SOIL SURVEY OF

El Dorado Area, California

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
University of California
Agricultural Experiment Station

Major fieldwork for this soil survey was done in 1965. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the area in 1965. This survey was made cooperatively by the Soil Conservation Service and Forest Service and the University of California Agricultural Experiment Station. It is part of the technical assistance furnished to the El Dorado County and Georgetown Divide Resource Conservation Districts.

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

HOW TO USE THIS SOIL SURVEY

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

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

Finding and Using Information

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

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, the section "Use of the Soils for Crops," and the discussions of range sites and woodland groups.

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

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

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.

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, Morphology, and Classification of the Soils.

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

Cover: Pear orchards on Aiken and Cohasset soils. Sierra Nevada Range in background.

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

THE EL DORADO AREA is in the east-central part of California (fig. 1). It is in the western half of El Dorado County in the Central Sierra Nevada. The Area is

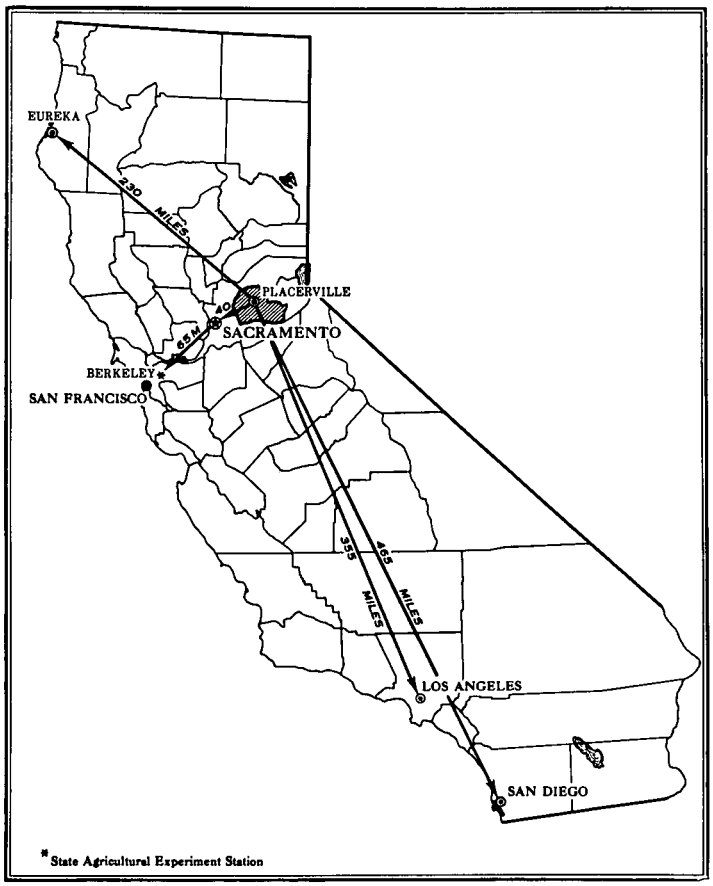

Figure 1.—**Location of the El Dorado Area in California.**

mainly within the Cosumnes and American Rivers drainage basins and is made up of rolling foothills to steep mountainous slopes. It extends about 6 miles into the western side of the El Dorado National Forest. Placerville, the county seat of El Dorado County and the largest town in the El Dorado Area, has a population of about 6,000. The survey area has a total area of 539,065 acres.

Farming is of considerable importance in the El Dorado Area, but the acreage used for crops has been reduced by urban expansion. The main crops are pears, apples, and irrigated pasture. Livestock is produced in the western part of the Area, where forage is abundant. Woodland crops are produced in the eastern part of the survey area.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the El Dorado Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the kinds of 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 (*19*)[1] 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. Aiken and Boomer, for example, are the names of two soil series. All the soils in the United States that have the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

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

[1] Italic numbers in parentheses refer to Literature Cited, p. 84.

example, Aiken loam, 3 to 9 percent slopes, is one of several phases within the Aiken 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, roads, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in 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. One such kind of mapping unit shown on the soil map of the El Dorado Area is the soil complex. A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Boomer-Sites loams, 9 to 15 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in the El Dorado Area.

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

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

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

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the El Dorado 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.

There are two main physiographic regions in the El Dorado Area, (1) the lower and middle foothills and (2) the mountainous uplands. The small alluvial areas are not shown on the general soil map. One or more soil associations are in each physiographic region. The soil associations have been grouped principally on the basis of soil differences that are related to differences in parent rock.

Texture given in the descriptive title of each of the associations is the texture of the surface layer. The brief description of the major soils in each association is that of the profile described as representative for the series being discussed.

The eight soil associations in the El Dorado Area are discussed in the following pages.

Soils of the Lower and Middle Foothills

The lower and middle foothills of the Sierra Nevada Range are in the western part of the El Dorado Area. They consist of rolling to steep hills that have a few conspicuous peaks. The elevation typically ranges from 500 to 3,500 feet. The annual precipitation ranges from 25 to 50 inches. Rock outcrops are common. Depth to bedrock ranges from 0 to more than 60 inches. The lower and middle foothills make up about 50 percent of the survey area.

There are five soil associations in the lower and middle foothills. The soils in these associations formed in material from weathered slates, schists, metabasic igneous rocks, acid igneous rocks, basic igneous rocks, and serpentine rocks. The plant cover is mainly grass and oak trees, but there are areas of brush and coniferous trees.

1. Auburn-Argonaut association

Well-drained silt loams and gravelly loams formed in material weathered from basic rocks and metasedimentary rocks

This association is in the southwestern part of the survey area at elevations of 500 to 1,800 feet. The soils are generally undulating to hilly, but they become steep to very steep in areas adjacent to the major streams and rivers. Rock outcrops are common. The annual average precipitation ranges from 25 to 35 inches. The vegetation consists mostly of grass and oak trees, but there are scattered areas of brush and Digger pine. The association occupies about 25 percent of the survey area.

Auburn soils make up about 75 percent of the association and Argonaut soils about 10 percent. The remaining 15 percent consists of Perkins soils, moderately deep variant; Sobrante and Whiterock soils; and scattered areas of Metamorphic rock land.

The Auburn soils have a surface layer of brown silt loam and a subsoil of reddish-yellow silt loam. The depth to bedrock ranges from 12 to 26 inches. These soils formed in material weathered from diabase, slates, and schist.

The Argonaut soils have a surface layer of strong-brown gravelly loam and gravelly silt loam and a subsoil of yellowish-red, yellowish-brown, and brown heavy clay and gravelly clay. The depth to bedrock ranges from 20 to 40 inches. These soils formed in material weathered from metaandesite.

Sobrante soils are scattered throughout the association. Perkins soils, moderately deep variant, are adjacent to drainageways in the Clarksville-Latrobe area. Whiterock soils are in two narrow belts, one west of Latrobe and the other in the southern part of the Mother Lode Belt.

The soils of this association are used mainly for range, watershed, and wildlife habitat. Some areas are used for woodland, pasture, hay, grain, and orchards.

2. *Boomer-Auburn association*

Well-drained silt loams and gravelly loams formed in material weathered from basic igneous rocks or metasedimentary rocks

This association is in the northwestern part of the survey area at elevations of 1,000 to 2,000 feet. The soils generally are undulating to hilly, but they are steep to very steep in areas adjacent to major streams and rivers. Slopes are 2 to 70 percent. Rock outcrops are common. The average annual precipitation is 25 to 50 inches. The vegetation typically consists of grass and oak trees and commercial stands of coniferous trees. The association occupies about 10 percent of the survey area.

Boomer soils make up about 50 percent of the association, and Auburn soils, about 40 percent. The remaining 10 percent consists of Argonaut and Sobrante soils and scattered areas of Metamorphic rock land.

The Boomer soils have a surface layer of yellowish-red gravelly loam and a subsoil of red gravelly clay loam, gravelly sandy clay loam, and very gravelly sandy clay loam. The depth to bedrock ranges from 24 to 52 inches. These soils formed in material weathered from diabase, slates, and schists.

The Auburn soils have a surface layer of brown silt loam and a subsoil of reddish-yellow silt loam. The depth to bedrock ranges from 12 to 26 inches. These soils formed in material weathered from diabase, slates, and schists.

The soils of this association are used mainly for range, water supply, wildlife habitat, and some commercial timber production. A few areas are used for pasture, hay, grain, or orchards.

3. *Rescue association*

Well-drained sandy loams formed in material weathered from basic rocks

This association is in small areas scattered throughout the western part of the survey area. It is at elevations of 1,000 to 2,500 feet. The soils are undulating to steep. The average annual precipitation is 25 to 35 inches. The vegetation is chamise brush and scattered areas of pine, oak, and grass. The association occupies about 5 percent of the survey area.

Rescue soils make up about 85 percent of the association. The remaining 15 percent consists of Loamy alluvial land, Argonaut soils, and soils of the Rescue series, clayey variant.

The Rescue soils have a surface layer of reddish-brown sandy loam and a subsoil of yellowish-red and reddish-yellow heavy sandy loam and sandy clay loam. The depth to weathered bedrock ranges from 40 inches to more than 60 inches. These soils formed in material weathered from gabbrodiorite rock. Stones and some rock outcrops are common.

Loamy alluvial land is adjacent to streams. Argonaut soils are along drainageways and on concave slopes. Rescue soils, clayey variant, are in wet swales and below seeps.

The soils of this association are used mainly for grazing, watershed, and wildlife habitat. Some small areas are used for hay, grain, and pasture.

4. *Serpentine rock land-Delpiedra association*

Excessively drained to somewhat excessively drained rock land and loams formed in material weathered from ultrabasic rocks

This association is mainly scattered throughout the lower and middle foothills, but two areas are in the mountainous uplands. Where elevations are 500 to 1,800 feet, the average annual rainfall is 25 to 35 inches. In the two areas in the mountainous uplands, where elevations are 500 to 3,200 feet, precipitation is 25 to 50 inches. This association is undulating to very steep. The vegetation consists of chamise, grasses, and scattered Digger pines. This association occupies about 5 percent of the survey area.

Serpentine rock land makes up about 85 percent of the association, and Delpiedra soils, about 10 percent. The remaining 5 percent consists of Auburn soils.

Serpentine rock land is in areas of highly resistant serpentine and other ultrabasic rock formations. Rock outcrops and stones occupy 50 to 90 percent of the surface area, and there is a thin mantle of soil material in crevices.

The Delpiedra soils have a surface layer of reddish-brown loam and a subsoil of reddish-brown and yellowish-red clay loam. The depth to bedrock ranges from 10 to 24 inches. These soils formed in material weathered from serpentine. Rock outcrops are common.

The soils of this association are used mainly for watershed, for wildlife habitat, and as a source of rock for roads. Delpiedra soils are grazed. Some areas are mined for chrome.

5. *Auberry-Ahwahnee-Sierra association*

Well-drained coarse sandy loams and sandy loams formed in material weathered from granitic rocks

This association is in two main areas, one in the vicinity of Gold Hill-Lotus and the other west of Aukum and extending north to near Oak Hill. The soils generally are gently rolling to hilly, but they are steep where they break into the major streams and rivers. In relation to the adjacent associations, this association has the appearance of being in a basin. These soils formed in material weathered from granodiorite. The surface is commonly broken by rock outcrops. The vegetation consists of grass and oak

trees and scattered pockets of commercial conifers. Elevations are 500 to 2,500 feet. The average annual rainfall is 25 to 35 inches. This association occupies about 5 percent of the survey area.

Auberry soils make up about 55 percent of the association; Ahwahnee soils, about 25 percent; and Sierra soils, about 10 percent. The remaining 10 percent consists of Chawanakee soils and Acidic rock land.

The Auberry soils have a surface layer of brown and light yellowish-brown coarse sandy loam and a subsoil of very pale brown, light yellowish-brown, and yellowish-brown coarse sandy clay loam and coarse sandy loam. The depth to weathered granodiorite bedrock ranges from 24 inches to more than 60 inches. These soils generally are gently rolling to hilly.

The Ahwahnee soils have a surface layer of very dark gray and grayish-brown coarse sandy loam and a subsoil of pale-brown and light yellowish-brown heavy coarse sandy loam. The depth to weathered granodiorite bedrock ranges from 24 to 40 inches. These soils are hilly to steep on sides of hills that break into the major drainageways.

The Sierra soils have a surface layer of brown sandy loam and a subsoil of mainly yellowish-red and red clay loam. The depth to weathered bedrock ranges from 40 inches to more than 60 inches. The largest area of the Sierra soils is in the southern part of the Aukum-Oak Hill block. These soils are rolling to steep.

The Chawanakee soils are hilly to steep on slopes that break into the major rivers.

The soils of this association are used mainly for annual range, watershed, and wildlife habitat. Some areas have been planted to dryland walnuts. In areas where irrigation water is available, these soils can be planted to pasture and deciduous orchards. Vineyards are being introduced on these soils. Timbered areas are harvested for wood products.

Soils of the Mountainous Uplands

The mountainous uplands of the Sierra Nevada are located in the eastern part of the El Dorado Area. They consist of tabular ridges and rolling to steep uplands that are deeply entrenched by rivers and streams that flow westward. Elevations range from 1,500 feet to more than 5,500 feet. Annual precipitation ranges from 35 inches to more than 60 inches, and much of it falls as snow. The soils are 15 inches to more than 60 inches deep to bedrock. Rock outcrops are common. The mountainous uplands make up about 50 percent of the survey area.

There are three associations in the mountainous uplands. The soils in these associations formed in material weathered from slates and schists, metabasic rocks, volcanic conglomerate, and granitic rocks. The plant cover is dominantly forests of conifers and hardwoods, and there are scattered areas of brush.

6. Holland-Musick-Chaix association

Well-drained coarse sandy loams and sandy loams formed in material weathered from granitic rocks

This association is in two main areas in the survey area, one in the Aukum-Grizzly Flat area and the other in the Mosquito area. The soils are gently rolling to hilly on uplands. The relief generally is smooth and the hills are rounded, but areas that adjoin river canyons are steep and, in places, precipitous. In relation to the surrounding topography, this association has the appearance of being in a basin. These soils formed in material weathered from granodiorite. Rock outcrops are common, especially where the soils are steeper. The vegetation consists of conifers and hardwoods. Elevations are 1,800 to 5,000 feet. Average annual precipitation is 35 to 60 inches. This association occupies about 10 percent of the survey area.

Holland soils make up about 35 percent of the association; Musick soils, about 20 percent; and Chaix soils, about 15 percent. The remaining 30 percent consists of Chawanakee, Hotaw, and Shaver soils and Acidic rock land.

The Holland soils have a surface layer of brown coarse sandy loam and sandy loam and a subsoil of strong-brown, brown, and yellowish-brown sandy clay loam. The substratum is pale-brown coarse sandy loam. The depth to weathered granitic bedrock ranges from 40 inches to more than 60 inches. The Holland soils are mainly rolling to steep.

The Musick soils have a surface layer of brown sandy loam and a subsoil of reddish-brown, red, and reddish-yellow sandy clay loam, clay loam, and sandy clay. The depth to weathered granitic bedrock is more than 48 inches. The Musick soils are mainly rolling to steep.

The Chaix soils have a surface layer of dark grayish-brown coarse sandy loam and a subsoil of brown coarse sandy loam. The substratum is pale-brown coarse sandy loam. The depth to weathered granitic rock ranges from 24 to 40 inches. These soils are mainly steep and have slopes that break into the rivers.

Chawanakee soils are hilly to steep and occupy areas that break into the major rivers. Hotaw soils are present throughout the association. Shaver soils are mainly in the Grays Corners-Aukum area. Acidic rock land is mainly steep and very steep and is on side slopes that break into the major rivers.

The soils in this association are used mainly for timber, water supply, and wildlife habitat. Some areas have been cleared and are used for grazing and dryland walnuts. In areas where irrigation water is available, deciduous orchards and pasture have been planted.

7. Cohasset-Aiken-McCarthy association

Well-drained cobbly loams and loams formed in material weathered from volcanic conglomerate

This association is in three main areas, the Volcanoville Ridge area east of Georgetown, the Camino-Pollock Pines area east of Placerville, and the Omo Ranch-Farnham Ridge area southeast of Placerville. The soils occupy broad, sloping, tabular ridges and the steep sides of these ridges. The vegetation consists of conifers and hardwoods. Elevations are 2,000 to 5,500 feet. Average annual precipitation is 35 inches to more than 60 inches at the higher elevations. Much of the precipitation falls as snow. This association occupies about 10 percent of the survey area.

Cohasset soils make up about 45 percent of the association; Aiken soils, about 20 percent; and McCarthy soils, about 20 percent. The remaining 15 percent consists of Crozier and Iron Mountain soils.

The Cohasset soils have a surface layer of brown and reddish-brown cobbly loam and a subsoil of reddish-

brown and yellowish-red cobbly loam and cobbly clay loam. The depth to andesitic conglomerate ranges from 40 inches to more than 60 inches. These soils are moderately sloping to strongly sloping on ridgetops and are steep on side slopes.

The Aiken soils have a surface layer of brown and reddish-brown loam and clay loam and a subsoil of yellowish-red and red clay loam and clay. The depth to weathered andesitic conglomerate is more than 48 inches. These soils are gently sloping to strongly sloping on broad ridgetops.

The McCarthy soils have a surface layer of dark grayish-brown and brown cobbly loam and a subsoil of strong-brown very cobbly loam. The depth of andesitic conglomerate ranges from 24 to 40 inches. These soils are steep on side slopes below areas of Aiken and Cohasset soils.

Crozier soils are present throughout this association. Iron Mountain soils are in patches on the ridgetops and in long, thin bands on the steep sides of ridges. Mapped with the Iron Mountain soils are rocky areas commonly called lava caps.

The soils in this association are used mainly for timber production, water supply, and wildlife habitat. In the Camino-Pollock Pines area, large acreages have been planted to pear and apple orchards.

8. *Mariposa-Josephine-Sites association*

Well-drained gravelly silt loams, silt loams, and loams formed in material weathered from metasedimentary rocks

This association is present throughout the eastern half of the survey area at elevations of 1,500 feet to more than 5,500 feet. The soils are rolling to steep on uplands that have sharp ridges. There are a few, wide, rolling valleys. The streams have entrenched in a herringbone pattern. Soils adjacent to the major rivers and streams commonly are rocky and very steep. The vegetation consists of conifers, hardwoods, and brush. The shallower soils tend to be brushy. The average annual precipitation ranges from 35 inches to more than 60 inches, and much of it falls as snow.

The soils in this association formed in vertically tilted slates and schists, and some metamorphosed basic rocks. Because of the early vertical uplifting of the parent rock and its mixed mineralogy and varying degree of metamorphism, these soils are quite variable within short horizontal distances. This association occupies about 30 percent of the survey area.

Mariposa soils make up about 50 percent of the association; Josephine soils, about 30 percent; and Sites soils, about 10 percent. The remaining 10 percent consists of Boomer, Diamond Springs, and Maymen soils and Metamorphic rock land.

The Mariposa soils have a surface layer of pink gravelly silt loam and a subsoil of reddish-yellow gravelly silt loam. The depth to bedrock ranges from 15 to 30 inches. These soils occupy narrow ridge crests and are very steep on side slopes. Rock outcrops and slate fragments are common.

The Josephine soils have a surface layer of yellowish-brown and reddish-yellow silt loam and a subsoil of reddish-yellow silty clay loam and yellow very gravelly silt loam. The depth to bedrock ranges from 40 to 60 inches. These soils are moderately sloping to very steep throughout the association. Rock outcrops and slate fragments are common.

The Sites soils have a surface layer of brown and reddish-brown loam and a subsoil of yellowish-red and red clay loam and clay. The depth to bedrock ranges from 40 inches to more than 60 inches. Rock outcrops and slate fragments are common.

Boomer soils are intermingled with Sites soils at the lower elevations. Diamond Springs soils are along the western fringe of the association. Maymen soils are mainly adjacent to the very steep soils that break into the major rivers and in the Slate Mountain area east of Georgetown.

The soils in this association are used mainly for timber, water supply, and wildlife habitat. Some areas have been cleared and planted to deciduous orchards.

Descriptions of the Soils

This section describes the soil series and mapping units of the El Dorado Area. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

In the pages that follow, a general description of each soil series is given. Following each series description is a fairly detailed description of one mapping unit in the series. This detailed description is followed by brief descriptions of the rest of the mapping units. Miscellaneous land types, such as Acidic rock land and Loamy alluvial land, are described in alphabetic order along with other mapping units.

In each series description is a short, nontechnical description of a profile representative for the series. In the description of the first mapping unit is a more detailed description of the same profile, which can be used by scientists, engineers, and others in making highly technical interpretations. The descriptions of the rest of the mapping units tell mainly how these units differ from the one described in detail.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. At the end of the description of each mapping unit are listed the capability unit, woodland group, and range site, where applicable, in which the mapping unit has been placed. The page where each of these groups is described can be found readily by referring to the "Guide to Mapping Units."

Unless otherwise stated, the colors mentioned are for dry soils.

For more general information about the soils, the reader can refer to the section "General Soil Map," in which the broad patterns of soils are described. Many of the terms used in the soil descriptions and other parts of the survey are defined in the Glossary.

Acidic Rock Land

Acidic rock land (AcF) occurs in areas of granitic rock and on rhyolitic ridges. In areas of granitic rock, it is mainly steep to very steep and occupies the canyon walls of the American and Cosumnes Rivers. It is associated with the Chawanakee, Ahwahnee, Chaix, Shaver, and

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

Soil	Acres	Percent
Acidic rock land	6,407	1.2
Ahwahnee coarse sandy loam, 9 to 15 percent slopes	486	.1
Ahwahnee very rocky coarse sandy loam, 9 to 30 percent slopes	1,468	.3
Ahwahnee very rocky coarse sandy loam, 30 to 50 percent slopes	3,887	.7
Aiken loam, 3 to 9 percent slopes	1,670	.3
Aiken loam, 3 to 9 percent slopes, eroded	775	.1
Aiken loam, 9 to 15 percent slopes	2,920	.5
Aiken loam, 9 to 15 percent slopes, eroded	1,162	.2
Aiken loam, 15 to 30 percent slopes	2,690	.5
Aiken cobbly loam, 3 to 30 percent slopes	972	.2
Argonaut gravelly loam, 2 to 15 percent slopes	2,304	.4
Argonaut extremely stony loam, 15 to 30 percent slopes	542	.1
Argonaut very rocky loam, 3 to 30 percent slopes	2,304	.4
Argonaut clay loam, 3 to 9 percent slopes	653	.1
Argonaut loam, seeped variant	1,203	.2
Auberry coarse sandy loam, 5 to 9 percent slopes	946	.2
Auberry coarse sandy loam, 9 to 15 percent slopes	1,390	.3
Auberry coarse sandy loam, 15 to 30 percent slopes	959	.2
Auberry rocky coarse sandy loam, 5 to 15 percent slopes	2,720	.5
Auberry very rocky coarse sandy loam, 15 to 30 percent slopes	2,829	.5
Auberry very rocky coarse sandy loam, 30 to 50 percent slopes	3,990	.7
Auberry very rocky coarse sandy loam, moderately deep, 9 to 30 percent slopes	1,235	.2
Auburn silt loam, 2 to 30 percent slopes	15,692	2.9
Auburn very rocky silt loam, 2 to 30 percent slopes	63,396	11.8
Auburn very rocky silt loam, 30 to 50 percent slopes	28,559	5.3
Auburn extremely rocky silt loam, 3 to 70 percent slopes	7,722	1.4
Auburn cobbly clay loam, heavy subsoil variant, 9 to 50 percent slopes	607	.1
Boomer gravelly loam, 3 to 15 percent slopes	1,466	.3
Boomer gravelly loam, 15 to 30 percent slopes	1,773	.3
Boomer very rocky loam, 3 to 30 percent slopes	4,204	.8
Boomer very rocky loam, 30 to 50 percent slopes	10,361	1.9
Boomer very rocky loam, 50 to 70 percent slopes	1,925	.4
Boomer-Sites loams, 9 to 15 percent slopes	593	.1
Boomer-Sites loams, 15 to 30 percent slopes	1,703	.3
Boomer-Sites very rocky loams, 9 to 50 percent slopes	3,559	.7
Chaix very rocky coarse sandy loam, 9 to 50 percent slopes	4,920	.9
Chaix very rocky coarse sandy loam, 50 to 70 percent slopes	2,381	.4
Chawanakee very rocky coarse sandy loam, 9 to 50 percent clopes	2,385	.4
Cohasset sandy loam, 15 to 30 percent slopes	1,055	.2
Cohasset cobbly sandy loam, 9 to 50 percent slopes	1,875	.4
Cohasset loam, 3 to 9 percent slopes	752	.1
Cohasset loam, 9 to 15 percent slopes	2,882	.5
Cohasset loam, 15 to 30 percent slopes	4,983	.9
Cohasset cobbly loam, 3 to 15 percent slopes	2,414	.5
Cohasset cobbly loam, 15 to 50 percent slopes	8,160	1.5
Crozier cobbly loam, 9 to 50 percent slopes	2,521	.5
Delpiedra very rocky loam, 3 to 50 percent slopes	1,692	.3
Diamond Springs very fine sandy loam, 3 to 9 percent slopes	247	.1
Diamond Springs very fine sandy loam, 9 to 15 percent slopes	2,948	.6
Diamond Springs very fine sandy loam, 15 to 30 percent slopes	846	.2
Diamond Springs very rocky very fine sandy loam, 3 to 50 percent slopes	2,321	.4
Diamond Springs gravelly sandy loam, grayish subsoil variant, 9 to 30 percent slopes	529	.1
Diamond Springs gravelly sandy loam, grayish subsoil variant, 30 to 50 percent slopes	585	.1
Gullied land	2,430	.6
Holland coarse sandy loam, 5 to 9 percent slopes	516	.1
Holland coarse sandy loam, 9 to 15 percent slopes	3,195	.6
Holland coarse sandy loam, 15 to 30 percent slopes	3,780	.7
Holland rocky coarse sandy loam, 5 to 15 percent slopes	631	.1
Holland very rocky coarse sandy loam, 15 to 50 percent slopes	7,077	1.3
Holland very rocky coarse sandy loam, 50 to 70 percent slopes	1,332	.3
Horseshoe gravelly sandy loam, 9 to 15 percent slopes	190	(1)
Horseshoe gravelly loam, 30 to 50 percent slopes	787	.1
Hotaw very rocky coarse sandy loam, 15 to 50 percent slopes	3,159	.6
Iron Mountain very rocky sandy loam, 3 to 50 percent slopes	5,527	1.0
Josephine gravelly loam, 9 to 15 percent slopes	1,968	.4
Josephine gravelly loam, 15 to 30 percent slopes	4,351	.8
Josephine very rocky loam, 15 to 50 percent slopes	10,639	2.0
Josephine silt loam, 5 to 15 percent slopes	2,505	.5
Josephine silt loam, 15 to 30 percent slopes	12,007	2.2
Josephine silt loam, 30 to 50 percent slopes	3,634	.7
Josephine very rocky silt loam, 9 to 50 percent slopes	10,953	2.0
Josephine very rocky silt loam, 50 to 70 percent slopes	2,985	.6
Josephine-Mariposa gravelly loams, 15 to 30 percent slopes	1,359	.3
Loamy alluvial land	624	.1
Mariposa gravelly silt loam, 3 to 30 percent slopes	5,715	1.1
Mariposa very rocky silt loam, 3 to 50 percent slopes	32,853	6.1
Mariposa very rocky silt loam, 50 to 70 percent slopes	25,459	4.7
Mariposa-Josephine very rocky loams, 15 to 50 percent slopes	21,127	3.9
Mariposa-Josephine very rocky loams, 50 to 70 percent slopes	5,218	1.0
Maymen very rocky loam, 15 to 70 percent slopes	8,675	1.6
McCarthy cobbly loam, 9 to 50 percent slopes	9,496	1.7
Metamorphic rock land	11,677	2.2
Mixed alluvial land	1,058	.2
Musick sandy loam, 9 to 15 percent slopes	2,061	.4
Musick sandy loam, 15 to 30 percent slopes	2,296	.4
Musick rocky sandy loam, 5 to 15 percent slopes	710	.1
Musick very rocky sandy loam, 15 to 50 percent slopes	3,183	.6
Perkins gravelly loam, 3 to 30 percent slopes	201	(1)
Perkins gravelly loam, moderately deep variant, 2 to 5 percent slopes	967	.2
Placer diggings	9,108	1.7
Rescue sandy loam, 2 to 9 percent slopes	3,801	.7
Rescue sandy loam, 9 to 15 percent slopes	740	.1
Rescue sandy loam, 15 to 30 percent slopes	249	.1

See footnote at end of table.

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

Soil	Acres	Percent	Soil	Acres	Percent
Rescue very stony sandy loam, 3 to 15 percent slopes	6, 535	1. 2	Sierra very rocky sandy loam, 30 to 50 percent slopes	833	. 2
Rescue very stony sandy loam, 15 to 30 percent slopes	2, 471	. 5	Sites loam, 9 to 15 percent slopes	2, 789	. 5
Rescue very stony sandy loam, 30 to 50 percent slopes	1, 155	. 2	Sites loam, 15 to 30 percent slopes	5, 407	1. 0
Rescue extremely stony sandy loam, 3 to 50 percent slopes, eroded	10, 286	1. 9	Sites loam, 30 to 50 percent slopes	1, 149	. 2
Rescue clay, clayey variant	679	. 1	Sites stony loam, 30 to 50 percent slopes	782	. 2
Serpentine rock land	18, 201	3. 4	Sites very rocky loam, 15 to 50 percent slopes	1, 912	. 4
Shaver coarse sandy loam, 5 to 9 percent slopes	288	. 1	Sites very rocky loam, 50 to 70 percent slopes	258	. 1
Shaver coarse sandy loam, 9 to 15 percent slopes	1, 648	. 3	Sites clay loam, 9 to 15 percent slopes	1, 124	. 2
Shaver coarse sandy loam, 15 to 30 percent slopes	1, 813	. 3	Sites clay loam, 15 to 30 percent slopes	2, 628	. 3
Shaver rocky coarse sandy loam, 5 to 15 percent slopes	462	. 1	Sites clay loam, 30 to 50 percent slopes	461	. 1
Shaver very rocky coarse sandy loam, 15 to 50 percent slopes	1, 635	. 3	Sobrante silt loam, 3 to 15 percent slopes	4, 870	. 9
Sierra sandy loam, 9 to 15 percent slopes, eroded	675	. 1	Sobrante silt loam, 15 to 30 percent slopes	591	. 1
Sierra sandy loam, 15 to 30 percent slopes, eroded	356	. 1	Sobrante very rocky silt loam, 3 to 30 percent slopes	960	. 2
Sierra rocky sandy loam, 5 to 15 percent slopes	343	. 1	Tailings	1, 798	. 3
Sierra very rocky sandy loam, 15 to 30 percent slopes	473	. 1	Wet alluvial land	626	. 1
			Whiterock gravelly silt loam, 3 to 50 percent slopes	3, 153	. 6
			Reservoirs	7, 123	1. 3
			Rivers	2, 770	. 5
			Total	539, 065	100. 0

[1] Less than 0.05 percent.

Sierra soils. In the Pleasant Valley area, it occupies plateaus and escarpments of rhyolitic ridges along with soils of the Diamond Springs series, grayish subsoil variant.

About 60 percent of the area of this land type is bare rock. The remaining 40 percent has a thin mantle of soil. This land type is excessively drained. Runoff is very rapid, and the erosion hazard is very high, although there is little soil available to erode.

Included in mapping are small areas of Ahwahnee very rocky coarse sandy loam and Sierra very rocky sandy loam that have slopes of more than 50 percent.

This land type is used for watershed and wildlife habitat. It has no farming value. Capability unit VIIIs–1 (18, 22); range site and woodland suitability group not assigned.

Ahwahnee Series

The Ahwahnee series consists of well-drained soils that are underlain by weathered granitic rocks at a depth of 24 to 40 inches. These are rolling to steep soils on foothills. Slopes are 9 to 50 percent. Elevations range from 500 feet to 2,500 feet. The average annual rainfall is 25 to 35 inches, average annual temperature is 60° F., and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses, forbs, and oaks, and there are scattered Digger and ponderosa pines. Ahwahnee soils are associated principally with Auberry, Sierra, and Auburn soils.

In a representative profile, the surface layer is very dark gray and grayish-brown, neutral and slightly acid sandy loam and coarse sandy loam about 8 inches thick. The subsoil is pale-brown and light yellowish-brown, slightly acid heavy coarse sandy loam. Weathered granodiorite occurs at a depth of about 26 inches.

Ahwahnee soils are used for annual range.

Ahwahnee coarse sandy loam, 9 to 15 percent slopes (AcC).—This soil is strongly sloping. Exposed bedrock occupies less than 5 percent of the surface.

Representative profile, 7 miles southwest of Pilot Hill, 0.1 mile east of the high-water mark on Folsom Reservoir, 0.1 mile southwest of the northeast corner of sec. 8, T. 10 N., R. 8 E.:

A11—0 to 2½ inches, very dark gray (N 3/0) sandy loam, black (N 2/0) when moist; massive; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores; neutral; clear, smooth boundary.

A12—2½ to 8 inches, grayish-brown (10YR 5/2) coarse sandy loam, dark brown (10YR 3/3) when moist; massive; soft, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine tubular pores; slightly acid; clear, smooth boundary.

B1—8 to 18 inches, pale-brown (10YR 6/3) heavy coarse sandy loam, dark yellowish brown (10YR 4/4) when moist; massive; hard, friable, slightly sticky and nonplastic; common fine and medium roots; common very fine tubular and interstitial pores and few fine tubular pores; slightly acid; clear, smooth boundary.

B2t—18 to 26 inches, light yellowish-brown (10YR 6/4) heavy coarse sandy loam, brown (7.5YR 4/4) when moist; massive; very hard, friable, slightly sticky and nonplastic; few fine and medium roots; common very fine tubular and interstitial pores; few thin clay films in pores and as bridges; slightly acid; abrupt, irregular boundary.

C—26 inches, weathered granodiorite that has many thin clay films in pores and as bridges.

Total thickness of the A horizon is about 6 to 10 inches. Depth to rock is 24 to 40 inches.

Included in mapping are small areas of Auberry coarse sandy loam, Sierra sandy loam, Auburn very rocky silt loam, and a soil that is similar to this Ahwahnee soil but has a paler surface layer.

