percent fines at a depth of 48 to 60 inches. | Cemented pan at a depth of 15 to 20 inches; slopes are 2 to 8 percent. | About 15 to 20 inches of SM, SC, SM-SC or GM-GC material; high shear strength. | Features generally not applicable. | Features generally not applicable. |
| Poor: slopes are 30 to 50 percent; gravelly and very gravelly clay textures. | Severe: slopes are 30 to 50 percent; A-2 or A-7 material; high shrink-swell. | Poor: slopes are 30 to 50 percent; A-2 or A-7 material; high shrink-swell. | Unsuitable-- | Unsuitable-- | Slopes are 30 to 50 percent. | Slopes are 30 to 50 percent; SC or CL material; medium to high shear strength; low compacted permeability. | Features generally not applicable. | Features generally not applicable. |
| Poor: bedrock at a depth of 24 to 40 inches; slopes are 15 to 75 percent. | Severe: slopes are 15 to 75 percent. | Poor: bedrock at a depth of 24 to 40 inches; slopes are 15 to 75 percent. | Unsuitable-- | Unsuitable-- | Bedrock at a depth of 24 to 40 inches; slopes are 15 to 75 percent. | Bedrock at a depth of 24 to 40 inches; slopes are 15 to 75 percent. | Features generally not applicable. | Features generally not applicable. |
| Poor: slopes are 30 to 75 percent; very stony and cobbly. | Severe: slopes are 30 to 75 percent. | Poor: slopes are 30 to 75 percent. | Unsuitable-- | Unsuitable-- | Slopes are 30 to 75 percent. | Slopes are 30 to 75 percent. SM, GC, or SC material; high shear strength; stones and cobbles. | Features generally not applicable. | Features generally not applicable. |

TABLE 9.—Engineering

| Soil series and map symbols | Degree and kind of soil limitation for— | | | | | |
|---|---|---|---|---|---|--|
| | Septic-tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill ¹ | |
| | | | | | Trench type | Area type |
| Zoate: ZOF, ZR Rock outcrop part of ZR too variable for valid estimates. | Severe: cemented pan and bedrock at a depth of 12 to 20 inches. | Severe: cemented pan and bedrock at a depth of 12 to 20 inches. | Severe: cemented pan and bedrock at a depth of 12 to 20 inches. | Severe: cemented pan and bedrock at a depth of 12 to 20 inches. | Severe: cemented pan and bedrock at a depth of 12 to 20 inches. | Slight where slopes are 4 to 8 percent, moderate where 8 to 15 percent, severe where 15 to 50 percent. |

¹Permeability not used as criteria except in flooded soils. On-site deep studies of the underlying strata, water table, and hazards of aquifer pollution and drainage into ground water need to be made for landfills deeper than 5 or 6 feet.

²Pervious material in places below a depth of 5 feet.

Group C consists of soils that have a slow rate of infiltration when thoroughly wetted. They are chiefly soils having a layer that impedes the downward movement of water or soils that have moderately fine texture to fine texture and slow infiltration rate. These soils have a slow rate of water transmission. In this group are Acoma, Basket, Bicondoa, Bit, Buster, Cath, Decan, Decathon, Deerlodge, Hamtah, Homestake, Linco, Lize, Kyler variant, Met, Nevtah, Nevu, Pamsdel, Poorma, clay variant, Satt, Sierocloff, Swisbob, Timpahute, Uana, Ursine, Urtah, Urwil, Vicu, Wilpar, and Winz soils.

Group D consists of soils that have a very slow rate of infiltration when thoroughly wetted. They are chiefly clay soils with a high swelling potential, soils with a permanently high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious materials. Such soils have a very slow rate of water transmission. In this group are Acana, Aned, Cedarán, Denmark, Itca, Jarab, Kyler, Lien, Minu, Pahránagat, Pioche, Roval, Seval, Shroe, Stampede, Tica, Udel, Umil, Vil, Winu, and Zoate soils.

Use of the Soils for Recreational Development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 10 the soils of the survey area are rated according to limitations that affect their suitability for camp areas, paths and trails, picnic areas, and playgrounds.

In table 10 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation

can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have gentle slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but may be moderately dusty when dry.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but may be moderately dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry. They are free of flooding during the season of use, and they do not have slopes or stoniness that greatly increase cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, have good drainage, are free from flooding during periods of heavy use, and have a surface that is firm after rains but not dusty

interpretations—Continued

| Degree and kind of soil limitation for—continued | | Suitability as a source of— | | | Soil features affecting— | | | |
|---|---|---|---------------|---------------|---|---|------------------------------------|------------------------------------|
| Cover material for area landfill | Local roads and streets | Road fill | Sand | Gravel | Pond reservoir areas | Dikes, levees, and other embankments | Drainage for crops and pasture | Irrigation |
| Poor: cemented pan and bedrock at a depth of 12 to 20 inches. | Severe: cemented pan and bedrock at a depth of 12 to 20 inches; slopes are 4 to 50 percent. | Poor: cemented pan and bedrock at a depth of 12 to 20 inches; slopes are 4 to 50 percent. | Unsuitable... | Unsuitable... | Cemented pan at a depth of 12 to 20 inches; slopes are 4 to 50 percent. | Cemented pan and bedrock at a depth of 12 to 20 inches; slopes are 4 to 50 percent. | Features generally not applicable. | Features generally not applicable. |

^a Weakly cemented material in substratum pervious in places.

⁴ Contamination hazard to water supplies in places.

when dry. If grading and leveling are required, depth to rock is important.

Formation and Classification of the Soils

This section discusses the factors of soil formation and the classification of soils according to the higher categories of the soil taxonomy of the National Cooperative Soil Survey as used by the Soil Conservation Service, U.S. Department of Agriculture.

Factors of Soil Formation

Soil is a natural body on the earth's surface in which plants grow. It is a mixture of varying proportions of rocks, minerals, organic matter, water, and air. The rocks and minerals are fragmented and partly or wholly weathered. Soils have distinctive layers, or horizons, that are the products of environmental forces acting upon materials deposited or accumulated through geologic activity.

The characteristics of a soil at any given moment are determined by the interaction of the parent material; the climate in which the soil material accumulated and has since existed; the biological forces that act upon the soil material; the relief which influences the local environment of the soil, its drainage, moisture content, aeration, stability, and exposure to sun and wind; and the length of time that climate, biological factors, and relief have acted upon the parent material.

Land surfaces are not always stable long enough to permit the development of well-expressed indicators of soil formation. This is particularly evident in the high desert region. Deep incisions in the earth reveal sequences of buried soils that have varying degrees of

development and overlying geologic material. Each buried soil indicates a period of relative stability, although short lived, during which the soil forming processes had begun to leave their mark. Sandwiched between such buried soils are various thicknesses and arrangements of sand, gravel, rock, or other materials which are recognized by geologists as representatives of periods of great erosion and deposition. Vegetation may have existed on these coarse materials, but apparently not long enough to leave evidence of soil formation. Such soils have become important time-stratigraphic markers in the study of ancient environmental history.

Parent material

Parent material is the weathered rock of unconsolidated material from which soils form. The hardness, grain size, porosity, and weatherable mineral content of the parent material greatly influence soil formation. The main sources of parent material in the Meadow Valley Area are volcanic rocks, limestone, quartzite, alluvium, lacustrine deposits, and aeolian deposits.

The volcanic rocks of the survey area, which are mostly ignimbrites but include some tuffs, provide the majority of the parent material for the soils on the mountains and higher foothills. Within the Meadow Valley Watershed, all parent rock is of volcanic origin except for an area of limestone covering an area of about five square miles near the Utah border approximately 10 miles northeast of Ursine (?).

The ignimbrites and tuffs are less dense than most rocks. They contain significant amounts of volcanic glass, hence weather readily. The soils derived from these rocks provide an ample supply of potassium for plant needs. In many of these soils hardpan form from the silica released by weathering of the ignimbrites and tuffs.

TABLE 10.—*Suitability of the soils for recreation*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soils. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table. Absence of data indicates interpretation not made]

| Soil series and map symbols | Degree and kind of limitation for— | | | |
|--|--|---|---|---|
| | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
| *Acana: ACC, AE ----- For Ursine part of AE see Ursine series. | Moderate: very slowly permeable hardpan at a depth of 10 to 20 inches; dry for long periods; dusty when disturbed; 25 to 30 percent coarse fragments on surface. | Moderate: dry for long periods; dusty when disturbed; 25 to 30 percent coarse fragments on surface. | Moderate: 25 to 30 percent coarse fragments on surface; dry for long periods; dusty when disturbed. | Severe: very slowly permeable hardpan at a depth of 10 to 20 inches; slopes are mostly 2 to 8 percent. |
| Acoma: AGD ----- | Moderate: slow permeability. | None to slight ----- | Moderate: gravelly sandy clay texture at a depth of 2 to 4 inches. | Severe: slopes are 2 to 15 percent. |
| Alluvial land: AL. Too variable for valid interpretations. | | | | |
| Aned: ANC ----- | Moderate: moderately slow permeability above a very slowly permeable hardpan at a depth of 14 to 20 inches. | None to slight: clay loam texture at a depth of less than 6 inches. | None to slight: clay loam texture at a depth of less than 6 inches. | Moderate: moderately slow permeability over a very slowly permeable hardpan at a depth of 14 to 20 inches; slopes are 2 to 8 percent. |
| *Badland: BA, BB, BD2 ----- For Bit part of BB, see Bit series. For Buster and Holsine parts of BD2, see Buster and Holsine series. | Severe: slopes are more than 30 percent; surface texture very variable; slow and very slow permeability. | Severe: slopes are more than 30 percent; surface texture very variable. | Severe: slopes are more than 30 percent; surface texture very variable. | Severe: slow and very slow permeability; slopes are more than 30 percent; surface texture very variable. |
| *Basket: BKF, BL ----- For interpretation of Lize and Satt parts of BL see Lize and Satt series. | Severe: slopes are 15 to 50 percent. | Severe: slopes are 15 to 50 percent. | Severe: slopes are 15 to 50 percent. | Severe: slopes are 15 to 50 percent; 20 to 30 percent coarse fragments on surface. |
| Bicondoa: Bm ----- | Moderate: slow permeability. | None to slight ----- | None to slight ----- | Moderate: slow permeability. |
| Bn ----- | Moderate: slow permeability; silty clay loam surface texture. | Moderate: silty clay loam surface texture. | Moderate: silty clay loam surface texture. | Moderate: slow permeability; silty clay loam surface texture. |
| Bo ----- | Severe: seasonal high water table above a depth of 20 inches. | Severe: seasonal high water table above a depth of 20 inches; subject to flooding during season of use. | Severe: seasonal high water table above a depth of 20 inches; subject to flooding. | Severe: seasonal high water table above a depth of 20 inches; subject to frequent flooding; slow permeability. |
| Bit ----- Mapped only in one unit in association with Badland. | Slight: dry for long periods; dusty; very slow permeable hardpan at a depth of 24 to 36 inches. | None to slight: dry for long periods; dusty. | None to slight: dry for long periods; dusty. | Moderate: slopes mostly 2 to 8 percent; very slowly permeable hardpan at a depth of 24 to 36 inches. |