Permeability of this Ahwahnee soil is moderately rapid. Surface runoff is medium, and the erosion hazard is moderate to high. The available water holding capacity is 3.5 to 5 inches. The effective rooting depth is 24 to 40 inches.

This soil is used for range. Capability unit IVe–1(18); range site 3; woodland suitability group not assigned.

Ahwahnee very rocky coarse sandy loam, 9 to 30 percent slopes (AdD).—In areas of this soil, rock outcrops occupy 5 to 25 percent of the surface.

Included in mapping are small areas of Auberry very rocky coarse sandy loam, Auburn very rocky silt loam, Chawanakee very rocky coarse sandy loam, Chaix very rocky coarse sandy loam, and Sierra very rocky sandy loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for range. Capability unit VIs–1(18); range site 3; woodland suitability group not assigned.

Ahwahnee very rocky coarse sandy loam, 30 to 50 percent slopes (AdE).—In areas of this soil, rock outcrops make up 5 to 25 percent of the surface.

Included in mapping are small areas of Auberry very rocky coarse sandy loam, Auburn very rocky silt loam, Chawanakee very rocky coarse sandy loam, Chaix very rocky coarse sandy loam, and Sierra very rocky sandy loam.

Surface runoff is rapid, and the erosion hazard is very high.

This soil is used for range and watershed. Capability unit VIIs–1(18); range site 3; woodland suitability group not assigned.

Aiken Series

The Aiken series consists of well-drained soils that are underlain by deeply weathered andesitic conglomerate at a depth of 4 feet or more. These soils are gently sloping to moderately steep on wide, smooth ridges and the sides of ridges. Slopes are 3 to 30 percent. Elevations range from 2,500 feet to 5,000 feet. The average annual precipitation, including snow, is 40 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods. Aiken soils are associated principally with Cohasset, Josephine, McCarthy, Musick, and Sites soils.

In a representative profile, the surface layer is brown and reddish-brown, medium acid loam and clay loam about 24 inches thick. The subsoil is red and yellowish-red, medium acid and strongly acid heavy clay loam and clay that extend to a depth of more than 72 inches.

Aiken soils are used for woodland and for deciduous fruit orchards.

Aiken loam, 3 to 9 percent slopes (AfB).—This soil is moderately sloping.

Representative profile, 8 miles northeast of Georgetown and 3 miles east of Volcanoville, 0.1 mile east and 0.45 mile south of the northwest corner of sec. 14, T. 13 N., R. 11 E.:

O1&O2—3 inches to 0, litter and duff.

A11—0 to 3 inches, brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) when moist; weak, medium, subangular blocky structure parting to strong, very fine, granular; slightly hard, friable, nonsticky and nonplastic; many very fine roots and common fine and coarse roots; many very fine and fine interstitial and tubular pores; medium acid; abrupt, smooth boundary.

A12—3 to 9 inches, brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) when moist; massive parting to strong, very fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine roots and common fine to coarse roots; many very fine and fine interstitial and tubular pores; medium acid; clear, smooth boundary.

A31—9 to 15 inches, brown (7.5YR 4/4) loam, dark reddish brown (5YR 3/3) when moist; strong, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots and common fine, medium, and coarse roots; many very fine and fine interstitial and tubular pores; medium acid; clear, wavy boundary.

A32—15 to 24 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) when moist; strong, very fine, granular structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots, few medium and coarse roots; many very fine and fine interstitial and tubular pores; medium acid; clear, smooth boundary.

B1—24 to 35 inches, yellowish-red (5YR 4/6) heavy clay loam, dark reddish brown (2.5YR 3/4) when moist; weak, fine and medium, subangular blocky structure; hard, friable, sticky and plastic; common very fine roots and few fine and coarse roots; many very fine and few fine tubular pores and many very fine interstitial pores; medium acid; clear, smooth boundary.

B21t—35 to 43 inches, red (2.5YR 5/6) clay, dark red (2.5YR 3/6) when moist; massive; hard, firm, sticky and plastic; few fine, medium, and coarse roots; common fine and medium tubular pores; many thin clay films in pores; strongly acid; clear, smooth boundary.

B22t—43 to 52 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) when moist; massive; hard, firm, sticky and plastic; few fine, medium, and coarse roots; common fine and medium tubular pores; many thin clay films in pores; strongly acid; clear, smooth boundary.

B31—52 to 62 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) when moist; moderate, fine, subangular blocky structure; hard, friable, sticky and plastic; few very fine, fine, medium, and coarse roots; common fine and medium tubular pores; common thin clay films in pores and on ped faces; strongly acid; gradual, irregular boundary.

B32—62 to 72 inches, yellowish-red (5YR 5/8) clay, yellowish red (5YR 4/6) when moist; moderate, fine, angular blocky structure; hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; common fine and medium tubular pores; common thin clay films in pores and on ped faces; strongly acid.

Depth to weathered andesitic conglomerate ranges from 4 feet to more than 10 feet, but a depth of 6 to 10 feet is most common. Total thickness of the A horizon is 15 to 30 inches. Texture of the B2t horizon ranges from heavy clay loam to clay.

Included in mapping are small areas of Cohasset loam, Aiken cobbly loam, and Iron Mountain very rocky sandy loam. A small area of a soil that has a sandy loam surface layer, on Barney Ridge southeast of Omo Ranch, also is included.

Permeability of this Aiken soil is moderately slow. Surface runoff is slow, and the erosion hazard is slight. The available water holding capacity is 7 to 10 inches. The effective rooting depth is 48 inches to more than 60 inches.

This soil is used for apple and pear orchards, pasture, and woodland. Capability unit IIe–1(22); range site not assigned; woodland suitability group 1.

Aiken loam, 3 to 9 percent slopes, eroded (AfB2).—This soil is similar to Aiken loam, 3 to 9 percent slopes, except that the surface layer is only 8 to 15 inches thick as a result of erosion. Most of the erosion took place before sprinkler irrigation and cover crops were used in the orchards.

Included in mapping are small areas of Cohasset loam and Aiken cobbly loam.

This soil is used for woodland, apple and pear orchards, and pasture. Capability unit IIe–1(22); range site not assigned; woodland suitability group 1.

Aiken loam, 9 to 15 percent slopes (AfC).—This soil is strongly sloping.

Included in mapping are small areas of Aiken cobbly loam and Cohasset loam.

The erosion hazard is slight to moderate, and runoff is slow to medium.

This soil is used for woodland, for pear and apple orchards, and for pasture. Capability unit IIIe–1(22); range site not assigned; woodland suitability group 1.

Aiken loam, 9 to 15 percent slopes, eroded (AfC2).—This soil is similar to Aiken loam, 3 to 9 percent slopes, except that the surface layer is only 8 to 15 inches thick as a result of erosion and the soil is more sloping. Most of the erosion occurred before sprinkler irrigation and cover crops were used in the orchards.

Included in mapping are small areas of Cohasset loam and Aiken cobbly loam.

The erosion hazard is slight to moderate, and runoff is slow to medium.

This soil is used for pear and apple orchards, irrigated pasture, and woodland. Capability unit IIIe–1(22); range site not assigned; woodland suitability group 1.

Aiken loam, 15 to 30 percent slopes (AfD).—This soil is similar to Aiken loam, 3 to 9 percent slopes, except that it is more sloping.

Included in mapping are small areas of Cohasset loam, Aiken cobbly loam, Iron Mountain very rocky sandy loam, McCarthy cobbly loam, Sites loam, and Musick sandy loam.

The erosion hazard is moderate, and runoff is medium.

This soil is used for woodland, apple and pear orchards, and irrigated pasture. Capability unit IVe–1(22); range site not assigned; woodland suitability group 2.

Aiken cobbly loam, 3 to 30 percent slopes (AgD).—This soil is similar to Aiken loam, 3 to 9 percent slopes, except that it is more sloping and 10 to 20 percent, by volume, of the soil mass is cobblestones. In a few small areas, there are scattered stones.

Included in mapping are small areas of Cohasset cobbly loam, Aiken loam, McCarthy cobbly loam, Iron Mountain very rocky sandy loam, Sites very rocky loam, and Musick very rocky sandy loam.

The erosion hazard is slight to moderate, and runoff is slow to medium. The available water holding capacity is 6.5 to 8 inches.

This soil is used mainly for woodland, but some areas are used for apple and pear orchards and for irrigated pasture. Capability unit IVe–1(22); range site not assigned; woodland suitability group 2.

Argonaut Series

The Argonaut series consists of well-drained soils underlain by metabasic or basic rocks at a depth of 20 to 40 inches (fig. 2). These soils are undulating to moderately steep on broad ridges. Slopes are 2 to 30 percent. Elevations generally range from 500 feet to 1,600 feet, but occasional areas are as high as 2,500 feet. The average annual rainfall is 25 to 35 inches, average annual temperature is 60° F., and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses, forbs, and areas of oaks, Digger pine, and brush. Wiregrass, sedges, and species of *Stipa* are found in some areas. Argonaut soils are associated principally with Auburn, Rescue, and Whiterock soils.

Figure 2.—Profile of Argonaut gravelly loam, 2 to 15 percent slopes.

In a representative profile, the surface layer is strong-brown, medium acid gravelly loam and gravelly silt loam about 7 inches thick. The subsoil is yellowish-red, yellowish-brown, and brown, medium acid and slightly acid heavy silt loam, clay, and gravelly clay. At a depth of about 30 inches is weathered metaandesite.

Argonaut soils are used for range and pasture.

Argonaut very rocky loam, 3 to 30 percent slopes (AmD).—This soil has slopes of dominantly less than 15 percent. Five to 25 percent of the surface has outcrops of bedrock.

Representative profile, 0.5 mile southwest of Latrobe and about 75 feet south of Latrobe Road, near the center of NE¼ sec. 16, T. 8 N., R. 9 E.:

A11—0 to 3 inches, strong-brown (7.5YR 5/6) gravelly loam, yellowish red (5YR 3/6) when moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular

and interstitial pores; medium acid; clear, smooth boundary.

A12—3 to 7 inches, strong-brown (7.5YR 5/6) gravelly silt loam, yellowish red (5YR 4/6) when moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores and few medium tubular pores; medium acid; clear, smooth boundary.

B1t—7 to 10 inches, yellowish-red (5YR 5/6) heavy silt loam, yellowish red (5YR 4/6) when moist; massive; hard, friable, slightly sticky and plastic; common very fine and fine roots; many very fine and fine tubular pores and few medium tubular pores; few thin films in pores; medium acid; abrupt, smooth boundary.

B21t—10 to 13 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/8) when moist; massive; very hard, firm, sticky and very plastic; few very fine roots; few fine tubular pores; many moderately thick clay films in pores; slightly acid; clear, smooth boundary.

B22t—13 to 27 inches, yellowish-brown and yellowish-red (7.5YR 5/4, 10YR 5/4, and 5YR 5/6) clay, brown and yellowish red (7.5YR 5/4, 10YR 5/3, and 5YR 4/6) when moist; massive; very hard, very firm, sticky and very plastic; few very fine roots; few fine tubular pores; many moderately thick clay films in pores; slightly acid; clear, wavy boundary.

B23t—27 to 30 inches, brown (7.5YR 4/4) gravelly clay, brown (7.5YR 4/4) when moist; massive; very hard, very firm, sticky and plastic; very few very fine roots; very few very fine pores; many moderately thick clay films in pores; slightly acid; abrupt, wavy boundary.

R—30 inches, weathered metaandesite.

The A horizon is strong brown to yellowish red or reddish brown in color, is slightly acid to medium acid, and contains common distinct mottles and black manganese stains in places. Total thickness of the A horizon is 6 to 12 inches. A stone lens or hard broken rock fragments generally are found between the A horizon and B horizon where the soil formed in metaandesite. Depth to the B21t horizon ranges from 10 to 20 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in mapping are small areas of Auburn very rocky silt loam.

Permeability of this Argonaut soil is very slow. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The available water holding capacity is about 2.5 to 4.0 inches. The effective rooting depth for most plants is 20 to 30 inches, although the clay subsoil restricts root movement and available moisture.

This soil is used for range. Capability unit VIs–1(18); range site 1; woodland suitability group not assigned.

Argonaut gravelly loam, 2 to 15 percent slopes (AkC).—This soil is similar to Argonaut very rocky loam, 3 to 30 percent slopes, except that less than 5 percent of the surface has outcrops of bedrock.

Included in mapping are small areas of Auburn silt loam and Sobrante silt loam.

This soil is used for range. Occasional crops of hay and grain or irrigated pasture are grown. Capability unit IVe–3(18); range site 1; woodland suitability group not assigned.

Argonaut extremely stony loam, 15 to 30 percent slopes (AlD).—This soil is moderately steep. It formed in colluvium from metabasic rock and is underlain by slate. Three to 15 percent of the surface is covered with stones and boulders. The surface layer and upper part of the subsoil contain 20 to 50 percent, by volume, gravel, cobblestones, and stones. The depth to the underlying slate ranges from 24 to 40 inches.

Included in mapping are small areas of Auburn very rocky silt loam and Whiterock gravelly silt loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for range, wildlife habitat, and watershed. Capability unit VIIs–1(18); range site 1; woodland suitability group not assigned.

Argonaut clay loam, 3 to 9 percent slopes (AnB).—This soil is similar to Argonaut very rocky loam, 3 to 30 percent slopes, except that it formed in material weathered from gabbrodiorite and has a slightly acid clay loam surface layer. In addition, less than 5 percent of the surface is exposed bedrock.

Included in mapping are small areas of Rescue sandy loam and Rescue clay, clayey variant.

This soil is used mainly for range. Small areas are used for irrigated pasture. Capability unit IVe–3(18); range site 1; woodland suitability group not assigned.

Argonaut Series, Seeped Variant

The Argonaut series, seeped variant, consists of poorly drained soils that are underlain by bedrock at a depth of 25 to 40 inches. These soils are nearly level to gently sloping on uplands and are in concave positions around spring and seep areas. Slopes are 0 to 5 percent. Elevations range from 1,800 feet to 4,000 feet. The average annual rainfall is 35 to 50 inches, average annual temperature is 54° F., and the frost-free season is 140 to 240 days. Vegetation consists of meadow grasses and sedges. Argonaut soils, seeped variant, are associated principally with Aiken, Cohasset, Holland, Josephine, Mariposa, and Sites soils.

In a representative profile, the surface layer is very dark grayish-brown and brown, slightly acid and medium acid loam about 8 inches thick. The subsoil is pale-brown and light olive-brown, medium acid to neutral silty clay loam and clay. Weathered gleyed slate is at a depth of about 32 inches.

Argonaut soils, seeped variant, are used for range and pasture.

Argonaut loam, seeped variant (AoB).—This soil has slopes of 0 to 5 percent.

Representative profile, 3 miles south of Georgetown, 0.7 mile south and 0.5 mile east of the northwest corner of sec. 23, T. 12 N., R. 10 E.:

A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

A12—3 to 8 inches, brown (10YR 5/3) loam, dark yellowish brown (10YR 3/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine roots; common very fine and fine tubular pores; medium acid; gradual, wavy boundary.

B1t—8 to 17 inches, pale-brown (10YR 6/3) silty clay loam that has few, fine, distinct, yellowish-brown (10YR 5/4) mottles, dark yellowish brown (10YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine roots; common very fine and fine tubular pores; few thin clay films on ped faces and in pores; medium acid; gradual, wavy boundary.

B21t—17 to 25 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) when moist and has many, medium, distinct, yellowish-brown (10YR 5/4) mottles when moist; moderate, medium, subangular blocky struc-

ture; very hard, firm, sticky and plastic; few fine roots; few fine tubular pores; common thin clay films on ped faces and in pores; slightly acid; gradual, wavy boundary.

B22t—25 to 32 inches, light olive-brown (2.5Y 5/4) clay that has common, fine, distinct, yellowish-brown (10YR 5/8) mottles when dry and when moist; weak, medium, prismatic structure; very hard, firm, sticky and plastic; no roots; few fine tubular pores; few thin clay films on ped faces and in pores; neutral; abrupt, wavy boundary.

C—32 inches, weathered gleyed slate.

Depth to weathered bedrock ranges from 25 to 40 inches. This soil formed in material weathered from acidic, basic, or metamorphic bedrock. The A horizon ranges from sandy loam to silt loam in texture. Total thickness of the A horizon is 6 to 10 inches. The B2t horizon ranges from heavy clay loam to clay.

Included in mapping are small areas of a soil that is similar to this Argonaut soil, except that it has a subsoil of loam to light clay loam. Also included are small areas of Wet alluvial land and Mixed alluvial land. In a few areas slopes range to about 15 percent.

Permeability of this Argonaut soil is very slow. Surface runoff is very slow to slow, and the erosion hazard is slight. The effective rooting depth is 25 to 40 inches for most roots, although some roots are restricted by the clay subsoil. This soil has a seasonal high water table at a depth of 20 to 40 inches in winter and spring that drops to a depth of more than 5 feet or disappears during summer and fall. The available water holding capacity is about 3.5 to 6 inches.

This soil is used for dryland and irrigated pasture. Capability unit IVw–2(18, 22); range site and woodland suitability group not assigned.

Auberry Series

The Auberry series consists of well-drained soils that are underlain by weathered granitic rocks, mostly at a depth of 40 inches to more than 60 inches. These soils are gently rolling to steep on foothills. Slopes are 5 to 50 percent. Elevations range from 700 to 1,800 feet. The average annual rainfall is 25 to 35 inches, average annual temperature is 60° F., and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses, forbs, oaks, and scattered ponderosa and Digger pines. Auberry soils are associated principally with Ahwahnee, Auburn, Holland, Musick, and Boomer soils.

In a representative profile, the surface layer is brown and light yellowish-brown, slightly acid coarse sandy loam about 13 inches thick. The upper part of the subsoil is very pale brown, light yellowish-brown, and yellowish-brown, slightly acid coarse sandy clay loam about 23 inches thick. The lower part of the subsoil consists of yellowish-brown, light yellowish-brown, and strong brown, slightly acid coarse sandy loam that grades to well-weathered granodiorite at a depth of 56 inches.

Auberry soils are used for range, woodland, pear and apple orchards, and irrigated pasture.

Auberry very rocky coarse sandy loam, 15 to 30 percent slopes (AtD).—This soil is moderately steep. Five to 25 percent of the surface has outcrops of bedrock.

Representative profile, 3.5 miles west of Coloma, 0.25 mile north of State Highway 49, and 1,300 feet north of the south quarter corner of sec. 2, T. 11 N., R. 9 E.:

A1—0 to 8 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

A3—8 to 13 inches, light yellowish-brown (10YR 6/4) coarse sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and plastic; common very fine and fine roots; many very fine and fine tubular and interstitial pores; few thin clay films as bridges and in pores; slightly acid; clear, smooth boundary.

B21t—13 to 18 inches, very pale brown (10YR 7/4) coarse sandy clay loam, dark brown (10YR 4/3) when moist; massive; very hard, friable, slightly sticky and plastic; common very fine and fine roots; many very fine and fine tubular and interstitial pores; many thin clay films as bridges and in pores; slightly acid; clear, smooth boundary.

B22t—18 to 25 inches, light yellowish-brown (10YR 6/4) coarse sandy clay loam, yellowish brown (10YR 5/4) when moist; massive; very hard, firm, slightly sticky and plastic; few very fine roots; many very fine and fine tubular and interstitial pores; many thin clay films as bridges and in pores; slightly acid; clear, smooth boundary.

B31—25 to 36 inches, yellowish-brown (10YR 5/4) light coarse sandy clay loam, brown (7.5YR 5/4) when moist; massive; very hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine, fine, and medium interstitial pores; common, yellowish-red (5YR 5/6), thin clay films as bridges; slightly acid; clear, smooth boundary.

B32—36 to 42 inches, light yellowish-brown (10YR 6/4) coarse sandy loam, brown (7.5YR 5/4) when moist; massive; very hard, firm, nonsticky and nonplastic; no roots observed; common fine and medium interstitial pores; common, strong-brown (7.5YR 5/6), thin clay films as bridges; slightly acid; clear, smooth boundary.

B33—42 to 56 inches, yellowish-brown and strong-brown (10YR 5/4, 7.5YR 5/6) light coarse sandy loam, strong brown (7.5YR 5/6) when moist; massive; very hard, very firm, nonsticky and nonplastic; no roots observed; few fine and medium interstitial pores; few thin clay films as bridges; slightly acid; clear, wavy boundary.

C—56 inches, yellow (10YR 7/6) well-weathered granodiorite, yellowish brown (10YR 5/4) when moist; few thin clay films as bridges.

Depth to weathered granodiorite ranges from 40 inches to more than 60 inches. The A horizon ranges from brown to pale brown in color. Texture of the A horizon generally is coarse sandy loam, but minor areas are sandy loam. Total thickness of the A horizon is 10 to 15 inches. The color of the B horizon ranges from brown to very pale brown, and its texture ranges from heavy sandy loam to sandy clay loam.

Included in mapping are small areas of Ahwahnee very rocky coarse sandy loam, Sierra very rocky sandy loam, and Boomer very rocky loam.

Permeability of this Auberry soil is moderate. Surface runoff is medium to rapid, and the erosion hazard is high. The available water holding capacity is 5 to 9 inches. The effective rooting depth is 40 inches to more than 60 inches.

This soil is used for range, woodland, and, in a few areas, pear and apple orchards. Capability unit VIs–1(18); range site 3; woodland suitability group 6.

Auberry coarse sandy loam, 5 to 9 percent slopes (ArB).—This soil is similar to Auberry very rocky coarse sandy loam, 15 to 30 percent slopes, except that less than 5 percent of the surface has rock outcrops.

Included in mapping are small areas of somewhat poorly drained soils, with or without a clay subsoil, in swale or seep positions. Also included are small areas of Ahwahnee coarse sandy loam and Sierra sandy loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for deciduous orchards and vineyards and for irrigated pasture. Capability unit IIIe–1(18); range site 3; woodland suitability group not assigned.

Auberry coarse sandy loam, 9 to 15 percent slopes (ArC).—This soil is similar to Auberry very rocky coarse sandy loam, 15 to 30 percent slopes, except that less than 5 percent of the surface has rock outcrops.

Included in mapping are small areas of Ahwahnee coarse sandy loam and Sierra sandy loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for deciduous orchards, walnuts, and vineyards and for irrigated pasture. Capability unit IVe–1(18); range site 3; woodland suitability group not assigned.

Auberry coarse sandy loam, 15 to 30 percent slopes (ArD).—This soil is similar to Auberry very rocky coarse sandy loam, 15 to 30 percent slopes, except that less than 5 percent of the surface has rock outcrops.

Included in mapping are small areas of Ahwahnee very rocky coarse sandy loam, Sierra sandy loam, and Boomer gravelly loam.

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

This soil is used mainly for range. A few areas remain in woodland. Some areas are used for deciduous orchards, walnuts, and irrigated pasture. Capability unit VIe–1(18); range site 3; woodland suitability group not assigned.

Auberry rocky coarse sandy loam, 5 to 15 percent slopes (AsC).—This soil is similar to Auberry very rocky coarse sandy loam, 15 to 30 percent slopes, except that 5 to 10 percent of the surface has rock outcrops.

Included in mapping are small areas of Ahwahnee coarse sandy loam and Sierra rocky sandy loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for range, pear and apple orchards, walnuts, and irrigated pasture. Capability unit IVe–7(18); range site 3; woodland suitability group not assigned.

Auberry very rocky coarse sandy loam, 30 to 50 percent slopes (AtE).—This soil is similar to Auberry very rocky coarse sandy loam, 15 to 30 percent slopes, except that it is more sloping.

Included in mapping are small areas of Ahwahnee very rocky coarse sandy loam, Sierra very rocky sandy loam, Boomer very rocky loam, and Chawanakee very rocky coarse sandy loam.

Surface runoff is rapid, and the erosion hazard is very high.

This soil is used for range and woodland. Capability unit VIIs–1(18); range site 3; woodland suitability group 6.

Auberry very rocky coarse sandy loam, moderately deep, 9 to 30 percent slopes (AuD).—This soil is similar to Auberry very rocky sandy loam, 15 to 30 percent slopes, except that it is thinner and the depth to weathered granitic rock ranges from 24 to 40 inches.

Included in mapping are small areas of Ahwahnee very rocky coarse sandy loam, Sierra very rocky coarse sandy loam, and Boomer very rocky loam.

The effective rooting depth is 24 to 40 inches. The available water holding capacity is 3 to 5 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for range and woodland. Capability unit VIs–1(18); range site 3; woodland suitability group 7.

Auburn Series

The Auburn series consists of well-drained soils that are underlain by hard metamorphic rocks at a depth of 12 to 26 inches. These soils are undulating to very steep on foothills. Slopes are 2 to 70 percent. Elevations range from 500 feet to 1,800 feet. The average annual rainfall is 25 to 35 inches, average annual temperature is 60° F., and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses, forbs, and oaks, and there are scattered areas of Digger pine and brush. Auburn soils are associated principally with Argonaut, Boomer, Sobrante, and Whiterock soils.

In a representative profile (fig. 3), the surface layer is brown, slightly acid silt loam about 3 inches thick. The subsoil is reddish-yellow, slightly acid silt loam. Weathered metabasic rock is at a depth of about 14 inches.

Auburn soils are used mainly for range. A few small areas are used for irrigated pasture.

Auburn very rocky silt loam, 2 to 30 percent slopes (AxD).—This soil is gently sloping to moderately steep. Outcrops of bedrock cover 5 to 25 percent of the surface.

Representative profile, 5 miles west of Shingle Springs, 2,000 feet west and 1,200 feet south of the northeast corner of sec. 7, T. 9 N., R. 9 E.:

A1—0 to 3 inches, brown (7.5YR 5/4) silt loam, dark reddish brown (5YR 3/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine and fine pores; slightly acid; clear, wavy boundary.

B2—3 to 14 inches, reddish-yellow (5YR 6/8) silt loam, dark reddish brown (5YR 3/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; slightly acid; abrupt, wavy boundary.

R—14 inches, weathered metabasic rock.

Depth to bedrock ranges from 12 to 26 inches. As much as 25 percent of the soil mass consists of gravel- and cobblestone-size rock fragments. The color of the A horizon ranges from reddish brown or brown to yellowish red. The texture is loam or silt loam. The total thickness of the A horizon is 3 to 10 inches. There is a slight increase in clay content in the B horizon. Reaction is slightly acid or neutral.

Included in mapping are small areas of Argonaut very rocky loam, Boomer very rocky loam, and Sobrante very rocky silt loam. In the Folsom Reservoir area, there is a soil similar to this Auburn soil that has a darker colored surface layer and formed on mica schist.

Permeability of this Auburn soil is moderate. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The available water holding capacity is 2 to 4 inches. The effective rooting depth is 12 to 26 inches.

This soil is used for range. A few small areas are used as irrigated pasture. Capability unit VIs–1(18); range site 1; woodland suitability group not assigned.

Auburn silt loam, 2 to 30 percent slopes (AwD).—This soil has slopes that are dominantly between 5 and 15 percent. It is similar to Auburn very rocky silt loam, 2 to 30

Figure 3.—**Profile of Auburn very rocky silt loam, 2 to 30 percent slopes.**

percent slopes except that less than 5 percent of the surface is exposed bedrock.

Included in mapping are small areas of Argonaut gravelly loam; Perkins gravelly loam, moderately deep variant; and Sobrante silt loam.

This soil is used for range, irrigated pasture, and some dryland hay and grain. Capability unit IVe–8(18); range site 1; woodland suitability group not assigned.

Auburn very rocky silt loam, 30 to 50 percent slopes (AxE).—This soil is steep in the more prominent foothills and slopes that drop into creek channels and drainageways.

Included in mapping are small areas of Boomer very rocky loam. In the Folsom Reservoir area, there is a soil similar to this Auburn soil that has a darker surface layer and formed from mica schist.

Surface runoff is medium to rapid, and the erosion hazard is moderate to high.

This soil is used for range. Capability unit VIIs–1(18); range site 1; woodland suitability group not assigned.

Auburn extremely rocky silt loam, 3 to 70 percent slopes (AyF).—This soil has slopes that dominantly range from 15 to 50 percent. It is similar to Auburn very rocky silt loam, 2 to 30 percent slopes, except that 25 to 50 percent of the surface has rock outcrops and the depth to bedrock ranges from 12 to 20 inches.

Included in mapping are small areas of Metamorphic rock land.

The available water holding capacity of this Auburn soil is 2 to 4 inches. Surface runoff is slow to very rapid, and the erosion hazard is slight to very high. The effective rooting depth is 12 to 20 inches.

This soil is used for range. Capability unit VIIs–1(18); range site 1; woodland suitability group not assigned.

Auburn Series, Heavy Subsoil Variant

The Auburn series, heavy subsoil variant, consists of well-drained soils that are underlain at a depth of 8 to 27 inches by vertically tilted schists and slates of the Calaveras Formation. These soils are rolling to steep on foothills. Slopes are 9 to 50 percent. Elevations range from 1,000 feet to 1,700 feet. The average annual precipitation is 30 to 35 inches, average annual temperature is 59° F., and the frost-free season is 170 to 270 days. Vegetation is chamise brush and open areas of annual grass and oaks. Auburn soils, heavy subsoil variant, are associated principally with normal Auburn soils.

In a representative profile, the surface layer is light-brown, medium acid gravelly light clay loam about 4 inches thick. The subsoil is light yellowish-brown and pink, slightly acid cobbly and very cobbly clay loam about 23 inches thick. The parent material is slightly weathered Calaveras slate.

Auburn soils, heavy subsoil variant, are used for range and watershed.

Auburn cobbly clay loam, heavy subsoil variant, 9 to 50 percent slopes (AzE).—This soil is strongly sloping to steep.

Representative profile, 1.5 miles west of El Dorado, 0.3 mile west of U.S. Highway 50, and 0.1 mile east of the southwest corner of sec. 27, T. 10 N., R. 10 E.:

A1—0 to 4 inches, light-brown (7.5YR 6/4) gravelly light clay loam, reddish brown (5YR 4/4) when moist; massive; hard, friable, sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine tubular pores and few fine tubular pores; common thin clay films in pores and as bridges; medium acid; clear, smooth boundary.

B21t—4 to 13 inches, light reddish-brown (5YR 6/4) cobbly clay loam, yellowish red (5YR 4/6) when moist; massive; hard, friable, sticky and plastic; common very fine, fine, medium, and coarse roots; common very fine tubular pores and few fine tubular pores; many thin clay films in pores and as bridges; slightly acid; gradual, smooth boundary.

B22t—13 to 27 inches, pink (7.5YR 7/4) very cobbly clay loam, strong brown (7.5YR 5/6) when moist; massive; hard, friable, sticky and plastic; few fine roots and common medium roots; common very fine tubular pores and few fine tubular pores; many thin clay films in pores and as bridges; slightly acid; clear, irregular boundary.

R—27 inches, slightly weathered Calaveras slate.

Depth to parent material ranges from 8 to 27 inches. The A horizon ranges from light brown to yellowish red in color and from gravelly loam to gravelly light clay loam in texture. The thickness of the A horizon is 2 to 4 inches. The lower part of the B horizon is 50 to 80 percent fragments of slate that are 3 to 8 inches long. In many places the parent rock interrupts the B horizon.

Included in mapping are small areas of Auburn very rocky silt loam and Metamorphic rock land.

Permeability of this Auburn soil, heavy subsoil variant, is moderate. Surface runoff is medium to rapid, and the erosion hazard is moderate to high. The available water holding capacity is 1 to 3 inches. The effective rooting depth is 8 to 27 inches.

This soil is used for range and watershed. Capability unit VIIs–1(18); range site 1; woodland suitability group not assigned.

Boomer Series

The Boomer series consists of well-drained soils that are underlain by basic schists at a depth of 24 to 52 inches. These soils are undulating to very steep on uplands. Slopes are 3 to 70 percent. Elevations are 1,000 to 3,500 feet. The average annual precipitation is 35 to 50 inches, average annual temperature is 57° F., and the frost-free season is 170 to 270 days. Vegetation is mainly coniferous forest and annual grasses. Boomer soils are associated principally with Auburn and Sites soils.

In a representative profile, the surface layer is yellowish-red, medium acid gravelly loam about 13 inches thick. The subsoil is red, medium acid gravelly clay loam to very gravelly sandy clay loam about 39 inches thick. This is underlain by basic schist at a depth of about 52 inches.

Boomer soils are used for woodland and range.

Boomer very rocky loam, 30 to 50 percent slopes (BkE).—This soil is in the transition zone between areas of grass and oak trees and coniferous forest. Rock outcrops cover 5 to 25 percent of the surface.

Representative profile, 6 miles northwest of Coloma and 0.25 mile east of the west quarter corner of sec. 33, T. 12 N., R. 9 E.:

O1&O2—1 inch to 0, pine needles and decomposing litter.

A1—0 to 5 inches, yellowish-red (5YR 5/6) gravelly loam, dark reddish brown (5YR 3/4) when moist; moderate, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine roots; many very fine tubular pores; medium acid; clear, smooth boundary.

A3—5 to 13 inches, yellowish-red (5YR 5/6) gravelly loam, dark reddish brown (5YR 3/4) when moist; moderate, medium subangular blocky structure and weak, medium and fine, granular structure; slightly hard, friable, sticky and plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular and intersitial pores and few medium tubular pores; few thin clay films in pores; medium acid; clear, smooth boundary.

B21t—13 to 24 inches, red (2.5YR 4/6) gravelly clay loam, dark red (2.5YR 3/6) when moist; moderate, medium and fine, subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine, fine, medium, and coarse roots; many very fine tubular and interstitial pores and few fine tubular pores; many thin clay films in pores; medium acid; clear, smooth boundary.

B22t—24 to 37 inches, red (2.5YR 4/8) gravelly sandy clay loam, dark red (2.5YR 3/6) and yellowish red (5YR 4/6) when moist; moderate, medium and fine, subangular blocky structure; hard, firm, sticky and plastic; few fine, medium, and coarse roots; many very fine tubular and interstitial pores and few fine tubular pores; many thin clay films in pores; medium acid; gradual, smooth boundary.

B31t—37 to 52 inches, red (2.5YR 4/6) very gravelly sandy clay loam, red (2.5YR 4/6) and yellowish red (5YR 4/6) when moist; massive; hard, firm, sticky and plastic; very few fine, medium, and coarse roots; few fine pores; many thin clay films as bridges and coating gravel; medium acid; clear, slightly wavy boundary.

R—52 inches, well-fractured schist that has dark-red (2.5YR 3/6) sandy clay loam in cracks, variable dark red (2.5YR 3/6), yellowish red (5YR 4/6), and strong brown (7.5YR 5/6) when moist; firm, sticky and slightly plastic; many thin clay films as bridges and coats on gravel; medium acid.

As much as 35 percent of the soil mass consists of gravel- and cobblestone-sized rock fragments. The A horizon is 10 to 15 inches thick and is brown to yellowish red in color. The B horizon is reddish brown to red and is medium acid or slightly acid. Depth to rock is 24 to 52 inches.

Included in mapping are small areas of Auburn silt loam and Sites loam.

Permeability of this Boomer soil is moderately slow. Surface runoff is rapid, and the erosion hazard is high. The available water holding capacity is 4 to 7 inches. The effective rooting depth is 24 to 52 inches.

This soil is used for range and woodland. Capability unit VIs–1(22); range site 2; woodland suitability group 5.

Boomer gravelly loam, 3 to 15 percent slopes (BhC).—This soil is similar to Boomer very rocky loam, 30 to 50 percent slopes, except that less than 5 percent of the surface has exposed rock outcrops.

Included in mapping are small areas of Auburn silt loam, Argonaut gravelly loam, and Sobrante silt loam.

Surface runoff is medium, and the erosion hazard is slight to moderate.

This soil is used mainly for range and woodland. A few small areas are used for dryland or irrigated pasture, grain, and deciduous orchards. Capability unit IIIe–1(22); range site 2; woodland suitability group 4.

Boomer gravelly loam, 15 to 30 percent slopes (BhD).—This soil is similar to Boomer very rocky loam, 30 to 50 percent slopes, except that less than 5 percent of the surface has exposed rock outcrops.

Included in mapping are small areas of Auburn silt loam and Sobrante silt loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used mainly for range and woodland. A few areas are used for dryland and irrigated pasture and pear and apple orchards. Capability unit IVe–1(22); range site 2; woodland suitability group 4.

Boomer very rocky loam, 3 to 30 percent slopes (BkD).—This soil is similar to Boomer very rocky loam, 30 to 50 percent slopes, except that it is less sloping.

Included in mapping are small areas of Auburn very rocky silt loam, Argonaut very rocky loam, Sites very rocky loam, and Sobrante very rocky silt loam.

Surface runoff is medium, and the erosion hazard is slight to moderate.

This soil is used for range, irrigated or dryland pasture, and woodland. Capability unit VIs–1(22); range site 2; woodland suitability group 4.

Boomer very rocky loam, 50 to 70 percent slopes (BkF).—This soil is adjacent to the major drainageways, and depth to the parent rock ranges from 24 to 40 inches.

Included in mapping are small areas of Auburn very rocky silt loam, Sites very rocky loam, and Metamorphic rock land.

Surface runoff is rapid, and the erosion hazard is high. The available water holding capacity is 4 to 6 inches for the 24- to 40-inch rooting depth.

This soil is used for woodland, range, and watershed. Capability unit VIIs–1(22); range site 2; woodland suitability group 6.

Boomer-Sites loams, 9 to 15 percent slopes (BpC).—These soils are rolling on uplands at elevations of about 2,000 feet to 3,500 feet. Boomer loam makes up about 55 percent of the complex. Slopes are convex. About 35 percent of this complex is Sites loam, which occupies plane and slightly concave toe slopes. About 10 percent of the complex is included areas of Mariposa gravelly silt loam and Josephine silt loam. Small areas near the Kelsey Lumber Company have a surface layer of clay loam.

The profile of the Boomer soil is similar to the one described for Boomer very rocky loam, 30 to 50 percent slopes, and the profile of the Sites soil is similar to the one described for Sites loam, 15 to 30 percent slopes.

Surface runoff is medium, and the erosion hazard is slight to moderate.

Soils in this complex are used for woodland and deciduous orchards. Capability unit IIIe–1(22); range site not assigned; woodland suitability group 4.

Boomer-Sites loams, 15 to 30 percent slopes (BpD).—These soils have a profile similar to the one described as representative for their respective series, but they are strongly sloping. Boomer soils make up 55 percent and Sites soils make up 35 percent of this complex. Included areas of Mariposa and Josephine soils make up the remaining 10 percent.

Surface runoff is medium, and the erosion hazard is moderate.

Soils of this complex are used for woodland and deciduous orchards. Capability unit IVe–1(22); range site not assigned; woodland suitability group 5.

Boomer-Sites very rocky loams, 9 to 50 percent slopes (BrE).—These soils have slopes of 9 to 50 percent, and 5 to 25 percent of the surface has rock outcrops and slate fragments. Otherwise, they have profiles similar to those described as representative for their respective series. Boomer soils make up 55 percent and Sites soils make up 35 percent of this complex. About 10 percent of the complex is included areas of Mariposa very rocky silt loam, Josephine very rocky loam, and Josephine very rocky silt loam.

Soils of this complex are used for woodland. Capability unit VIs–1(22); range site not assigned; woodland suitability group 5.

Chaix Series

The Chaix series consists of well-drained soils that are underlain by weathered granitic rock at a depth of 24 to 40 inches. These soils are rolling to very steep on mountainous uplands. Slopes are 9 to 70 percent. Elevations range from 2,000 feet to 4,000 feet. The average annual precipitation, including snow, is 35 to 50 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods, and there are scattered areas of brush. Chaix soils are associated principally with Chawanakee, Holland, and Shaver soils.

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In a representative profile, the surface layer is dark grayish-brown, slightly acid coarse sandy loam about 8 inches thick. The subsoil and substratum are brown and pale-brown, medium acid coarse sandy loam about 26 inches thick. The parent material is weathered granodiorite rock and is at a depth of about 34 inches.

Chaix soils are used for woodland.

Chaix very rocky coarse sandy loam, 9 to 50 percent slopes (CcE).—This soil is strongly sloping to steeply sloping. Rock outcrops cover 5 to 25 percent of the surface.

Representative profile in a wooded area, 3 miles north of Aukum, 0.4 mile west and 0.1 mile south of the northeast corner of sec. 35, T. 9 N., R. 11 E.:

O1&O2—2 inches to 0, litter and duff.

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, medium, and coarse roots; many very fine and fine interstitial pores; slightly acid; clear, smooth boundary.

B2—8 to 18 inches, brown (10YR 5/3) coarse sandy loam, dark yellowish brown (10YR 3/4) when moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, medium, and coarse roots; many very fine and fine interstitial pores; medium acid; clear, smooth boundary.

C1—18 to 34 inches, pale-brown (10YR 6/3) coarse sandy loam, brown (10YR 4/3) when moist; massive; soft, friable, nonsticky and nonplastic; common fine and medium roots; many very fine and fine interstitial pores; medium acid; clear, smooth boundary.

C2—34 inches, weathered granodiorite.

The A horizon ranges from dark grayish brown or brown to light gray in color. Reaction is medium acid to slightly acid. Texture is coarse sandy loam to sandy loam. The total thickness of the A horizon is about 3 to 8 inches. The B horizon ranges from very pale brown to brown in color. Reaction is medium acid to strongly acid.

Included in mapping are small areas of Chawanakee very rocky coarse sandy loam, Ahwahnee very rocky coarse sandy loam, Hotaw very rocky coarse sandy loam, and Mariposa very rocky silt loam.

Permeability of this Chaix soil is moderately rapid. Surface runoff is medium to rapid, and the erosion hazard is high. The available water holding capacity is 3 to 5 inches. The effective rooting depth is 24 to 40 inches.

This soil is used mainly for woodland. Capability unit VIIs–1(22); range site not assigned; woodland suitability group 6.

Chaix very rocky coarse sandy loam, 50 to 70 percent slopes (CcF).—This soil is adjacent to major rivers and streams.

Included in mapping are a few areas of a soil similar to this Chaix soil that is more than 40 inches deep over granodiorite bedrock. Small areas of Acidic rock land, Holland very rocky coarse sandy loam, and Mariposa very rocky silt loam also are included.

Surface runoff is rapid, and the erosion hazard is very high.

This soil is used for woodland and watershed. Capability unit VIIs–1(22); range site not assigned; woodland suitability group 6.

Chawanakee Series

The Chawanakee series consists of excessively drained soils that are underlain by weathered granitic rock at a depth of 10 to 24 inches. These soils are rolling to steep on

uplands. Slopes are 9 to 50 percent. Elevations range from 1,200 feet to 2,400 feet. The average annual precipitation, including snow, is 25 to 40 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly mixed coniferous forest, brush, and grass. Chawanakee soils are associated principally with Auberry, Ahwahnee, Shaver, and Holland soils.

In a representative profile, the surface layer is grayish-brown, slightly acid coarse sandy loam about 3 inches thick. The next layer, about 13 inches thick, is pale-brown and light brownish-gray, slightly acid coarse sandy loam. Weathered granitic rock is at a depth of about 16 inches.

Chawanakee soils are used for woodland and watershed.

Chawanakee very rocky coarse sandy loam, 9 to 50 percent slopes (ChE).—This soil is strongly sloping to steep. It is adjacent to the major drainageways. Outcrops of bedrock cover 5 to 25 percent of the surface.

Representative profile, 1.5 miles south of Somerset, 100 feet west of Mt. Aukum road, ⅛ mile south and ⅛ mile east of the northwest corner of sec. 19, T. 9 N., R. 12 E.:

O1&O2—½ inch to 0, pine litter and duff.
A1—0 to 3 inches, grayish-brown (10YR 5/2) coarse sandy loam, dark brown (10YR 3/3, 4/3) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; slightly acid; clear, smooth boundary.
AC—3 to 9 inches, pale-brown (10YR 6/3) coarse sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine interstitial pores; slightly acid; clear, smooth boundary.
C1—9 to 16 inches, light brownish-gray (10YR 6/2) coarse sandy loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores; slightly acid; abrupt, irregular boundary.
C2—16 inches, decomposed granodiorite.

Depth to weathered granodiorite ranges from 10 to 24 inches. Reaction is slightly acid to medium acid. Thickness of the A horizon is 3 to 6 inches.

Included in mapping are small areas of Ahwahnee very rocky coarse sandy loam, Chaix very rocky coarse sandy loam, Acidic rock land, and Gullied land.

Permeability of this Chawanakee soil is moderately rapid. Surface runoff is medium to rapid, and the erosion hazard is moderate to high. The available water holding capacity is 1 to 3 inches. The effective rooting depth is 10 to 24 inches.

This soil is used for woodland and watershed. Capability unit VIIs-1(22); range site not assigned; woodland suitability group 7.

Cohasset Series

The Cohasset series consists of well-drained soils that are underlain by weathered andesitic conglomerate at a depth of more than 40 inches. These soils are gently sloping to strongly sloping on smooth ridges or are moderately steep to steep on sides of ridges. Slopes are 3 to 50 percent. Elevations range from 2,000 feet to 5,500 feet. The average annual precipitation, including snow, is 40 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods. Cohasset soils are associated principally with Aiken, McCarthy, Josephine, and Sites soils.

In a representative profile, the surface layer is brown and reddish-brown, slightly acid cobbly loam about 14 inches thick. The subsoil is reddish-brown and yellowish-red, medium acid cobbly heavy loam and cobbly clay loam about 32 inches thick. The parent rock is slightly weathered andesitic conglomerate, and it is at a depth of about 46 inches.

Cohasset soils are used for woodland and for deciduous fruit orchards.

Cohasset cobbly loam, 15 to 50 percent slopes (CoE).—This soil is strongly sloping to steep (fig. 4).

Representative profile, 0.5 mile north of Sly Park Guard Station and 0.7 mile northwest of intersection of Sly Park Road and Rainbow Trail (Sly Park Hills), 1,000 feet northeast of the west quarter corner of sec. 18, T. 10 N., R. 13 E.:

O1&O2—2 inches to 0, litter and duff.
A11—0 to 6 inches, brown (7.5YR 5/4, 4/4) cobbly loam, dark brown (7.5YR 3/2) when moist; moderate, fine, granular and subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

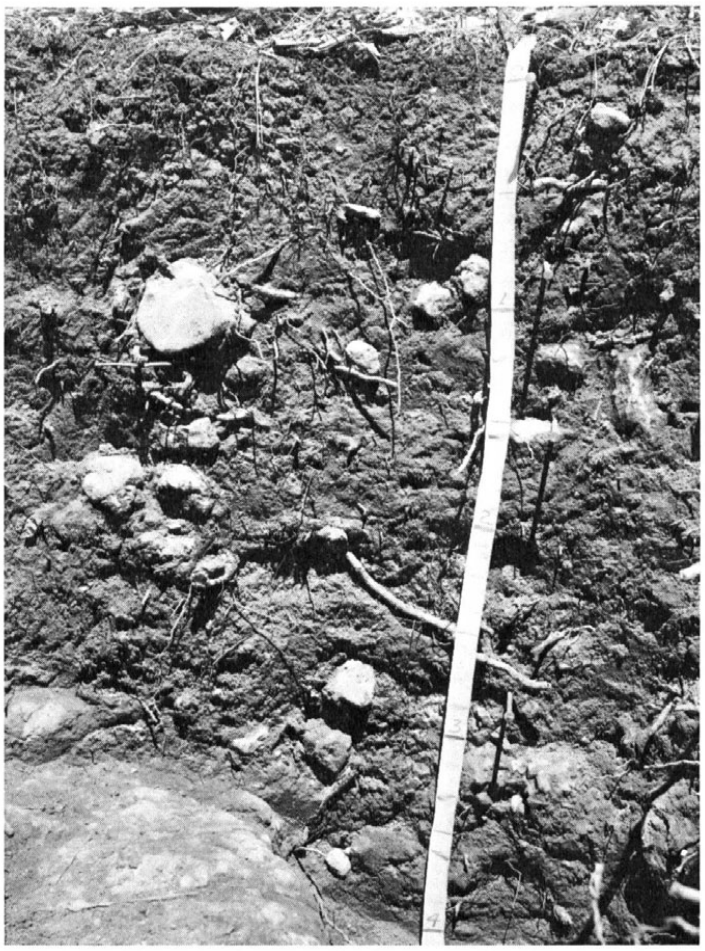

Figure 4.—**Profile of Cohasset cobbly loam, 15 to 50 percent slopes.**

A12—6 to 14 inches, reddish-brown (5YR 4/4) cobbly loam, dark reddish brown (5YR 3/4) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many very fine and fine tubular and interstitial pores; slightly acid; gradual, smooth boundary.

B1t—14 to 22 inches, reddish-brown (5YR 5/4) cobbly heavy loam, dark reddish brown (5YR 3/4) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many very fine and fine tubular and interstitial pores; few thin clay films in pores; medium acid; gradual, smooth boundary.

B2t—22 to 35 inches, yellowish-red (5YR 5/6) cobbly clay loam, dark reddish brown (5YR 3/4) when moist; massive; hard, slightly firm, sticky and plastic; many fine, medium, and coarse roots; common very fine and fine tubular and interstitial pores; many thin clay films in pores and as bridges; medium acid; gradual, smooth boundary.

B3t—35 to 46 inches, yellowish-red (5YR 5/6) cobbly heavy loam, reddish brown (5YR 4/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; common very fine and fine tubular and interstitial pores; common thin clay films in pores and as bridges; medium acid; clear, irregular boundary.

R—46 inches, slightly weathered andesitic conglomerate.

The A horizon is 10 to 30 percent cobblestones, and the B horizon is 20 to 35 percent cobblestones. The A horizon is slightly acid to medium acid in reaction. Total thickness of the A horizon is about 14 to 30 inches. The B horizon is medium acid to strongly acid and ranges from yellowish red to reddish yellow or reddish brown.

Included in mapping are small areas of Aiken cobbly loam, Crozier cobbly loam, McCarthy cobbly loam, Josephine very rocky silt loam, Sites very rocky loam, and Iron Mountain very rocky sandy loam.

Permeability of this Cohasset soil is moderate. Surface runoff is medium to rapid, and the erosion hazard is moderate to high. The available water holding capacity is 6 to 10 inches. The effective rooting depth is 40 inches to more than 60 inches.

This soil is used for woodland. Capability unit VIe–1 (22); range site not assigned; woodland suitability group 2.

Cohasset sandy loam, 15 to 30 percent slopes (CkD).—This soil is on Barney Ridge near Omo Ranch. It contains less than 5 percent cobblestones. The surface layer is dark grayish-brown to brown, medium acid sandy loam. The subsoil is reddish-brown heavy loam.

Included in mapping are small areas of Cohasset cobbly loam, Cohasset cobbly sandy loam, McCarthy cobbly loam, and Aiken loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for woodland. Capability unit IVe–1 (22); range site not assigned; woodland suitability group 2.

Cohasset cobbly sandy loam, 9 to 50 percent slopes (ClE).—This soil is on Barney Ridge near Omo Ranch. The surface layer is dark grayish-brown to brown, medium acid cobbly sandy loam. The subsoil is reddish-brown heavy loam.

Included in mapping are areas of Cohasset sandy loam, Cohasset cobbly loam, McCarthy cobbly loam, and Iron Mountain very rocky sandy loam.

Surface runoff is medium to rapid, and the erosion hazard is moderate to high.

The soil is used for woodland. Capability unit VIe–1 (22); range site not assigned; woodland suitability group 2.

Cohasset loam, 3 to 9 percent slopes (CmB).—This soil is similar to Cohasset cobbly loam, 15 to 50 percent slopes, except that it has less than 5 percent cobblestones in the profile.

Included in mapping are small areas of Aiken loam, Cohasset cobbly loam, Crozier cobbly loam, and McCarthy cobbly loam.

Surface runoff is slow to medium, and the erosion hazard is slight.

This soil is used for deciduous orchards and woodland. Capability unit IIe–1(22); range site not assigned; woodland suitability group 1.

Cohasset loam, 9 to 15 percent slopes (CmC).—This soil is similar to Cohasset cobbly loam, 15 to 50 percent slopes, except that it has less than 5 percent cobblestones, by volume, throughout the profile.

Included in mapping are small areas of Aiken loam, Cohasset cobbly loam, Crozier cobbly loam, Sites loam, and Josephine loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for deciduous orchards and woodland. Capability unit IIIe–1(22); range site not assigned; woodland suitability group 1.

Cohasset loam, 15 to 30 percent slopes (CmD).—This soil is similar to Cohasset cobbly loam, 15 to 50 percent slopes, except that it contains less than 5 percent cobblestones, by volume.

Included in mapping are small areas of Aiken loam, Cohasset cobbly loam, Crozier cobbly loam, McCarthy cobbly loam, Sites loam, and Josephine silt loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for deciduous orchards and woodland. Capability unit IVe–1(22); range site not assigned; woodland suitability group 2.

Cohasset cobbly loam, 3 to 15 percent slopes (CoC).—This soil is similar to Cohasset cobbly loam, 15 to 50 percent slopes, except that it has a surface layer that is 10 to 20 percent cobblestones and a subsoil that is 10 to 25 percent cobblestones.

Included in mapping are small areas of Aiken cobbly loam, Cohasset loam, Crozier cobbly loam, McCarthy cobbly loam, and Iron Mountain very rocky sandy loam.

Surface runoff is medium, and the erosion hazard is slight to moderate.

This soil is used mainly for woodland. Some areas are used for apple and pear orchards. Capability unit IIIe–1(22); range site not assigned; woodland suitability group 1.

Crozier Series

The Crozier series consists of well-drained soils that are underlain by andesitic conglomerate at a depth of 24 to 40 inches. These soils are strongly sloping on ridges and moderately steep and steep on sides of ridges. Slopes are 9 to 50 percent. Elevations are 2,000 to 5,500 feet. The average annual precipitation, including snow, is 40 to 60 inches, average annual temperature is 55° F., and the frost-free

season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods. Crozier soils are associated principally with Aiken, Cohasset, and McCarthy soils.

In a representative profile, the surface layer is brown and reddish-brown, slightly acid and medium acid cobbly loam about 16 inches thick. The subsoil is yellowish-red, medium acid and strongly acid cobbly heavy loam and cobbly clay loam about 20 inches thick. The parent material, at a depth of about 36 inches, consists of weathered andesitic breccia.

Crozier soils are used for woodland.

Crozier cobbly loam, 9 to 50 percent slopes (CrE).—This soil occupies andesitic ridges and their side slopes.

Representative profile in a wooded area, 4 miles southeast of Placerville and 0.25 mile south of the northeast corner of sec. 27, T. 10 N., R. 11 E.:

O1&O2—1 inch to 0, litter and duff.

A1—0 to 10 inches, brown (7.5YR 4/4) cobbly loam, dark reddish brown (5YR 3/3) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

A3—10 to 16 inches, reddish-brown (5YR 4/4) cobbly loam, dark reddish brown (5YR 3/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular and interstitial pores; medium acid; clear, smooth boundary.

B1t—16 to 23 inches, yellowish-red (5YR 4/6) cobbly heavy loam, dark reddish brown (5YR 3/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine and fine tubular and interstitial pores; common thin clay films in pores and as bridges; medium acid; gradual, smooth boundary.

B2t—23 to 36 inches, yellowish-red (5YR 4/6) cobbly clay loam, dark reddish brown (5YR 3/4) when moist; massive; hard, friable, sticky and plastic; many medium and coarse roots; many fine and medium tubular pores; many thin clay films in pores and as bridges; strongly acid; clear, wavy boundary.

R—36 inches, andesitic breccia, weathered in upper few inches.

The A horizon is 10 to 30 percent cobblestones, and the B horizon is 20 to 35 percent cobblestones. The total thickness of the A horizon is about 7 to 16 inches. The color of the B horizon ranges from yellowish red to reddish brown in a hue of 5YR.

Included in mapping are small areas of Cohasset cobbly loam, McCarthy cobbly loam, and Iron Mountain very rocky sandy loam.

Permeability of this Crozier soil is moderate. Surface runoff is medium to rapid, and the erosion hazard is moderate to high. The available water holding capacity is 3 to 6 inches. The effective rooting depth is 24 to 40 inches.

This soil is used mainly for woodland. Capability unit VIe–1(22); range site not assigned; woodland suitability group 5.

Delpiedra Series

The Delpiedra series consists of somewhat excessively drained soils that are underlain by hard serpentine rock at a depth of 10 to 24 inches. These soils are on foothills. Slopes are 3 to 50 percent. Elevations range from 500 to 1,800 feet. The average annual rainfall is 25 to 35 inches, average annual temperature is 60° F., and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses, forbs, brush, and Digger pine. Delpiedra soils are associated principally with Auburn and Rescue soils and Serpentine rock land.

In a representative profile, the surface layer is reddish-brown, slightly acid loam about 2 inches thick. The subsoil is reddish-brown and yellowish-red, slightly acid and neutral clay loam about 10 inches thick. The parent rock, at a depth of about 12 inches, is hard ultrabasic rock, mainly serpentine.

Delpiedra soils are used for annual range and watershed.

Delpiedra very rocky loam, 3 to 50 percent slopes (DeE).—This soil is gently sloping to steep. Outcrops of bedrock cover 5 to 25 percent of the surface.

Representative profile, 3 miles southwest of Lotus, on the right side of a dirt road, near the south sixteenth corner of the west section line of sec. 26, T. 11 N., R. 9 E.:

A1—0 to 2 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 2/2) when moist; weak, fine, granular structure and weak, fine, subangular blocky; slightly hard, friable, slightly plastic and nonsticky; many fine roots; slightly acid; abrupt, smooth boundary.

B21t—2 to 7 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (2.5YR 2/4) when moist; moderate, medium, subangular blocky structure; hard, firm, plastic and slightly sticky; few roots; many thin clay films in pores and on ped faces; slightly acid; gradual, smooth boundary.

B22t—7 to 12 inches, yellowish-red (5YR 4/6) clay loam, dark reddish brown (2.5YR 2/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, plastic and sticky; few roots; many thin clay films in pores and on ped faces; neutral; abrupt, wavy boundary.

C—12 inches, fractured, partly decomposed serpentine.

Depth to bedrock ranges from 10 to 24 inches. Total thickness of the A horizon is about 2 to 8 inches. The B horizon ranges from heavy loam to clay loam in texture.

Included in mapping are small areas of Auburn very rocky silt loam and Serpentine rock land.

Permeability of this Delpiedra soil is moderate. Surface runoff is medium to rapid, and the erosion hazard is slight to high. The available water holding capacity is 2 to 4 inches. The effective rooting depth is 10 to 24 inches.

This soil is used for range and watershed. Capability unit VIIs–1(18); range site 5; woodland suitability group not assigned.

Diamond Springs Series

The Diamond Springs series consists of well-drained soils that are underlain by fine-grained acid igneous rocks at a depth of 24 to 50 inches. These soils formed on mountainous uplands. Slopes are 3 to 50 percent. Elevations range from 1,200 to 2,000 feet. The average annual precipitation, including snow, is 30 to 40 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly grass and oak trees and coniferous forest. Diamond Springs soils are associated principally with Auberry, Auburn, and Boomer soils.

In a representative profile, the surface layer is pale brown and very pale brown, medium acid and very strongly acid very fine sandy loam and loam about 9 inches thick. The subsoil is very pale brown, very strongly acid clay loam about 19 inches thick. The substratum is white, very strongly acid clay loam and strongly acid coarse sandy clay

loam. The parent rock is fine-grained metamorphic acid igneous rock and is at a depth of about 40 inches.

Diamond Springs soils are used for deciduous orchards, woodland, and range.

Diamond Springs very fine sandy loam, 3 to 9 percent slopes (DfB).—This soil is moderately sloping.

Representative profile, 0.5 mile west of El Dorado, 75 feet east of Missouri Flat Road, 300 feet south of the railroad tracks, and 0.1 mile west and 0.15 mile south of the northeast corner of sec. 34, T. 10 N., R. 10 E.:

A11—0 to 3 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; medium acid; abrupt, slightly wavy boundary.

A12—3 to 9 inches, very pale brown (10YR 7/3) loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots, many medium roots, and few coarse roots; many very fine and fine tubular pores and common medium tubular pores; very strongly acid; few krotovinas; clear, slightly wavy boundary.

B1t—9 to 14 inches, very pale brown (10YR 8/4) light clay loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard, friable, sticky and plastic; common very fine and fine roots and many medium roots; many very fine and fine tubular pores and common medium tubular pores; common thin clay films in pores; very strongly acid; few krotovinas; clear, slightly wavy boundary.

B21t—14 to 20 inches, very pale brown (10YR 8/4, 7/4) clay loam, light yellowish brown (10YR 6/4) when moist; massive; hard, firm, sticky and plastic; few fine roots and common medium roots; many very fine and fine tubular pores and common medium tubular pores; many moderately thick clay films in pores and as bridges; very strongly acid; gradual, smooth boundary.

B22t—20 to 28 inches, very pale brown (10YR 8/4) clay loam, light yellowish brown (10YR 6/4) when moist; massive; very hard, firm, very sticky and plastic; few fine roots; common very fine pores and few fine pores; continous clay films, light brown (7.5YR 6/4) and reddish brown (5YR 4/4) to strong brown (7.5YR 5/6) when moist, moderately thick in pores and as bridges; very strongly acid; clear, wavy boundary.

C1—28 to 36 inches, white (10YR 8/2) clay loam, very pale brown (10YR 7/4) when moist; massive; very hard, firm, sticky and plastic; very few fine roots; common very fine and fine pores; many moderately thick clay films in pores and as bridges; very strongly acid; clear wavy boundary.

C2—36 to 40 inches, white (10YR 8/2) coarse sandy clay loam that has brownish-yellow (10YR 6/6) mineral grains, very pale brown (10YR 7/4) when moist; massive; very hard, firm, sticky and plastic; many moderately thick and thick clay films in fracture planes; strongly acid; clear, irregular boundary.

C3—40 inches, well-weathered metadacite with few clay films in rock fracture.

The A horizon is very pale brown to light brown very fine sandy loam to loam about 5 to 12 inches thick. The B horizon is very pale brown to yellowish-red and is strongly acid to very strongly acid. The texture of the B horizon ranges from sandy clay loam or clay loam to silty clay loam.

Included in mapping are small areas of Auberry coarse sandy loam and Boomer gravelly loam.

Permeability of this Diamond Springs soil is moderately slow. Surface runoff is medium, and the erosion hazard is slight to moderate. The available water holding capacity is 4 to 9 inches. The effective rooting depth is 24 to 50 inches.

This soil is used for pear and apple orchards, woodland, and limited range. Capability unit IIIe–1(22); range site not assigned; woodland suitability group 4.

Diamond Springs very fine sandy loam, 9 to 15 percent slopes (DfC).—This soil is similar to Diamond Springs very fine sandy loam, 3 to 9 percent slopes, except that it is more sloping.

Included in mapping are small areas of Auberry coarse sandy loam and Boomer gravelly loam.

The erosion hazard is moderate, and runoff is medium.

This soil is used for pear and apple orchards, woodland, and limited range. Capability unit IVe–1(22); range site not assigned; woodland suitability group 5.

Diamond Springs very fine sandy loam, 15 to 30 percent slopes (DfD).—This soil is similar to Diamond Springs very fine sandy loam, 3 to 9 percent slopes, except that it is more sloping.

Included in mapping are small areas of Auberry coarse sandy loam and Boomer gravelly loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for woodland and limited range. Capability unit VIe–1(22); range site not assigned; woodland suitability group 6.

Diamond Springs very rocky very fine sandy loam, 3 to 50 percent slopes (DgE).—This soil is similar to Diamond Springs very fine sandy loam, 3 to 9 percent slopes, except that 5 to 25 percent of the surface is rock outcrops.

Included in mapping are small areas of Auberry very rocky coarse sandy loam and Boomer very rocky loam.

Surface runoff is medium to rapid, and the erosion hazard is slight to high.

This soil is used for woodland and limited range. Capability unit VIs–1(22); range site not assigned; woodland suitability group 6.

Diamond Springs Series, Grayish Subsoil Variant

The Diamond Springs series, grayish subsoil variant, consists of well-drained soils that are underlain by weathered rhyolitic tuff at a depth of 36 to 60 inches. These soils are strongly sloping to steep on mountainous uplands. Slopes are 9 to 50 percent. Elevations are 2,000 feet to 4,000 feet. The average annual precipitation is 35 to 50 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods. Diamond Springs soils, grayish subsoil variant, are associated principally with Cohasset and McCarthy soils.

In a representative profile, the surface layer is grayish-brown, slightly acid gravelly sandy loam about 5 inches thick. The subsoil is light brownish-gray and light-gray, slightly acid and medium acid loam and gravelly loam about 33 inches thick. The substratum is light-gray, strongly acid gravelly sandy loam that grades to weathered rhyolitic tuff at a depth of 48 inches.

Diamond Springs soils, grayish subsoil variant, are used mainly for woodland.

Diamond Springs gravelly sandy loam, grayish subsoil variant, 30 to 50 percent slopes (DmE).—This soil has steep slopes and is on the sides of rhyolitic ridges.

Representative profile in a wooded area, 2 miles south of Camino, ¼ mile north of the Stark Grade Road, 1½ miles

east of the Newton Road intersection, and ⅛ mile northeast of the south quarter corner of sec. 15, T. 10 N., R. 12 E.:

O1&O2—1 inch to 0, pine litter and duff.
A1—0 to 5 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; strong, fine and medium, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots and common fine and medium roots; many very fine, fine, and medium interstitial pores; slightly acid; clear, smooth boundary.
B1—5 to 13 inches, light brownish-gray (10YR 6/2) loam, dark brown (10YR 4/3) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores and common fine tubular pores; slightly acid; gradual, smooth boundary.
B21—13 to 25 inches, light-gray (10YR 7/2) loam, dark brown and brown (10YR 3/3, 5/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores and common tubular pores; medium acid; gradual, smooth boundary.
B22—25 to 38 inches, light-gray (10YR 7/2) gravelly loam, brown (10YR 4/3, 5/3) when moist; weak, fine, subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores and common fine tubular pores; medium acid; clear, smooth boundary.
C1—38 to 48 inches, light-gray (10YR 7/1) gravelly sandy loam, light yellowish brown and brown (10YR 6/4, 5/3) when moist; massive; hard, friable, sticky and slightly plastic; few fine and medium roots; many medium and coarse interstitial pores; strongly acid; gradual, smooth boundary.
C2—48 inches, light-gray (10YR 7/1), weathered rhyolitic tuff that has some manganese stains (crushes to gravelly sandy loam), light brownish gray (2.5Y 6/2) when moist; few fine and medium roots in fracture planes; very strongly acid.

The color of the A horizon ranges from gray to grayish brown. The thickness of the A horizon is 5 to 8 inches. The B horizon is light gray to white and is medium acid to strongly acid.

Included in mapping are small areas of Acidic rock land, McCarthy cobbly loam, Cohasset cobbly loam, and a shallow soil similar to this Diamond Springs soil, grayish subsoil variant, that formed in rhyolitic tuff.

Permeability of this Diamond Springs soil, grayish subsoil variant, is moderate. Surface runoff is medium to rapid, and the erosion hazard is high. The available water-holding capacity is 4 to 8 inches. The effective rooting depth is 36 to 60 inches.

This soil is used mainly for woodland. Capability unit VIe-1(22); range site not assigned; woodland suitability group 2.

Diamond Springs gravelly sandy loam, grayish subsoil variant, 9 to 30 percent slopes (DmD).—This soil occupies side slopes of rhyolitic ridges.

Included in mapping are small areas of McCarthy cobbly loam, Cohasset cobbly loam, and a similar but shallow soil that formed in rhyolitic tuff.

Surface runoff is medium, and the erosion hazard is slight to moderate.

This soil is used for woodland. Capability unit IVe-1(22); range site not assigned; woodland suitability group 2.

Gullied Land

Gullied land (GuF) is steep to very steep and is on south-facing, granitic slopes that break into the Middle Fork of the Cosumnes River between Somerset and Coles Station. About 90 percent of the area has been cut by gullies and is severely eroded, and 10 percent is remnant pedestals of the original soils. This land type is associated with the Chawanakee, Shaver, Holland, and Musick soils. The erosion hazard is very high, and runoff is very rapid. The vegetation is dense stands of chamise, manzanita, and wedgeleaf ceanothus.