TABLE 10.—*Suitability of the soils for recreation—Continued*

| Soil series and map symbols | Degree and kind of limitation for— | | | |
|--|---|---|--|---|
| | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
| *Buster: Buster part of BD2 ----- For interpretation of Holsine and Badland parts of BD2, see Holsine series and Badland. | Moderate: loamy sand surface textures. | Moderate: loamy sand surface textures. | Moderate: loamy sand surface textures. | Moderate: slopes mostly 2 to 8 percent; loamy sand surface textures. |
| BR ----- Rough broken land too variable to be rated, part of BR. | Moderate: moderately slow permeability. | None to slight ----- | None to slight ----- | Moderate: moderately slow permeability. |
| Cath: CAC ----- | Moderate: slow permeability; clay loam textures less than 6 inches from surface. | None to slight: clay loam textures less than 6 inches from surface. | None to slight: clay loam textures less than 6 inches from surface. | Moderate: slow permeability; slopes mostly 2 to 8 percent; clay loam textures less than 6 inches from surface. |
| *Cedaran: CD, CE ----- For interpretation of Decan part of CD and Rock outcrop part of CE, see Decan series and Rock outcrop. | Severe: slopes 4 to 30 percent. | Moderate: slopes 4 to 30 percent; 20 to 50 percent coarse fragments on surface. | Severe: slopes 4 to 30 percent. | Severe: slopes 4 to 30 percent; depth to bedrock is 12 to 18 inches; coarse fragments on surface 20 to 50 percent. |
| Cedaran part of IO ----- | Severe: slopes 15 to 50 percent. | Severe: slopes 15 to 50 percent; class 1 to 2 stoniness. | Severe: slopes 15 to 50 percent. | Severe: slopes 15 to 50 percent; depth to bedrock is 12 to 18 inches; coarse fragments on surface more than 20 percent. |
| *Cliffdown: CG ----- For interpretation of Geer part of CG, see Geer series. | Slight: 20 to 25 percent coarse fragments in surface layer; dry for long periods; dusty. | Slight: 20 to 25 percent coarse fragments in surface layer; dry for long periods; dusty. | Slight: 20 to 25 percent coarse fragments in surface layer; dry for long periods; dusty. | Moderate: slopes mostly 2 to 6 percent; 15 to 20 percent coarse fragments on surface. |
| *Decan: DA ----- For interpretation of Uana part of DA, see Uana series. | Moderate: slow permeability; slopes mostly less than 15 percent; clay loam surface textures; 15 to 25 percent coarse fragments in surface layer. ² | Moderate: clay loam surface textures. | Moderate to severe: slopes mostly less than 15 percent; clay loam surface textures; 15 to 25 percent coarse fragments in surface layer. ² | Severe: slopes 2 to 30 percent. ² |
| *Decathon: DCC, DED, DEE ----- For interpretation of Basket part of DED and DEE, see Basket series. | Moderate: moderately slow permeability; clay loam textures less than 6 inches from surface; 20 to 25 percent coarse fragments on soil surface. ² | Slight: clay loam textures less than 6 inches from surface; 20 to 25 percent coarse fragments on surface. | Slight: clay loam textures less than 6 inches from surface; 20 to 25 percent coarse fragments on surface. | Severe: slopes mostly more than 6 percent; 20 to 25 percent coarse fragments on surface. ² |
| *Deerlodge: DG, DH ----- For interpretation of Ursine part of DH, see Ursine series. | Moderate: moderately slow permeability; sandy clay loam textures less than 6 inches from surface; 25 to 30 percent coarse fragments on surface. ² | Moderate: 25 to 30 percent coarse fragments on surface; sandy clay loam textures less than 6 inches from surface. | Moderate: 25 to 30 percent coarse fragments on surface; sandy clay loam textures less than 6 inches from surface. | Severe: slopes 4 to 15 percent; 20 to 30 percent coarse fragments on surface. ² |

TABLE 10.—*Suitability of the soils for recreation*—Continued

| Soil series and map symbols | Degree and kind of limitation for— | | | |
|--|---|--|---|--|
| | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
| *Deerlodge: DG ----- For Deerlodge gravelly sandy loam component of DG, see Deerlodge above. | Severe: slopes 15 to 30 percent. ² | Moderate: slopes 15 to 30 percent; 20 to 50 percent coarse fragments on surface. | Severe: slopes 15 to 30 percent. | Severe: slopes 15 to 30 percent. ² |
| Denmark: DN, DMD ----- | Severe: very slowly permeable hardpan at a depth of 10 to 20 inches; dry for long periods; dusty. | Moderate: 20 to 30 percent coarse fragments on surface; dry for long periods; dusty. | Moderate: slopes 2 to 15 percent; 20 to 30 percent coarse fragments on surface. | Severe: slopes 2 to 15 percent; 20 to 30 percent coarse fragments on surface; very slowly permeable hardpan at a depth of 10 to 20 inches. |
| Fanu: FAC ----- | Slight: light sandy clay loam subsoil. | None ----- | None ----- | Slight: light sandy clay loam subsoil. |
| Four Star: ----- Mapped only in one unit in association with Holtle series. | Severe: seasonal high water table at a depth of 12 to 24 inches. | Severe: seasonal high water table at a depth of 12 to 24 inches. | Severe: seasonal high water table at a depth of 12 to 24 inches. | Severe: seasonal high water table at a depth of 12 to 24 inches; moderately slow permeability. |
| *Geer: Gf, Gg, GE, GM, Gh ----- For interpretation of Heist part of GM, see Heist series. | Slight: dry for long periods; dusty. | None ----- | Slight: dry for long periods; dusty. | Moderate: dry for long periods; dusty. |
| Gk ----- | Moderate: seasonal high water table at a depth of 24 to 60 inches. | Slight: seasonal high water table at a depth of 24 to 60 inches. | Slight: seasonal high water table at a depth of 24 to 60 inches. | Moderate: seasonal high water table at a depth of 24 to 60 inches. |
| *Hamtah: HA, HC ----- For interpretation of Tica part of HA and Udel and Rock outcrop parts of HC, see Tica and Udel series and Rock outcrop. | Severe: slopes 30 to 50 percent; stoniness class 1 to 3. | Severe: slopes 30 to 50 percent; class 1 to 3 stoniness. | Severe: slopes 30 to 50 percent. | Severe: slopes 30 to 50 percent; class 1 to 3 stoniness. |
| Heist: HDC, HEC ----- | Slight: dry for long periods; dusty. | None ----- | Slight: dry for long periods; dusty. | Moderate: slopes mostly 2 to 6 percent; dry for long periods; dusty. |
| *Holsine: HN ----- For interpretation of Usine and Buster parts of HN, see Usine and Buster series. | Moderate: surface covered with 40 to 50 percent coarse fragments. | Moderate: surface covered with 40 to 50 percent coarse fragments. | Moderate: surface covered with 40 to 50 percent coarse fragments. | Severe: surface covered with 40 to 50 percent coarse fragments; slopes mostly 2 to 8 percent. |
| *Holtle: HOC, HR ----- For interpretation of Four Star part of HR, see Four Star series. | None ----- | None ----- | None ----- | Moderate: slopes mostly 2 to 6 percent. |
| Homestake: HSC ----- | Moderate: 25 to 35 percent coarse fragments on surface. | Moderate: 25 to 35 percent coarse fragments on surface. | Moderate: 25 to 35 percent coarse fragments on surface. | Severe: 25 to 35 percent coarse fragments on surface; slopes mostly 2 to 8 percent. |
| HTC ----- | Severe: more than 50 percent coarse fragments on surface. | Severe: more than 50 percent coarse fragments on surface. | Severe: more than 50 percent coarse fragments on surface. | Severe: more than 50 percent coarse fragments on surface. |

TABLE 10.—*Suitability of the soils for recreation—Continued*

| Soil series and map symbols | Degree and kind of limitation for— | | | |
|--|--|---|--|---|
| | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
| *Itca: IND ----- | Severe: more than 50 percent coarse fragments on surface. | Severe: more than 50 percent coarse fragments on surface. | Severe: more than 50 percent coarse fragments on surface. | Severe: slopes 2 to 15 percent; 12 to 18 inches to hard bedrock; more than 50 percent coarse fragments on surface. |
| IO, IR ----- For interpretation of Cedar series. For Rock outcrop part of IR, see Rock outcrop. | Severe: slopes 15 to 50 percent; more than 50 percent coarse fragments on surface; class 2 to 3 stoniness. | Severe: more than 50 percent coarse fragments on surface; class 2 to 3 stoniness. | Severe: slopes 15 to 50 percent; more than 50 percent coarse fragments on surface; class 2 to 3 stoniness. | Severe: slopes 15 to 50 percent; 12 to 18 inches to hard bedrock; more than 50 percent coarse fragments on surface; class 2 to 3 stoniness. |
| Jarab: JCD ----- | Moderate: very slowly permeable hardpan at a depth of 12 to 18 inches. | Moderate: 20 to 40 percent coarse fragments on surface. | Moderate: 20 to 40 percent coarse fragments on surface. | Severe: very slowly permeable hardpan at a depth of 12 to 18 inches; slopes 2 to 15 percent; 30 to 40 percent coarse fragments on surface. |
| Kyler: KO ----- | Severe: slopes 15 to 30 percent; 45 to 55 percent coarse fragments on surface. | Moderate: slopes 15 to 30 percent; 45 to 55 percent coarse fragments on surface; class 1 to 2 stoniness. | Severe: slopes 15 to 30 percent; 45 to 55 percent coarse fragments on surface. | Severe: slopes 15 to 30 percent; 45 to 55 percent coarse fragments on surface; hard bedrock at a depth of 6 to 18 inches. |
| Kyler, moderately deep variant: KR. | Severe: slopes 50 to 75 percent; class 4 stoniness. | Severe: slopes 50 to 75 percent; class 4 stoniness. | Severe: slopes 50 to 75 percent; class 4 stoniness. | Severe: slopes 50 to 75 percent; 30 to 35 percent coarse fragments on surface; class 4 stoniness. |
| Lien: LAB ----- | Severe: very slowly permeable hardpan at a depth of 6 to 12 inches. | Moderate: 30 to 40 percent coarse fragments on surface. | Moderate: 30 to 40 percent coarse fragments on surface. | Severe: 30 to 40 percent coarse fragments on surface; very slowly permeable hardpan at a depth of 6 to 12 inches. |
| *Linco: LC, LD ----- For interpretation of Acana part of LC and Badland part of LD, see Acana series and Badland. | Severe: slopes 15 to 30 percent. | Moderate: slopes 15 to 30 percent; 20 to 50 percent coarse fragments on surface; dry for long periods; dusty. | Severe: slopes 15 to 30 percent; dry for long periods; dusty. | Severe: slopes 15 to 30 percent; 20 to 50 percent coarse fragments on surface; dry for long periods; dusty. |
| *Lize: LE, LT ----- For interpretation of Tica part of LT, see Tica series. | Severe: slopes 15 to 50 percent. | Severe: slopes 15 to 50 percent. | Severe: slopes 15 to 50 percent. | Severe: slopes 15 to 50 percent; 20 to 35 percent coarse fragments on surface. |
| *Met: MU ----- For interpretation of Ursine part of MU, see Ursine series. | Slight: very slowly permeable hardpan at a depth of 24 to 40 inches; dry for long periods; dusty. | Slight: dry for long periods; dusty. | Slight: dry for long periods, dusty. | Moderate: very slowly permeable hardpan at a depth of 24 to 40 inches; dry for long periods; dusty. |

TABLE 10.—*Suitability of the soils for recreation*—Continued

| Soil series and map symbols | Degree and kind of limitation for— | | | |
|---|--|--|---|---|
| | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
| Minu: MVC ----- | Moderate: very slowly permeable hardpan at a depth of 15 to 20 inches; 20 to 30 percent coarse fragments on surface. | Moderate: 20 to 30 percent coarse fragments on surface. | Moderate: 20 to 30 percent coarse fragments on surface. | Severe: very slowly permeable hardpan at a depth of 15 to 20 inches; 20 to 30 percent coarse fragments on surface; slopes 2 to 8 percent. |
| MWC ----- | Moderate: very slowly permeable hardpan at a depth of 12 to 18 inches; 20 to 30 percent coarse fragments on surface. | Moderate: 20 to 30 percent coarse fragments on surface; class 1 to 3 stoniness. | Moderate: 20 to 30 percent coarse fragments on surface; class 1 to 3 stoniness. | Severe: very slowly permeable hardpan at a depth of 12 to 18 inches; 20 to 30 percent coarse fragments on surface; class 1 to 3 stoniness. |
| *Nevtah: NR ----- For interpretation of Rock outcrop part of NR, see Rock outcrop. | Severe: very slowly permeable hardpan at a depth of 18 to 40 inches; slopes 4 to 30 percent; class 1 to 4 stoniness. | Moderate to severe: class 1 to 4 stoniness; slope 4 to 30 percent; 20 to 30 percent coarse fragments on surface. | Severe: slopes 4 to 30 percent; class 1 to 4 stoniness. | Severe: very slowly permeable hardpan at a depth of 12 to 40 inches; slopes 4 to 30 percent; 20 to 30 percent coarse fragments on surface; class 1 to 4 stoniness. |
| Nevu: NSD ----- | Severe: very slowly permeable hardpan at a depth of 18 to 27 inches. | Moderate: 25 to 35 percent coarse fragments on surface. | Moderate: slopes 4 to 15 percent; 25 to 35 percent coarse fragments on surface. | Severe: very slowly permeable hardpan at a depth of 18 to 27 inches; slopes 4 to 15 percent; 25 to 35 percent coarse fragments on surface. |
| Pahranagat: Pa, Pd ----- | Moderate: moderately slow permeability; dry for long periods; dusty. | Slight: dry for long periods; dusty. | Slight: dry for long periods; dusty. | Moderate: moderately slow permeability; dry for long periods; dusty. |
| Pe ----- | Severe: seasonal high water table at a depth of 12 to 24 inches. | Severe: seasonal high water table at a depth of 12 to 24 inches. | Severe: seasonal high water table at a depth of 12 to 24 inches. | Severe: seasonal high water table at a depth of 12 to 24 inches. |
| Pg ----- | Moderate: moderately slow permeability; silty clay loam surface textures. | Moderate: silty clay loam surface textures. | Moderate: silty clay loam surface textures. | Moderate: silty clay loam surface textures. |
| Pamsdel: PMC ----- | Moderate: moderately permeable above a very slowly permeable hardpan at a depth of 20 to 26 inches. | Slight: 15 to 20 percent coarse fragments on surface. | Slight: 15 to 20 percent coarse fragments on surface. | Moderate: moderately permeable above a very slowly permeable hardpan at a depth of 20 to 26 inches; moist or wet only for short periods during season of use; slopes mostly 2 to 8 percent; 15 to 20 percent coarse fragments on surface. |

TABLE 10.—*Suitability of the soils for recreation*—Continued

| Soil series and map symbols | Degree and kind of limitation for— | | | |
|--|---|---|--|---|
| | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
| *Patter: PN, PR ----- For interpretation of Geer part of PN and Shroe part of PR, see Geer and Shroe series. | Severe: in some places this soil may flood 1 to 2 times in 3 years; dry for long periods; dusty. | Slight: in some places this soil may flood 1 to 2 times in 3 years. | Moderate: in some places this soil may flood for short periods 1 to 2 times in 3 years; dry for long periods; dusty. | Moderate: in some places this soil may flood for short periods 1 to 2 times in 3 years; dry for long periods; dusty. |
| PO ----- For interpretation of Geer and Heist parts of PO, see Geer and Heist series. | Severe: floods 1 to 2 times in 3 years during season of use. | Slight: floods 1 to 2 times in 3 years during season of use. | Moderate: floods for short periods 1 to 2 times in 3 years during season of use. | Moderate: floods for short periods 1 to 2 times in 3 years during season of use; moderate permeability. |
| *Pioche: PS ----- For interpretation of Rock outcrop part of PS, see Rock outcrop. | Severe: slopes 8 to 30 percent; more than 50 percent coarse fragments on surface. | Severe: slopes 8 to 30 percent; more than 50 percent coarse fragments on surface; class 1 to 3 stoniness. | Severe: slopes 8 to 30 percent; more than 50 percent coarse fragments on surface; class 1 to 3 stoniness. | Severe: slopes 8 to 30 percent; more than 50 percent coarse fragments on surface; hard bedrock at a depth of 6 to 18 inches. |
| Poorma: PTB ----- | Slight: occasional flooding in small local areas. | Slight: occasional flooding in small local areas. | Slight: occasional flooding in small local areas. | Moderate: occasional flooding in small local areas; slopes 0 to 4 percent. |
| Poorma, clay variant: PV ----- | Severe: very slowly permeable; occasional flooding in small local areas. | Slight: occasional flooding in small local areas. | Slight: occasional flooding in small local areas. | Severe: very slowly permeable; occasional flooding in small local areas. |
| Rock land: RO. Too variable for valid interpretation. | | | | |
| Rock outcrop. Too variable for valid interpretation. Mapped only in association or complex with Cedar, Itca, Kyler, Nevtah, Pioche, Tica, Udel, Urtah, Winu, and Zoate soils. | | | | |
| Rough broken land. Too variable for valid interpretation. Mapped only in association with Buster soils. | | | | |
| *Roal: RRD, RV ----- For interpretation of Acana part of RV, see Acana series. | Moderate: moderately slow permeability above a very slowly permeable hardpan at a depth of 10 to 20 inches; 20 to 25 percent coarse fragments on surface. | Moderate: 20 to 25 percent coarse fragments on surface. | Slight: 20 to 25 percent coarse fragments on surface. | Severe: moderately slow permeability above a very slowly permeable hardpan at a depth of 10 to 20 inches; 20 to 25 percent coarse fragments on surface. |
| Satt: SCC2, SAD2 ----- | Moderate: slopes 2 to 15 percent; class 1 to 2 stoniness; very slowly permeable hardpan at a depth of 20 to 30 inches. | Moderate: class 1 to 2 stoniness; 10 to 20 percent coarse fragments on surface. | Slight: class 1 to 2 stoniness; 10 to 20 percent coarse fragments on surface. | Moderate: very slowly permeable hardpan at a depth of 20 to 30 inches; class 1 to 2 stoniness. |

TABLE 10.—*Suitability of the soils for recreation—Continued*

| Soil series and map symbols | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
|---|---|---|---|--|
| Satt (Con.) SD ----- | Severe: class 3 to 5 stoniness; very slowly permeable hardpan at a depth of 20 to 30 inches. | Severe: class 3 to 5 stoniness. | Severe: class 3 to 5 stoniness. | Severe: class 3 to 5 stoniness; very slowly permeable hardpan at a depth of 20 to 30 inches. |
| Seval: SEF ----- | Severe: very slowly permeable hardpan at a depth of 20 to 28 inches; slopes 30 to 50 percent; more than 50 percent coarse fragments on surface. | Severe: slopes 30 to 50 percent; more than 50 percent coarse fragments on surface. | Severe: slopes 30 to 50 percent; more than 50 percent coarse fragments on surface. | Severe: very slowly permeable hardpan at a depth of 20 to 28 inches; slopes 30 to 50 percent; more than 50 percent coarse fragments on surface. |
| Shroe: SGD ----- | Moderate: slowly permeable; slopes 2 to 15 percent; 20 to 25 percent coarse fragments on surface. | Moderate: 20 to 25 percent coarse fragments on surface; sandy clay loam textures at 2 to 3 inches from surface. | Moderate: slopes 2 to 15 percent; 20 to 25 percent coarse fragments on surface; silty clay loam texture 2 to 3 inches from surface. | Severe: slopes 2 to 15 percent; 20 to 25 percent coarse fragments on surface. |
| SH ----- | Severe: slopes 15 to 30 percent. | Moderate: 20 to 30 percent coarse fragments on surface; slopes 15 to 30 percent. | Severe: slopes 15 to 30 percent. | Severe: slopes 15 to 30 percent; 20 to 30 percent coarse fragments on surface. |
| Sieroclipf: SKC ----- | Moderate: very slowly permeable hardpan at a depth of 20 to 30 inches; 30 to 40 percent coarse fragments on surface. | Slight: 30 to 40 percent $\frac{3}{4}$ - to 1-inch coarse fragments on surface. | Slight: 30 to 40 percent $\frac{3}{4}$ - to 1-inch coarse fragments on surface. | Moderate: very slowly permeable hardpan at a depth of 20 to 30 inches; slopes mostly 2 to 6 percent; 30 to 40 percent $\frac{3}{4}$ - to 1-inch coarse fragments on surface. |
| Slickens: SL Too variable for valid interpretation. | | | | |
| Stampede: ST ----- | Moderate: slowly permeable over very slowly permeable hardpan at a depth of 28 to 35 inches; 10 to 20 percent coarse fragments on surface. | Slight: 10 to 20 percent coarse fragments on surface. | Slight: 10 to 20 percent coarse fragments on surface. | Moderate: 10 to 20 percent coarse fragments on surface; very slowly permeable hardpan at a depth of 28 to 35 inches. |
| Swisbob: SWC ----- | Severe: very slowly permeable; 85 to 90 percent coarse fragments on surface. | Severe: 85 to 90 percent coarse fragments on surface. | Severe: 85 to 90 percent coarse fragments on surface. | Severe: slopes 4 to 8 percent; very slowly permeable; 85 to 90 percent coarse fragments on surface. |
| *Tica: TN, TR For interpretation of Nevtah part of TN and Rock outcrop part of TR, see Nevtah series and Rock outcrop. | Severe: slopes 15 to 30 percent; class 1 to 3 stoniness. | Moderate: slopes 15 to 30 percent; class 1 to 3 stoniness; 40 to 50 percent coarse fragments on surface. | Severe: slopes 15 to 30 percent. | Severe: slopes 15 to 30 percent; hard bedrock at a depth of 10 to 20 inches; 40 to 50 percent coarse fragments on surface; class 1 to 3 stoniness. |