This land type is used for watershed and wildlife. It has no farming value. Capability unit VIIIs-1(18, 22); range site and woodland suitability group not assigned.

Holland Series

The Holland series consists of well-drained soils that are underlain by weathered granitic rocks at a depth of more than 40 inches. These soils are gently rolling to very steep on mountainous uplands. Slopes are 5 to 70 percent. Elevations range from 1,800 feet to 5,000 feet. The average annual precipitation, including snow, is 35 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods. Holland soils are associated principally with Aiken, Cohasset, Hotaw, Josephine, Musick, Shaver, and Sites soils.

In a representative profile, the surface layer is brown, medium acid coarse sandy loam and sandy loam about 21 inches thick. The subsoil is strong-brown, brown, and yellowish-brown, medium acid sandy clay loam about 24 inches thick. The substratum consists of pale-brown, medium acid coarse sandy loam underlain by slightly weathered granodiorite at a depth of about 59 inches.

Holland soils are used for woodland, pear and apple orchards, and, in a few areas, range.

Holland rocky coarse sandy loam, 5 to 15 percent slopes (HhC).—This soil is moderately sloping to strongly sloping. Rock outcrops cover 5 to 10 percent of the surface.

Representative profile, 1.25 miles northeast of Fair Play, 600 feet north of Slug Gulch Road, and 0.14 mile southwest of the center of sec. 27, T. 9 N., R. 12 E.:

A11—0 to 2 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) when moist; moderate, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores and few fine tubular pores; medium acid; clear, smooth boundary.
A12—2 to 10 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots and few fine and medium roots; many very fine tubular and interstitial pores and few fine tubular pores; medium acid; clear, smooth boundary.
A3—10 to 21 inches, brown (10YR 5/3) sandy loam, dark brown (7.5YR 3/4) when moist; massive; hard, very friable, slightly sticky and slightly plastic; common very fine roots and few fine and medium roots; many very fine tubular and interstitial pores; common fine tubular pores and few medium tubular pores; common thin clay films in pores and as bridges; medium acid; clear, slightly wavy boundary.
B21t—21 to 30 inches, strong-brown (7.5YR 5/6) sandy clay loam, dark brown (7.5YR 3/4) when moist; massive;

extremely hard, friable, sticky and slightly plastic; few very fine roots; common very fine and fine tubular pores; many thin clay films in pores and as bridges; medium acid; gradual, smooth boundary.

B22t—30 to 36 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; massive; extremely hard, firm, sticky and slightly plastic; very few very fine roots; common very fine tubular pores and few fine tubular pores; many thin clay films in pores and as bridges; medium acid; gradual, smooth boundary.

B3t—36 to 45 inches, yellowish-brown (10YR 5/4) sandy clay loam (near sandy loam), dark yellowish brown (10YR 4/4) when moist; massive; hard, firm, slightly sticky and slightly plastic; very few very fine roots; few very fine and fine tubular pores; common thin clay films in pores and as bridges; medium acid; clear, wavy boundary.

C1—45 to 59 inches, pale-brown (10YR 6/3) coarse sandy loam, brown (10YR 4/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; no roots observed; few thin clay films in pores; medium acid; abrupt, irregular boundary.

C2—59 inches, slightly weathered granodiorite.

A thin mantle of litter and duff is present in places. Depth to weathered bedrock ranges from 40 inches to more than 60 inches. The A horizon is brown to dark brown. The total thickness of the A1 horizon is 10 to 15 inches. The B2 horizon is heavy sandy loam to clay loam and is medium acid to strongly acid.

Included in mapping are small areas of Musick rocky sandy loam, Shaver rocky coarse sandy loam, and Josephine gravelly loam. Along the contacts between the granodiorite and slate, the parent material tends to weather to clay.

Permeability of this Holland soil is moderately slow. Surface runoff is medium, and the erosion hazard is moderate to high. The available water holding capacity is 5 to 8 inches. The effective rooting depth is 40 inches to more than 60 inches.

This soil is used for woodland, deciduous fruits and nuts, and, in a few areas, range. Capability unit IVe–7(22); range site not assigned; woodland suitability group 2.

Holland coarse sandy loam, 5 to 9 percent slopes (HgB).—This soil is similar to Holland rocky coarse sandy loam, 5 to 15 percent slopes, except that less than 5 percent of the surface is rock outcrops.

Included in mapping are small areas of Musick sandy loam, Shaver coarse sandy loam, Josephine gravelly loam, and Argonaut loam, seeped variant.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for deciduous fruits and nuts, woodland, and, in a few areas, range. Capability unit IIIe–1(22); range site not assigned; woodland suitability group 1.

Holland coarse sandy loam, 9 to 15 percent slopes (HgC).—This soil is similar to Holland rocky coarse sandy loam, 5 to 15 percent slopes, except that less than 5 percent of the surface is rock outcrops.

Included in mapping are small areas of Musick sandy loam, Shaver coarse sandy loam, and Josephine gravelly loam.

Surface runoff is medium, and the erosion hazard is moderate to high.

This soil is used for deciduous fruits and nuts, woodland, and, in a few areas, range. Capability unit IVe–1(22); range site not assigned; woodland suitability group 2.

Holland coarse sandy loam, 15 to 30 percent slopes (HgD).—This soil is similar to Holland rocky coarse sandy loam, 5 to 15 percent slopes, except that less than 5 percent of the surface is rock outcrops.

Included are small areas of Musick sandy loam, Shaver coarse sandy loam, and Josephine gravelly loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for woodland, pear and apple orchards, and nuts. Capability unit VIe–1(22); range site not assigned; woodland suitability group 3.

Holland very rocky coarse sandy loam, 15 to 50 percent slopes (HkE).—This soil is similar to Holland rocky coarse sandy loam, 5 to 15 percent slopes, except that 5 to 25 percent of the surface is rock outcrops.

Included in mapping are small areas of Hotaw very rocky coarse sandy loam, Musick very rocky sandy loam, Shaver very rocky coarse sandy loam, Josephine very rocky loam, and Chawanakee very rocky coarse sandy loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for woodland. Capability unit VIs–1(22); range site not assigned; woodland suitability group 3.

Holland very rocky coarse sandy loam, 50 to 70 percent slopes (HkF).—This soil is adjacent to major drainageways. It is similar to Holland rocky coarse sandy loam, 5 to 15 percent slopes, except that 5 to 25 percent of the surface is rock outcrops.

Included in mapping are small areas of Hotaw very rocky coarse sandy loam, Musick very rocky sandy loam, Shaver very rocky coarse sandy loam, Chawanakee very rocky coarse sandy loam, and Josephine very rocky loam.

Surface runoff is rapid, and the erosion hazard is high.

This soil is used for timber. Capability unit VIIs–1(22); range site not assigned; woodland suitability group 6.

Horseshoe Series

The Horseshoe series consists of well-drained soils that are underlain by alluvium from mixed sources. Slopes are 9 to 50 percent. Elevations range from 2,500 to 3,500 feet. The average annual precipitation, including snow, is 45 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods. Horseshoe soils are associated principally with Mariposa, Josephine, Cohasset, Aiken, and Sites soils.

In a representative profile, the surface layer is reddish-brown and yellowish-red, slightly acid and medium acid gravelly loam about 15 inches thick. The upper part of the subsoil is yellowish-red, strongly acid and very strongly acid gravelly heavy loam and gravelly clay loam about 35 inches thick. This is underlain by yellowish-red, very strongly acid very gravelly clay loam that extends to a depth of more than 60 inches.

Horseshoe soils are used mainly for woodland.

Horseshoe gravelly loam, 30 to 50 percent slopes (HsE).—This soil is on terrace remnants that break into the American River.

Representative profile in a wooded area, 8 miles east of Georgetown and 0.5 mile northeast of the east portal of

the new Georgetown ditch tunnel, near the east quarter corner of sec. 25, T. 13 N., R. 11 E.:

O1&O2—2 inches to 0, partially decomposed forest litter.
A1—0 to 3 inches, reddish-brown (5YR 5/4) gravelly loam, dark reddish brown (5YR 3/4) when moist; strong, very fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and few medium roots; many very fine pores; slightly acid; abrupt, smooth boundary.
A3—3 to 15 inches, yellowish-red (5YR 5/6) gravelly loam, dark red (2.5YR 3/6) when moist; moderate, very fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine roots; common fine roots and few medium and coarse roots; many very fine pores; medium acid; gradual, smooth boundary.
B1t—15 to 30 inches, yellowish-red (5YR 5/6) gravelly heavy loam, dark red (2.5YR 3/6) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots, few medium and coarse roots; many very fine pores; few thin clay films in pores; strongly acid; gradual, smooth boundary.
B2t—30 to 50 inches, yellowish-red (5YR 5/8) gravelly clay loam, yellowish red (5YR 4/8) when moist; massive; slightly hard, firm, slightly sticky and plastic; common very fine and fine roots and few medium and coarse roots; many very fine pores; thin, nearly continuous clay films in pores; very strongly acid; gradual, smooth boundary.
IIB3t—50 to 70 inches, yellowish-red (5YR 5/8) very gravelly clay loam, yellowish red (5YR 4/8) when moist; spotted with black stains; massive; hard, firm, slightly sticky and plastic; few roots; many very fine pores and few fine and medium pores; thin, nearly continuous clay films in pores; very strongly acid; clear, smooth boundary.
IIIC—70 to 72 inches, yellowish-red (5YR 5/8) gravelly heavy loam, yellowish red (5YR 4/8) when moist; massive; hard, firm, slightly sticky and slightly plastic; no roots; common very fine tubular pores; few thin clay films in pores; very strongly acid.

This soil formed in old river deposits, and in some places the parent material is stratified. The soil is 5 to 30 percent cobblestones and gravel, by volume. Total thickness of the A horizon is about 8 to 18 inches. Depth to the IIB3 horizon ranges from 50 inches to more than 60 inches.

Included in mapping are small areas of Mariposa very rocky silt loam and Josephine very rocky silt loam. Also included, along the American River, are some areas of soils that have slopes of 50 to 60 percent.

Permeability of this Horseshoe soil is moderate. Surface runoff is medium to rapid, and the erosion hazard is high. The available water holding capacity is 8 to 10 inches. The effective rooting depth is more than 60 inches.

This soil is used for woodland. Capability unit VIe–1(22); range site not assigned; woodland suitability group 2.

Horseshoe gravelly sandy loam, 9 to 15 percent slopes (HrC).—This soil is on terrace remnants. The surface layer is light grayish-brown gravelly sandy loam that ranges from 5 to 10 inches in thickness. The subsoil is medium acid to strongly acid sandy clay loam to gravelly clay loam.

Included in mapping are small areas of Mariposa gravelly loam, Josephine silt loam, and Cohasset cobbly loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used mainly for woodland. A few areas have been cleared and are used for pasture. Capability unit IVe–1(22); range site not assigned; woodland suitability group 1.

Hotaw Series

The Hotaw series consists of well-drained soils that are underlain by weathered granitic rocks at a depth of 24 to 40 inches. These soils are hilly to steep on uplands. Slopes are 15 to 50 percent. Elevations range from 1,800 feet to 5,000 feet. The average annual precipitation is 35 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is coniferous forest and associated hardwoods. Hotaw soils are associated principally with Holland, Musick, and Shaver soils.

In a representative profile, the surface layer is grayish-brown, slightly acid coarse sandy loam about 12 inches thick. The subsoil is pale-brown, medium and coarse sandy loam and light-brown, strongly acid sandy clay loam about 23 inches thick. This is underlain by weathered coarse-grained acid igneous rock, mainly granodiorite, at a depth of about 35 inches.

Hotaw soils are used for woodland.

Hotaw very rocky coarse sandy loam, 15 to 50 percent slopes (HtE).—This soil is moderately steep to steep. Outcrops of bedrock cover 5 to 25 percent of the surface.

Representative profile in a wooded area, 0.5 mile east of Aukum and 0.1 mile northeast of the southwest corner of sec. 12, T. 8 N., R. 11 E.:

O1&O2—1 inch to 0, litter and duff.
A1—0 to 12 inches, grayish-brown (10YR 5/2) coarse sandy loam, dark brown (10YR 3/3) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, wavy boundary.
B1t—12 to 22 inches, pale-brown (10YR 6/3) heavy coarse sandy loam, brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores; few thin clay films in pores; medium acid; clear, smooth boundary.
B2t—22 to 35 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and slightly plastic; many fine and medium roots; common very fine and fine tubular pores; many moderately thick clay films on ped faces, in pores, and as bridges; strongly acid; clear, wavy boundary.
C—35 inches, weathered granodiorite.

The A horizon ranges from brown to grayish brown in color and from slightly acid to medium acid in reaction. Total thickness of the A horizon is 8 to 12 inches. The B horizon ranges from pale brown to light brown or reddish brown.

Included in mapping are small areas of Holland very rocky coarse sandy loam, Chawanakee very rocky coarse sandy loam, Chaix very rocky coarse sandy loam, and Josephine very rocky silt loam.

Permeability of this Hotaw soil is moderately slow. Surface runoff is medium to rapid, and the erosion hazard is high. The available water holding capacity is 4 to 8 inches. The effective rooting depth is 24 to 40 inches.

This soil is used for woodland. Capability unit VIs–1(22); range site not assigned; woodland suitability group 6.

Iron Mountain Series

The Iron Mountain series consists of excessively drained soils that are underlain by hard volcanic rock at a depth

of 5 to 20 inches. These soils are undulating on ridgetops and steep on side slopes. Slopes are 3 to 50 percent. Elevations range from 2,000 feet to 5,000 feet. The average annual precipitation, including snow, is 35 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly stunted conifers, hardwoods, shrubs, and annual grasses. Iron Mountain soils are associated principally with Aiken, Cohasset, and McCarthy soils.

In a representative profile, the soil is dark-brown, medium acid cobbly sandy loam about 12 inches thick. This is underlain by hard volcanic breccia.

Iron Mountain soils are used for watershed and wildlife habitat.

Iron Mountain very rocky sandy loam, 3 to 50 percent slopes (ImE).—This soil is gently sloping to steeply sloping. Exposed lava cap covers 25 to 40 percent of the surface.

Representative profile, 1.5 miles west of Sly Park Dam and 1,000 feet south of the north quarter corner of sec. 13, T. 10 N., R. 12 E.:

A11—0 to 5 inches, dark-brown (10YR 4/3) cobbly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; many very fine and fine interstitial and tubular pores; medium acid; clear, wavy boundary.

A12—5 to 12 inches, dark-brown (10YR 4/3) cobbly sandy loam, dark brown (7.5YR 3/2) when moist; massive; soft, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine interstitial and tubular pores; medium acid; abrupt, smooth boundary.

R—12 inches, hard volcanic breccia.

Depth to bedrock ranges from 5 to 20 inches. The color of the A horizon ranges from dark grayish-brown to brown. Gravel, cobblestones, and stones make up 35 percent of the soil mass.

Included in mapping are small areas of McCarthy cobbly loam.

Permeability of this Iron Mountain soil is moderately rapid. Surface runoff is medium to rapid, and the erosion hazard is slight to high. The available water holding capacity is 0.5 to 2.0 inches. The effective rooting depth is 5 to 20 inches.

This soil is used for watershed and wildlife habitat. Capability unit VIIs–1(22); range site not assigned; woodland suitability group 7.

Josephine Series

The Josephine series consists of well-drained soils that are underlain by vertically tilted schists, slates, and contact metamorphic rocks at a depth of 40 to 60 inches. These soils are gently rolling to very steep on mountainous uplands. Slopes are 5 to 70 percent. Elevations range from 1,500 feet to 5,500 feet. The average annual precipitation, including snow, is 35 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods, and there are scattered areas of brush. Josephine soils are associated principally with Mariposa, Sites, Musick, Holland, and Cohasset soils.

In a representative profile, the surface layer is yellowish-brown and reddish-yellow, medium acid and strongly acid silt loam about 14 inches thick. The upper part of the subsoil is reddish-yellow, very strongly acid silty clay loam about 19 inches thick. The lower part of the subsoil is yellow, very strongly acid, very gravelly silt loam. This is underlain by slate at a depth of 50 inches.

Josephine soils are used mainly for woodland. A few areas are used for deciduous fruit orchards.

Josephine silt loam, 15 to 30 percent slopes (JtD).—This soil is moderately steep.

Representative profile, 2.5 miles south of the Georgetown Ranger Station, on the south side of Cove Hill Road, near the center of NE¼ sec. 18, T. 12 N., R. 11 E.:

O1&O2—1 inch to 0, duff and litter.

A1—0 to 4 inches, yellowish-brown (10YR 5/4) silt loam, brown (7.5YR 4/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; many very fine tubular and interstitial pores and common fine tubular and intersititial pores; medium acid; abrupt, smooth boundary.

A3—4 to 14 inches, reddish-yellow (7.5YR 6/6) silt loam, yellowish red (5YR 4/6) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine tubular and interstitial pores and common fine tubular and interstitial pores; strongly acid; clear, slightly wavy boundary.

B21t—14 to 24 inches, reddish-yellow (7.5YR 6/6) silty clay loam, yellowish red (5YR 4/8) when moist; weak, medium, subangular blocky structure that appears massive in places; slightly hard, firm, slightly sticky and plastic; common very fine, fine, and medium roots and few coarse roots; common very fine and fine tubular pores; many thin clay films on ped faces and in pores; very strongly acid; clear, smooth boundary.

B22t—24 to 33 inches, reddish-yellow (7.5YR 7/6) silty clay loam, yellowish red (5YR 5/6) when moist; weak, medium, subangular blocky structure that appears massive in places; hard, firm, slightly sticky and plastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; many thin clay films on ped faces and in pores; very strongly acid; gradual, smooth boundary.

B3t—33 to 50 inches, yellow (10YR 7/6) very gravelly silt loam, reddish yellow (7.5YR 6/8) when moist; massive; slightly hard, firm, slightly sticky and slightly plastic; very few very fine to medium roots; common very fine tubular pores, few thin clay films in pores; very strongly acid; abrupt, irregular boundary.

C—50 inches, light-gray (N 6/0), weathered, vertically tilted slate; strongly acid; some roots penetrate fractures.

Gravel and slate fragments make up less than 5 percent of the soil, by volume. The A horizon ranges from reddish-yellow and yellowish-brown to yellowish-red in color. Total thickness of the A horizon is 5 to 15 inches. The B horizon is reddish-yellow or yellowish-red to yellow and is medium acid to very strongly acid.

Included in mapping are small areas of Mariposa gravelly silt loam, Josephine gravelly loam, and Sites loam.

Permeability of this Josephine soil is moderate. Surface runoff is medium, and the erosion hazard is moderate. The available water holding capacity is 6 to 10 inches. The effective rooting depth is 40 to 60 inches.

This soil is used for woodland and deciduous orchards. Capability unit IVe–1(22); range site not assigned; woodland suitability group 2.

Josephine gravelly loam, 9 to 15 percent slopes (JrC).—This soil is similar to Josephine silt loam, 15 to 30 percent slopes, except that it is less sloping. Also, it has a surface layer of brown to reddish-brown, medium acid gravelly loam and a subsoil of red to reddish-brown, me-

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dium acid to strongly acid clay loam. The parent material is mica schist.

Included in mapping are small areas of Josephine silt loam, Sites loam, Mariposa gravelly silt loam, Musick sandy loam, and Holland coarse sandy loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for woodland and deciduous orchards. Capability unit IIIe–1 (22) ; range site not assigned; woodland suitability group 1.

Josephine gravelly loam, 15 to 30 percent slopes (JrD).—This soil is similar to Josephine silt loam, 15 to 30 percent slopes, except that it has a surface layer of brown to reddish-brown, medium acid gravelly loam and a subsoil of red to reddish-brown, medium acid clay loam.

Included in mapping are small areas of Josephine silt loam, Mariposa gravelly silt loam, Sites loam, Musick sandy loam, and Holland coarse sandy loam.

This soil is used for woodland and deciduous orchards. Capability unit IVe–1 (22) ; range site not assigned; woodland suitability group 2.

Josephine very rocky loam, 15 to 50 percent slopes (JsE).—This soil is similar to Josephine silt loam, 15 to 30 percent slopes, except that it has a surface layer of brown to reddish-brown, medium acid gravelly loam and a subsoil of red to reddish-brown, medium acid to strongly acid clay loam. The parent material is mica schist. About 5 to 25 percent of the surface is rock outcrops.

Included in mapping are small areas of Josephine very rocky silt loam, Mariposa very rocky silt loam, Sites very rocky loam, Musick very rocky sandy loam, and Holland very rocky coarse sandy loam.

Surface runoff is medium to rapid, and the erosion hazard is moderate to high.

This soil is used for woodland. Capability unit VIs–1 (22) ; range site not assigned; woodland suitability group 2.

Josephine silt loam, 5 to 15 percent slopes (JtC).—This soil is similar to Josephine silt loam, 15 to 30 percent slopes, except that it is less sloping.

Included in mapping are small areas of Mariposa gravelly silt loam, Josephine gravelly loam, and Sites loam.

Surface runoff is medium, and the erosion hazard is slight to moderate.

This soil is used for woodland and deciduous orchards. Capability unit IIIe–1 (22) ; range site not assigned; woodland suitability group 1.

Josephine silt loam, 30 to 50 percent slopes (JtE).—This soil is similar to Josephine silt loam, 15 to 30 percent slopes, except that it is more sloping.

Included in mapping are small areas of Mariposa very rocky silt loam, Josephine very rocky loam, and Sites loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This land is used for woodland. Capability unit VIe–1 (22) ; range site not assigned; woodland suitability group 2.

Josephine very rocky silt loam, 9 to 50 percent slopes (JuE).—This soil is similar to Josephine silt loam, 15 to 30 percent slopes, except that 5 to 25 percent of the surface is outcrops of bedrock.

Included in mapping are small areas of Mariposa very rocky silt loam, Josephine very rocky loam, and Sites very rocky loam.

Surface runoff is medium to rapid, and the erosion hazard is moderate to high.

This soil is used for woodland. Capability unit VIs–1 (22) ; range site not assigned; woodland suitability group 2.

Josephine very rocky silt loam, 50 to 70 percent slopes (JuF).—This soil is similar to Josephine silt loam, 15 to 30 percent slopes, except that 5 to 25 percent of the surface is rock outcrops.

Included in mapping are small areas of Mariposa very rocky silt loam, Josephine very rocky loam, Maymen very rocky loam, and Sites very rocky loam.

Surface runoff is rapid, and the erosion hazard is high.

This soil is used for woodland. Capability unit VIIs–1 (22) ; range site not assigned; woodland suitability group 3.

Josephine-Mariposa gravelly loams, 15 to 30 percent slopes (JvD).—These soils are hilly on uplands. Josephine gravelly loam makes up about 60 percent of this complex and is on plane and slightly concave side slopes; Mariposa gravelly loam makes up about 35 percent and is on ridges and sharp breaks; and Boomer gravelly loam and Sites loam make up about 5 percent. There are a few small areas of included soils that have slopes of 3 to 15 percent.

The profile of the Josephine soil is similar to the one described for Josephine gravelly loam, 15 to 30 percent slopes, and the profile of the Mariposa soil is similar to the one described for Mariposa very rocky silt loam, 3 to 50 percent slopes.

Surface runoff is medium, and the erosion hazard is moderate.

The soils of this complex are used for woodland and deciduous orchards. Capability unit IVe–1 (22) ; range site not assigned; woodland suitability group 2.

Loamy Alluvial Land

Loamy alluvial land (LoB) consists of small areas of recent alluvium that have slopes of 2 to 5 percent and are adjacent to stream channels. The alluvium is variable in color and is stratified sandy loam, loam, and clay loam that, in places, becomes gravelly as depth increases. The depth to underlying rock is more than 48 inches.

This land type is moderately well drained. Surface runoff is slow to medium, permeability is moderate to moderately slow, and the erosion hazard is slight. The available water holding capacity is 8 to 10 inches. This land type occasionally is flooded by overflowing streams.

Loamy alluvial land is suitable for irrigated pasture and deciduous orchards if it is protected from overflow. Capability unit IIe–1 (18, 22) ; range site not assigned; woodland suitability group 1.

Mariposa Series

The Mariposa series consists of well-drained soils that are underlain at a depth of 15 to 30 inches by vertically tilted schists and slate and contact metamorphic rock. These soils are sloping or rolling to very steep on mountainous uplands. Slopes are 3 to 70 percent. Elevations range from 1,500 feet to 5,000 feet. The average annual

precipitation, including snow, is 35 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly mixed coniferous forest and associated hardwoods and brush. Mariposa soils are associated principally with Josephine, Maymen, and Sites soils.

In a representative profile, the surface layer is pink, medium acid gravelly silt loam about 8 inches thick. The subsoil is reddish-yellow, medium acid and strongly acid gravelly silt loam about 18 inches thick. This is underlain by schists or slate at a depth of about 26 inches.

Mariposa soils are used mainly for woodland and watershed. Small areas are used for range or pasture.

Mariposa very rocky silt loam, 3 to 50 percent slopes (MbE).—This soil has south- and west-facing slopes along narrow ridgetops. Outcrops of bedrock cover 5 to 25 percent of the surface.

Representative profile, 0.75 mile southeast of Kelsey and 1,000 feet northeast of the center of sec. 24, T. 11 N., R. 10 E.:

O1&O2—1 inch to 0, pine needles, duff, and partially decomposed litter.

A1—0 to 8 inches, pink (7.5YR 7/4) gravelly silt loam, reddish brown (5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots and common fine and medium roots; many very fine pores and common fine pores; medium acid; clear, smooth boundary.

B1—8 to 15 inches, reddish-yellow (7.5YR 7/6) gravelly silt loam, yellowish red (5YR 4/6) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine pores, common fine pores, and few medium pores; few, thin, discontinuous clay films in pores; medium acid; clear, smooth boundary.

B2t—15 to 26 inches, reddish-yellow (7.5YR 6/6) gravelly heavy silt loam, yellowish red (5YR 4/6) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine pores and few fine pores; common, thin, continuous clay films, mainly in pores; strongly acid; abrupt, irregular boundary.

C&R—26 inches, yellow (10YR 7/6) weathered slate or schist, yellowish brown when moist; nearly vertically tilted cleavage planes.

The soil is 10 to 30 percent gravel-sized rock fragments, by volume. The soil colors are related to the bedding of the metamorphic rocks and commonly are variable within short horizontal distances. The A horizon is pink to brown in color, slightly acid to medium acid in reaction, and gravelly loam to gravelly silt loam in texture. The B horizon ranges from gravelly silt loam to gravelly clay loam.

Included in mapping are small areas of Josephine very rocky loam, Josephine very rocky silt loam, Sites very rocky loam, and Maymen very rocky loam.

Permeability of this Mariposa soil is moderate. Surface runoff is medium to rapid, and the erosion hazard is slight to high. The available water holding capacity is 2 to 4 inches. The effective rooting depth is 15 to 30 inches.

This soil is used for woodland. Capability unit VIs–1 (22); range site not assigned; woodland suitability group 5.

Mariposa gravelly silt loam, 3 to 30 percent slopes (MaD).—This soil is similar to Mariposa very rocky silt loam, 3 to 50 percent slopes, except that less than 5 percent of the surface has outcrops of bedrock.

Included in mapping are small areas of Josephine silt loam, Josephine gravelly loam, and Sites loam.

Surface runoff is medium, and the erosion hazard is slight to moderate.

This soil is used mainly for woodland. A few areas are used for range and irrigated pasture. Capability unit IVe–8(22); range site not assigned; woodland suitability group 5.

Mariposa very rocky silt loam, 50 to 70 percent slopes (MbF).—This soil is adjacent to the major rivers. In a few areas along the Middle Fork of the American River, slopes range up to 85 percent.

Included in mapping are small areas of Josephine very rocky silt loam, Josephine very rocky loam, Sites very rocky loam, Maymen very rocky loam, and Metamorphic rock land.

Surface runoff is rapid, and the erosion hazard is high.

This soil is used for woodland and watershed. Capability unit VIIs–1(22); range site not assigned; woodland suitability group 6.

Mariposa-Josephine very rocky loams, 15 to 50 percent slopes (McE).—These soils are hilly to steep on mountainous uplands. Mariposa very rocky loam makes up about 60 percent of this complex and occupies the ridges, the sharp breaks, and most of the south-facing and west-facing slopes. Josephine very rocky silt loam makes up about 35 percent and occupies concave slopes and most of the smoother north-facing and east-facing slopes. Inclusions of Sites very rocky loam make up about 5 percent.

The profile of the Mariposa soil is similar to the one described for Mariposa very rocky silt loam, 3 to 50 percent slopes, and the profile of the Josephine soil is similar to the one described for Josephine silt loam, 15 to 30 percent slopes.

Surface runoff is medium to rapid, and the erosion hazard is moderate to high.

These soils are used for woodland. Capability unit VIs–1(22); range site not assigned; woodland suitability group 5.

Mariposa-Josephine very rocky loams, 50 to 70 percent slopes (McF).—These soils are very steep on mountainous uplands. This complex is about 55 percent Mariposa very rocky loam; about 35 percent Josephine very rocky silt loam; and about 10 percent inclusions of Sites very rocky loam, Boomer very rocky loam, and Maymen very rocky loam.

Surface runoff is rapid, and the erosion hazard is high.

These soils are used for woodland and watershed. Capability unit VIIs–1(22); range site not assigned; woodland suitability group 6.

Maymen Series

The Maymen series consists of excessively drained soils that are underlain by vertically tilted schists and slates at a depth of 6 to 16 inches. These soils are hilly to very steep on mountainous uplands. Slopes are 15 to 70 percent. Elevations range from 2,000 feet to 4,000 feet. The average annual precipitation, including snow, is 35 to 50 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly brush, and there are scattered areas of stunted conifers and hardwoods. Maymen soils are associated principally with Mariposa and Josephine soils.

In a representative profile, the surface layer is brown, light yellowish-brown, and reddish-yellow, strongly acid and very strongly acid gravelly loam and gravelly silt loam. This is underlain at a depth of about 9 inches by hard, vertically tilted slate.

Maymen soils are used for watershed and wildlife habitat.

Maymen very rocky loam, 15 to 70 percent slopes (MfF).—This soil is moderately steep to very steep. Outcrops of bedrock cover 5 to 25 percent of the surface.

Representative profile, 2 miles north of Slate Mountain Lookout, 0.45 mile south and 0.3 mile west of the northeast corner of sec. 25, T. 12 N., R. 11 E.:

O1&O2—1 inch to 0, litter from manzanita.
A11—0 to ¼ inch, brown (10YR 5/3) gravelly loam, brown (7.5YR 4/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores and common fine tubular pores; strongly acid; abrupt, smooth boundary.
A12—¼ inch to 2 inches, light yellowish-brown (10YR 6/4) gravelly loam, strong brown (7.5YR 5/6) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; many very fine tubular pores and common fine tubular pores; very strongly acid; clear, smooth boundary.
A13—2 to 9 inches, reddish-yellow (7.5YR 6/6) gravelly silt loam, strong brown (7.5YR 5/6) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine and fine roots and few medium and coarse roots; many very fine tubular and interstitial pores; few clay films in pores; very strongly acid; abrupt, irregular boundary.
R—9 inches, hard slate.

The profile is brown, light yellowish brown, or reddish brown. The A horizon is strongly acid or very strongly acid gravelly loam or gravelly silt loam.

Included in mapping are small areas of Mariposa very rocky silt loam and Metamorphic rock land.

Permeability of this Maymen soil is moderate. Surface runoff is rapid, and the erosion hazard is high. The available water holding capacity is 1 to 2 inches. The effective rooting depth is 6 to 16 inches.

This soil is used for watershed. Capability unit VIIs–1(22); range site and woodland suitability group not assigned.

McCarthy Series

The McCarthy series consists of well-drained soils that are underlain by volcanic conglomerate and breccia at a depth of 24 to 40 inches. These soils are strongly sloping on ridges and are steep on side slopes. Slopes are 9 to 50 percent. Elevations range from 2,000 to 5,000 feet. Annual precipitation, including snow, is 35 to 60 inches, annual average temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods, and there are scattered areas of brush. McCarthy soils are associated principally with Cohasset, Aiken, and Iron Mountain soils.

In a representative profile, the surface layer is dark grayish-brown and brown, slightly acid cobbly loam about 10 inches thick. The subsoil is strong-brown, medium acid very cobbly loam about 28 inches thick. This is underlain by weathered andesitic conglomerate.

McCarthy soils are used for woodland.

McCarthy cobbly loam, 9 to 50 percent slopes (MhE).—This soil is on side slopes of andesitic ridges.

Representative profile, 1 mile west of Sly Park Dam and 0.25 mile north of the west quarter corner of sec. 18, T. 10 N., R. 13 E.:

O1&O2—3 inches to 0, litter and duff.
A11—0 to 3 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.
A12—3 to 10 inches, brown (7.5YR 5/4) cobbly loam, dark reddish brown (5YR 3/3) when moist; moderate fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.
B2—10 to 24 inches, strong-brown (7.5YR 5/6) very cobbly loam, reddish brown (5YR 4/4) when moist; weak, fine, subangular blocky structure and moderate, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; many fine roots and common coarse roots; many very fine and fine tubular and interstitial pores; medium acid; clear, wavy boundary.
B3—24 to 38 inches, strong-brown (7.5YR 5/6) very cobbly loam, yellowish red (5YR 4/6) when moist; massive; hard, slightly firm, slightly sticky and slightly plastic; common fine roots and many medium and coarse roots; common very fine and fine tubular and interstitial pores; medium acid; gradual, wavy boundary.
C2—38 inches, well-weathered andesitic conglomerate.

The profile is 10 to 50 percent cobblestones, and the weighted average is more than 35 percent. The A horizon is slightly acid to medium acid cobbly loam or cobbly sandy loam. The B horizon is medium acid to strongly acid very cobbly loam and very cobbly sandy loam.

Included in mapping are small areas of Iron Mountain very rocky sandy loam and Cohasset cobbly loam. In the Barney Ridge area are some areas of McCarthy soils that have a cobbly sandy loam surface layer. Slopes in places are as gentle as 5 percent and as steep as 60 percent.

Permeability of this McCarthy soil is moderate. Surface runoff is medium to rapid, and the erosion hazard is moderate to high. The available water holding capacity is 3 to 6 inches. The effective rooting depth is 24 to 40 inches.

This soil is used for woodland. Capability unit VIe–1(22); range site not assigned; woodland suitability group 5.