TABLE 10.—*Suitability of the soils for recreation*—Continued

| Soil series and map symbols | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
|---|--|---|--|--|
| Timpahute: TT8 ----- | Moderate: slowly permeable above a very slowly permeable hardpan at a depth of 23 to 30 inches; 50 to 60 percent mostly less than 1 inch coarse fragments on surface. | Slight: 50 to 60 percent mostly less than 1 inch coarse fragments on surface. | Moderate: 50 to 60 percent mostly less than 1 inch coarse fragments on surface; clay loam textures 2 to 4 inches from surface. | Moderate: slowly permeable above a very slowly permeable hardpan at a depth of 23 to 30 inches; slopes mostly 2 to 4 percent; clay loam textures 2 to 4 inches from surface; 50 to 60 percent mostly less than 1 inch coarse fragments on surface. |
| Uana: ----- Mapped only in association with Decan series. | Severe: clay textures 3 to 5 inches from surface. | Moderate: clay textures 3 to 5 inches from surface. | Moderate: clay textures 3 to 5 inches from surface; 15 to 20 percent coarse fragments on surface; slopes 2 to 15 percent. | Severe: slowly permeable above a very slowly permeable hardpan at a depth of 21 to 30 inches; slopes 2 to 15 percent; clay textures 3 to 5 inches from surface. |
| *Udel: UK ----- For interpretation of Rock outcrop part of UK, see Rock outcrop. | Severe: slopes 30 to 50 percent; 50 to 60 percent coarse fragments on surface; hard bedrock at a depth of 4 to 15 inches. | Severe: slopes 30 to 50 percent; 50 to 60 percent coarse fragments on surface; hard bedrock at a depth of 4 to 15 inches. | Severe: slopes 30 to 50 percent; 50 to 60 percent coarse fragments on surface; hard bedrock at a depth of 4 to 15 inches. | Severe: slopes 30 to 50 percent; 50 to 60 percent coarse fragments on surface; hard bedrock at a depth of 4 to 15 inches. |
| Umil: UMB ----- | Moderate: very slowly permeable hardpan at a depth of 10 to 14 inches; 40 to 50 percent coarse fragments on surface; moist or wet only for short periods during season of use. | Moderate: 40 to 50 percent coarse fragments on surface. | Moderate: 40 to 50 percent coarse fragments on surface. | Severe: very slowly permeable hardpan at a depth of 10 to 14 inches; 40 to 50 percent coarse fragments on surface. |
| *Ursine: URD, US ----- For interpretation of Badland part of US, see Badland. | Moderate: very slowly permeable hardpan at a depth of 14 to 20 inches; slopes 2 to 15 percent; 20 to 30 percent coarse fragments on surface; moist or wet only for short periods during season of use. | Slight: 20 to 30 percent coarse fragments on surface. | Moderate: slopes 2 to 15 percent; 20 to 30 percent coarse fragments on surface. | Severe: very slowly permeable hardpan at a depth of 14 to 20 inches; slopes 2 to 15 percent; 20 to 30 percent coarse fragments on surface. |
| URE ----- | Severe: slopes 15 to 30 percent; very slowly permeable hardpan at a depth of 10 to 20 inches. | Moderate: slopes 15 to 30 percent; 20 to 30 percent coarse fragments on surface. | Severe: slopes 15 to 30 percent. | Severe: very slowly permeable hardpan at a depth of 10 to 20 inches; slopes 15 to 30 percent; 20 to 30 percent coarse fragments on surface. |
| *Urtah: UT ----- For Rock outcrop part of UT, see Rock outcrop. | Severe: slopes 30 to 50 percent; more than 50 percent coarse fragments on surface; class 1 to 3 stoniness. | Severe: slopes 30 to 50 percent; more than 50 percent coarse fragments on surface; class 1 to 3 stoniness. | Severe: slopes 30 to 50 percent; more than 50 percent coarse fragments on surface; class 1 to 3 stoniness. | Severe: slopes 30 to 50 percent; more than 50 percent coarse fragments on surface; class 1 to 3 stoniness. |

TABLE 10.—*Suitability of the soils for recreation—Continued*

| Soil series and map symbols | Degree and kind of limitation for— | | | |
|--|---|---|---|---|
| | Camp areas ¹ | Paths and trails | Picnic areas | Playgrounds ¹ |
| Urwil: UWD ----- | Moderate: slowly permeable; slopes 2 to 15 percent; clay loam textures 1 to 3 inches from surface. | Moderate: clay loam textures 1 to 3 inches from surface. | Moderate: slopes 2 to 15 percent; clay loam textures 1 to 3 inches from surface. | Severe: slopes 2 to 15 percent. |
| Usine: ----- Mapped only in one unit in association with Hol-sine and Buster series. | Severe and moderate: slopes 8 to 30 percent; 40 to 50 percent coarse fragments on surface. | Moderate: slopes 8 to 30 percent; 40 to 50 percent coarse fragments on surface. | Severe: slopes 8 to 30 percent. | Severe: slopes 8 to 30 percent; 40 to 50 percent coarse fragments on surface. |
| Vicu: VCC ----- | Moderate: slowly permeable; 15 to 20 percent coarse fragments on surface; class 1 to 2 stoniness. | Slight: class 1 to 2 stoniness; 15 to 20 percent coarse fragments on surface. | Moderate: class 1 to 2 stoniness; 15 to 20 percent coarse fragments on surface. | Moderate: slowly permeable; slopes mostly 2 to 8 percent; class 1 to 2 stoniness. |
| Vil: VGC ----- | Moderate: moderately slow permeability above a very slowly permeable hardpan at a depth of 15 to 20 inches; 20 to 30 percent coarse fragments on surface. | Moderate: 20 to 30 percent coarse fragments on surface. | Moderate: 20 to 30 percent coarse fragments on surface. | Severe: moderately slow permeability above a very slowly permeable hardpan at a depth of 15 to 20 inches; 20 to 30 percent coarse fragments on surface. |
| Wilpar: WMF ----- | Severe: slopes 30 to 50 percent. | Severe: slopes 30 to 50 percent. | Severe: slopes 30 to 50 percent. | Severe: slopes 30 to 50 percent; 20 to 25 percent coarse fragments on surface. |
| *Winu: WNG, WR ----- For interpretation of Rock outcrop part of WR, see Rock outcrop. | Severe: slopes 15 to 75 percent; class 2 to 5 stoniness. | Severe: slopes 15 to 75 percent; class 2 to 5 stoniness. | Severe: slopes 15 to 75 percent; class 2 to 5 stoniness. | Severe: slopes 15 to 75 percent; class 2 to 5 stoniness; 20 to 30 percent coarse fragments on surface. |
| Winz: WS ----- | Severe: slopes 30 to 75 percent; class 2 to 5 stoniness. | Severe: slopes 30 to 75 percent; class 2 to 5 stoniness. | Severe: slopes 30 to 75 percent; class 2 to 5 stoniness. | Severe: slopes 30 to 75 percent; class 2 to 5 stoniness. |
| Zoate: ZOF, ZR ----- | Severe: more than 50 percent coarse fragments on surface; slopes 4 to 50 percent. | Severe: more than 50 percent coarse fragments on surface; slopes 4 to 50 percent. | Severe: more than 50 percent coarse fragments on surface; slopes 4 to 50 percent. | Severe: more than 50 percent coarse fragments on surface; slopes 4 to 50 percent; hard bedrock at a depth of 10 to 20 inches. |

¹ Very slowly permeable hardpan below a depth of 20 inches, not considered a severe limitation where average annual precipitation, is below 12 inches and occurs mostly during nonuse months

² Hardpan or hard bedrock between depths of 20 and 60 inches affects permeability.

The limestone is separate or in mixed bodies with quartzite and provides parent material for a few of the mountain and foothill soils in the area of Pioche and Caselton. Also, a few scattered areas of limestone are north of Panaca, Caliente, and Ursine.

Limestone tends to weather more rapidly than other rocks in the survey area. The limestone rocks contain minerals which weather to carbonates. Some soils have

enough carbonates to prevent the movement of clay, although clay movement is in most of the older soils which lack carbonate. When incorporated in an indurated hardpan, limestone pebbles usually weather more rapidly than the cementing agent.

Quartzite is the parent rock for only a few of the soils in the survey area. Quartzite, unlike ignimbrite, is very resistant to weathering because of its density.

Alluvium is the parent material of most of the soils in the valleys. It consists of sandy, loamy, silty, and clayey material of mixed mineralogy that has washed from surrounding uplands and eroding escarpments of lacustrine deposits. These materials have been deposited on fans and narrow flood plains. Because of high porosity and high content of weatherable minerals, these kinds of deposits usually weather rapidly. Weathering of the silty materials can proceed rapidly under favorable conditions because of good permeability and high content of readily weatherable minerals. In clayey material permeability is restricted, weatherable mineral content is relatively low, and weathering is less obvious. Some of the silty and clayey materials contain varying amounts of saline salts and exchangeable sodium.

Eolian deposits are in localized dunes and are of a limited extent. They are generally found east of Panaca. The materials are fine and very fine sands of mixed mineralogy. They are porous and under favorable conditions have a potential for considerable alteration.

Within the survey area there are broad differences between soils resulting from varying mineralogy of the parent material. Within each discrete area where the parent materials are of similar mineralogy, the resultant soils, when formed under comparable conditions such as climate, relief, and biological activity, have similar kinds and sequence of horizons.

An interesting relationship exists between parent material and soil characteristics of the terrace soils on the eastern and western sides of Panaca Valley and along Patterson Wash. The soils on the eastern side developed in alluvium influenced significantly by ignimbrite and have developed horizons of clay accumulation and hardpans cemented mainly by silica. Examples are soils of the Acana, Roval, and Vil series. The soils on the western side developed in alluvium influenced by limestone. They have developed hardpans cemented mainly by calcite. No horizons of accumulated clay are in these soils. Examples are soils of the Sierocloff series. Expressed in soil science terms, the soils on the eastern side have duripans while those on the western side have petrocalcic horizons.

Climate

Climate affects soil formation through its influence on vegetation, on weathering, and on runoff and erosion. The main climatic factors that affect soil formation are precipitation and temperature.

The climate of the survey area is characterized generally by warm, dry summers and cool, moist winters. The winter temperatures, however, are much colder in the Meadow Valley Watershed basin where -25° to -30° F readings are not uncommon. The average annual air temperature within the survey area ranges from a high of 53° F on the terraces adjacent to Panaca Valley to a low of 35° to 47° F at the highest elevations of the watershed. The average annual precipitation ranges from a low of 8 inches to a high of 24 inches. A temperature inversion layer occurs generally throughout the survey area at elevations between 6,000 and 7,000 feet. In this layer the minimum temperatures usually are about 10 degrees higher than the minimums above and below the inversion layer.

At the lowest elevations where the precipitation is the least and temperatures are the highest, weathering of parent materials is slow, leaching is incomplete, and eluviation and illuviation proceed at a minimal rate. The plant cover consists usually of a sparse stand of drought-tolerant shrubs and scattered miscellaneous grasses. The typical soils are low in organic matter and have light-colored, thin A horizons. As elevation increases, there is an accompanying increase in precipitation. This is reflected by deeper leaching of salts and calcium carbonate, in decreasing acidity, changes in kind and density of vegetation, and thickening and darkening of the A horizons with a concurrent increase in organic-matter content.

Biological forces

Plants, animals, insects, and microflora are important biological entities that influence soil formation. Plants, the only entity to be discussed, appear to have the major effect. Because of their response to climate, plants vary considerably in kind and amount of different elevations.

On the poorly drained areas, the dense growth of sedges, grass, and other plants supplies the organic matter which gives such soils as Bicondoa, Four Star, and Pahranaagat series their dark color.

At the lower elevations on the well-drained plains, alluvial fans, and terraces, the vegetation is mainly desert shrubs. In these areas, vegetation covers only a small part of the soil surface because of the limited amount of moisture available for plant growth. The thin vegetative cover provides meager shade and adds little organic matter to the soil. Salt-tolerant shrubs, which are a significant part of the plant cover, tend to recycle salts from the deeper subsurface layers to the surface layer.

The plant cover of shrubs and grasses on the alluvial fans and terraces of higher elevations is transitional between the desert shrub cover and the upland shrub and tree cover. The density of plants in these intermediate areas is greater than at the lower elevations. Also, the soils usually accumulate more organic matter and have darker-colored A horizons.

An even denser vegetative cover grows on the upland foothills and mountain areas. It is dominated by shrubs, grasses, and trees. Because of the more abundant vegetation, the A horizons are dark, have structure which facilitates water intake, and show significant increase in thickness and organic-matter content.

Relief

The mountain ranges are characterized mainly by excessive relief. Runoff is medium to very rapid. The hazard of erosion is moderate to very severe. Accelerated erosion reduces the effects of soil development processes by removing the soil material often before development can progress significantly. Soil development in areas subjected to erosion usually is reflected only by dark-colored A horizons. The restricted time factor does not permit the soil-forming processes to cause any other obvious changes. Horizons of alteration and horizons of clay accumulation develop in mountainous soils mainly because of the stabilizing effects good vegetative cover has upon the residual soil material. Most of the mountain soils in the survey area

have been stable long enough for the A and B2t horizons to develop. Soils of the Itca, Hamtah, and Nevtah series are examples.

Most of the higher terrace soils have also remained stable long enough to form A and B2t horizons. Examples are those of the Decan, Uana, and Vil series. The intermediate terraces for the most part have been strongly dissected or truncated. Such erosion has limited soil development to the formation of thin A horizons. Examples are Met, Ursine, and Linco series.

The youngest soils in the survey are on flood plains. The soils under meadow grasses or other relatively dense cover have not been in place long enough to form B horizons, or they have received frequent surface depositions of soil material with a resultant sequence of buried A horizons.

Time

The effect of time on soil formation in the survey area is readily apparent. The existence of flood plains, lacustrine terraces, sequences of alluvial fans and terraces, and the mountains offers an opportunity to determine the relative age of the landscape surfaces.

Thickness and other characteristics of A and B horizons reflect the relative age of soils. Age, or degree of development, is a reflection of the amount of weathering of parent material caused by the interaction of moisture, temperature, and biological activity, all influenced by time. In sequence from recent to older landscapes, the intensity of soil development increases.

Flood plains and presently aggrading alluvial fans provide the most youthful soil materials. Some young materials, exposed by erosion and road construction, are also present in the steep mountains. Soils on these landforms exhibit little or no profile development other than A1 horizons. Geer series on the flood plain and alluvial fans, Linco series on terrace side slopes, and Udel series in the mountains are examples of soils that formed in recent material.

Most of the terraces in the survey area have been covered with an alluvial mantle which is younger than the underlying geologic material. Therefore, the effects of time upon the development of the terrace soils is not as obvious as is typical for the progression from flood plains to mountains.

The lacustrine materials that formed most of the upper terraces in the survey area is believed to date to the Tertiary period, Panaca Formation of the Miocene epoch. Most of the soils on these landforms have A, B2t, and Ccam or Csicam horizons. At the upper extremes of these terraces where they contact the mountains are alluvial fans believed to be late Pleistocene or early Holocene. Soils developed in these deposits generally exhibit a high degree of development, and in some instances more development than the soils on the lower and older terrace materials. This apparent contradiction of the normal soil development-time sequence is believed to be a result either or both of two factors: the truncation of the older lacustrine terrace surfaces by erosion and the subsequent deposition thereon of an alluvial mantle of new, more youthful, soil material. Soils that formed in sediment overlying older lacustrine terrace materials include those of the Acana, Timpahute, Roval, and Buster series. The Vil, Minu, and Satt

series are on the higher, younger, alluvial fan material.

An exception to the time-development relationship is the Ursine series. This soil has A1, Cca, and Ccam horizons. It is believed that the very high carbonate content of this soil has restricted clay movement so much that B2t horizons were not formed, although the Ursine soils are about the same age as the less calcareous Acana soils which do have B2t horizons.

The mountain soils of the survey area mostly formed in residuum from volcanic rocks believed to be of the Tertiary or Cretaceous periods. They, too, with the exception of Udel and Cedar series, have well developed horizons of clay accumulations (B2t horizons). Examples are Wilpar, Tica, and Itca soils. Texture of these B2t horizons ranges from clay loam to clay. A few of the foothill and mountain soils have developed in residuum derived from limestone that is believed to be of the Cambrian period. These soils exhibit a minimum of development other than A horizons, and they are relatively youthful. Examples are the Kyler and Urtah series.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 and revised later. The system currently used by the National Cooperative Soil Survey was developed in the early sixties and adopted in 1965 (5). It is under continual study.⁶

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 11 shows the classification of each soil series of the survey area by family, subgroup, and order, according to the current system.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is

⁶ See the unpublished working document "Selected Chapters From the Unedited Text of the Soil Taxonomy of the National Cooperative Soil Survey." It is ordinarily available in the SCS State Office and is a good source of information on current soil classification.

TABLE 11.—*Soil series classified according to the current system*

| Series | Family | Subgroup | Order |
|------------------------|---|---------------------------------|------------|
| Acana | Loamy, mixed, mesic, shallow | Xerollic Durargids | Aridisols. |
| Acoma | Fine, montmorillonitic, mesic | Xerollic Paleargids | Aridisols. |
| Aned | Loamy, mixed, mesic, shallow | Aridic Durixerolls | Mollisols. |
| Basket | Loamy-skeletal, mixed, frigid | Xerollic Haplargids | Aridisols. |
| Bicondoa ¹ | Fine, montmorillonitic (calcareous), frigid | Fluvaquentic Haplaquolls | Mollisols. |
| Bit | Coarse-loamy, carbonatic, mesic | Xerollic Palerotherids | Aridisols. |
| Buster | Fine-loamy, mixed, frigid | Durixerollic Haplargids | Aridisols. |
| Cath | Fine-loamy, mixed, mesic | Durixerollic Haplargids | Aridisols. |
| Cedaran | Loamy-skeletal, mixed, frigid | Lithic Haploxerolls | Mollisols. |
| Cliffdown | Loamy-skeletal, mixed (calcareous), mesic | Typic Torriorthents | Entisols. |
| Decan | Fine, montmorillonitic, frigid | Aridic Durixerolls | Mollisols. |
| Decathon | Fine-loamy, mixed, frigid | Xerollic Durargids | Aridisols. |
| Deerlodge | Fine-loamy, mixed, mesic | Xerollic Durargids | Aridisols. |
| Denmark | Loamy, carbonatic, mesic, shallow | Xerollic Palerotherids | Aridisols. |
| Fanu | Fine-loamy, mixed, frigid | Calciorthidic Haploxerolls | Mollisols. |
| Four Star ¹ | Coarse-loamy, mixed, frigid | Cumulic Haplaquolls | Mollisols. |
| Geer | Coarse-loamy, mixed (calcareous), mesic | Typic Torriorthents | Entisols. |
| Hamtah | Clayey-skeletal, montmorillonitic | Argic Pachic Cryoborolls | Mollisols. |
| Heist | Coarse-loamy, mixed (calcareous), mesic | Xeric Torriorthents | Entisols. |
| Holsine | Coarse-loamy, mixed, frigid | Xerollic Calciorthids | Aridisols. |
| Hottle | Coarse-loamy, mixed, frigid | Aridic Duric Haploxerolls | Mollisols. |
| Homestake | Clayey-skeletal, montmorillonitic, frigid | Durargidic Argixerolls | Mollisols. |
| Itca | Clayey-skeletal, montmorillonitic, frigid | Lithic Argixerolls | Mollisols. |
| Jarab | Loamy-skeletal, mixed, mesic, shallow | Orthidic Durixerolls | Mollisols. |
| Kyler | Loamy-skeletal, carbonatic, mesic | Lithic Xeric Torriorthents | Entisols. |
| Kyler variant | Loamy-skeletal, carbonatic, mesic | Torriorthentic Haploxerolls | Mollisols. |
| Lien | Loamy-skeletal, mixed, frigid, shallow | Xerollic Durothids | Aridisols. |
| Linco | Coarse-loamy, mixed (calcareous), mesic | Durorthidic Xeric Torriorthents | Entisols. |
| Lize | Fine-loamy, mixed, frigid | Calcic Pachic Argixerolls | Mollisols. |
| Met | Coarse-loamy, carbonatic, mesic | Entic Durorthids | Aridisols. |
| Minu | Loamy, mixed, frigid, shallow | Haploxerollic Durargids | Aridisols. |
| Nevtah | Loamy-skeletal, mixed | Pachic Cryoborolls | Mollisols. |
| Nevu | Fine-loamy, mixed, frigid | Aridic Durixerolls | Mollisols. |
| Pahranagat | Fine-silty, mixed (calcareous), mesic | Fluventic Haplaquolls | Mollisols. |
| Pamsdel | Loamy-skeletal, carbonatic, frigid | Aridic Petrocalcic Palexerolls | Mollisols. |
| Patter | Coarse-loamy, mixed, mesic | Durixerollic Camborthids | Aridisols. |
| Pioche | Clayey-skeletal, montmorillonitic, mesic | Lithic Argixerolls | Mollisols. |
| Poorma | Coarse-loamy, mixed, frigid | Durixerollic Camborthids | Aridisols. |
| Poorma variant | Fine, montmorillonitic, calcareous, frigid | Aquic Durorthidic Torriorthents | Entisols. |
| Royal | Loamy, mixed, mesic, shallow | Aridic Durixerolls | Mollisols. |
| Satt | Clayey-skeletal, montmorillonitic | Duric Cryoborolls | Mollisols. |
| Seal | Fine, montmorillonitic, mesic | Aridic Durixerolls | Mollisols. |
| Shroe | Loamy-skeletal, mixed, mesic | Aridic Argixerolls | Mollisols. |
| Sieroclipf | Loamy-skeletal, carbonatic, mesic | Xerollic Palerotherids | Aridisols. |
| Stampede ¹ | Fine, montmorillonitic, frigid | Aridic Durixerolls | Mollisols. |
| Swisbob | Fine, montmorillonitic | Duric Cryoborolls | Mollisols. |
| Tica | Clayey-skeletal, montmorillonitic | Argic Lithic Cryoborolls | Mollisols. |
| Timpahute | Fine, montmorillonitic, mesic | Xerollic Nadurargids | Aridisols. |
| Uana | Fine, montmorillonitic, frigid | Aridic Durixerolls | Mollisols. |
| Udel | Loamy-skeletal, mixed | Lithic Cryoborolls | Mollisols. |
| Umil | Loamy, mixed, frigid, shallow | Xerollic Durorthids | Aridisols. |
| Ursine | Loamy-skeletal, carbonatic, mesic, shallow | Xerollic Durorthids | Aridisols. |
| Urtah | Loamy-skeletal, carbonatic | Cryic Rendolls | Mollisols. |
| Urwil | Clayey-skeletal, montmorillonitic | Argic Pachic Cryoborolls | Mollisols. |
| Usine | Sandy-skeletal, mixed, frigid | Xeric Torriorthents | Entisols. |
| Vicu | Clayey-skeletal, montmorillonitic, frigid | Xerollic Paleargids | Aridisols. |
| Vil | Loamy, mixed, frigid, shallow | Aridic Durixerolls | Mollisols. |
| Wilpar | Clayey-skeletal, montmorillonitic | Argic Cryoborolls | Mollisols. |
| Winu | Fine-loamy, mixed | Argic Pachic Cryoborolls | Mollisols. |
| Winz | Clayey-skeletal, montmorillonitic | Mollic Cryoborolls | Alfisols. |
| Zoate | Clayey-skeletal, montmorillonitic, mesic, shallow | Aridic Durixerolls | Mollisols. |

¹ Taxadjunct. Classification is for soils of the survey area.

named with a word of three or four syllables ending in sol (Ent-i-sol).