Metamorphic Rock Land

Metamorphic rock land (MmF) is in areas of highly resistant schist and slate formations. Rock outcrops and stones occupy from 50 to 90 percent of the surface, and the rest has a thin mantle of soil material. This land type is mainly steep to very steep and occupies areas that break into the major drainageways. At the lower elevations, it is associated with Auburn soils, and at higher elevations it is associated with Maymen and Mariposa soils.

This land type is excessively drained. Surface runoff is very rapid, and the erosion hazard is slight to moderate.

Metamorphic rock land is used for watershed and wildlife habitat. It has no farming value. Capability unit VIIIs–1(18, 22); range site and woodland suitability group not assigned.

Mixed Alluvial Land

Mixed alluvial land (MpB) consists of small areas of recent mixed alluvium adjacent to stream channels. This material is variable in color and is stratified gravelly sandy loam, gravelly loam, and gravelly clay loam that grades into sand and gravel as depth increases. The depth to unrelated underlying rock is more than 36 inches. Permeability is moderately rapid to slow. This land type is moderately well drained to somewhat poorly drained. Surface runoff is slow to medium, and the erosion hazard is moderate. The land is subject to frequent flooding in winter.

Mixed alluvial land is used for pasture and range. Capability unit IVw–2(18, 22); range site not assigned; woodland suitability group 5.

Musick Series

The Musick series consists of well-drained soils that are underlain by acid igneous rocks at a depth below 48 inches. These soils are gently rolling to steep on mountainous uplands. Slopes are 5 to 50 percent. Elevations range from 2,000 to 5,000 feet. The average annual precipitation, including snow, is 35 to 60 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods. Musick soils are associated principally with Holland, Shaver, Aiken, and Sites soils.

In a representative profile, the surface layer is brown, medium acid sandy loam about 12 inches thick. The subsoil is variegated reddish-brown, red, reddish-yellow, and light-red, strongly acid sandy clay loam, clay loam, and sandy clay about 44 inches thick. The substratum consists of variegated light-red, red, and reddish-yellow, very strongly acid heavy sandy loam.

Musick soils are used for woodland and deciduous orchards.

Musick sandy loam, 15 to 30 percent slopes (MrD).—This soil is moderately steep.

Representative profile, 5.5 miles southwest of Somerset, 50 feet south of old Caldor Railroad right-of-way, and 35 feet north of the west quarter corner of sec. 19, T. 9 N., R. 13 E.:

O1&O2—3 inches to 0, pine litter and duff.

A1—0 to 6 inches, brown (10YR 5/3) sandy loam, dark brown (7.5YR 3/3) when moist; moderate, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; medium acid; abrupt, slightly wavy boundary.

A3—6 to 12 inches, brown (7.5YR 5/4) heavy sandy loam, reddish brown (5YR 4/4) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and many medium and coarse roots; many very fine and fine tubular and interstitial pores; medium acid; clear, slightly wavy boundary.

B1t—12 to 18 inches, variegated reddish-brown and red (5YR 5/4, 2.5YR 5/6) light sandy clay loam, variegated yellowish red and red (5YR 4/6, 2.5YR 4/6) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and slightly plastic; common very fine and fine roots and many medium and coarse roots; many very fine and fine tubular and interstitial pores; common thin clay films as bridges and in pores; strongly acid; clear, smooth boundary.

B21t—18 to 28 inches, variegated red and reddish-yellow (2.5YR 5/8, 5YR 6/6) heavy clay loam near sandy clay, variegated red and yellowish red (2.5YR 4/6, 4/8; 5YR 5/6) when moist; weak, very coarse, prismatic structure; very hard, firm, sticky and plastic; common very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; many moderately thick clay films on ped faces, as bridges, and in pores; strongly acid; gradual, smooth boundary.

B22t—28 to 42 inches, variegated light-red and reddish-yellow (2.5YR 6/8, 5YR 6/8) light sandy clay, variegated red and reddish yellow (2.5YR 4/8, 5YR 6/8) when moist; weak, very coarse, prismatic structure; very hard, firm, sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular pores; many moderately thick clay films on ped faces, as bridges, and in pores; strongly acid; gradual, smooth boundary.

B3—42 to 56 inches, variegated light-red, red, and reddish-yellow (2.5YR 6/8, 2.5YR 5/8, 5YR 6/8) heavy sandy loam, variegated red, light red, and reddish yellow (2.5YR 5/8, 2.5YR 6/8, 5YR 6/8) when moist; massive; hard, firm, nonsticky and nonplastic; few fine and medium roots; many very fine and fine tubular and interstitial pores; common thin clay films as bridges and in pores; very strongly acid; gradual, wavy boundary.

C—56 to 60 inches, variegated reddish-yellow (5YR 6/8, 7/8) sandy loam, variegated reddish yellow and light red (5YR 6/8, 2.5YR 6/8) when moist; massive; hard, firm, slightly sticky and slightly plastic; few moderately thick clay films; very strongly acid.

The A horizon generally is sandy loam, but it is silt loam in few minor areas that are highly micaceous. Total thickness of the A horizon is 10 to 20 inches. The B horizon is massive or has weak, prismatic to subangular blocky structure. Granitic rock is at a depth of 48 inches to more than 60 inches.

Included in mapping are small areas of Holland coarse sandy loam, Shaver coarse sandy loam, and Josephine gravelly loam.

Permeability of this Musick soil is moderately slow. Surface runoff is medium to rapid, and the erosion hazard is high. The available water holding capacity is 7 to 10 inches. The effective rooting depth is 48 inches to more than 60 inches.

This soil is used for woodland and deciduous orchards. Capability unit VIe–1(22); range site not assigned; woodland suitability group 3.

Musick sandy loam, 9 to 15 percent slopes (MrC).—This soil is similar to Musick sandy loam, 15 to 30 percent slopes, except that it is less sloping.

Included in mapping are small areas of Holland coarse sandy loam, Shaver coarse sandy loam, Josephine gravelly loam, and Argonaut loam, seeped variant. Some toe slopes and swale areas have soils with slopes of 5 percent.

Surface runoff is medium, and the erosion hazard is moderate to high.

This soil is used for deciduous orchards and woodland. Capability unit IVe–1(22); range site not assigned; woodland suitability group 2.

Musick rocky sandy loam, 5 to 15 percent slopes (MsC).—This soil is similar to Musick sandy loam, 15 to 30 percent slopes, except that 5 to 10 percent of the surface is outcrops of bedrock.

Included in mapping are small areas of Holland coarse sandy loam and Shaver coarse sandy loam.

Surface runoff is medium, and the erosion hazard is moderate to high.

This soil is used for deciduous orchards and woodland. Capability unit IVe–7(22); range site not assigned; woodland suitability group 2.

Musick very rocky sandy loam, 15 to 50 percent slopes (MtE).—In areas of this soil, rock outcrops occupy from 5 to 25 percent of the surface.

Included in mapping are small areas of Holland very rocky coarse sandy loam, Shaver very rocky coarse sandy loam, Chaix very rocky coarse sandy loam, and Josephine very rocky loam. In addition, along the major rivers, there are a few areas of soils that have slopes of as much as 70 percent.

This soil is used for woodland. Capability unit VIs–1(22); range site not assigned; woodland suitability group 3.

Perkins Series

The Perkins series consists of well-drained soils that are undulating to hilly on remnants of terraces. These soils formed in material that washed from mixed sources, and they are underlain by weathered granodiorite. Slopes are 3 to 30 percent. Elevations range from 700 to 800 feet. The average annual rainfall is 25 to 30 inches, average annual temperature is 60° F., and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses and forbs, and there are scattered areas of oaks. Perkins soils are associated principally with Auberry and Boomer soils.

In a representative profile, the surface layer is brown, slightly acid gravelly loam and cobbly heavy loam about 13 inches thick. The subsoil is yellowish-red, red, and strong-brown, slightly acid and neutral cobbly clay loam and cobbly light clay about 35 inches thick. The substratum is weathered granodiorite.

Perkins soils are used for annual range.

Perkins gravelly loam, 3 to 30 percent slopes (PeD).—This soil is in the Coloma-Lotus area.

Representative profile, 4 miles west of Coloma, 0.6 mile north of Highway 49, and 0.1 mile north of the west quarter corner of sec. 2, T. 11 N., R. 9 E.:

A11—0 to 4 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/4) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

A12—4 to 13 inches, brown (7.5YR 5/4) cobbly heavy loam, dark brown (7.5YR 3/4) when moist; massive, hard, friable, sticky and slightly plastic; common very fine roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

B21t—13 to 35 inches, yellowish-red (5YR 5/6) cobbly clay loam, yellowish red (5YR 3/8) when moist; massive; very hard, slightly firm, sticky and plastic; common very fine roots; many fine interstitial and few fine tubular pores; many thin clay films in pores and as bridges; slightly acid; gradual, smooth boundary.

B22t—35 to 48 inches, variegated yellowish-red, red, and strong-brown (5YR 4/6, 2.5YR 4/6, 7.5YR 4/6) cobbly light clay, dark red and yellowish red (2.5YR 3/6, 5YR 4/6) when moist; massive; very hard, firm, sticky and plastic; very few roots; common fine interstitial pores; many moderately thick clay films in pores and as bridges; neutral.

C—48 inches, weathered granodiorite.

This soil in places lies on unconforming granodiorite rock that is at a depth ranging from 48 inches to more than 60 inches. Gravel and cobblestones make up 5 to 15 percent, by volume, of the A horizon and 20 to 25 percent, by volume, of the B horizon. The A horizon is brown to reddish brown and is massive or has granular structure. Total thickness of the A horizon is 10 to 15 inches.

Included in mapping are small areas of Auberry coarse sandy loam and Placer diggings.

Permeability of this Perkins soil is slow. Surface runoff is medium, and the erosion hazard is slight to moderate. The available water holding capacity is 6 to 9 inches. The effective rooting depth is 48 to 60 inches or more.

This soil is used for range. Capability unit IVe–3(18); range site 2; woodland suitability group not assigned.

Perkins Series, Moderately Deep Variant

The Perkins series, moderately deep variant, consists of moderately well drained soils that formed in medium-textured alluvium underlain by unrelated rock at a depth of 24 to 40 inches. These soils are nearly level to gently sloping on stream terraces. Slopes are 2 to 5 percent. Elevations range from 450 to 700 feet. The average annual rainfall is 23 to 25 inches, average annual temperature is 62° F., and the frost-free season is 170 to 270 days. Vegetation is annual grasses and forbs. Perkins soils, moderately deep variant, are associated principally with Auburn, Argonaut, and Whiterock soils.

In a representative profile, the surface layer is brown and reddish-brown, slightly acid gravelly loam and clay loam about 17 inches thick. The upper part of the subsoil is reddish-brown, slightly acid very gravelly sandy clay loam. At a depth of 33 inches, the subsoil is unrelated pale-olive, mildly alkaline sandy clay. Depth to unrelated rock is about 37 inches.

Perkins soils, moderately deep variant, are used mainly for range.

Perkins gravelly loam, moderately deep variant, 2 to 5 percent slopes (PgB).—This soil has gentle slopes (fig. 5).

Representative profile, 2 miles south of Clarksville, 0.25 mile west of Latrobe Road, and 0.25 mile west of the southeast corner of sec. 14, T. 9 N., R. 8 E.:

Ap—0 to 4 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/4) when moist; massive; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine and fine pores; slightly acid; abrupt, smooth boundary.

A1—4 to 12 inches, reddish-brown (5YR 4/4) gravelly heavy loam, dark reddish brown (5YR 3/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores and few fine and medium pores; slightly acid; clear, smooth boundary

A3—12 to 17 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores and few fine and medium pores; few thin clay films in pores; slightly acid; abrupt, smooth boundary.

B21t—17 to 25 inches, reddish-brown (5YR 5/4) very gravelly sandy clay loam, dark red (2.5YR 3/6) when moist; massive; hard, firm, slightly sticky and plastic; few very fine roots; common very fine pores; many moderately thick clay films as bridges and in pores; slightly acid; gradual, smooth boundary.

B22t—25 to 33 inches, reddish-brown (5YR 5/4) very gravelly sandy clay loam, reddish brown (5YR 4/4) when moist; massive; hard, firm, slightly sticky and plastic; very few very fine roots; common very fine pores; many moderately thick clay films as bridges and in pores; slightly acid; abrupt, wavy boundary.

IIB23—33 to 37 inches, pale-olive (5Y 6/3) sandy clay, olive (5Y 5/3) when moist; massive; very hard, very firm; clay films fill all voids; mildly alkaline; slightly effervescent; abrupt, wavy boundary.

Figure 5.—**Profile of Perkins gravelly loam, moderately deep variant, 2 to 5 percent slopes.**

IIR—37 inches, fractured hard greenstone.

Gravel and cobblestones are present throughout the profile and increase to make up 50 to 60 percent of the B horizon by volume. B2t horizon is reddish brown to yellowish red and generally lies abruptly on unrelated pale-olive soil material. The unrelated soil material generally has weathered to sandy clay or clay and contains some lime in places.

Included in mapping are small areas of Auburn silt loam, Argonaut gravelly loam, and Whiterock gravelly silt loam.

Permeability of this Perkins soil is moderately slow. Surface runoff is slow, and the erosion hazard is slight. The available water holding capacity is 4 to 6 inches. The effective rooting depth is 24 to 40 inches.

This soil is used for range. Capability unit IIIe–8(18); range site 2; woodland suitability group not assigned.

Placer Diggings

Placer diggings (PrD) consists of areas of stony, cobbly, and gravelly material, commonly in beds of creeks and other streams, or of areas that have been placer mined and contain enough fine sand or silt to support some grass for grazing. The material that makes up this land type is derived from a mixture of rocks and commonly is stratified or poorly sorted. In some areas where slopes are steep, the material consists of fines from stamp mills or tailings from placer mining. The depth of the soil material is variable, ranging from 6 inches to more than 5 feet. Areas in streambeds frequently are flooded during the rainy season. Natural drainage varies from place to place.

The vegetation is variable, but it generally consists of grass, browse, oak, and a few conifers. Alder, willow, cottonwood, or maple generally are along the edges of areas adjacent to streams.

This land type has some value for grazing and for wildlife habitat, and it provides watering places for livestock. Capability unit VIIs–1(18, 22); range site 6; woodland suitability group not assigned.

Rescue Series

The Rescue series consists of well-drained soils that are underlain by gabbrodiorite rocks at a depth of more than 40 inches. These soils are undulating to steep in the foothills. Slopes are 2 to 50 percent. Elevations range from 1,000 feet to 2,500 feet. The average annual rainfall is 25 to 35 inches, average annual temperature is 57° F., and the frost-free season is 170 to 270 days. Vegetation is mainly chamise, annual grasses, and scattered pines. Rescue soils are associated principally with Auburn, Argonaut, and Sobrante soils.

In a representative profile, the surface layer is reddish-brown, medium acid and slightly acid sandy loam about 10 inches thick. The subsoil is yellowish-red and reddish-yellow, slightly acid heavy sandy loam and sandy clay loam about 24 inches thick. The underlying material is reddish-yellow, slightly acid coarse sandy loam and very pale brown, slightly acid loamy coarse sand.

Rescue soils are used for annual range, perennial pasture, irrigated pasture, and forage crops.

Rescue sandy loam, 2 to 9 percent slopes (ReB).—This soil is moderately sloping.

Representative profile, 4 miles west of Rescue, on the east side of Deer Valley Road, near the center of the NE¼SE¼ sec. 19, T. 10 N., R. 9 E.:

A1—0 to 5 inches, reddish-brown (5YR 5/4) sandy loam, dark reddish brown (5YR 3/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine roots; many very fine tubular and interstitial pores and few fine tubular pores; medium acid; clear, smooth boundary.

A3—5 to 10 inches, reddish-brown (5YR 4/4) sandy loam, dark reddish brown (5YR 3/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine roots; many very fine tubular and interstitial pores and few fine tubular pores; few thin clay films in pores; slightly acid; clear, slightly wavy boundary.

B1t—10 to 14 inches, yellowish-red (5YR 4/6) heavy sandy loam, yellowish red (5YR 3/6) when moist; massive; hard, friable, sticky and plastic; common very fine and fine roots; common very fine tubular pores; many thin clay films in pores and as bridges; slightly acid; gradual, smooth boundary.

B2t—14 to 26 inches, yellowish-red (5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when moist; massive; extremely hard, firm, sticky and plastic; few fine, medium, and coarse roots; few very fine and fine tubular

pores; many moderately thick clay films in pores; slightly acid; gradual, smooth boundary.

B3t—26 to 34 inches, reddish-yellow (5YR 6/8) heavy sandy loam, variegated reddish brown and reddish yellow (5YR 4/4, 6/6) when moist; massive; extremely hard, firm, sticky and plastic; very few fine, medium, and coarse roots; few very fine tubular and interstitial pores; many thin clay films in pores and as bridges; slightly acid; clear, slightly wavy boundary.

C1—34 to 55 inches, reddish-yellow (5YR 7/8) coarse sandy loam, yellowish red (5YR 5/6) when moist; massive; very hard, firm, slightly sticky and slightly plastic; very few fine, medium, and coarse roots; few very fine tubular and interstitial pores; few thin clay films in pores and as bridges; slightly acid; clear, slightly wavy boundary.

C2—55 to 66 inches, very pale-brown (10YR 7/4) loamy coarse sand, strong brown (7.5YR 5/6) when moist; massive; slightly hard, firm, nonsticky and nonplastic; very few fine, medium, and coarse roots; few very fine tubular and interstitial pores; slightly acid; gradual, wavy boundary.

C3—66 inches, weathered gabbrodiorite.

Thickness of the A horizon ranges from 6 to 10 inches. The A horizon is reddish brown to yellowish red.

Included in mapping are small areas of Argonaut clay loam and Rescue clay, clayey variant.

Permeability of this Rescue soil is moderately slow. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The available water holding capacity is 4 to 7 inches. The effective rooting depth is 40 inches to more than 60 inches.

This soil is used for range, dryland pasture, irrigated pasture, and forage crops. Capability unit IIIe–1(18); range site 2; woodland suitability group not assigned.

Rescue sandy loam, 9 to 15 percent slopes (ReC).—This soil is similar to Rescue sandy loam, 2 to 9 percent slopes, except that it is more sloping.

Included in mapping are small areas of Argonaut clay loam.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for range and dryland pasture. Capability unit IVe–1(18); range site 2; woodland suitability group not assigned.

Rescue sandy loam, 15 to 30 percent slopes (ReD).—This soil is similar to Rescue sandy loam, 2 to 9 percent slopes, except that it is more sloping.

Included in mapping are small areas of Argonaut clay loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for range and pasture. Capability unit VIe–1(18); range site 2; woodland suitability group not assigned.

Rescue very stony sandy loam, 3 to 15 percent slopes (RfC).—This soil is similar to Rescue sandy loam, 2 to 9 percent slopes, except that 1 to 3 percent of the surface is covered with stones. Because the stones are small enough to be removed, this soil can be cultivated.

Included in mapping are small areas of Argonaut clay loam.

Surface runoff is slow to medium, and the erosion hazard is slight to moderate.

This soil is used for range and pasture. Most areas under brush cover are subject to slight erosion. Capability unit VIs–1(18); range site 2; woodland suitability group not assigned.

Rescue very stony sandy loam, 15 to 30 percent slopes (RfD).—This soil is similar to Rescue sandy loam, 2 to 15 percent slopes, except that 1 to 3 percent of the surface is covered with stones.

Included in mapping are small areas of Argonaut clay loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for range, pasture, and some woodland. Large areas are covered with chamise. Capability unit VIs–1(18); range site 2; woodland suitability group 5.

Rescue very stony sandy loam, 30 to 50 percent slopes (RfE).—This soil is similar to Rescue sandy loam, 2 to 9 percent slopes, except that 1 to 3 percent of the surface is covered with stones.

Included in mapping are small areas of Boomer very rocky loam.

Surface runoff is rapid, and the erosion hazard is high.

This soil is used for annual range and woodland. Large areas are covered by chamise brush. Capability unit VIIs–1(18); range site 2; woodland suitability group 5.

Rescue extremely stony sandy loam, 3 to 50 percent slopes, eroded (RgE2).—This soil has stones on 3 to 15 percent of its surface. The thickness of the surface layer is only 3 to 8 inches.

Included in mapping are small areas of Metamorphic rock land and Serpentine rock land.

Surface runoff is medium to rapid, and the erosion hazard is moderate to high.

This soil is used mainly for watershed. Almost all of it is covered with chamise brush. Capability unit VIIs–1(18); range site 2; woodland suitability group 5.

Rescue Series, Clayey Variant

The Rescue series, clayey variant, consists of poorly drained soils that are underlain by basic igneous rock at a depth of more than 40 inches. These soils are nearly level in wet drainageways and swales. Elevations are 500 to 1,500 feet. The average annual precipitation is 25 to 35 inches, average annual temperature is 59° F., and the frost-free season is 170 to 270 days. Vegetation consists of reeds, sedges, meadow grasses, and a few willows. Rescue soils, clayey variant, are associated principally with Auburn soils and normal Rescue soils.

In a representative profile, the surface layer is mottled, very dark gray and black, slightly acid and mildly alkaline clay about 23 inches thick. The upper part of the substratum is mottled, very dark grayish-brown, mildly alkaline clay about 13 inches thick. Below this, the substratum is mottled, dark grayish-brown, mildly alkaline clay loam that grades to weathered basic igneous rock at a depth of about 48 inches.

Rescue soils, clayey variant, are used for hay and irrigated pasture.

Rescue clay, clayey variant (Rk).—This soil has slopes of less than 2 percent.

Representative profile in native meadow, about 4.5 miles west of Rescue and 0.3 mile south and 0.3 mile west of the northeast corner of sec. 30, T. 10 N., R. 9 E.:

A11—0 to 15 inches, very dark gray (N 3/0) clay, black (N 2/0) when moist; strong, medium, angular blocky structure; very hard, firm, sticky and very plastic; many very fine roots and few medium roots; many

very fine and fine tubular and interstitial pores; many moderately thick organic films in pores and on ped faces; slightly acid; gradual, smooth boundary.

A12—15 to 23 inches, black (10YR 2/1) clay, black (10YR 2/1) when moist; common, medium, distinct, grayish-brown (10YR 5/2) mottles, very dark grayish-brown (10YR 3/2) when moist; massive; very hard, firm, sticky and very plastic; common very fine and fine roots and few medium roots; common fine tubular pores; many moderately thick organic films in pores; mildly alkaline; gradual, smooth boundary.

C1g—23 to 36 inches, very dark grayish-brown (2.5Y 3/2) clay, very dark grayish brown (2.5Y 3/2) when moist; common, medium, prominent, white (10YR 8/1) mottles, common, medium, distinct, and strong brown (7.5YR 5/6) when moist; massive; very hard, firm, sticky and very plastic; common very fine and fine roots and few medium roots; common very fine and fine tubular pores; common thin clay films in pores; mildly alkaline; diffuse, smooth boundary.

C2g—36 to 48 inches, dark grayish-brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) when moist; many, medium, distinct, brown (10YR 5/3) mottles, many, medium, prominent, and yellowish brown (10YR 5/6) when moist; massive; hard, firm, sticky and plastic; very few, very fine and fine, medium roots; many fine interstitial pores; mildly alkaline; gradual wavy boundary.

C3—48 inches, weathered basic igneous rock.

Depth to bedrock is more than 40 inches and generally is more than 48 inches. In places there is 2 to 4 inches of loamy overwash covering the clay surface layer. Total thickness of the A horizon is 10 to 25 inches. The C horizon is very dark grayish brown to dark gray and is neutral or mildly alkaline.

Included in mapping, about 1 mile west of Rescue, is a soil that is similar to this Rescue soil, clayey variant, except that the surface layer is dark reddish-brown clay loam, the subsoil is grayish-brown, mottled clay, and the soil is somewhat poorly drained. Also included are small areas of Rescue sandy loam, Auburn gravelly silt loam, Delpiedra very rocky loam, and Loamy alluvial land.

The water table fluctuates between depths of 18 and 36 inches from winter to early in summer. Most of the wetness is because of springs and seeps from higher lying, adjacent areas. This soil generally is channeled, but lateral movement of water into the channels is slow. Permeability is slow. Surface runoff is slow, and the erosion hazard is none to slight. The available water holding capacity is 6 to 10 inches. The effective rooting depth is 40 inches to more than 60 inches, although the fine texture and the height of the water table do not favor the development of an extensive root system below a depth of about 25 to 30 inches.

This soil is used for hay and irrigated pasture. Capability unit IIIw–5(18); range site and woodland suitability group not assigned.

Serpentine Rock Land

Serpentine rock land (SaF) is in areas of highly resistant serpentine and other ultrabasic rock formations. Rock outcrops and stones make up from 50 to 90 percent of the surface, and there is a thin mantle of soil. This land type is undulating to very steep. At lower elevations it is associated with Delpiedra soils.

Included with this miscellaneous land type, above an elevation of 1,000 feet, are small, scattered areas of a soil that has a surface layer of reddish-brown, slightly acid loam and a subsoil of reddish-brown and yellowish-red, neutral very gravelly heavy clay loam and clay. Depth to hard bedrock ranges from 10 to 24 inches.

This land type is excessively drained. Surface runoff is very rapid, and the erosion hazard is slight to moderate.

Serpentine rock land is used for watershed and wildlife habitat. It has no farming value. Capability unit VIIIs–1(18, 22); range site and woodland suitability group not assigned.

Shaver Series

The Shaver series consists of well-drained soils that are underlain by granitic rocks at a depth of more than 40 inches. These soils are gently rolling to steep on mountainous uplands. Slopes are 5 to 50 percent. Elevations range from 2,000 feet to 4,000 feet. The average annual precipitation, including snow, is 35 to 50 inches, average annual temperature is 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and associated hardwoods. Shaver soils are associated principally with Holland, Musick, and Chaix soils.

In a representative profile, the surface layer is dark grayish-brown, brown, and yellowish-brown, medium acid coarse sandy loam about 30 inches thick. The subsoil is yellowish-brown, medium acid coarse sandy loam. The parent rock, at a depth of about 51 inches, is well-weathered granodiorite.

Shaver soils are used mainly for woodland, deciduous fruits, and nuts. Some areas are used for range.

Shaver coarse sandy loam, 9 to 15 percent slopes (ShC).—This soil is strongly sloping.

Representative profile, 3 miles south of Somerset, 25 feet west of the Fair Play Road, and 0.3 mile northwest of the center of sec. 30, T. 9 N., R. 12 E.:

O1&O2—1½ inches to 0, litter and duff, mainly pine needles and oak leaves.

A11—0 to 6 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots and common fine roots; many very fine tubular and interstitial pores and common fine tubular and interstitial pores; medium acid; clear, smooth boundary.

A12—6 to 15 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) when moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; common very fine and fine tubular and interstitial pores; medium acid; gradual, smooth boundary.

A13—15 to 30 inches, yellowish-brown (10YR 5/4) coarse sandy loam, dark brown (10YR 3/3) when moist; massive; soft, friable, nonsticky and nonplastic; common fine and medium roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; medium acid; gradual, smooth boundary.

B2—30 to 51 inches, yellowish-brown (10YR 5/4) coarse sandy loam, brown (10YR 4/3) when moist; massive; soft, friable, nonsticky and nonplastic; common fine, medium, and coarse roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; medium acid; gradual, smooth boundary.

C—51 inches, well-weathered granodiorite.

Depth to weathered granodiorite is more than 40 inches. The texture of the A and B horizons ranges from coarse sandy loam to sandy loam. Total thickness of the A horizon is 20 to 30 inches. The B horizon is brown to yellowish brown.

Included in mapping are small areas of Holland coarse sandy loam, Musick sandy loam, and Shaver rocky coarse sandy loam.

478-431 O—74——5

Permeability of this Shaver soil is moderately rapid. Surface runoff is medium, and the erosion hazard is moderate to high. The available water holding capacity is 4 to 7 inches. The effective rooting depth is 40 inches to more than 60 inches.

This soil is used for deciduous fruits and nuts, range, and woodland. Capability unit IVe–1 (22); range site not assigned; woodland suitability group 2.

Shaver coarse sandy loam, 5 to 9 percent slopes (SbB).—This soil is similar to Shaver coarse sandy loam, 9 to 15 percent slopes, except that it is less sloping.

Included in mapping are small areas of Holland coarse sandy loam, Musick sandy loam, Shaver rocky coarse sandy loam, and Argonaut loam, seeped variant.

Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for deciduous fruits and nuts, woodland, and range. Capability unit IIIe–1 (22); range site not assigned; woodland suitability group 1.

Shaver coarse sandy loam, 15 to 30 percent slopes (SbD).—This soil is similar to Shaver coarse sandy loam, 9 to 15 percent slopes, except that it is more sloping.

Included in mapping are small areas of Holland coarse sandy loam, Musick sandy loam, and Chaix very rocky coarse sandy loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for woodland. Capability unit VIe–1 (22); range site not assigned; woodland suitability group 3.

Shaver rocky coarse sandy loam, 5 to 15 percent slopes (ScC).—This soil is similar to Shaver coarse sandy loam, 9 to 15 percent slopes, except that 5 to 10 percent of the surface is exposed outcrops of bedrock.

Included in mapping are small areas of Holland coarse sandy loam, Musick sandy loam, and Chaix very rocky coarse sandy loam.

This soil is used for woodland, deciduous fruits, nuts, and very limited range. Capability unit IVe–7 (22); range site not assigned; woodland suitability group 2.

Shaver very rocky coarse sandy loam, 15 to 50 percent slopes (SdE).—This soil is similar to Shaver coarse sandy loam, 9 to 15 percent slopes, except that 5 to 25 percent of the surface is exposed outcrops of bedrock.

Included in mapping are small areas of Holland very rocky coarse sandy loam, Musick very rocky sandy loam, Chaix very rocky coarse sandy loam, Ahwahnee very rocky coarse sandy loam, Mariposa very rocky loam, and Josephine very rocky loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for woodland. Capability unit VIs–1 (22); range site not assigned; woodland suitability group 3.

Sierra Series

The Sierra series consists of well-drained soils that are underlain by granitic rocks at a depth of 40 inches to more than 60 inches. These soils are gently rolling to steep on foothills. Slopes are 5 to 50 percent. Elevations range from 1,000 feet to 2,000 feet. The average annual rainfall is 30 to 35 inches, average annual temperature is 60° F., and the frost-free season is 170 to 270 days. Vegetation is annual grasses and forbs and scattered areas of hardwoods and conifers. Sierra soils are associated principally with Auberry, Ahwahnee, Holland, and Musick soils.

In a representative profile, the surface layer is brown, medium acid sandy loam about 7 inches thick. The subsoil is about 65 inches thick. In sequence from the top, the upper 15 inches is brown and yellowish-red, medium acid loam. The next 22 inches is yellowish-red and red, slightly acid clay loam. The next 14 inches is red, slightly acid sandy clay loam. The lower part is light-red, slightly acid sandy clay loam that extends to a depth of 72 inches.

Sierra soils are used for range, pasture, deciduous orchards, vineyards, and woodland.

Sierra sandy loam, 9 to 15 percent slopes, eroded (SfC2).—This soil is strongly sloping. Erosion has removed 3 to 7 inches of the surface layer (fig 6).

Representative profile, 3 miles west of Aukum and 0.2 mile east of the center of sec. 8, T. 8 N., R. 11 E.:

A1—0 to 7 inches, brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 3/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular and interstitial pores; medium acid; clear, smooth boundary.

B11t—7 to 13 inches, brown (7.5YR 5/4) loam, reddish brown (5YR 4/4) when moist; moderate, medium and coarse, subangular blocky structure; hard, firm, slightly sticky and plastic; many very fine and fine roots; many very fine and fine tubular pores and common medium tubular pores; common thin clay films on ped faces and in pores; medium acid; gradual, smooth boundary.

B12t—13 to 22 inches, yellowish-red (5YR 5/6) heavy loam, yellowish red (5YR 3/6) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine roots; many very fine and fine tubular pores and common medium tubular pores; common thin clay films on ped faces and in pores; medium acid; gradual, smooth boundary.

B21t—22 to 30 inches, yellowish-red (5YR 4/6) clay loam, dark red (2.5YR 3/6) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine roots; common very fine and fine medium tubular pores; many moderately thick clay films on ped faces and in pores; slightly acid; gradual, smooth boundary.

B22t——30 to 44 inches, red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, slightly sticky and plastic; few very fine and fine roots; common very fine, fine, and medium tubular pores; many moderately thick clay films on ped faces and in pores; slightly acid; gradual, smooth boundary.

B31t—44 to 58 inches, red (2.5YR 5/8) light sandy clay loam, red (2.5YR 4/8) when moist; massive; very hard, slightly firm, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular and interstitial pores; common thin clay films in pores and as bridges; slightly acid; gradual, smooth boundary.

B32—58 to 72 inches, light-red (2.5YR 6/8) light sandy clay loam, red (2.5YR 4/8) when moist; massive; very hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular and interstitial pores; common thin clay films in pores and as bridges; slightly acid; gradual, smooth boundary.

B33—72 to 80 inches, yellowish-red (5YR 5/8) light sandy clay loam, red (2.5YR 4/6) when moist; massive; hard, firm, slightly sticky and slightly plastic; no roots observed; common very fine and fine tubular and interstitial pores; common thin clay films in pores and as bridges; slightly acid.