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used

to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquents* (*Aqu*, meaning water or wet, and *ent*, from Entisol).

GREAT GROUP. Soil suborders are separated into

great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Haplaquents* (*Hapl*, meaning simple horizons, *aqu*, for wetness or water, and *ent*, from Entisols).

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is *Typic Haplaquents* (a typical Haplaquent).

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (table 11). An example is the coarse-loamy, siliceous, acid, thermic family of *Typic Haplaquents*.

SERIES. The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile. Soil series are named for a geographic location near the place where that series was first observed and mapped. The series are further explained in the section "How This Survey Was Made."

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Glossary

- Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.
- 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 low from this cause.
- Alluvial fan.** A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.
- Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.
- Association, soil.** A group of soils geographically associated in a characteristic repeating pattern.
- Available water capacity** (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.
- Badland.** Areas of rough, irregular land where most of the surface is occupied by ridges, gullies, and deep channels. Land hard to traverse.
- Blanket (engineering).** A thin layer of clayey soil or other slowly permeable material placed on the upstream floor of an embankment to retard the seepage of water.
- 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 soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay film.** A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.
- Climax vegetation.** The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.
- Coarse fragments.** Mineral or rock particles more than 2 millimeters in diameter.
- Coarse-textured soil.** Sand and loamy sand.
- Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.
- Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
- Loose.*—Noncoherent when dry or moist; does not hold together in a mass.
- Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
- Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
- Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
- Sticky.*—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.
- Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
- Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

- Cemented.**—Hard and brittle; little affected by moistening.
- Decreaser.** Any of the climax range plants most heavily grazed. Because they are the most palatable, they are first to be destroyed by overgrazing.
- Drainage class (natural).** Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.
- Excessively drained soils** are commonly very porous and rapidly permeable and have a low available water capacity.
- Somewhat excessively drained soils** are also very permeable and are free from mottling throughout their profile.
- Well-drained soils** are nearly free from mottling and are commonly of intermediate texture.
- Moderately well drained soils** commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.
- Somewhat poorly drained soils** are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.
- Poorly drained soils** are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.
- Very poorly drained soils** are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.
- Erosion.** The wearing away of the land surface by wind (sandblast), running water, and other geological agents.
- Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.
- Fine-textured soil.** *Moderately fine textured:* Clay loam, sandy clay loam, silty clay loam; *fine-textured:* sandy clay, silty clay, and clay. Roughly, soil that contains 35 percent or more clay.
- Flood plain.** Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.
- Friability.** Term for the ease with which soil crumbles. A friable soil is one that crumbles easily.
- Gravelly soil material.** From 15 to 50 percent of material, by volume, consists of rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.
- Ground water (geology).** Water that fills all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.
- 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 soluble salts, clay, and sesquioxides (iron and aluminum oxides).
- B horizon.**—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.
- C horizon.**—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.
- R layer.**—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.
- Impervious soil.** Soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.
- Increasesers.** Species in the climax vegetation that increase in relative amount as the more desirable plants are reduced by close grazing; increasesers commonly are shorter than decreaseers, and some are less palatable to livestock.
- 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.** On range, plants that come in and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface. (Most weeds are "invaders").
- Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are—
- Border.**—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
- Basin.**—Water is applied rapidly to relatively level plots surrounded by levees or dikes.
- Controlled flooding.**—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
- Corrugation.**—Water is applied to small, closely spaced furrows or ditches in fields or close-growing crops, or in orchards, to confine the flow of water to one direction.
- Furrow.**—Water is applied in small ditches made by cultivation implements used for tree and row crops.
- Sprinkler.**—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
- Subirrigation.**—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
- Wild flooding.**—Irrigation water, released at high points, flows onto the field without controlled distribution.
- Lacustrine deposit (geology).** Material deposited in lake water and exposed by lowering the water level or elevation of the land.
- Leaching.** The removal of soluble materials from soil or other material by percolating water.
- Lime concretion.** An aggregate cemented by the precipitation of calcium carbonate (CaCO₃).
- Medium-textured soil.** Soil of very fine sandy loam, loam, silt loam, or silt texture.
- Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.
- Mottling, soil.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.
- Munsell notation.** A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.
- Parent material.** Disintegrated and partly weathered rock from which soil has formed.
- Ped.** An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.
- Percolation.** The downward movement of water through the soil.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Poor space. That fraction of the total space in a soil that is not occupied by solid particles.

Porosity, soil. The degree to which the soil mass is permeated with pores or cavities.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range condition. The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair, and poor.* The classification is based on the percentage of original, or climax, vegetation on the site, as compared to what ought to grow on it if management were good.

Range seeding. Establishing perennial grasses or improved re-seeding grasses or legumes on rangeland to prevent the loss of soil and water and to restore the productivity of native grassland.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind of climax vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

| pH | | pH | |
|-----------------------|------------|-----------------------|----------------|
| Extremely acid ----- | Below 4.5 | Neutral ----- | 6.6 to 7.3 |
| Very strongly acid -- | 4.5 to 5.0 | Mildly alkaline ----- | 7.4 to 7.8 |
| Strongly acid ----- | 5.1 to 5.5 | Moderately alkaline _ | 7.9 to 8.4 |
| Medium acid ----- | 5.6 to 6.0 | Strongly alkaline --- | 8.5 to 9.0 |
| Slightly acid ----- | 6.1 to 6.5 | Very strongly | |
| | | alkaline ----- | 9.1 and higher |

Runoff (hydraulics). The removal of water by flow over the surface of the soil.

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. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silica. Silica is a combination of silicon and oxygen. The mineral form is called quartz.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil

of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Site index. A numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age; for example, the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace. (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. 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 proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Valley fill. Alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading sediment onto the lowland as a series of adjacent alluvial fans.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock

material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles

that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. In referring to a capability unit, range site, wildlife suitability group, or woodland suitability group, read the introduction to the section it is in for general information about its management. Dashes in columns indicate soil was not placed in that interpretive group. Other information is given in tables as follows:

Temperature and precipitation data, tables 1, 2, 3, and 4, pages 4 and 5.
 Acreage and extent, table 5, page 15.
 Estimated yields, table 6, page 78.
 Wildlife, table 7, page 86.

Engineering uses of the soils, tables 8 and 9, pages 104 through 151.
 Suitability for recreation, table 10, page 152.

| Map symbol | Mapping unit | Page | Capability unit or subclass | | Range site | Wildlife suitability group | | Woodland suitability group | | |
|------------|---|------|-----------------------------|---------|------------|----------------------------|----------|----------------------------|--------|-----|
| | | | Irrigated | Dryland | | Irrigated | Dryland | | | |
| | | | Symbol | Page | Symbol | Page | Symbol | Symbol | Symbol | |
| ACC | Acana gravelly sandy loam, 2 to 8 percent slopes----- | 16 | ----- | -- | VIIIs | 77 | NV 28-41 | ----- | 3-42 | --- |
| AE | Acana-Ursine association----- | 16 | ----- | -- | VIIIs | 77 | ----- | ----- | ----- | --- |
| | Acana gravelly sandy loam, 2 to 8 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-41 | ----- | 3-42 | --- |
| | Ursine gravelly loam, 2 to 15 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-40 | ----- | 4-43 | --- |
| AGD | Acoma gravelly sandy loam, 2 to 15 percent slopes----- | 17 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 1c1 |
| AL | Alluvial land----- | 17 | ----- | -- | VIIIw | 77 | ----- | ----- | ----- | --- |
| ANC | Aned sandy loam, 2 to 8 percent slopes----- | 18 | ----- | -- | VIIIs | 77 | ----- | ----- | 334 | 1c1 |
| BA | Badland----- | 19 | ----- | -- | VIIIe | 77 | ----- | ----- | ----- | --- |
| BB | Badland-Bit association----- | 19 | ----- | -- | ----- | -- | ----- | ----- | ----- | --- |
| | Badland----- | -- | ----- | -- | VIIIe | 77 | ----- | ----- | ----- | --- |
| | Bit fine sandy loam, 0 to 8 percent slopes----- | -- | IIIe-25 | 74 | VIIs | 76 | NV 28-46 | 2-32-I | 3-32 | --- |
| BD2 | Badland-Buster association, eroded-Badland----- | 19 | ----- | -- | ----- | -- | ----- | ----- | ----- | --- |
| | Buster loamy sand, 0 to 8 percent slopes, eroded----- | -- | ----- | -- | VIIs | 76 | ----- | ----- | 334 | 2o1 |
| | Holsine gravelly sandy loam, 0 to 8 percent slopes----- | -- | ----- | -- | VIc | 76 | NV 28-41 | ----- | 3-42 | --- |
| BKF | Basket gravelly fine sandy loam, 30 to 50 percent slopes----- | 20 | ----- | -- | VIIe | 76 | ----- | ----- | 324 | 2f1 |
| BL | Basket-Lize association----- | 20 | ----- | -- | ----- | -- | ----- | ----- | 324 | --- |
| | Basket gravelly fine sandy loam, 30 to 50 percent slopes----- | -- | ----- | -- | VIIe | 76 | ----- | ----- | ----- | 2f1 |
| | Lize stony fine sandy loam, 30 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | ----- | 1x1 |
| | Satt very stony sandy loam, 4 to 15 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | ----- | 1x1 |
| Bm | Bicondoa sandy loam----- | 21 | IIIw-123 | 75 | ----- | -- | ----- | 2-23-I | ----- | --- |
| Bn | Bicondoa silty clay loam, drained-- | 21 | IIIw-123 | 75 | ----- | -- | ----- | 2-23-I | ----- | --- |
| Bo | Bicondoa complex----- | 21 | IVw-123 | 76 | ----- | -- | ----- | 4-11-I | ----- | --- |
| BR | Buster-Rough broken land association----- | 23 | ----- | -- | ----- | -- | ----- | ----- | ----- | --- |
| | Buster fine sandy loam, 0 to 2 percent slopes----- | -- | IIIIs-115 | 75 | VIc | 76 | NV 28-46 | 2-42-I | 3-42 | --- |
| | Rough broken land----- | -- | ----- | -- | VIIIe | 77 | ----- | ----- | ----- | --- |
| CAC | Cath gravelly loam, 2 to 8 percent slopes----- | 24 | IIIe-25 | 74 | VIc | 76 | NV 28-45 | 2-42-I | 3-42 | --- |
| CD | Cedaran-Decan association----- | 25 | ----- | -- | ----- | -- | ----- | ----- | 334 | --- |
| | Cedaran cobbly loam, 4 to 30 percent slopes----- | -- | ----- | -- | VIIe | 76 | ----- | ----- | ----- | 2d1 |
| | Decan gravelly clay loam, 2 to 15 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | ----- | 1c1 |

GUIDE TO MAPPING UNITS--Continued

| Map symbol | Mapping unit | Page | Capability unit or subclass | | Range site | Wildlife suitability group | | Woodland suitability group | | | | |
|------------|--|------|-----------------------------|---------|------------|----------------------------|----------|----------------------------|----------|--------|------|-----|
| | | | Irrigated | Dryland | | Irrigated | Dryland | | | | | |
| | | | Symbol | Page | | Symbol | Page | | Symbol | Symbol | | |
| CE | Cedaran-Rock outcrop complex----- Cedaran cobbly loam, 4 to 30 percent slopes----- | 25 | ----- | -- | VIIIs | 77 | ----- | ----- | --- | | | |
| | Rock outcrop----- | -- | ----- | -- | ----- | ----- | ----- | 334 | 2d1 | | | |
| CG | Cliffdown-Geer association----- Cliffdown gravelly sandy loam, 2 to 8 percent slopes----- | 26 | ----- | -- | ----- | ----- | ----- | ----- | --- | | | |
| | Geer fine sandy loam, 0 to 2 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-37 | 3-43-I | 4-43 | --- | | |
| DA | Decan-Uana association----- Decan gravelly clay loam, 2 to 15 percent slopes----- | 27 | ----- | -- | ----- | ----- | ----- | ----- | --- | | | |
| | Decan gravelly clay loam, 15 to 30 percent slopes----- | -- | ----- | -- | IIc-1 | 74 | VIIc | 76 | NV 28-44 | 2-33-I | 3-32 | --- |
| | Uana gravelly loam, 2 to 15 percent slopes----- | -- | ----- | -- | ----- | ----- | ----- | ----- | --- | | | |
| DCC | Decathon gravelly loam, 2 to 8 percent slopes----- | 28 | ----- | -- | ----- | ----- | ----- | ----- | --- | | | |
| DED | Decathon-Basket association, moderately steep----- | 28 | ----- | -- | ----- | ----- | ----- | ----- | --- | | | |
| | Decathon gravelly loam, 2 to 8 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | --- | | | |
| | Basket gravelly sandy loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIe | 76 | ----- | ----- | --- | | | |
| DEE | Decathon-Basket association, steep-- Decathon gravelly loam, 2 to 8 percent slopes----- | 28 | ----- | -- | ----- | ----- | ----- | ----- | --- | | | |
| | Basket gravelly fine sandy loam, 30 to 50 percent slopes-- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | --- | | | |
| | | -- | ----- | -- | VIIe | 76 | ----- | ----- | --- | | | |
| DG | Deerlodge association----- Deerlodge gravelly sandy loam, 4 to 15 percent slopes----- | 29 | ----- | -- | ----- | ----- | NV 28-40 | ----- | 3-42 | --- | | |
| | Deerlodge gravelly loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | --- | | | |
| | | -- | ----- | -- | VIIe | 76 | ----- | ----- | --- | | | |
| DH | Deerlodge-Ursine association----- Deerlodge gravelly sandy loam, 4 to 15 percent slopes----- | 29 | ----- | -- | ----- | ----- | NV 28-40 | ----- | --- | | | |
| | Ursine gravelly loam, 2 to 15 percent slopes----- | -- | ----- | -- | ----- | ----- | ----- | ----- | --- | | | |
| | | -- | ----- | -- | ----- | ----- | ----- | 4-43 | --- | | | |
| DMD | Denmark gravelly loam, 2 to 15 percent slopes----- | 30 | ----- | -- | VIIIs | 77 | NV 28-40 | ----- | 3-42 | --- | | |
| DN | Denmark-Linco association----- Denmark cobbly loam, 2 to 15 percent slopes----- | 30 | ----- | -- | ----- | ----- | NV 28-40 | ----- | 3-42 | --- | | |
| | Linco gravelly sandy loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | --- | | | |
| | | -- | ----- | -- | VIIe | 76 | ----- | ----- | --- | | | |
| FAC | Fanu gravelly fine sandy loam, 0 to 8 percent slopes----- | 31 | IVe-60 | 76 | VIIc | 76 | NV 28-44 | 2-42-I | 4-41 | --- | | |
| GE | Geer fine sandy loam, gravel substratum----- | 33 | IIIs-45 | 75 | ----- | ----- | ----- | 2-33-I | 3-33 | --- | | |
| Gf | Geer silt loam----- | 33 | IIc-1 | 74 | ----- | ----- | ----- | 2-33-I | 3-33 | --- | | |
| Gg | Geer silt loam, slightly saline---- | 33 | IIw-61 | 74 | ----- | ----- | ----- | 2-33-I | 3-33 | --- | | |
| Gh | Geer silt loam, strongly saline---- | 33 | ----- | ----- | VIIw | 77 | NV 28-47 | ----- | 4-24 | --- | | |
| Gk | Geer silt loam, wet----- | 33 | IIIw-60 | 75 | ----- | ----- | ----- | 1-14-I | ----- | --- | | |
| GM | Geer-Heist association----- Geer fine sandy loam, 0 to 2 percent slopes----- | 33 | ----- | ----- | ----- | ----- | NV 28-44 | ----- | ----- | --- | | |
| | Heist gravelly sandy loam, 0 to 8 percent slopes----- | -- | IIc-1 | 74 | VIIc | 76 | ----- | 2-33-I | 3-32 | --- | | |
| | | -- | IIIe-25 | 74 | VIIIs | 77 | ----- | 2-42-I | 3-42 | --- | | |

GUIDE TO MAPPING UNITS--Continued

| Map symbol | Mapping unit | Page | Capability unit or subclass | | Range site | Wildlife suitability group | | Woodland suitability group | |
|------------|--|------|-----------------------------|---------|------------|----------------------------|----------|----------------------------|--------|
| | | | Irrigated | Dryland | | Irrigated | Dryland | | |
| | | | Symbol | Page | | Symbol | Page | | Symbol |
| HA | Hamtah-Tica association----- | 34 | ----- | -- | VIIIs | 77 | ----- | ----- | --- |
| | Hamtah very stony clay loam, 30 to 50 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-50 | ----- | 3-41 |
| | Tica very stony loam, 15 to 30 percent slopes----- | -- | ----- | -- | ----- | -- | ----- | ----- | 324 |
| HC | Hamtah-Udel association----- | 34 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Hamtah very stony clay loam, 30 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-50 | ----- | 3-41 |
| | Udel very gravelly sandy loam, 30 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 434 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | --- |
| HDC | Heist gravelly sandy loam, 0 to 8 percent slopes----- | 35 | IIIe-25 | 74 | VIIIs | 77 | NV 28-44 | 2-42-I | 3-42 |
| HEC | Heist gravelly sandy loam, sand substratum, 0 to 8 percent slopes----- | 35 | IIIe-25 | 74 | VIIIs | 77 | NV 28-44 | 2-42-I | 3-42 |
| HN | Holsine-Usine association----- | 36 | ----- | -- | VIIIs | 77 | ----- | ----- | --- |
| | Holsine gravelly sandy loam, 0 to 8 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-41 | ----- | 3-42 |
| | Usine cobbly sandy loam, 8 to 30 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-40 | ----- | 3-42 |
| | Buster loamy sand, 0 to 8 percent slopes, eroded----- | -- | ----- | -- | ----- | -- | ----- | ----- | 334 |
| HOC | Holtle loam, 0 to 8 percent slopes----- | 37 | IVe-60 | 76 | VIc | 76 | NV 28-44 | 2-42-I | 3-42 |
| HR | Holtle-Four Star association----- | 37 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Holtle loam, 0 to 8 percent slopes----- | -- | IVe-60 | 76 | VIc | 76 | ----- | 2-42-I | 3-42 |
| | Four Star loam, 0 to 4 percent slopes----- | -- | IVw-123 | 76 | ----- | -- | ----- | ----- | --- |
| HSC | Homestake gravelly sandy loam, 4 to 8 percent slopes----- | 38 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 |
| HTC | Homestake very stony sandy loam, 2 to 8 percent slopes----- | 38 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 |
| IND | Itca stony clay loam, 2 to 15 percent slopes----- | 39 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 |
| IO | Itca-Cedaran association----- | 39 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Itca stony loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 434 |
| | Cedaran stony loam, 15 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 434 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | --- |
| IR | Itca-Rock outcrop association----- | 39 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Itca very stony loam, 15 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 434 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | --- |
| JCD | Jarab cobbly loam, 2 to 15 percent slopes----- | 40 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 |
| KO | Kyler-Rock outcrop complex----- | 41 | ----- | -- | VIIIs | 77 | ----- | ----- | --- |
| | Kyler very cobbly loam, 15 to 30 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-39 | ----- | 4-43 |
| | Rock outcrop----- | -- | ----- | -- | ----- | -- | ----- | ----- | --- |
| KR | Kyler-Rock outcrop association----- | 41 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Kyler stony loam, 30 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-52 | ----- | 4-43 |
| | Kyler very stony loam, moderately deep variant, 50 to 75 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 334 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | --- |