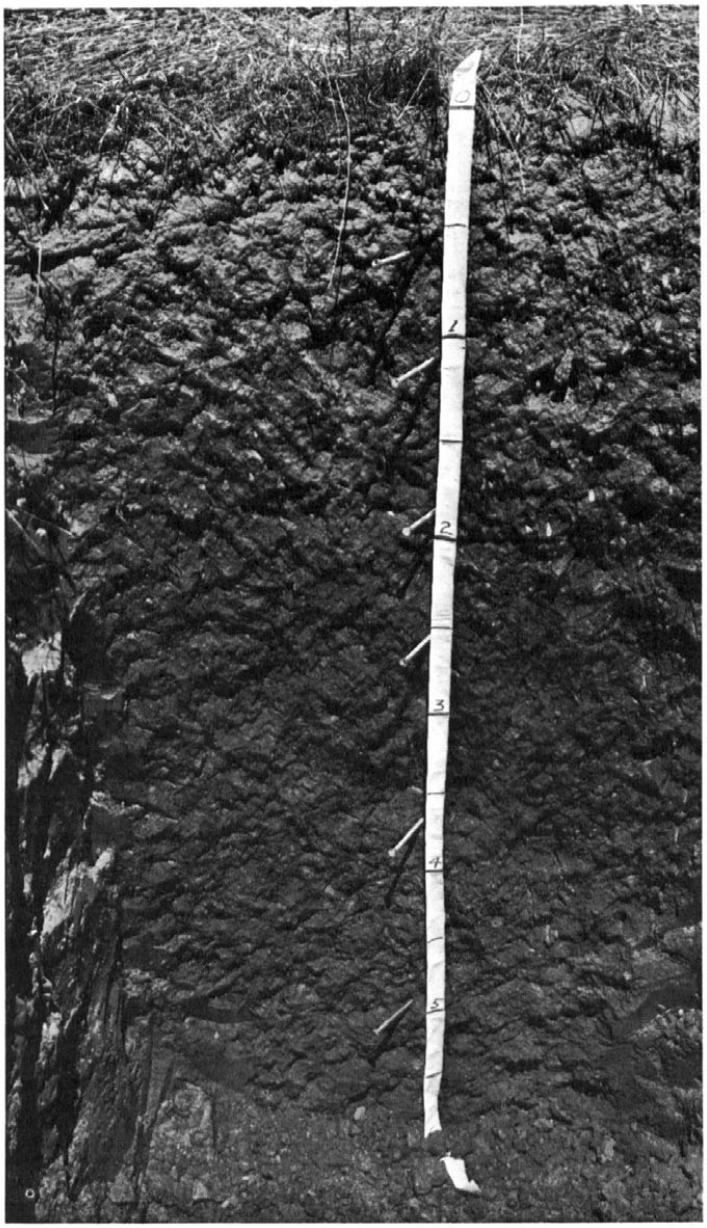

Figure 6.—**Profile of Sierra sandy loam, 9 to 15 percent slopes, eroded.**

Depth to weathered parent rock ranges from 40 inches to more than 60 inches. The A horizon averages from 6 to 9 inches in thickness and is brown to strong brown coarse sandy loam to light loam. The B2 horizon is massive or subangular blocky sandy clay loam to clay loam.

Included in mapping are small areas of Sierra sandy loam that has slopes of 3 to 9 percent, Auberry coarse sandy loam, Ahwahnee coarse sandy loam, Musick sandy loam, and Argonaut loam, seeped variant.

Permeability of this Sierra soil is moderately slow. Surface runoff is medium, and the erosion hazard is moderate. The available water holding capacity is 6 to 10 inches. The effective rooting depth is 40 inches to more than 60 inches.

This soil is used mainly for annual range. Small areas are used for deciduous orchards, vineyards, and irrigated pasture. Capability unit IVe–1(18); range site 3; woodland suitability group not assigned.

Sierra sandy loam, 15 to 30 percent slopes, eroded (SfD2).—This soil is similar to Sierra sand loam, 9 to 15 percent slopes, eroded, except that it is more sloping.

Included in mapping are small areas of Auberry coarse sandy loam, Ahwahnee very rocky coarse sandy loam, and Musick sandy loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used mainly for range. Some areas are used for deciduous orchards. Capability unit VIe–1(18); range site 3; woodland suitability group not assigned.

Sierra rocky sandy loam, 5 to 15 percent slopes (SgC).—This soil is similar to Sierra sandy loam, 9 to 15 percent slopes, eroded, except that outcrops of bedrock make up 5 to 10 percent of the surface area and the surface layer is 9 to 16 inches thick and is grayish brown to brown.

Included in mapping are small areas of Auberry coarse sandy loam, Ahwahnee very rocky coarse sandy loam, Musick rocky sandy loam, and Argonaut loam, seeped variant.

This soil is used for range. Capability unit IVe–7(18); range site 3; woodland suitability group not assigned.

Sierra very rocky sandy loam, 15 to 30 percent slopes (ShD).—This soil is similar to Sierra sandy loam, 9 to 15 percent slopes, eroded, except that the surface is 5 to 25 percent rock outcrops and the surface layer is 9 to 16 inches thick and is grayish-brown to brown.

Included in mapping are small areas of Ahwahnee very rocky coarse sandy loam, Auberry very rocky coarse sandy loam, Musick very rocky sandy loam, Holland very rocky coarse sandy loam, and Josephine very rocky silt loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for range and woodland. Capability unit VIs–1(18); range site 3; woodland suitability group 5.

Sierra very rocky sandy loam, 30 to 50 percent slopes (ShE).—This soil is similar to Sierra sandy loam, 9 to 15 percent slopes, eroded, except that the surface is 5 to 25 percent rock outcrops and the surface layer is 9 to 16 inches thick and is grayish-brown to brown.

Included in mapping are small areas of Auberry very rocky coarse sandy loam, Ahwahnee very rocky coarse sandy loam, Musick very rocky sandy loam, and Josephine very rocky silt loam.

Surface runoff is rapid, and the erosion hazard is very high.

This soil is used for range and woodland. Capability unit VIIs–1(18); range site 3; woodland suitability group 6.

Sites Series

The Sites series consists of well-drained soils that are underlain by vertically tilted metasedimentary and metabasic rocks at a depth of 40 inches to more than 60 inches. These soils are rolling to very steep on mountainous uplands. Slopes are 9 to 70 percent. Elevations range from 2,000 to 5,000 feet. The average annual precipitation, including snow, is 35 to 60 inches, average annual temperature is about 55° F., and the frost-free season is 140 to 240 days. Vegetation is mainly coniferous forest and asso-

ciated hardwoods. Sites soils are associated principally with Josephine, Mariposa, Aiken, and Musick soils.

In a representative profile, the surface layer is brown and reddish-brown, slightly acid and medium acid loam about 14 inches thick. The upper part of the subsoil is yellowish-red, medium acid clay loam, and red strongly acid clay about 39 inches thick. The lower part of the subsoil is light-red, very strongly acid clay loam that is underlain at a depth of 69 inches by weathered schist and slate.

Sites soils are used for woodland and for deciduous orchards.

Sites loam, 15 to 30 percent slopes (SkD).—This soil is moderately steep.

Representative profile, 5 miles east of Placerville, 1,000 feet north of Blakely Reservoir, and 1,000 feet northwest of the southeast corner of sec. 1, T. 10 N., R. 11 E. (fig. 7):

O1&O2—3 inches to 0, pine needles, duff, and partially decomposed litter.

A11—0 to 7 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 3/3) when moist; strong, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many fine and medium tubular and interstitial pores; slightly acid; clear, smooth boundary.

A12—7 to 14 inches, reddish-brown (5YR 5/4) loam, dark reddish brown (5YR 3/3) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and coarse roots; common very fine and fine tubular and interstitial pores and many medium tubular and interstitial pores; medium acid; clear, smooth boundary.

B1t—14 to 21 inches, yellowish-red (5YR 4/6) clay loam, reddish brown (5YR 4/4) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots and many medium and coarse roots; common very fine and medium tubular and interstitial pores; common thin clay films in pores and on ped faces; medium acid; clear, smooth boundary.

B21t—21 to 29 inches, red (2.5YR 5/6) clay, red (2.5YR 4/6) when moist; strong, medium and coarse, subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; common very fine and medium tubular and interstitial pores; many thin clay films in pores and on ped faces; strongly acid; gradual, smooth boundary.

B22t—29 to 53 inches, red (2.5YR 5/8) clay, red (2.5YR 4/8) when moist; strong, medium and coarse, angular and subangular blocky structure; hard, firm, sticky and plastic; few fine and common medium roots; common very fine and medium tubular pores; continuous, moderately thick clay films in pores and on ped faces; strongly acid; gradual, smooth boundary.

B3t—53 to 69 inches, light-red (2.5YR 6/8) clay loam, red (2.5YR 4/8) when moist; moderate, fine, subangular blocky structure; hard, friable, slightly sticky and plastic; common fine and medium roots; few fine tubular pores; many moderately thick clay films in pores and on ped faces; contains reddish-yellow (5YR 6/8), highly weathered parent material; very strongly acid; clear, irregular boundary.

R—69 inches, weathered schist and slate.

Depth to weathered slate and schist ranges from 40 inches to more than 60 inches. The A horizon ranges from 10 to 15 inches in thickness and from brown, reddish-brown, and yellowish-brown to red in color. It has granular or subangular blocky structure. The B2t horizon ranges from medium acid to very strongly acid and is silty clay, heavy clay loam, or clay.

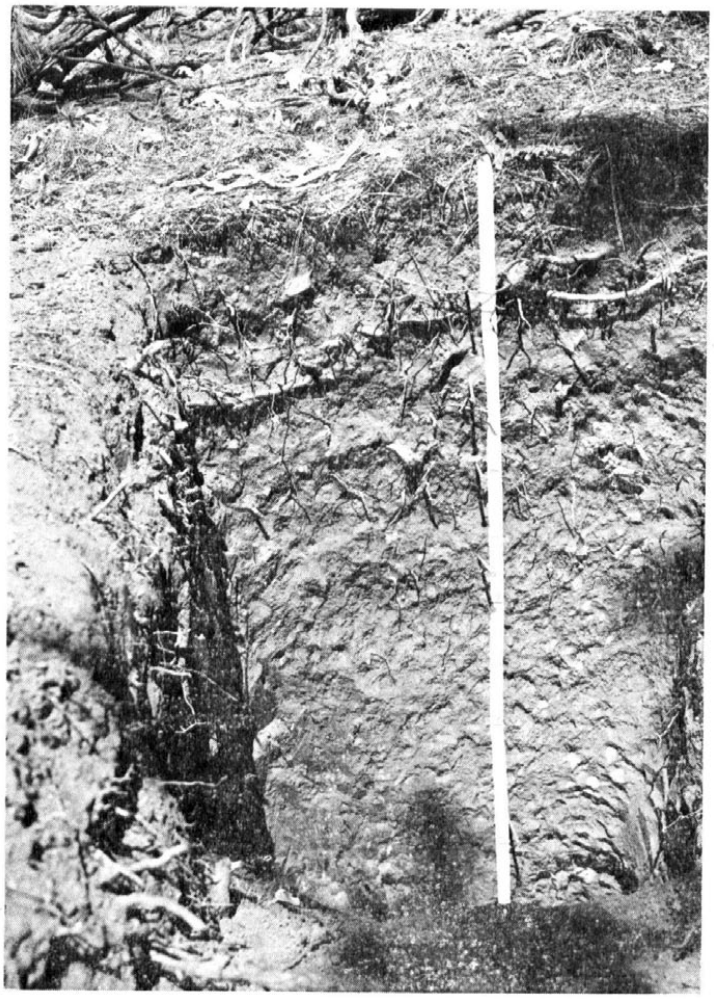

Figure 7.—**Profile of Sites loam, 15 to 30 percent slopes.**

Included in mapping are small areas of Mariposa gravelly silt loam, Josephine silt loam, Josephine gravelly loam, Aiken loam, and Boomer gravelly loam. Also included are small areas where depth to bedrock is 36 to 40 inches.

Permeability of this Sites soil is moderately slow. Surface runoff is medium, and the erosion hazard is moderate. The available water holding capacity is 5 to 10 inches. The effective rooting depth is 40 inches to more than 60 inches.

This soil is used for woodland and deciduous orchards. Capability unit IVe–1 (22); range site not assigned; woodland suitability group 2.

Sites loam, 9 to 15 percent slopes (SkC).—This soil is similar to Sites loam, 15 to 30 percent slopes, except that it is less sloping.

Included in mapping are small areas of Mariposa gravelly silt loam, Josephine silt loam, Josephine gravelly loam, Aiken loam, and Boomer gravelly loam.

Surface runoff is medium, and the erosion hazard is slight to moderate.

This soil is used for woodland and deciduous orchards. Capability unit IIIe–1 (22); range site not assigned; woodland suitability group 1.

Sites loam, 30 to 50 percent slopes (SkE).—This soil is similar to Sites loam, 15 to 30 percent slopes, except that it is more sloping.

Included in mapping are small areas of Boomer gravelly loam, Mariposa very rocky silt loam, Josephine silt loam, and Josephine gravelly loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for woodland. Capability unit VIe–1 (22); range site not assigned; woodland suitability group 2.

Sites stony loam, 30 to 50 percent slopes (SoE).—This soil has stones and coarse fragments that make up 15 to 35 percent, by volume, of the upper 30 inches of the profile. The profile, as a whole, is 10 to 20 percent stones. Depth to parent rock generally is more than 5 feet.

Included in mapping are small areas of Josephine silt loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for woodland. Capability unit VIe–1 (22); range site not assigned; woodland suitability group 2.

Sites very rocky loam, 15 to 50 percent slopes (SrE).—This soil is similar to Sites loam, 15 to 30 percent slopes, except that rock outcrops make up 5 to 25 percent of the surface area.

Included in mapping are small areas of Boomer very rocky loam, Mariposa very rocky silt loam, Josephine very rocky silt loam, and Josephine very rocky loam.

Surface runoff is medium to rapid, and the erosion hazard is moderate to high.

This soil is used for woodland. Capability unit VIs–1 (22); range site not assigned; woodland suitability group 2.

Sites very rocky loam, 50 to 70 percent slopes (SrF).—This soil is similar to Sites loam, 15 to 30 percent slopes, except that rock outcrops make up 5 to 25 percent of the surface area.

Included in mapping are small areas of Boomer very rocky loam, Mariposa very rocky silt loam, Josephine very rocky silt loam, and Josephine very rocky loam.

Surface runoff is rapid, and the erosion hazard is high.

This soil is used for woodland. Capability unit VIIs–1 (22); range site not assigned; woodland suitability group 3.

Sites clay loam, 9 to 15 percent slopes (SsC).—This soil is similar to Sites loam, 15 to 30 percent slopes, except it has a surface layer of clay loam about 12 inches thick.

Included in mapping were small areas of Josephine silt loam, Mariposa gravelly silt loam, and Sites loam.

Surface runoff is medium, and the erosion hazard is slight to moderate.

This soil is used for woodland and deciduous orchards. Capability unit IIIe–1(22); range site not assigned; woodland suitability group 4.

Sites clay loam, 15 to 30 percent slopes (SsD).—This soil is similar to Sites loam, 15 to 30 percent slopes, except that the surface layer is clay loam about 12 inches thick.

Included in mapping are small areas of Josephine silt loam and Mariposa gravelly silt loam.

This soil is used for woodland and deciduous orchards. Capability unit IVe–1(22); range site not assigned; woodland suitability group 5.

Sites clay loam, 30 to 50 percent slopes (SsE).—This soil is similar to Sites loam, 15 to 30 percent slopes, except that the surface layer is clay loam about 10 inches thick.

Included in mapping are small areas of Josephine silt loam, Sites loam, and Mariposa very rocky silt loam.

Surface runoff is medium to rapid, and the erosion hazard is high.

This soil is used for woodland. Capability unit VIe–1 (22); range site not assigned; woodland suitability group 5.

Sobrante Series

The Sobrante series consists of well-drained soils that are underlain by fine-grained metamorphic rocks at a depth of 22 to 36 inches. These soils are undulating to hilly and are in the foothills. Slopes are 3 to 30 percent. Elevations range from 800 to 1,800 feet. The average annual temperature is 60° F., average annual rainfall is 25 to 35 inches, and the frost-free season is 170 to 270 days. Vegetation is chiefly annual grasses and forbs, and there are scattered oaks. Sobrante soils are associated principally with Auburn, Argonaut, and Boomer soils.

In a representative profile, the surface layer is reddish-brown, medium acid silt loam about 5 inches thick. The subsoil is yellowish-red, slightly acid silt loam and light clay loam about 19 inches thick. The substratum is well-weathered basic schist about 6 inches thick. Bedrock is at a depth of 30 inches.

The Sobrante soils are used mainly for range. A few small areas are used for irrigated pasture and deciduous orchards.

Sobrante silt loam, 3 to 15 percent slopes (SuC).—This soil is gently sloping to strongly sloping (fig. 8).

Representative profile, 2½ miles south of Shingle Springs, 200 feet west of French Creek Road, and 200 feet south of the north quarter corner of sec. 19, T. 9 N., R. 10 E.:

A1—0 to 5 inches, reddish-brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/4) when moist; massive; slightly hard and hard, friable, slightly sticky and slightly plastic; many micro and very fine roots; common very fine, fine, and medium tubular and interstitial pores; medium acid; clear, smooth boundary.

B1—5 to 11 inches, yellowish-red (5YR 4/6) silt loam, yellowish red (5YR 3/6) when moist; weak, medium, subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine roots; many very fine and fine tubular pores; few thin clay films in pores; slightly acid; clear, smooth boundary.

B2t—11 to 24 inches, yellowish-red (5YR 5/6) light clay loam near silty clay loam, dark red (2.5YR 3/6) when moist; moderate, medium, subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine roots; common very fine tubular pores and many fine and medium tubular pores; many thin clay films in pores and on ped faces; slightly acid; clear, wavy boundary.

C—24 to 30 inches, soft, well-weathered basic schist; slightly acid.

R—30 inches hard basic schist; pockets of slightly weathered material.

The A horizon is reddish brown to strong brown, is slightly acid to medium acid, and ranges from 3 to 9 inches in thickness. The B horizon ranges from reddish brown to yellowish red and from silt loam and light clay loam to light silty clay loam.

Included in mapping are small areas of Auburn silt loam, Argonaut gravelly loam, and Boomer gravelly loam.

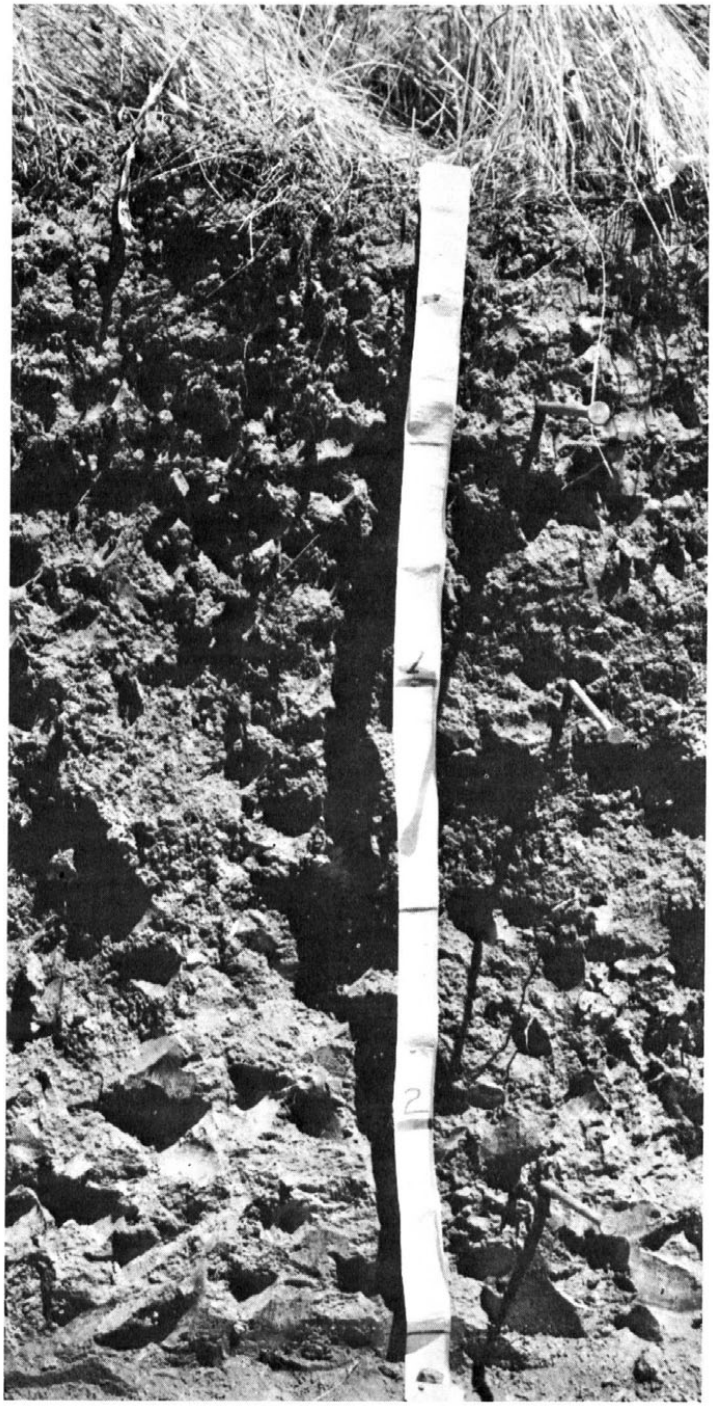

Figure 8.—Profile of Sobrante silt loam, 3 to 15 percent slopes.

Permeability of this Sobrante soil is moderate. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The available water holding capacity is 4 to 7 inches. Effective rooting depth is 22 to 36 inches.

This soil is used mainly for range. Small areas are used for pasture and deciduous orchards. Capability unit IIIe–8(18); range site 2; woodland suitability group not assigned.

Sobrante silt loam, 15 to 30 percent slopes (SuD).—This soil is similar to Sobrante silt loam, 3 to 15 percent slopes, except that it is more sloping.

Included in mapping are small areas of Auburn silt loam and Boomer gravelly loam.

The erosion hazard on this Sobrante soil is moderate. Surface runoff is medium.

This soil is used for range and for pasture. Capability unit IVe–8(18); range site 2; woodland suitability group not assigned.

Sobrante very rocky silt loam, 3 to 30 percent slopes (SwD).—This soil is similar to Sobrante silt loam, 3 to 15 percent slopes, except that it is more sloping and rock outcrops make up 5 to 25 percent of the surface area.

Included in mapping are small areas of Auburn very rocky silt loam, Argonaut very rocky loam, and Boomer very rocky loam.

This soil is used for range. Capability unit VIs–1(18); range site 2; woodland suitability group not assigned.

Tailings

Tailings (TaD) consists of cobbly and stony tailings from dredge mining and hydraulic mining and in hard-rock mine dumps. All the soil material either has been washed away, as in hydraulic mining, or has been buried, as in dredge mining or mine dumps. Surface runoff is slight, and the erosion hazard is none to slight.

This land type is used for watershed and wildlife habitat. It has no farming value. Capability unit VIIIs–1(18, 22); range site and woodland suitability group not assigned.

Wet Alluvial Land

Wet alluvial land (WaB) consists of small areas of recent alluvium adjacent to stream channels. The alluvium is stratified sandy loam, loam, and clay that generally become gravelly as depth increases. Depth to underlying rock is more than 48 inches.

This land type is somewhat poorly drained. The water table is at a depth of 2 to 3 feet in winter and spring but drops to a depth of 4 feet or more late in summer and in fall. Permeability is moderate to moderately slow. Surface runoff is slow, and the erosion hazard is slight. This land type occasionally is flooded. The available water holding capacity is 8 to 10 inches.

This land type is used for irrigated pasture and dryland pasture. Capability unit IIw–2(18, 22); range site and woodland suitability group not assigned.

Whiterock Series

The Whiterock series consists of excessively drained soils that are underlain by slate at a depth of 5 to 12 inches. These soils are undulating to steep on foothills. Slopes are 3 to 50 percent. Elevations range from 450 to 1,500 feet. The average annual rainfall is 23 to 30 inches, annual average temperature is 61° F., and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses, forbs, and a few areas of oak or brush. Whiterock soils are associated principally with Auburn, Argonaut, and Mariposa soils.

In a representative profile, the surface layer is pale-brown and white, medium acid and strongly acid gravelly silt loam about 5 inches thick. The next layer is white, strongly acid cobbly silt loam. This is underlain at a depth of 8 inches by hard slate.

Whiterock soils are used for range and watershed.

Whiterock gravelly silt loam, 3 to 50 percent slopes (WhE).—This soil is gently sloping to strongly sloping (fig. 9). As much as 2 percent of the surface is outcrops of slate.

Representative profile, 3 miles west of Latrobe, ⅛ mile east of the Sacramento County Line, and ⅛ mile south of Latrobe Road, near the west section line of sec. 19, T. 8 N., R. 9 E.:

A11—0 to 1 inch, pale-brown (10YR 6/3) gravelly silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; medium acid; abrupt, smooth boundary.

A12—1 to 5 inches, white (10YR 8/2) gravelly silt loam, brown (10YR 4/3) when moist; massive; hard, friable, nonsticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; strongly acid; clear, smooth boundary.

AC—5 to 8 inches, white (10YR 8/2) cobbly silt loam, brown (10YR 5/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; strongly acid; abrupt, wavy boundary.

R—8 inches, hard slate.

A few, thin, vertical slabs of outcropping bedrock are in most areas. Cobblestones make up 0 to 20 percent of the AC horizon.

Figure 9.—**Profile of Whiterock gravelly silt loam, 3 to 50 percent slopes.**

Included in mapping are small areas of Metamorphic rock land, Auburn silt loam, and Argonaut extremely stony loam. In some included areas along the Mother Lode belt, the surface layer is only slightly acid.

Permeability of this Whiterock soil is moderate. Surface runoff is medium to rapid, and the erosion hazard is slight to high. The available water holding capacity is 0.5 to 1.5 inches. The effective rooting depth is 5 to 12 inches.

This soil is used for range. Capability unit VIIs-1(18); range site 4; woodland suitability group not assigned.

Use and Management of the Soils

This section discusses use of the soils for crops and gives estimated yields and soil management practices. It also discusses use of the soils for range, woodland, wildlife habitat, and engineering.

Use of the Soils for Crops

The main crops that are grown in the survey area are discussed in the paragraphs that follow. Table 2 gives the acreage of fruit and nut crops. The statistics are for the year 1968 and are compiled from the El Dorado County Agricultural Commissioner's report.

TABLE 2.—*Acreage of fruit and nut crops*

Crop	Bearing	Nonbearing
Pears	2, 220	245
Apples	500	76
Walnuts	260	150
Cherries	66	15
Peaches	11	----
Plums	28	----
Grapes	10	8
Total	3, 095	494

Most of the commercial fruit and nut crops are grown under irrigation at elevations of less than 4,000 feet. Pears, apples, and walnuts are the main fruit and nut crops grown. Small acreages are used for cherries, peaches, plums, and grapes. Most walnuts are dryfarmed, but they need supplemental irrigation for establishment.

The pear industry was severely affected in 1959 by an insect-spread disease called pear decline. In 1958 there were 3,700 acres of bearing pears; by 1965, the acreage was reduced to about 2,000 acres. Improved management and resistant root stock have slowed pear decline, and at present there are about 2,200 acres in bearing pear trees and 245 acres in nonbearing pear trees.

Most of the areas west of State Highway 49 are used for pasture and range. There are about 5,240 acres of irrigated pasture. Most of the irrigated pasture is in small parcels. About 9,000 acres have been planted to perennial grasses and legumes.

Small, scattered acreages of barley, oats, milo, and sudan are grown. Most of these crops are used for hay and silage.

Most areas higher than 2,500 feet in elevation are used for woodland and are harvested for lumber. The acreage of commercial Christmas trees is increasing.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most common crops. The groups are made according to the limitations of the soils when used for common 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 horticultural crops or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the soils are grouped at three levels, the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in the El Dorado Area.)

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat. (None in the El Dorado 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 habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, clayey, or stony; and *c*, used in only some parts of the United States but not in the El Dorado Area, shows that the chief limitation is climate that is too cold or too dry.

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 in California in classes I through IV are given Arabic numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. Except for class I, the numerals used to designate units within the classes and subclasses are these:

0. A limitation caused by sand and gravel in the substratum. (Not used in the El Dorado Area.)
1. An actual or potential erosion hazard.
2. A limitation of wetness caused by poor drainage or flooding.
3. A limitation caused by slow to very slow permeability of the subsoil or substratum.
4. A limitation caused by coarse soil texture or excessive gravel. (Not used in the El Dorado Area.)
5. A limitation caused by a fine textured or very fine textured surface soil.
6. A limitation caused by salt or alkali. (Not used in the El Dorado Area.)
7. A limitation caused by cobblestones, stones, or rock outcrops.
8. A limitation caused by nearly impervious bedrock or hardpan that limits the effective rooting depth.
9. A limitation caused by low fertility or by toxicity. (Not used in the El Dorado Area.)

Soils in classes V through VIII are given the single, nonconnotative Arabic number 1. The management of soils in these classes when used for range or woodland is given in the sections "Use of the Soils for Range" and "Woodland Uses of the Soils," respectively.

Land resource areas

In the El Dorado Area, capability classification is further refined by designating the land resource area in which the soils in a unit occur. A land resource area is a broad geographic area that has a distinct combination of climate, soils, management needs, and cropping systems. The 48 conterminous States in the Nation have been divided into 156 land resource areas. Parts of two of these areas are in the El Dorado Area.

It is necessary to make assumptions that affect management in a land resource area if soils are to be placed consistently in capability units. In the paragraphs that follow, those land resource areas that have parts within the El Dorado Area are described so that local farming can be related to the resource areas. Following the description of each resource area is a list of those conditions typical of the area that guided placement of the soils in capability classes and units.

Land resource area 18.—This land resource area is in the lower and middle foothills of the Sierra Nevada. It is located in the western quarter of El Dorado County, extend-

ing from the Sacramento County line to near Placerville. The soils are rolling to very steep, and the area is dissected by rivers and streams that flow westerly into the Great Central Valley.

Elevations range from about 500 feet to about 2,500 feet. The average annual rainfall is 23 to 35 inches. The frost-free season is 170 to 270 days.

The major properties that limit use of soils in this resource area are steep slopes, shallowness to bedrock, coarse fragments in the profile, low available water holding capacity, and rock outcrops.

The soils in this land resource area are placed in capability units on the assumption that—

1. Irrigation water is available, or will be available when plans for future water development are realized. No attempt has been made to exclude tracts that might not be possible to irrigate because of location.
2. Rainfall is adequate for dryfarmed crops commonly grown in the area.
3. A moderately high level of management is used.
4. The major uses of soils in the area are for range, hay, irrigated pasture, dryland pasture, and deciduous fruits and nuts. Some vineyards are being introduced.

Land resource area 22.—This land resource area makes up part of the Sierra Nevada. It extends easterly from the eastern boundary of land resource area 18, near Placerville, to the eastern boundary of the El Dorado Area. It is characterized by hilly to very steep soils on mountainous uplands and by occasional, broad, tabular ridgetops and deeply entrenched rivers and streams. Elevations range from about 2,000 to 5,000 feet. The average annual precipitation is 35 to 60 inches, and a large part of its falls as snow. The frost-free season is 140 to 240 days.

The major properties that limit use of the soils in this resource area are low temperatures in winter, steep slopes, shallowness to bedrock, coarse fragments in the profile, low available water holding capacity, and rock outcrops.

The soils in this land resource area are placed in capability units on the assumption that—

1. Irrigation water is available, or will be available when plans for future water development are realized. No attempt has been made to exclude tracts of land that might not be possible to irrigate because of location.
2. A moderately high level of management is used.
3. The major uses of soils in the area are for woodland, deciduous fruits and nuts, and some irrigated pasture. Some vineyards are being introduced.

Management by capability units

In the following pages, the capability units in the El Dorado Area are described and suggestions for use and management of the soils are given. Soil series names are mentioned in each capability unit, but this does not mean that all mapping units of the series are in that particular unit. The soils in each unit are listed in the "Guide to Mapping Units" at the back of the survey.

In the following descriptions of the capability units, the available water holding capacity applies to the effective rooting zone, or the depth to which plant roots generally penetrate.

478-431 O—74——6

CAPABILITY UNIT IIe-1(18)

This unit consists only of Loamy alluvial land. This miscellaneous land type has slopes of 2 to 5 percent. Permeability is moderate to moderately slow, and drainage is moderately good. The effective rooting depth is about 48 inches. Available water holding capacity is 8 to 10 inches. Tillage is easy.

This land type is used for range, dryland pasture, and some alfalfa, irrigated pasture, and deciduous orchards. Crops respond well to applications of nitrogen and phosphorus fertilizers.

This land type generally is irrigated by sprinkler systems and, to a lesser extent, by the furrow method. Some surface smoothing can be done, but extensive leveling may expose unfavorable soil material. In places small levees or channel alinement may be required to prevent minor flooding.

CAPABILITY UNIT IIe-1(22)

This unit consists of well drained to moderately well drained soils that have slopes of 0 to 9 percent. These soils are in the Aiken and Cohasset series. Also in the unit is the land type Loamy alluvial land. Permeability of the subsoil is moderate. The effective rooting depth is 40 inches to more than 60 inches. Available water holding capacity is 6 to 10 inches. Runoff is slow to medium, and the erosion hazard is slight. The soils are easy to work.

These soils are used mainly for woodland. A few areas are used for apple and pear orchards. The soils are well suited to apple and pear orchards in areas where water is available for irrigation. Crops respond to applications of nitrogen and phosphorus fertilizers.

Irrigation should be done by sprinklers. Erosion can be controlled by tilling across the slope and by using cover crops in orchards during winter.

CAPABILITY UNIT IIw-2(18, 22)

This unit consists only of Wet alluvial land. This miscellaneous land type is more than 48 inches deep, is somewhat poorly drained, and has slopes of less than 6 percent. It is in narrow tracts on small, scattered alluvial fans and flood plains along streams. Permeability of the subsoil is moderate to moderately slow. Available water holding capacity is 8 to 10 inches. The water table is at a depth of 2 to 3 feet during winter and spring, but it is at a depth of 4 feet or more during summer. Some areas are subject to occasional flooding or overflow that generally is not damaging. These areas generally are channeled by streams.

This land type is used for range, irrigated pasture, and dryland pasture. Where it is protected from overflow, it can be used for deciduous fruits, mainly pears. Crops respond to applications of nitrogen and phosphorus fertilizers.

Care is required in irrigating to prevent raising the water table above its present level, particularly in areas where deeper rooted crops are grown. Crop residue should be disked into the soil to maintain good tilth. In places small levees or channel alinement may be required to help prevent minor flooding.

CAPABILITY UNIT IIIe-1(18)

This unit consists of well-drained soils that have slopes of 2 to 9 percent. These soils are in the Auberry and Rescue series. Permeability of the subsoil is moderate to moderately slow. Available water holding capacity is 4 to 9

inches. Runoff is medium, and the hazard of erosion is slight to moderate. The soils are easy to work.

These soils are used for range and for some pear and apple orchards. A few areas are used for vineyards, dryland pasture, irrigated pasture, or forage crops (fig. 10). Crops respond to applications of nitrogen and phosphorus fertilizers.

Irrigation water should be applied by sprinklers or furrows on the contour. Cover crops help to control erosion during the rainy season. Orchards should be planted across the slope. Adequate outlets are needed safely to dispose of runoff water.

CAPABILITY UNIT IIIe-1(22)

This unit consists of well-drained soils that have slopes of 3 to 15 percent. These soils are in the Aiken, Boomer, Cohasset, Diamond Springs, Holland, Josephine, Shaver, and Sites series. Permeability of the subsoil is moderately rapid to moderately slow. The effective rooting depth is 24 inches to more than 60 inches. Available water holding capacity is 4 to 10 inches. Runoff is slow to medium, and the erosion hazard is slight to moderate. Except for Cohasset cobbly loam, 3 to 15 percent slopes, the soils are easy to work.

These soils are used mainly for woodland. A few areas are used for range, pears, apples, and nuts. In areas where irrigation water is available, these soils are suited to pears, apples, walnuts, vineyards, and pasture. Crops respond to applications of nitrogen and phosphorus fertilizers.

Irrigation water should be applied by sprinklers. Tillage should be across the slopes. Growing cover crops in orchards and vineyards in rainy seasons helps to control erosion. Residue from cover crops should be returned to the soil. Cultivation should be limited to the control of weeds.

CAPABILITY UNIT IIIe-8(18)

This unit consists of moderately well drained and well drained soils that have slopes of 2 to 15 percent. These soils are in the Perkins series, moderately deep variant, and the Sobrante series. Permeability in the subsoil is moderately slow to moderate. The effective rooting depth is 22 to 40 inches. Available water holding capacity is 4 to 7 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. These soils are easy to work.

These soils are used for range, dryland and irrigated pasture, fruit trees, and some forage crops. Crops respond to applications of nitrogen and phosphorus fertilizers.

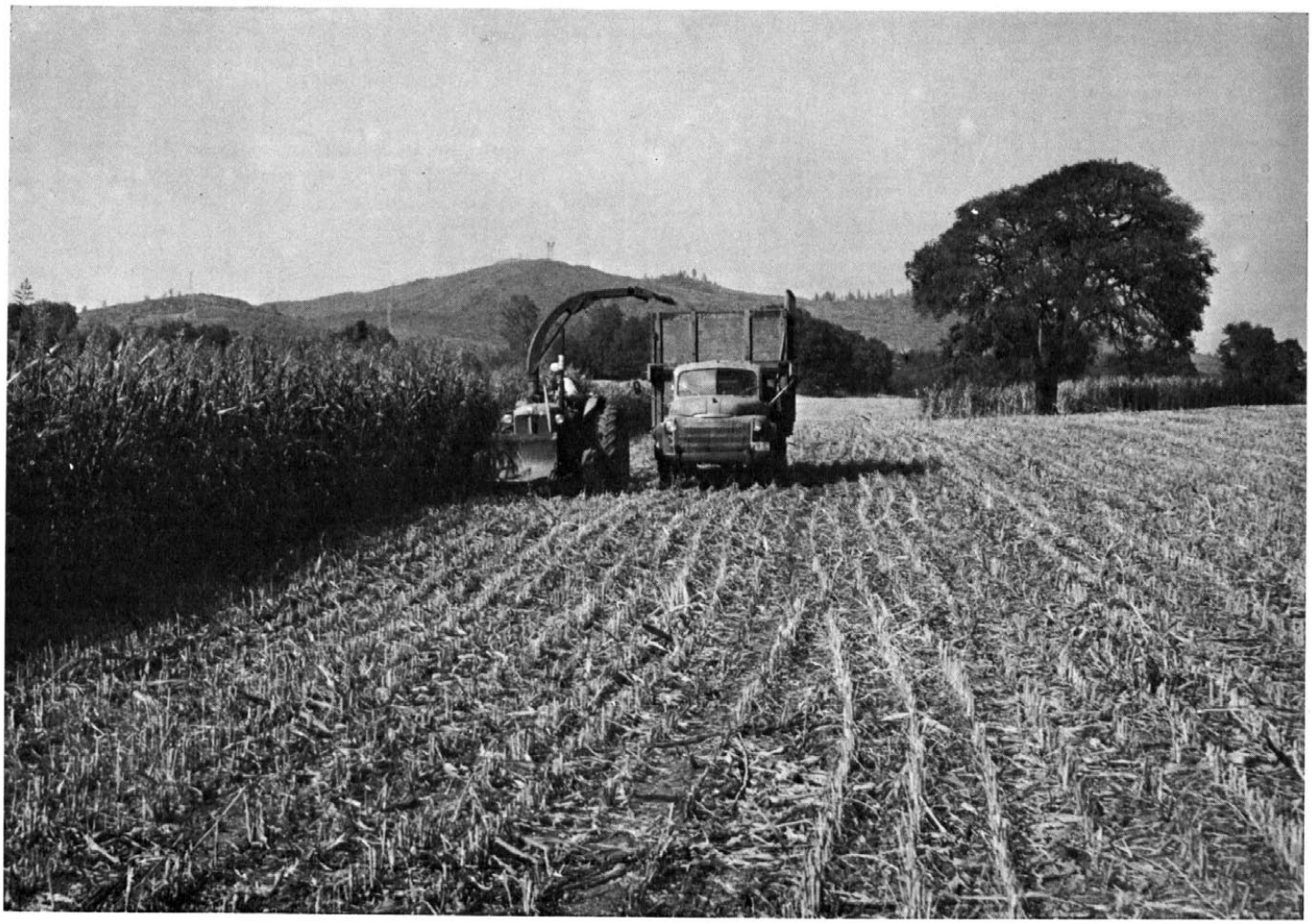

Figure 10.—Chopping sudan-milo hybrid for silage on Rescue sandy loam, 2 to 9 percent slopes.

The use of green-manure crops and crop rotation and the return of crop residue to the soil help to control erosion, improve soil tilth, increase water infiltration, and improve fertility. Green-manure crops can be grown in rotation with grain and forage crops. All tillage should be on the contour or across the slope.

Irrigation water should be applied by sprinklers. Cover crops grown in orchards and vineyards help to control sheet erosion during the rainy season.

CAPABILITY UNIT IIIw-5(18)

Rescue clay, clayey variant, is the only soil in this unit. This soil is poorly drained, has slow permeability, and occupies concave areas. Slopes are 0 to 2 percent. The wetness problem is aggravated by springs and seeps. Depth to the water table ranges from 18 to 36 inches. Available water holding capacity is 6 to 10 inches. Channeling is the only erosion problem.

This soil is used for pasture, meadow, and volunteer hay. Areas that are drained and protected from overflow can be used for small grain. Crops respond to applications of nitrogen and phosphorus fertilizers.

Drainage is very difficult because of the slowly permeable subsoil and the lack of drainage outlets. Care should be exercised to avoid the formation of deep gullies that reduce forage production.

CAPABILITY UNIT IVe-1(18)

This unit consists of well-drained soils that have slopes of 9 to 15 percent. These soils are in the Ahwahnee, Auberry, Rescue, and Sierra series. Permeability of the subsoil is moderately rapid to moderately slow. The effective rooting depth is 24 inches to more than 60 inches. Available water holding capacity is 3.5 to 10 inches. Runoff is medium, and the hazard of erosion is moderate. The soils are easy to work.

These soils are used primarily for range. Some areas are irrigated and used for pasture; walnut, pear, and apple orchards; forage crops; and vineyards. The soils are well suited to these crops if irrigation water is available. Crops respond to applications of nitrogen and phosphorus fertilizers.

Irrigation water should be applied by sprinklers. Orchards and vineyards should be planted across the slopes, and cover crops should be maintained during the rainy season.

Grain cut for hay can be grown 1 year and followed by 4 years of pasture. All tillage should be on the contour. On long slopes, stripcropping and diversion terracing are needed.

CAPABILITY UNIT IVe-1(22)

This unit consists of well-drained soils that have slopes of 3 to 30 percent. These soils are in the Aiken, Boomer, Cohasset, Diamond Springs, Holland, Horseshoe,, Josephine, Mariposa, Musick, Shaver, and Sites series and in the Diamond Springs series, grayish subsoil variant. Permeability of the subsoil is moderately rapid to moderately slow. The effective rooting depth is 24 inches to more than 60 inches. Available water holding capacity is 4 to 10 inches. Runoff is slow to medium, and the erosion hazard is slight to high. The soils are easy to work.

These soils are used primarily for woodland and some range. Some areas are used for walnuts and as pasture. In areas where irrigation water is available, these soils are well suited to pears, apples, walnuts, and pasture. Crops respond to applications of nitrogen and phosphorus fertilizers.

Irrigation water should be applied by sprinklers. Permanent cover crops should be used in orchards. All farming operations should be on the contour.

CAPABILITY UNIT IVe-3(18)

This unit consists of well drained and moderately well drained soils that have slopes of 2 to 30 percent. These soils are in the Argonaut and Perkins series. Permeability in the subsoil is slow to very slow. The effective rooting depth is 20 inches to more than 60 inches. Available water holding capacity is 2.5 to 9 inches. Runoff is medium, and the erosion hazard is slight to moderate. The soils are difficult to cultivate because they contain coarse fragments.

These soils are used for range. They are suitable for hay and grain or for irrigated pasture. If these soils are cropped, a cover of grasses and legumes should be grown 4 years out of 5. The use of crop residue, cross-slope tillage, and stripcropping on long slopes reduces runoff and helps to control erosion.

Irrigation water should be applied by sprinklers. Water should be applied slowly to prevent saturating the soil that overlies the slowly and very slowly permeable clay subsoil.

CAPABILITY UNIT IVe-7(18)

This unit consists of well-drained soils that have slopes of 5 to 15 percent. Exposed rock outcrops cover 5 to 10 percent of the surface. These soils are in the Auberry and Sierra series. Permeability of the subsoil is moderate to moderately slow. The effective rooting depth is 40 inches to more than 60 inches. Available water holding capacity is 5 to 10 inches. Runoff is medium, and the erosion hazard is moderate. Rock outcrops make tillage of intertilled crops difficult but not impracticable.

These soils are used primarily for range. Some walnut, pear, and apple orchards and pasture are grown in areas where irrigation water is available. The soils are well suited to vineyards. Crops respond to applications of nitrogen and phosphorus fertilizers.

Irrigation water should be applied by sprinklers. Tillage should be across the slope to control erosion. Cover crops should be grown during the rainy season.

CAPABILITY UNIT IVe-7(22)

This unit consists of well-drained soils that have slopes of 5 to 15 percent. These soils are in the Holland, Musick, and Shaver series. Permeability of the subsoil is moderately rapid to moderately slow. The effective rooting depth is 40 inches to more than 60 inches. Available water holding capacity is 4 to 10 inches. Runoff is medium, and the erosion hazard is moderate to high. About 5 to 10 percent of the surface is outcrops of bedrock that make tillage difficult but not impracticable.

The soils in this unit are used mainly for woodland. Some areas are used for pear, apple, and nut orchards in areas where irrigation water is available, or for limited range. These soils are well suited to vineyards, and a few areas are used for vineyards. Crops respond to applications of nitrogen and phosphorus fertilizers.

Irrigation water should be applied by sprinklers. Tillage should be on the contour. Cover crops should be grown in orchards and vineyards during the rainy season.

CAPABILITY UNIT IVe–8(18)

This unit consists of well-drained soils of the Auburn and Sobrante series. These soils have slopes of 2 to 30 percent. Permeability of the subsoil is moderate. The effective rooting depth is 12 to 36 inches. Available water holding capacity is 2 to 7 inches. The erosion hazard is slight to moderate. The soils are somewhat difficult to work.

These soils are used mainly for range. A few small areas are used for irrigated or dryland pasture. Hay or grain is suitable. Crops respond to applications of nitrogen and phosphorus fertilizers.

Irrigation water should be applied by sprinklers. Tillage should be across the slope. Cover crops should be maintained in orchards and vineyards.

Grain should be grown 1 year in every 5. All crop residue should be returned to the soil to maintain good tilth.

CAPABILITY UNIT IVe–8(22)

Mariposa gravelly silt loam, 3 to 30 percent slopes, is the only soil in this unit. This soil is well drained. Permeability of the subsoil is moderate. The effective rooting depth is 15 to 30 inches. Available water holding capacity is 2 to 4 inches. Runoff is medium, and the erosion hazard is slight to moderate. Gravel makes the soil somewhat difficult to work.

This soil is used mainly for woodland. A few areas are used for range and irrigated pasture. The soil is not well suited to dryland farming. Deciduous fruit crops, mainly apples, are marginally suited to this soil.

Irrigation water should be applied lightly and frequently by sprinklers because of slope and the low available water holding capacity. Tillage should be on the contour, and cover crops should be grown during the rainy season to control erosion. Crops respond to applications of nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVw–2(18, 22)

This unit consists of Argonaut loam, seeped variant, and Mixed alluvial land along streams and swales. Drainage is moderately good to poor. These soils are subject to frequent flooding and channeling. Permeability in the subsoil of the Argonaut soil is very slow. Permeability of Mixed alluvial land is moderately rapid to slow. The effective rooting depth ranges from 25 inches to more than 60 inches. Available water holding capacity is 3 to 6 inches. Erosion hazard is slight to moderate.

These soils are used for pasture, for native meadow, and, in land resource area 22, for woodland. Where drained and protected from overflow, these soils can be used for small grain.

Channel improvements, dikes, or levees may be necessary in some areas before permanent crops can be grown. These soils can be improved by drainage.

CAPABILITY UNIT VIe–1(18)

This unit consists of well-drained soils that have slopes of 2 to 30 percent. These soils are in the Auberry, Rescue, and Sierra series. Permeability of the subsoil is moderate to moderately slow. The effective rooting depth is 12 inches to more than 60 inches. The available water holding capacity is 2 to 10 inches. Runoff is slow to rapid, and the erosion hazard is slight to high.

These soils are used mainly for range. A few areas are used for woodland. Where irrigation water is available, apples, pears, and pasture are grown to a limited extent.

Irrigation water should be applied by sprinklers.

Orchards should be planted on the contour, and permanent cover crops should be maintained to prevent erosion. All farming operations should be done across the slope.

CAPABILITY UNIT VIe–1(22)

This unit consists of well-drained soils that mainly have slopes of 15 to 50 percent but in a few areas have slopes as gentle as 9 percent. These soils are in the Cohasset, Crozier, Diamond Springs, Holland, Horseshoe, Josephine, McCarthy, Musick, Shaver, and Sites series and in the Diamond Springs series, grayish subsoil variant. Permeability of the subsoil is moderately rapid to moderately slow. The effective rooting depth is 24 inches to more than 60 inches. Available water holding capacity is 3 to 10 inches. Runoff is medium to rapid, and the erosion hazard is moderate to high. These soils are difficult to work.

These soils are used for woodland and for limited range. If irrigation water is available, if permanent cover is maintained, and if irrigation water is applied by sprinklers, the soils that have slopes of less than 30 percent are suitable for pears and apples. All areas of these soils need to be protected from fires or from uses that leave the surface bare.

CAPABILITY UNIT VIs–1(18)

This unit consists of well-drained soils that have slopes of 3 to 30 percent. These soils are in the Ahwahnee, Argonaut, Auberry, Auburn, Rescue, Sierra, and Sobrante series. Permeability of the subsoil is moderately rapid to very slow. The available water holding capacity is 2 to 10 inches. Runoff is slow to rapid, and the erosion hazard is slight to high. About 5 to 25 percent of the surface is outcrops of bedrock and 1 to 3 percent is covered by stones, making tillage of intertilled crops impractical.

These soils are used for range and some woodland.

Rock outcrops, stones, and rolling to hilly slopes make these soils better suited to grazing than to most other uses. Firebreaks and trails should be maintained along roads. Seeding of perennial or annual grasses and legumes may be desirable if the plant cover is deteriorated. Forage plants grown on these soils respond well to applications of ammonium phosphate surface fertilizers. Adequate plant residue must be left at the end of grazing if maximum forage production is to be maintained.

CAPABILITY UNIT VIs–1(22)

This unit consists of well-drained soils that have slopes of 3 to 50 percent. These soils are in the Boomer, Diamond Springs, Holland, Hotaw, Josephine, Mariposa, Musick, Shaver, and Sites series. Permeability of the subsoil is moderately rapid to moderately slow. The effective rooting depth is 15 inches to more than 60 inches. Available water holding capacity is 2 to 10 inches. Runoff is medium to rapid, and the erosion hazard is slight to high. About 5 to 25 percent of the surface is outcrops of bedrock that make tillage of intertilled crops impractical.

These soils are used for mainly woodland. A few areas are used for range.

These soils are well suited to woodland. Firebreaks should be maintained along access roads. Areas that have been cleared or burned over tend to come back in brush and, unless properly managed, produce little forage for domestic livestock. These soils respond favorably to seeding of adapted range grasses and to fertilization of these grasses.

CAPABILITY UNIT VIIs-1(18)

This unit consists of well-drained to excessively drained soils that have slopes of 15 to 70 percent and a few areas where slopes are as gentle as 3 percent. The soils of this unit are in the Ahwahnee, Argonaut, Auberry, Auburn, Delpiedra, Rescue, Sierra, and Whiterock series and in the Auburn series, heavy subsoil variant. Also included is the land type Placer diggings. Permeability of the subsoil is moderately rapid to very slow. The effective rooting depth is 5 inches to more than 60 inches. Available water holding capacity is 0.5 to 10 inches. Runoff is slow to very rapid, and the erosion hazard is slight to very high. Fertility is moderate to very low. These soils are very rocky or extremely rocky, and 5 to 50 percent of the surface is rock outcrops. In some areas 1 to 15 percent of the surface is covered by stones. Other areas have as much as 80 percent slate fragments in the profile.

These soils are used chiefly for range, wildlife habitat, and watershed. Selected areas are used for woodland. Adequate plant residue should remain after grazing to maintain maximum production and to control erosion. Seeding of annual grasses and legumes is limited to critical areas of accidental burns.

CAPABILITY UNIT VIIs-1(22)

This unit consists of well-drained to excessively drained soils that have slopes of 3 to 70 percent. These soils are in the Boomer, Chaix, Chawanakee, Holland, Iron Mountain, Josephine, Mariposa, Maymen, and Sites series. Also included is the land type Placer diggings. Permeability of the subsoil is moderately rapid to moderately slow. The effective rooting zone is 5 inches to more than 60 inches. Available water holding capacity is 0.5 to 10 inches. Runoff is medium to rapid, and the erosion hazard is slight to very high. About 5 to 25 percent of the surface is exposed bedrock.

These soils are used for woodland, wildlife habitat, and watershed. A few areas are used for range.

To reduce erosion, these soils should be protected from fire by use of firebreaks. Brushy areas furnish browse and cover for wildlife.

CAPABILITY UNIT VIIIs-1(18, 22)

This unit consists of Acidic rock land, Gullied land, Metamorphic rock land, Serpentine rock land, and Tailings. All of these land types except Tailings have slopes of 30 to 75 percent. Tailings has slopes of less than 15 percent. Acidic rock land, Gullied land, and Tailings are more erodible than the other land types in this unit, and they produce more sediment and debris in lower lying areas.

These land types are used for watershed and wildlife habitat. They have no value for farming. Protecting the areas from fire helps to prevent erosion and subsequent sedimentation of the rivers.

Storie index rating[2]

The soils of the survey area are listed in alphabetic order and are rated according to the Storie index (*16*) in the "Guide to Mapping Units." This index expresses numerically the relative degree of suitability, or value, of a soil for general intensive farming. The rating is based on soil characteristics only. It does not take into account other factors, such as availability of water for irrigation, climate, and distance from markets, that might determine the desirability of growing specific crops in a given locality. For these reasons, the index in itself cannot be considered an index for land valuation.

Four factors that represent the inherent characteristics and qualities of the soil are considered in the index rating. Each factor is rated or evaluated separately in terms of percentage of the ideal, or 100 percent. The factors are:

Factor A, Profile characteristics.—Factor A expresses relative suitability of a profile for the growth of plant roots. Soils that have deep permeable profiles are rated 100 percent. Those that have a dense clay layer or a hardpan or are shallow over bedrock are rated less than 100 percent. The rating depends upon the extent to which root penetration is limited.

Factor B, Texture of the surface soil.—Factor B is rated according to the texture of the surface soil, which affects the ease of tillage and the capacity of the soil to hold water. The moderately coarse and medium textures—fine sandy loam, loam, and silt loam—are the most desirable and are rated 100 percent. The coarser and finer textures, such as sand and clay, are rated less than 100 percent.

Factor C, Slope.—Factor C is particularly important if the soil is irrigated. The amount of water that runs off a soil and its susceptibility to erosion are influenced by the slope of the soil. Smooth, nearly level or very gently sloping soils are rated 100 percent. The rating decreases as the slope increases.

Factor X, Other conditions.—Factor X is used to evaluate any limitations to use of the soil, such as poor drainage or a high water table, erosion, salts or alkali, low fertility, acidity, or unfavorable microrelief. If more than one limitation exists, the values of each are multiplied together to get the X factor.

The index rating of a soil is obtained by multiplying the four factors A, B, C, and X; thus, any one factor may dominate or control the final rating. For example, a soil may have an excellent profile justifying a rating of 100 percent for factor A, excellent texture of the surface soil justifying 100 percent for factor B, a smooth, nearly level surface justifying 100 percent for factor C, but a strong accumulation of salts or alkali that would give a rating of 20 percent for factor X. Multiplying these four ratings gives an index rating of 20 for this soil. The strong accumulation of salts or alkali dominates, makes the soil unproductive for crops, and justifies the low index rating of 20.

Soils are placed in grades according to their suitability for farming use as shown by their Storie index ratings. The six grades and their range in index ratings are—

[2] By GORDON L. HUNTINGTON, lecturer in soil morphology, Department of Soils and Plant Nutrition, University of California, Davis, California.

	Index rating
Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	Less than 10

Soils of grade 1 have few or no limitations that restrict their use for crops. Soils of grade 2 are suitable for most crops, but they have minor limitations that narrow the choice of crops and have few special management needs. Grade 3 soils are suited to a few crops or to special crops and require special management. Grade 4 soils are severely limited for crops. If used for crops, they require careful management. Grade 5 soils are not suited to cultivated crops but can be used for pasture and range. Grade 6 consists of soils and land types that generally are not suited to farming.

Estimated Yields and Soil Management Practices

Yield estimates and management practices given in this survey are based on observations made by the soil scientists who surveyed the El Dorado Area, on information furnished by farmers, and on suggestions furnished by crop specialists in the Soil Conservation Service. Federal and county census records and crop data also were reviewed and considered. More information was available for some soils than for others. If little or no information was available for a particular soil, yield estimates were made by comparison with similar soils. The range and woodland sections contain yield information on soils used for range and forest.

Table 3 gives yields of the principal irrigated crops grown on soils in the survey area under optimum management. This is the level of management under which, according to experience, field trials, and research findings, the highest returns could be expected at the present time.

Some important limitations should be kept in mind when using the yield estimates in table 3. First, the figures are estimates or predictions; second, the figures are averages that may be expected over a period of years. In any given year, the yield may be considerably higher or lower than the average.

The information on yields and management practices provided in this part of the soil survey will be most useful and helpful immediately upon release of this survey. New developments in crops, plant breeding, control of insects and diseases, use of fertilizer, tillage, irrigation, and drainage, will date some of the information on management. Newer and better practices can always be substituted, and the State and Federal farm advisory services are always ready to provide the latest information available.

Management commonly practiced for most crops grown in the El Dorado Area includes proper tillage operations and control of insects and weeds. Under an optimum level of management, the best adapted and most desirable known varieties of crops are grown. Harvesting, pruning, tillage, irrigation, and other management practices are performed at the proper time or season. Management by capability units is discussed in the section "Capability Grouping."

TABLE 3.—*Estimated average acre yields of principal crops*

[Only the soils that are widely used for crops are listed. Dashes indicate that the soil is not suited to the specific crop or that no yield data are available]

Soil name	Irrigated crops			Dryland walnuts	Soil name	Irrigated crops			Dryland walnuts
	Apples	Pears	Pasture			Apples	Pears	Pasture	
	Tons	*Tons*	*Animal-unit-months* [1]	*Pounds*		*Tons*	*Tons*	*Animal-unit-months* [1]	*Pounds*
Ahwahnee coarse sandy loam, 9 to 15 percent slopes	----	----	10	850	Auberry coarse sandy loam, 9 to 15 percent slopes	----	20	16	1,300
Aiken loam, 3 to 9 percent slopes	25	25	12	----	Auberry coarse sandy loam, 15 to 30 percent slopes	----	20	14	1,000
Aiken loam, 3 to 9 percent slopes, eroded	25	25	12	----	Auberry rocky coarse sandy loam, 5 to 15 percent slopes	----	20	14	1,200
Aiken loam, 9 to 15 percent slopes	25	25	12	----	Auburn silt loam, 2 to 30 percent slopes	----	----	14	----
Aiken loam, 9 to 15 percent slopes, eroded	25	25	12	----	Boomer gravelly loam, 3 to 15 percent slopes	----	18	14	----
Aiken loam, 15 to 30 percent slopes	20	20	12	----	Boomer gravelly loam, 15 to 30 percent slopes	----	18	14	----
Aiken cobbly loam, 3 to 30 percent slopes	25	25	11	----	Boomer-Sites loams, 9 to 15 percent slopes	20	20	12	----
Argonaut gravelly loam, 2 to 15 percent slopes	----	----	14	----	Boomer-Sites loams, 15 to 30 percent slopes	20	20	12	----
Argonaut clay loam, 3 to 9 percent slopes	----	----	14	----	Cohasset sandy loam, 15 to 30 percent slopes	20	20	12	----
Argonaut loam, seeped variant	----	----	12	----	Cohasset loam, 3 to 9 percent slopes	25	25	12	----
Auberry coarse sandy loam, 5 to 9 percent slopes	----	20	16	1,300	Cohasset loam, 9 to 15 percent slopes	25	25	12	----

See footnote at end of table.

TABLE 3.—*Estimated average acre yield of principal crops*—Continued

Soil name	Irrigated crops			Dryland walnuts	Soil name	Irrigated crops			Dryland walnuts
	Apples	Pears	Pasture			Apples	Pears	Pasture	
	Tons	*Tons*	*Animal-unit-months* [1]	*Pounds*		*Tons*	*Tons*	*Animal-unit-months* [1]	*Pounds*
Cohasset loam, 15 to 30 percent slopes	20	20	12		Musick rocky sandy loam, 5 to 15 percent slopes	20	20	11	900
Cohasset cobbly loam, 3 to 15 percent slopes	25	25	11		Perkins gravelly loam, 3 to 30 percent slopes			16	
Diamond Springs very fine sandy loam, 3 to 9 percent slopes	18	18	10		Perkins gravelly loam, moderately deep variant, 2 to 5 percent slopes			14	
Diamond Springs very fine sandy loam, 9 to 15 percent slopes	18	18	10		Rescue sandy loam, 2 to 9 percent slopes			14	
Diamond Springs gravelly sandy loam, grayish subsoil variant, 9 to 30 percent slopes	20	20	12		Rescue sandy loam, 9 to 15 percent slopes			14	
Holland coarse sandy loam, 5 to 9 percent slopes	25	25	12	1,000	Rescue very stony sandy loam, 3 to 15 percent slopes			12	
Holland coarse sandy loam, 9 to 15 percent slopes	20	20	12	1,000	Rescue clay, clayey variant			14	
Holland coarse sandy loam, 15 to 30 percent slopes	20	20	11	900	Shaver coarse sandy loam, 5 to 9 percent slopes	20	20		1,000
Holland rocky coarse sandy loam, 5 to 15 percent slopes	20	20	11	900	Shaver coarse sandy loam, 9 to 15 percent slopes	20	20		1,000
Horseshoe gravelly sandy loam, 9 to 15 percent slopes					Shaver coarse sandy loam, 15 to 30 percent slopes	20	20	11	900
Josephine gravelly loam, 9 to 15 percent slopes	25	25	12		Shaver rocky coarse sandy loam, 5 to 15 percent slopes	20	20	11	900
Josephine gravelly loam, 15 to 30 percent slopes	20	20	12		Sierra sandy loam, 9 to 15 percent slopes, eroded		20	16	1,300
Josephine silt loam, 5 to 15 percent slopes	25	25	12		Sierra sandy loam, 15 to 30 percent slopes, eroded		20	14	1,000
Josephine silt loam, 15 to 30 percent slopes	20	20	12		Sierra rocky sandy loam, 5 to 15 percent slopes		20	14	1,200
Loamy alluvial land			16		Sites loam, 9 to 15 percent slopes	25	25	12	1,000
Mariposa gravelly silt loam, 3 to 30 percent slopes	15	15	10		Sites loam, 15 to 30 percent slopes	20	20	12	1,000
Mixed alluvial land			12		Sites clay loam, 9 to 15 percent slopes	20	20	12	
Musick sandy loam, 9 to 15 percent slopes	20	20	12	1,000	Sites clay loam, 15 to 30 percent slopes	20	20	12	
Musick sandy loam, 15 to 30 percent slopes	20	20	11	900	Sobrante silt loam, 3 to 15 percent slopes		18	14	
					Sobrante silt loam, 15 to 30 percent slopes		18	14	
					Wet alluvial land			14	

[1] Animal-unit-months is a term used to express the carrying capacity of pasture. It is the amount of forage or feed required to maintain one animal, or 1,000 pounds of live weight, for a period of 30 days without injury to the pasture plants. An acre of pasture that provides 30 days of grazing for two animals has a carrying capacity of 2 animal-unit-months.

The following paragraphs discuss the management practices that were assumed when the yields for the crops specified in table 3 were estimated.

Irrigated apples.—About 50 to 100 pounds of nitrogen is applied during February. Excess nitrogen prior to harvesting interferes with coloring of the fruit. Potassium is usually adequate. About 500 pounds of phosphorus per acre is applied if phosphorus deficiencies develop. A fall application of zinc foliage spray may be used. Magnesium sulfate foliage spray occasionally is applied if deficiency symptoms are severe the previous season.

Irrigation and cover crops are the same as those used for pears, except that no legumes are used in the cover crop.

Irrigated pears.—These trees use 100 pounds of nitrogen per acre applied in the middle of February. About 50 to 100 additional pounds are applied during the first or second irrigation if the crop is heavy or lacks shoot vigor. In areas where orchards have a permanent sod cover, the amount of fertilizer applied generally is increased by 50 percent. Phosphorus and potassium are applied at rates of 500 pounds as symptoms or tissue analysis indicate. Agricultural borax is applied every 5 years at a rate of 50 pounds per acre. Zinc foliage sprays are used when deficiency symptoms are observed.

Irrigation water is applied at a rate of 0.25 to 0.35 inch per hour by sprinklers. A total of 3.5 to 5.5 inches of water is applied at each irrigation. Irrigation frequency is every 12 to 14 days during July and August. Approximately 3½ acre-feet of water is used during the year.

Permanent sod cover consists of 3 pounds of innoculated

White Dutch clover or 3 pounds of narrowleaf trefoil and 5 pounds of bromegrass or 4 pounds of creeping red fescue per acre. This cover crop is kept mowed, using a rotary mower during spring and summer through harvestings.

Annual cover crops used in areas where slopes are more gentle are 30 pounds of barley seed and 20 pounds of horsebeans per acre.

Irrigated pasture.—A combination of legumes and grasses is planted on a well-prepared seedbed. A combination of 3 pounds of narrowleaf trefoil or 2 pounds of Ladino clover and 1 pound of Salina strawberry clover with 5 pounds of Akaroa orchardgrass, 8 pounds of Alta fescue, or 8 pounds of Goars fescue per acre is used. Legume seed is innoculated before seeding. Nitrogen is applied at 30 to 40 pounds per acre, along with 15 pounds of phosphorus. Irrigation water is applied by sprinklers at a rate of 0.25 inch to 0.35 inch per acre. At the peak consumptive-use season of July and August, irrigation water is applied every 8 to 12 days. Approximately 4 acre-feet of water is used during the year.

Dryland walnuts.—About 100 pounds of nitrogen is applied late in January or early in February. About 50 pounds of agricultural borax per acre may be used if symptoms indicate the need.

Use of the Soils for Range [3]

The livestock industry in the El Dorado Area has undergone considerable change in the past decade. The 1968 El Dorado Area Agricultural Commissioner's Report estimates that there were 11,500 head of cattle, including calves, in the survey area that year. This same report lists an estimated 7,800 head of sheep and lambs. There are also several small flocks of Angora goats in the survey area, totaling about 1,000 head. A 1960 report (*23*) lists 12,700 head of cattle and 7,500 head of sheep and lambs in the Area.

Water development projects have eliminated the need of high mountain summer range for some operators. Subdivisions have taken large acreages formerly used for winter and early spring grazing in the western part of the survey area. As the population of the Area increases, grazing land will be reduced.

Most of the cattle are in herds of cows and calves that graze the lower foothills in winter and early in spring. Some operators use Federal grazing permits in summer or take their cattle to other parts of the State. Some operators transport them out of the State for summer feed. A few keep their stock in the survey area all year and use irrigated and dryland pastures and range in summer. There are many small, part-time cattle operations that depend on irrigated and dryland pastures for feed. Most of these are of the stocker-feeder type.

About 40 percent of the El Dorado Area is used for range. More than half of this acreage is Auburn soils. The Auberry, Boomer, Rescue, Sobrante, and Whiterock soils are the other important forage producers. They are mainly at elevations of about 450 feet in the western part of the survey area and extend eastward to elevations of 1,500 to 1,800 feet. At elevations between 1,200 and 1,800 feet, there is a gradual transition from grass and grass-oak to timber. Generally, the soils used for range are too steep, too shallow, or too rocky for cultivated crops. Large acreages that formerly were used for hay and grain now are used for grazing. Also, fairly large acreages along stream channels, in parks and meadows, and on shallow, stony ridgetops within timbered areas have some value for grazing. Some soils at elevations of about 1,800 feet have been cleared of trees and are used for forage. These soils produce poor quality forage and are not placed in range sites.