GUIDE TO MAPPING UNITS--Continued

| Map symbol | Mapping unit | Page | Capability unit or subclass | | Range site | Wildlife suitability group | | Woodland suitability group | | |
|------------|---|------|-----------------------------|---------|------------|----------------------------|----------|----------------------------|--------|--------|
| | | | Irrigated | Dryland | | Irrigated | Dryland | | | |
| | | | Symbol | Page | | Symbol | Page | | Symbol | Symbol |
| LAB | Lien gravelly fine sandy loam, 2 to 4 percent slopes----- | 42 | ----- | -- | VIIIs | 77 | ----- | ----- | 434 | 2d1 |
| LC | Linco-Acana association----- | 43 | ----- | -- | ----- | -- | ----- | ----- | 3-42 | --- |
| | Linco gravelly sandy loam, 15 to 20 percent slopes----- | -- | ----- | -- | VIIe | 76 | NV 28-40 | ----- | ---- | --- |
| | Acana gravelly sandy loam, 2 to 8 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-41 | ----- | ---- | --- |
| LD | Linco-Badland association----- | 43 | ----- | -- | ----- | -- | ----- | ----- | ---- | --- |
| | Linco gravelly sandy loam, 4 to 15 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-40 | ----- | 3-42 | --- |
| | Linco gravelly sandy loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIe | 76 | NV 28-40 | ----- | 3-42 | --- |
| | Badland----- | -- | ----- | -- | VIIIe | 77 | ----- | ----- | ---- | --- |
| LE | Lize association----- | 44 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 1x1 |
| LT | Lize-Tica association----- | 44 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | --- |
| | Lize stony fine sandy loam, 15 to 30 percent slopes----- | -- | ----- | -- | ----- | -- | ----- | ----- | ---- | 1x1 |
| | Tica very stony loam, 15 to 30 percent slopes----- | -- | ----- | -- | ----- | -- | ----- | ----- | ---- | 2x1 |
| MU | Met-Ursine association----- | 45 | ----- | -- | VIIIs | 77 | ----- | ----- | 4-43 | --- |
| | Met very fine sandy loam, 0 to 4 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-38 | 3-43-I | ---- | --- |
| | Ursine gravelly loam, 2 to 15 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-40 | ----- | ---- | --- |
| MVC | Minu gravelly sandy loam, 2 to 8 percent slopes----- | 46 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 2d1 |
| MWC | Minu stony sandy loam, 0 to 8 percent slopes----- | 46 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 2d1 |
| NR | Nevtah-Rock outcrop association----- | 46 | ----- | -- | ----- | -- | ----- | ----- | ---- | --- |
| | Nevtah stony loam, 4 to 15 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-51 | ----- | 3-41 | --- |
| | Nevtah very stony loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-51 | ----- | 3-41 | --- |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | ---- | --- |
| NSD | Nevu gravelly sandy loam, 4 to 15 percent slopes----- | 47 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 1o1 |
| Pa | Pahranagat silt loam, drained, strongly saline----- | 48 | ----- | -- | VIIw | 77 | NV 28-47 | ----- | 4-24 | --- |
| Pd | Pahranagat silt loam, strongly saline----- | 48 | ----- | -- | VIIw | 77 | NV 28-47 | ----- | 4-24 | --- |
| Pe | Pahranagat silty clay loam----- | 48 | IIIw-60 | 75 | ----- | -- | ----- | 3-14-I | ---- | --- |
| Pg | Pahranagat silty clay loam, drained----- | 48 | IIw-61 | 74 | ----- | -- | ----- | 1-14-I | ---- | --- |
| PMC | Pamsdel gravelly loam, 2 to 8 percent slopes----- | 50 | ----- | -- | VIIIs | 77 | ----- | ----- | 334 | 2f1 |
| PN | Patter-Geer association----- | 50 | ----- | -- | VIc | 76 | NV 28-44 | ----- | ---- | --- |
| | Patter loam, 0 to 4 percent slopes----- | -- | IIIe-20 | 74 | ----- | -- | ----- | 2-42-I | 3-42 | --- |
| | Geer fine sandy loam, 0 to 2 percent slopes----- | -- | IIc-1 | 74 | ----- | -- | ----- | 2-33-I | 3-32 | --- |
| PO | Patter-Heist association----- | 51 | ----- | -- | ----- | -- | ----- | ----- | ---- | --- |
| | Patter silty clay loam, 0 to 2 percent slopes, strongly saline----- | -- | ----- | -- | VIIw | 77 | NV 28-47 | ----- | 4-24 | --- |
| | Heist gravelly sandy loam, 0 to 8 percent slopes----- | -- | IIIe-25 | 75 | VIIIs | 77 | NV 28-44 | 2-42-I | 3-42 | --- |
| | Geer fine sandy loam, 0 to 2 percent slopes----- | -- | IIc-1 | 74 | VIc | 76 | NV 28-44 | 2-33-I | 3-32 | --- |

GUIDE TO MAPPING UNITS--Continued

| Map symbol | Mapping unit | Page | Capability unit or subclass | | Range site | | Wildlife suitability group | | Woodland suitability group | |
|------------|--|------|-----------------------------|------|------------|------|----------------------------|---------|----------------------------|--------|
| | | | Irrigated | | Dryland | | Irrigated | Dryland | | |
| | | | Symbol | Page | Symbol | Page | Symbol | Symbol | | Symbol |
| PR | Patter-Shroe association----- | 51 | ----- | -- | ----- | -- | ----- | ----- | ---- | --- |
| | Patter loam, 0 to 4 percent slopes----- | -- | IIIe-20 | 74 | VIc | 76 | NV 28-44 | 2-42-I | 3-42 | --- |
| | Shroe gravelly loam, 2 to 15 percent slopes----- | -- | ----- | -- | VIIs | 76 | ----- | ----- | 324 | 1f1 |
| PS | Pioche-Rock outcrop complex----- | 52 | ----- | -- | ----- | -- | ----- | ----- | ----- | --- |
| | Pioche extremely stony loam, 8 to 30 percent slopes----- | -- | ----- | -- | ----- | -- | ----- | ----- | 324 | 2x1 |
| | Rock outcrop----- | -- | ----- | -- | ----- | -- | ----- | ----- | ----- | --- |
| PTB | Poorma very fine sandy loam, 0 to 4 percent slopes----- | 52 | IVe-60 | 76 | VIc | 76 | NV 28-44 | 2-33-I | 3-42 | --- |
| PV | Poorma silt loam, clay variant----- | 53 | ----- | -- | VIIw | 77 | NV 28-47 | ----- | 4-24 | --- |
| RO | Rock land----- | 53 | ----- | -- | VIIIIs | 77 | ----- | ----- | ----- | --- |
| RRD | Roval gravelly loam, 2 to 15 percent slopes----- | 55 | ----- | -- | VIIIs | 77 | NV 28-45 | ----- | 3-42 | --- |
| RV | Roval-Acana association----- | 55 | ----- | -- | VIIIs | 77 | ----- | ----- | 3-42 | --- |
| | Roval gravelly loam, 2 to 15 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-45 | ----- | ----- | --- |
| | Acana gravelly sandy loam, 2 to 8 percent slopes----- | -- | ----- | -- | ----- | -- | NV 28-41 | ----- | ----- | --- |
| SAD2 | Satt stony sandy loam, 4 to 15 percent slopes, eroded----- | 56 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 1f1 |
| SCC2 | Satt stony fine sandy loam, 2 to 8 percent slopes, eroded----- | 56 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 1f1 |
| SD | Satt association----- | 56 | ----- | -- | VIIIs | 77 | ----- | ----- | ----- | --- |
| | Satt stony sandy loam, 4 to 15 percent slopes, eroded----- | -- | ----- | -- | ----- | -- | ----- | ----- | 324 | 1f1 |
| | Satt extremely stony sandy loam, 15 to 30 percent slopes----- | -- | ----- | -- | ----- | -- | ----- | ----- | 334 | 1x1 |
| SEF | Seval very gravelly sandy loam, 30 to 50 percent slopes----- | 57 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 2d1 |
| SGD | Shroe gravelly loam, 2 to 15 percent slopes----- | 58 | ----- | -- | VIIs | 76 | ----- | ----- | 324 | 1f1 |
| SH | Shroe-Badland association----- | 58 | ----- | -- | ----- | -- | ----- | ----- | ----- | --- |
| | Shroe cobbly sandy clay loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIs | 76 | ----- | ----- | 324 | 1f1 |
| | Shroe gravelly loam, 2 to 15 percent slopes----- | -- | ----- | -- | VIIs | 76 | ----- | ----- | 324 | 1f1 |
| | Badland----- | -- | ----- | -- | VIIIe | 77 | ----- | ----- | ----- | --- |
| SKC | Sieroclipf gravelly sandy loam, 2 to 8 percent slopes----- | 59 | ----- | -- | VIIIs | 77 | NV 28-41 | ----- | 3-42 | --- |
| SL | Slickens----- | 59 | ----- | -- | VIIIw | 77 | ----- | ----- | ----- | --- |
| ST | Stampede gravelly loam----- | 60 | IIIs-41 | 75 | VIIs | 76 | NV 28-45 | 2-42-I | 3-42 | --- |
| SWC | Swisbob very stony loam, 4 to 8 percent slopes----- | 61 | ----- | -- | VIIIs | 77 | NV 28-49 | ----- | 3-42 | --- |
| TN | Tica-Nevtah association----- | 61 | ----- | -- | ----- | -- | ----- | ----- | ----- | --- |
| | Tica very stony loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 2x1 |
| | Nevtah very stony loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-51 | ----- | 3-41 | --- |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | ----- | --- |
| TR | Tica-Rock outcrop association----- | 62 | ----- | -- | ----- | -- | ----- | ----- | ----- | --- |
| | Tica very stony loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 324 | 2x1 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | ----- | --- |
| TTB | Timpahute gravelly loam, 0 to 4 percent slopes----- | 62 | ----- | -- | VIIIs | 77 | NV 28-45 | ----- | 3-42 | --- |

GUIDE TO MAPPING UNITS--Continued

| Map symbol | Mapping unit | Page | Capability unit or subclass | | Range site | Wildlife suitability group | | Woodland suitability group | |
|------------|--|------|-----------------------------|------|------------|----------------------------|----------|----------------------------|--------|
| | | | Irrigated | | | Dryland | | | |
| | | | Symbol | Page | | Symbol | Page | | Symbol |
| UK | Udel-Rock outcrop association----- | 64 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Udel very gravelly sandy loam, 30 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 434 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | 2d1 |
| UMB | Umil gravelly loam, 2 to 4 percent slopes----- | 65 | ----- | -- | VIIIs | 77 | NV 28-40 | ----- | 4-43 |
| URD | Ursine gravelly loam, 2 to 15 percent slopes----- | 65 | ----- | -- | VIIIs | 77 | NV 28-40 | ----- | 4-43 |
| URE | Ursine gravelly loam, 15 to 30 percent slopes----- | 65 | ----- | -- | VIIe | 76 | NV 28-40 | ----- | 4-43 |
| US | Ursine-Badland association----- | 66 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Ursine gravelly loam, 2 to 15 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-40 | ----- | 4-43 |
| | Badland----- | -- | ----- | -- | VIIIe | 77 | ----- | ----- | --- |
| UT | Urtah-Rock outcrop association----- | 66 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Urtah very stony loam, 30 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | ----- | ----- | 324 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | 1x1 |
| UWD | Urwil stony fine sandy loam, 2 to 15 percent slopes----- | 67 | ----- | -- | VIIs | 76 | ----- | ----- | 324 |
| VCC | Vicu stony sandy loam, 2 to 8 percent slopes----- | 68 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 |
| VGC | Vil gravelly loam, 2 to 8 percent slopes----- | 69 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 |
| WMF | Wilpar very stony sandy loam, 30 to 50 percent slopes----- | 70 | ----- | -- | VIIIs | 77 | ----- | ----- | 334 |
| WNG | Winu extremely stony loam, 50 to 75 percent slopes----- | 71 | ----- | -- | VIIIs | 77 | NV 28-50 | ----- | 3-42 |
| WR | Winu-Rock outcrop association----- | 71 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Winu very stony loam, 15 to 30 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-50 | ----- | 3-42 |
| | Winu extremely stony loam, 30 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-50 | ----- | 3-42 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | --- |
| WS | Winz association----- | 72 | ----- | -- | VIIIs | 77 | ----- | ----- | 324 |
| ZOF | Zoate cobbly loam, 15 to 50 percent slopes----- | 72 | ----- | -- | VIIe | 76 | NV 28-42 | ----- | 3-42 |
| ZR | Zoate-Rock outcrop association----- | 73 | ----- | -- | ----- | -- | ----- | ----- | --- |
| | Zoate stony loam, 15 to 50 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-42 | ----- | 3-42 |
| | Zoate cobbly loam, 4 to 15 percent slopes----- | -- | ----- | -- | VIIIs | 77 | NV 28-42 | ----- | 4-43 |
| | Rock outcrop----- | -- | ----- | -- | VIIIIs | 77 | ----- | ----- | --- |

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