Most of the important range forage plants in the El Dorado Area are introduced. The original forage plants were a mixture of perennials and annuals, but the introduced plants are mostly cool-weather annuals. These annuals take advantage of soil moisture while it is there, produce seed, and mature by the time the moisture is gone. They furnish highly nutritious feed in spring when they are green and growing, but after maturity their nutritional value is low.

The forage-producing plants in the survey area are grouped into three classes: desirable, less desirable, and undesirable. Livestock graze selectively. They seek out the more palatable and nutritious plants. If grazing is not carefully regulated, the better, more desirable plants are weakened or eliminated because they are not allowed to produce seed. Less desirable plants then increase. If grazing pressure is continued, the second-choice plants also are thinned out or eliminated, and undesirable, unpalatable plants take their place or the soil is left bare.

Experience of ranchers and studies by research workers show that if only part of the current yearly growth of grass is grazed, damage to the more desirable plants is slight and higher production is attained. This vegetative material left at the end of the grazing season—

1. Serves as a mulch that increases intake rate and storage of water in the soil. The more water stored in the soil, the better the growth of plants for grazing.
2. Protects the soil from water erosion.
3. Reduces year-to-year fluctuation in forage production; plants make more efficient use of soil moisture.
4. Holds moisture near the surface after the first rains in fall so that seeds can germinate and get off to an early start.
5. Provides a reserve of feed for years when growing conditions are unfavorable.

In addition to managing the forage so that needed amounts of residue are left, there are range improvement practices that can materially increase production. These include trees and brush removal, fertilization, and seeding suitable grasses and legumes, or a combination of these practices. Sound management requires that grazing use be adjusted from season to season, according to the amount of forage produced. Because of the growth habits of annual forage plants, it is very difficult to properly utilize all the forage when it is most nutritious. If the forage is used as dry feed in summer or held for early feed in fall, protein supplements are needed by the livestock. Maintaining adquate reserves of feed and forage permits proper use of vegetation.

[3] By ROCHE D. BUSH, range conservationist, Soil Conservation Service.

Range sites

Range sites are kinds of land that produce significantly different kinds or amounts of vegetation. Each site has a different potential for production of forage and presents different management problems. The rangeland in the El Dorado Area has been grouped into six range sites. The descriptions of the range sites that follow include a brief description of the soils that make up the sites; a listing of the most desirable, less desirable, and undesirable forage plants; the acreage of the sites; and the estimated production of each site. The range site in which each soil has been placed is indicated in the "Guide to Mapping Units" at the back of this survey.

SITE 1: SHALLOW LOAMY

This range site consists of gently rolling to steep soils in the Argonaut and Auburn series and Auburn series, heavy subsoil variant. It is the most extensive site in the survey area. It occupies approximately 122,000 acres, beginning at the county line on the west and extending eastward to the vicinity of the communities of El Dorado and Cool. Elevations generally range from 500 to 1,600 feet but are as much as 2,000 feet in a few areas. The average annual rainfall ranges from 22 to 35 inches. Slopes are 3 to 50 percent, but 70 percent of the site has slopes of less than 30 percent.

The soils in this site have a surface layer that is mainly clay loam, silt loam, extremely stony loam, loam, or gravelly loam. These soils are 12 to 30 inches deep over bedrock. They are well drained and moderately well drained. The available water holding capacity is 2 to 5 inches, and the permeability is very slow to moderate. Runoff is medium to rapid, and the hazard of erosion is slight to very high. Rock outcrops cover 0 to 50 percent of the surface but do not impede livestock movement or decrease forage production, except in a few areas.

This site has a plant cover mainly of open grass or grass and oak, and there is some brush and Digger pine. The oak and brush tend to increase as the elevation and rainfall increase from west to east. Some areas have dense stands of oak and brush.

Where this site is producing at its maximum, approximately 70 percent of the plant cover is soft chess, wild oats, burclover, filaree, and other desirable species, including remnant perennial grasses that grow in the open or under the trees.

Approximately 20 percent of the vegetation is ripgut brome, annual fescues, annual lupines, and other less desirable plants. The remaining 10 percent consists of nitgrass, silver hairgrass, tarweed, popcornflower, turkeymullein, Medusahead, or other undesirable plants.

The soils in this site are well suited to adapted annual grasses and legumes. Forage plants respond to applications of nitrogen, phosphorus, and sulfur fertilizers. Repeated applications of phosphorus fertilizer are needed to maintain good stands of legumes.

About 8,500 acres in this site has been mapped as extremely rocky. Also, on about 600 acres the soils are moderately deep and have a cobbly clay loam surface layer. In these areas livestock movement is somewhat restricted and production is reduced because of the amount of rock outcrops and cobblestones on the surface.

Where needed, removal of trees and brush increases production on this site, except in the extremely rocky areas.

Total air-dry production is 3,000 pounds per acre in favorable years and 1,000 pounds in unfavorable years.

SITE 2: LOAMY

This range site consists of gently rolling to steep soils in the Boomer, Perkins, Rescue, and Sobrante series. It occupies approximately 62,000 acres and is above the lower foothills in the western part of the survey area. The soils of this site are intermingled at higher elevations with the soils of site 1 (fig. 11). Elevations generally range from 450 to 3,500 feet but are typically 1,000 to 1,600 feet. The average annual rainfall ranges from 25 to 50 inches but is typically 25 to 35 inches. Slopes range from 3 to 70 percent, but less than 2 percent of the site has slopes of more than 50 percent.

The soils in this site have a surface layer that is mainly loam, gravelly loam, cobbly loam, very stony sandy loam, silt loam, or sandy loam. These soils are 22 inches to more than 60 inches deep over bedrock or sediments. They are well drained and moderately well drained. The available water holding capacity is 4 to 9 inches, and the permeability is moderately slow to moderate. Runoff is slow to rapid, and the hazard of erosion is slight to very high. Rock outcrops and stones cover 0 to 25 percent of the surface but do not impede livestock movement or decrease forage production.

About 10,000 acres of the Rescue soils in this site is extremely stony. In this area livestock movement is restricted and total herbage production is reduced by 35 to 40 percent because of the stones on the surface.

This site typically has a grass and oak cover, and there is some brush and Digger pine. Some areas have dense stands of brush. Where the site is producing at its maximum, approximately 70 percent of the plant cover is soft chess, wild oats, burclover, filaree, and other desirable plants, including remnant perennials that grow in the open or under the trees.

Approximately 20 percent of the vegetation is ripgut brome, annual fescues, annual lupines, and other less desirable plants. The remaining 10 percent is nitgrass, silver hairgrass, tarweed, popcornflower, turkeymullein, Medusahead, or other undesirable plants.

Where an adequate seedbed can be prepared, the soils in this site are suited to Hardinggrass. The Rescue sandy loams are particularly well suited. All the soils are suited to adapted annual grasses and legumes. Forage plants respond to applications of nitrogen, phosphorus, and sulfur fertilizers. Repeated applications of phosphorus fertilizer are needed to maintain good stands of legumes on all soils in this site.

Where needed, removal of trees and brush increases production on this site, except in the extremely stony areas.

Total air-dry production is 3,500 pounds per acre in favorable years and 1,200 pounds in unfavorable years, except on the extremely stony soils. On these soils the yields are 2,200 pounds in favorable years and 900 pounds in unfavorable years.

SITE 3: GRANITIC

This range site consists of gently rolling to steep soils in the Ahwahnee, Auberry, and Sierra series. This site occu-

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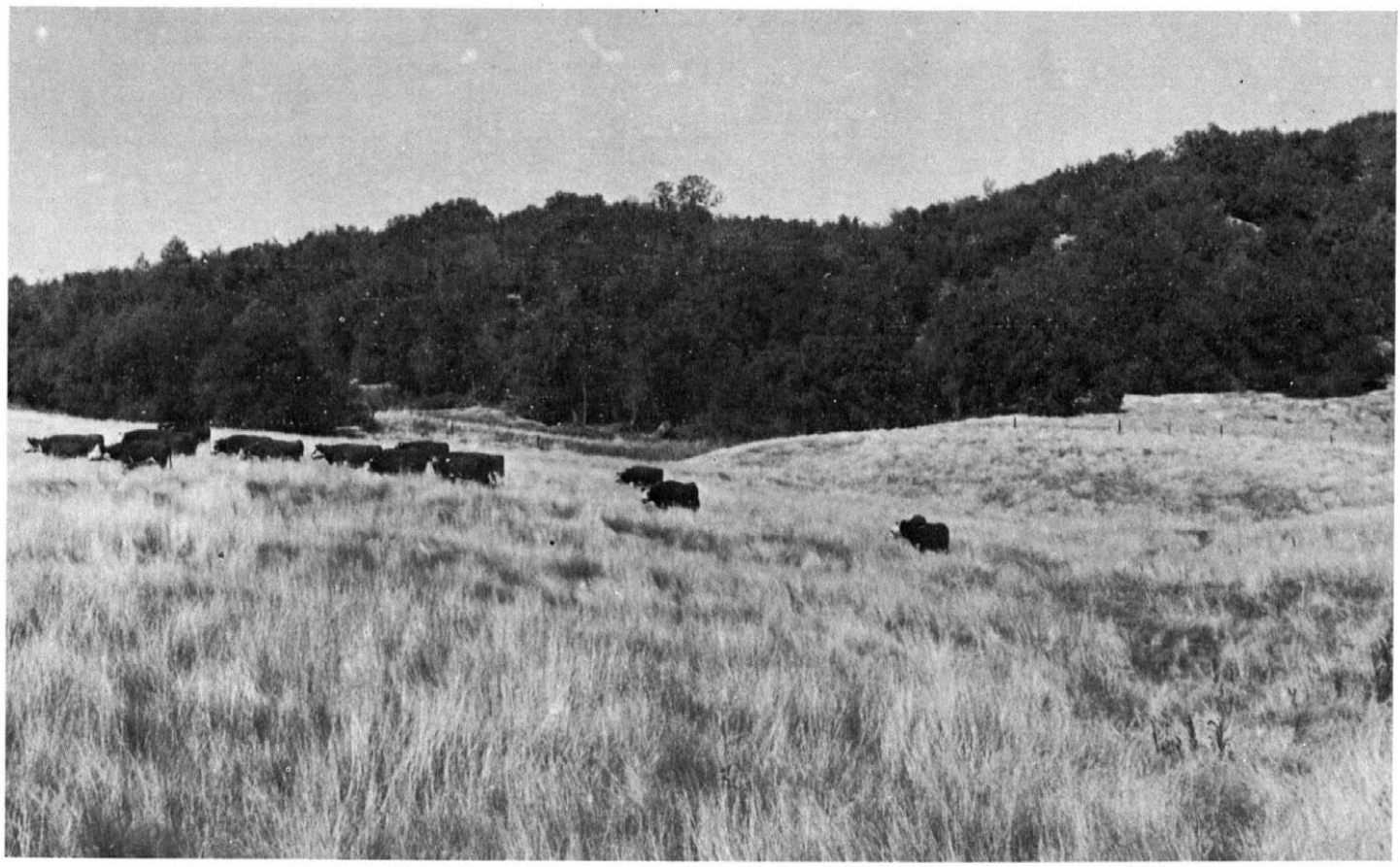

Figure 11.—Cattle grazing on Sobrante silt loam, 3 to 15 percent slopes, in range site 2. In the background is an area of Auburn very rocky silt loam, 2 to 30 percent slopes, in range site 1.

pies approximately 23,000 acres. It is in two rather large areas. One of these begins at Cold Springs and extends in a northwesterly direction, and Coloma is about in the center. The second area extends northward from the Amador County line west of Aukum to the Oak Hill area. Elevations range from 500 to 2,500 feet. The average annual rainfall ranges from 25 to 35 inches. Slopes are 5 to 50 percent, but more than two-thirds of the site has slopes of less than 30 percent.

The soils in this site have a surface layer of sandy loam or coarse sandy loam and are 24 inches to more than 60 inches deep to granitic bedrock. These soils are well drained. The available water holding capacity is 3 to 10 inches, and the permeability is moderately slow to moderately rapid. Runoff is medium to rapid and erosion hazard is moderate to very high. Rock outcrops cover 0 to 25 percent of the surface but do not impede livestock movement or decrease forage production appreciably.

This site typically has a plant cover of open grass or grass and oak. In the area north of the Amador County line to Oak Hill, Ponderosa pine also is present.

Where this site is producing at its maximum, about 70 percent of the plant cover is soft chess, wild oats, filaree, and other desirable plants, including remnant perennial grasses. Only a little burclover is present on this site, but other annual clovers thrive during favorable years.

Approximately 20 percent of the vegetation is ripgut brome, annual fescues, mouse barley, annual forbs, and other less desirable plants. The remaining 10 percent is fiddleneck, tarweed, Klamathweed, dogtail, nitgrass, turkeymullein, and other undesirable plants.

The Sierra soils in this site are well suited to Harding-grass in areas where adequate seedbed can be prepared. All soils in this site are suited to annual grasses and legumes. Forage plants respond to applications of nitrogen, phosphorus, and sulfur fertilizers. Repeated applications of phosphorus and sulfur fertilizers are necessary to maintain good stands of introduced legumes.

Where needed, removal of trees and brush increases production on this site.

Total air-dry production is 3,500 pounds per acre in favorable years and 1,000 pounds in unfavorable years.

SITE 4: VERY SHALLOW LOAMY

Whiterock gravelly silt loam, 3 to 50 percent slopes, is the only soil in this range site. This site occupies about 3,100 acres. It is in small, scattered areas intermingled with areas of site 1 at the western end of the survey area and the southern one-fourth of the Mother Lode Belt. The topography is rolling to steep. Slopes are 3 to 50 percent but dominantly are less than 30 percent. Elevations range from 450 to 1,500 feet. The average annual rainfall is 23 to 30 inches.

The soil in this site has a surface layer of gravelly silt

loam that is 5 to 12 inches thick over slate. The available water holding capacity is 0.5 to 1.5 inches, and the vegetation dries early in spring or during periods of extended drought in winter. Drainage is excessive. Runoff is medium to rapid, and the erosion hazard is slight to moderate.

This site typically has a plant cover of open grass and, in some areas, scattered stands of blue oak, Digger pine, and thickets of brush. Where this site is producing at its maximum, approximately 70 percent of the plant cover is soft chess, filaree, and other desirable plants. The site also supports wild oats and burclover in areas where the soil is slightly deeper.

About 20 percent of the vegetation is red brome, mouse barley, annual fescues, annual lupines, and other less desirable plants. The remaining 10 percent is nitgrass, silver hairgrass, owlclover, goldfield, popcornflower, and other undesirable plants.

The soil in this site is not suitable for seeding, fertilizing, or brush removal.

Total air-dry production is 1,500 pounds per acre in favorable years and 500 pounds in unfavorable years.

SITE 5: SERPENTINE

Delpiedra very rocky loam, 3 to 50 percent slopes, is the only soil in this range site. This site occupies about 1,700 acres. It is in thin bands oriented in a north-south direction and scattered throughout the survey area between elevations of 500 and 1,800 feet. The topography is undulating to steep. The average annual rainfall is 25 to 35 inches.

The soil in this site has a surface layer of loam and is 10 to 24 inches deep to serpentine rock. The available water holding capacity is 2 to 4 inches. Runoff is medium to rapid, and the erosion hazard is slight to high. Permeability is moderate. Rock outcrops cover 2 to 25 percent of the surface.

This site typically has a plant cover of brush or brush and grass, and there is some Digger pine. Chamise, yerba santa, toyon, and deerbrush are the dominant brush species.

Where this site is producing at its maximum, about 50 percent of the plant cover is soft chess, filaree, and other desirable plants. It also includes remnants of needlegrass and squirreltail. There is little or no burclover.

Approximately 35 percent of the understory is red brome, mouse barley, annual lupines, large amounts of annual fescues, and other less desirable plants. The remaining 15 percent is owlclover, goldfield, brodiaea, popcornflower, vinegarweed, and other undesirable plants.

Plants grown on this soil do not respond to applications of fertilizer. Clearing and seeding are not feasible.

Total air-dry production is 1,200 pounds per acre in favorable years and 400 pounds in unfavorable years.

SITE 6: PLACER DIGGINGS

Only Placer diggings is in this range site. This land type consists of variable soil material in stream channels and swales. About 9,000 acres is in this site, and it is present throughout the survey area. The areas are long and narrow, and most of them are small. They are near, and in many places within, areas of cobbly riverwash and mine tailings. Slopes generally are less than 9 percent.

The soil material in this site consists of debris left by placer mining. As a result, the material is a mixture of various soil materials and the surface is scarred and uneven. All areas contain some fine soil material that supports plant growth. The soil material is shallow to deep, and in many places it is underlain by coarse sand or gravel. Drainage and permeability are variable. Areas in streambeds are subject to flooding in winter.

Vegetation on this site varies. Many areas support a dense stand of trees and brush that have an understory of annual and perennial forbs and grasses. In some areas annual grasses and forbs are dominant. The main trees and brush plants are willow, alder, cottonwood, blackberry, wild rose, poison-oak, live oak, and white oak, none of which generally adds much to the usable forage. Desirable grasses and forbs, which furnish most of the forage on this site, are bluegrass, blue wildrye, mountain brome, sedges, soft chess, annual clovers, and filaree. Stinging nettle, horehound, wormwood, deergrass, curly dock, wiregrass, and other undesirable plants also are present.

Total air-dry production is extremely variable within short distances, depending on the soil materials present. Areas of this site are generally too narrow and soil material too variable for reseeding. Yields would not justify the cost of fencing and other management needs. Furthermore, because of annual flooding, the erosion hazard is severe if the areas are left unprotected in winter. Applying fertilizer is not feasible.

Small areas that have dense stands of trees and brush probably could be thinned and use of the site improved. The expense of clearing for increased yields alone would not be justified, because intensive practices that prevent regrowth of brush are required.

The total air-dry production is about 2,500 pounds per acre in favorable years and 1,000 pounds in unfavorable years.

Woodland Uses of the Soils [4]

Forests are among the important resources of the El Dorado Area. They supply raw material for one of the major industries, recreation for many people, food and cover for many kinds of wildlife, and protection for watersheds. They also form a backdrop for much of the outdoor beauty in the survey area.

There are approximately 317,000 acres of soils available for growing commercial forests in the survey area. This is about 57 percent of the total area. Approximately 64,000 acres are in the El Dorado National Forest.

Trees grow on most of the soils, but commercial conifers grow mainly on specific kinds of soil. The most widespread species of the commercial conifers is ponderosa pine. Others of commercial importance are sugar pine, white fir, incense-cedar, and Douglas-fir. Digger pine, knobcone pine, and other noncommercial conifers also grow in the survey area. California black oak and canyon live oak grow throughout the survey area. California black oak grows on soils suited to commercial conifers and commonly is in association with them. Several other noncommercial species of oak are present, including interior live oak, blue oak, and California white oak. Cottonwoods, willows, alders, bigleaf maple, Oregon ash, and other hardwoods grow along streams.

[4] By MILTON B. EDWARDS, woodland conservationist, Soil Conservation Service.

Woodland suitability groups

To assist woodland owners in planning use of their soils, the soils of the El Dorado Area have been placed in seven woodland suitability groups. Each group consists of soils that have similar characteristics, show similar response to management, and have similar limitations for the production of wood crops. For each group, ratings are given according to similarities of site quality, erosion hazard, equipment limitations, pest and disease hazards, windthrow hazard, and manageability. These are discussed in the paragraphs that follow. Each woodland suitability group is described, and factors that affect management of each group are discussed. Soils that have not been placed in a woodland suitability group are not suited to that use or are better suited to other uses. The woodland suitability group in which each soil has been placed is indicated in the "Guide to Mapping Units" at the back of this soil survey.

Site quality is a measure of the productivity of a soil for growing trees and is expressed as site index. In this survey it refers to site quality for ponderosa pine. Studies show that associated conifers on similar soils have about the same relationship in height and age as ponderosa pine (*5*). Site index for ponderosa pine is based on the height attained by the average dominant and codominant trees at 100 years of age (*10*).

The ratings used for site quality in this survey are high, medium, and low. The rating *high* means that the site index is more than 115; *medium*, that it ranges from 75 to 115; and *low*, that it is less than 75. Average production of wood in board feet per acre per year, over a 100-year period, for fully stocked, even-aged, unmanaged stands of trees growing on soils that have a site quality rating of high should be 700 board feet (International log rule, ⅛-inch kerf) or more. Under the same conditions, average annual production for trees growing on soils that have a site quality rating of medium should be between 300 and 700 board feet per acre. For soils that have a site quality rating of low, production would be less than 300 board feet per acre per year. Management should increase net production but experimental data indicating how much it would be increased are lacking.

In the El Dorado Area, effective depth of the soils is the most important soil factor affecting site quality. The effective depth is the depth to bedrock or to any other layer that prevents or restricts penetration of roots. Texture has some influence on effective depth if it affects permeability enough to prevent penetration of roots or to restrict drainage. Generally, moderate amounts of stones, cobblestones, or gravel in the profile have little effect on growth of trees, particularly if the soil is deep. In soils that are extremely stony or extremely cobbly, however, the rate of growth diminishes in proportion to the content of coarse fragments. Experimental data on this point are lacking, but it is obvious that a large volume of rock fragments in the rooting zone reduces the volume of soil available to hold water and to provide nutrients for the trees. At lower elevations, lack of precipitation reduces growth rates. By reducing the area available for trees, rock outcrops reduce wood production.

The hazard of erosion refers to the potential hazard of erosion of the soils. The length and steepness of slope, texture, and stability of the soil aggregates are considered in rating the erosion hazard. If soils are kept under a protective cover of forest litter and duff, they generally do not erode. Consequently, the soils are rated according to their susceptibility to erosion if the cover is removed through fire, logging, trampling by animals, or other disturbances. The susceptibility of forest soils to erosion if they are cultivated is not considered in rating erosion hazard in this section. Erosion hazard is rated as none or slight, moderate, high, or very high.

Equipment limitation refers to the characteristics of the soils that restrict or prevent the use of equipment that commonly is used in tending and harvesting trees. For example, Aiken loam, 3 to 9 percent slopes, has few equipment limitations except when it is wet. When this soil is wet, and this could be 6 months in a year, heavy equipment mires down. Tree-planting machines can be used on this soil, however, at carefully selected times. Steep slopes and large boulders on the surface increase the limitation to use of equipment; presence of sand or gravel decreases the limitation. Equipment limitation is rated slight, moderate, or severe.

The hazards of pests and disease depend on many properties and qualities of the soil, most of which are not well understood. Depth, texture, wetness, and inherent fertility are probably the four most important factors. Observations indicate that on wet soils, or on shallow soils that have rock outcrops, pests and diseases make the greatest inroads. The hazard of pests and disease is rated slight, moderate, or severe.

The hazard of windthrow generally is not serious, except on shallow soils derived from slate, shale, schist, volcanic breccia, or granitic material. It is rated slight, moderate, or severe.

Ratings for manageability are based on a summarization of all the qualities of a soil for growing and managing forest trees, including the qualities already listed. Manageability is rated high, medium, or low.

The ratings assigned are based on the best data available and on the judgment of qualified soil scientists, soil conservationists, and woodland conservationists. The ratings are subject to change as more information becomes available.

WOODLAND SUITABILITY GROUP 1

This group consists of soils in the Aiken, Cohasset, Holland, Horseshoe, Josephine, Shaver, and Sites series and Loamy alluvial land. These soils are gently sloping to rolling or strongly sloping. They are deep and very deep and have a surface layer of coarse sandy loam to silt loam. Some of the soils are gravelly or cobbly.

All the soils in this group are of high site quality. The erosion hazard is only slight, but equipment limitations are moderate to severe. Pest and disease hazards are slight, and the hazard of windthrow is slight. The soils are highly adaptable to management.

These soils are the best in the survey area for woodland. They are suitable for very intensive management. Seedlings become established fairly easily after logging if a seed source is near, and they grow rapidly to maturity. Economic returns can be expected at an early age. Thinning and pruning can be done even after the trees have become fairly large. Logging is fairly easy, but in low or level areas equipment is likely to bog down in wet weather. At times there may be enough snow on the ground to hinder or prevent the use of equipment.

Locating and building roads is fairly easy. Except on the cobbly and gravelly soils, roads built on soils in this group need to be graveled for year-round use. Roads and skid trails should be protected from runoff water. Main roads require bridges, ditches, and culverts. Temporary and minor roads should be outsloped, and the grades should be sloped downward toward the water-course for a short distance on both sides of creeks or draws. Grades of unsurfaced roads should not exceed 8 percent on the Holland and Shaver soils, 10 percent on the Josephine and Sites soils, and 12 percent on the Aiken, Horseshoe, and Cohasset soils and on Loamy alluvial land.

Fire is relatively easy to control on these soils, chiefly because of easy access and the dominantly gentle slopes. Areas where trees have been removed by fire or other causes can be prepared for planting fairly easily. Planting can be done by machine.

WOODLAND SUITABILITY GROUP 2

This group consists of soils in the Aiken, Cohasset, Holland, Horseshoe, Josephine, Mariposa, Musick, Shaver, and Sites series and in the Diamond Springs series, grayish subsoil variant. These soils are gently sloping to steep. They are deep and very deep and have a surface layer of coarse sandy loam to silt loam. Some of the soils are gravelly, cobbly, rocky, or very rocky.

All the soils in this group are of high site quality. The erosion hazard is moderate. Equipment limitations range from slight to severe but are mostly severe. Pest and disease hazards are slight to moderate, and the hazard of windthrow is slight to moderate. Adaptability of these soils to management ranges from poor to high but is mostly moderate.

These soils are suitable for intensive management. Seedlings become established easily after logging if a seed source is near, and they grow rapidly to maturity. Trees grow rapidly, and economic returns can be expected at an early age. Thinning and pruning can be done even after the trees have become fairly large. Because of steeper slopes, however, logging is more difficult than on soils in group 1, and it may be impractical in wet weather.

Locating and building roads is fairly difficult. Except on the gravelly and cobbly soils, roads built on soils in this group need to be graveled for year-round use. Roads and skid trails should be protected from runoff water. Main roads require bridges, ditches, and culverts. Temporary and minor roads should be outsloped, and the grades should be sloped downward toward the watercourse for a short distance on both sides of creeks or draws. Grades of unsurfaced roads should not exceed 8 percent on the Diamond Springs soils, grayish subsoil variant, and the Holland, Musick, and Shaver soils; 10 percent on the Josephine and Sites soils; and 12 percent on the Aiken and Cohasset soils.

Fire is difficult to control where slopes are steep. Areas where trees have been removed by fire or other causes can be prepared for planting only with difficulty. If planting is to be done by machines, terracing is necessary where slopes are steeper (fig. 12). Terraces should be outsloped slightly.

WOODLAND SUITABILITY GROUP 3

This group consists of soils in the Holland, Josephine, Musick, Shaver, and Sites series. These soils are moderately steep or very steep. They are deep and very deep and have a surface layer of coarse sandy loam to silt loam. Some of the soils are gravelly or rocky.

All the soils in this group are of high site quality. The erosion hazard is high, and equipment limitations are severe. Pest and disease hazards are slight to moderate but are typically slight. The hazard of windthrow is slight to moderate. These soils are mostly moderately adaptable to mangement, but some are poorly adaptable.

These soils are excellent forest soils, but because of steep slopes, they are only suitable for moderately intensive management. Seedlings become established fairly easily after logging if a seed source is near. Trees grow rapidly, and economic returns can be expected at an early age. Thinning and pruning can be done even after the trees have become fairly large.

Locating and building roads is difficult, but most of them do not need to be graveled, except in a few areas, for year-round use. Roads and skid trails should be protected from runoff water. Main roads require bridges, ditches, and culverts. Temporary and minor roads should be outsloped, and the grades should be sloped downward toward the watercourse for a short distance on both sides of creeks or draws. Grades of unsurfaced roads should not exceed 8 percent on the Holland, Musick, and Shaver soils, and 10 percent on the Josephine and Sites soils.

Fire is difficult to control because of slope. Areas where trees have been removed by fire or other causes can be prepared for planting only with difficulty. If planting is done by machines, terracing is necessary. Terraces should be outsloped slightly.

WOODLAND SUITABILITY GROUP 4

This group consists of soils in the Boomer, Diamond Springs, and Sites series. These soils are gently sloping to moderately steep. They are deep and moderately deep and have a surface layer of very fine sandy loam to clay loam. Some of the soils are gravelly, cobbly, or very rocky.

The soils in land resource area 18 that are included in this woodland suitability group require onsite investigation to determine adaptability for woodland management.

All the soils in this group are of medium site quality. The erosion hazard is slight, but equipment limitations are slight to severe. Pest and disease hazards are moderate, and the hazard of windthrow is slight to moderate. These soils are moderately adaptable to management.

These soils are suitable for moderately intensive management. Trees grow at a moderate rate. Thinning should be done at an early age, and trees should be pruned before they reach a diameter of 15 inches at chest height. Damage from insect pests can be expected but should not be excessive except in extremely dry years. Logging is fairly easy, but in low or level areas heavy equipment is likely to bog down in wet weather.

Locating and building roads is fairly easy. In some places they must be graveled for year-round use. Roads and skid trails should be protected from runoff water. Main roads require bridges, ditches, and culverts. Temporary and minor roads should be outsloped, and the grades should be sloped downward toward the watercourse for a short distance on both sides of creeks and drains. Grades of unsurfaced roads should not exceed 8 percent on the Diamond Springs soils, 10 percent on the Sites soils, and 12 percent on the Boomer soils.

Figure 12.—Josephine silt loam, 15 to 30 percent slopes, being terraced for machine planting of ponderosa pine after a fire.

Fire is relatively easy to control, chiefly because of easy access and the dominantly gentle slopes. Areas where trees have been removed by fire or other causes can be prepared for planting fairly easily. Planting can be done by machines on most of these soils without terracing. Where the slopes are steeper, terracing is necessary. Terraces should be outsloped slightly.

WOODLAND SUITABILITY GROUP 5

This group consists of soils in the Boomer, Crozier, Diamond Springs, Josephine, Mariposa, McCarthy, Rescue, Sierra, and Sites series and Mixed alluvial land. These soils are gently sloping to steep. They are deep and moderately deep and have a surface layer of coarse sandy loam to silt loam. Some of the soils are gravelly, very stony, extremely stony, cobbly, or very rocky.

All the soils in this group are of medium site quality. The erosion hazard is moderate. Equipment limitations are mostly severe but in some areas are moderate. Pest and disease hazards are moderate, and the hazard of windthrow is moderate. The soils are moderately adaptable to management.

These soils are suitable for moderately intensive management, but management is more difficult where slopes are steeper. Growth rates are moderate. Thinning should be done at an early age, and trees should be pruned before they reach a diameter of 15 inches at chest height. Damage from insect pests can be expected on some soils in most years but should not be excessive except in extremely dry years. Logging is difficult where slopes are steep, and in wet weather logging may be impractical.

Locating and building roads is fairly difficult. Only on a few soils in this group do roads need to be graveled for year-round use. Roads and skid trails should be protected from runoff water. Main roads require bridges, ditches, and culverts. Temporary and minor roads should be outsloped, and the grades should be sloped downward toward the watercourse for a short distance on both sides of creeks or draws. Grades of unsurfaced roads should not exceed 8 percent on the Diamond Springs and Sierra soils, 10 percent on the Mariposa, Josephine, and Sites soils, and 12 percent on the Boomer, Crozier, McCarthy, and Rescue soils and on Mixed alluvial land.

Fire is difficult to control where slopes are steep. Areas where trees have been removed by fire or other causes can be prepared for planting only with difficulty. If planting is done by machines, terracing is necessary where slopes are steeper. Terraces should be outsloped slightly. Because of cobblestones and rocks in some soils, planting by machine may be impractical.

WOODLAND SUITABILITY GROUP 6

This group consists of soils in the Auberry, Boomer, Chaix, Diamond Springs, Holland, Hotaw, Josephine,

Mariposa and Sierra series. These soils are moderately sloping to very steep. They are deep to shallow and have a surface layer of coarse sandy loam to silt loam. Most of the soils are very rocky.

All the soils in this group are of medium site quality. The erosion hazard is high and very high, and the equipment limitations are severe. Pest and disease hazards are moderate to severe, and the hazard of windthrow is moderate. The soils are moderately to poorly adaptable to management.

These soils are suitable for moderately intensive management, but management practices can be applied only with considerable difficulty. Growth rates are moderate, and economic returns from these soils cannot be expected to be so great or to be achieved so soon as those from soils in groups 1, 2, and 3. Thinning should be done at an early age, and trees should be pruned before they reach a diameter of 15 inches at chest height. Damage from insect pests and disease can be expected but should not be excessive except in extremely dry years. Logging is difficult and is almost impossible in wet weather.

Locating and building roads is difficult, but only in places do roads need to be graveled for year-round use. Roads and skid trails should be protected from runoff water. Main roads require bridges, ditches, and culverts. Temporary and minor roads should be outsloped, and the grades should be sloped downward toward the watercourse for a short distance on both sides of creeks or draws. Grades of unsurfaced roads should not exceed 8 percent on the Auberry, Chaix, Diamond Springs, Holland, Hotaw, and Sierra soils; 10 percent on the Josephine and Mariposa soils; and 12 percent on the Boomer soils.

Fire is difficult to control where slopes are steep. Areas where trees have been removed by fire or other causes can be prepared for planting only with difficulty. If planting is to be done by machines, terracing is necessary. Terraces should be outsloped. On the cobbly or very rocky soils, planting by machine is not feasible.

WOODLAND SUITABILITY GROUP 7

This group consists of soils in the Auberry, Chawanakee, and Iron Mountain series. These soils are gently sloping to very steep. They range from very shallow to moderately deep but are typically shallow. They have a surface layer of coarse sandy loam to loam and are very rocky.

All the soils in this group are of low site quality. The erosion hazard is slight to severe. Equipment limitations range from slight to severe but are mostly severe. Pest and disease hazards are severe, and the hazard of windthrow is severe. These soils are poorly adaptable to management.

Growth rates are low. Extensive management practices, such as fire protection, insect pest and disease control, protection from overgrazing, and control of erosion, are needed.

Wildlife [5]

Hunting and fishing are important in the economy of the El Dorado Area. As the population of California increases and the amount of wildlife habitat decreases, the value of hunting and fishing will increase.

Reservoirs, ponds, and streams in the survey area provide habitat for various fish, including rainbow trout, brown trout, black bass, and bluegill. They also provide habitat for a few wood ducks, mallards, and mudhens. Canada geese use the larger reservoirs during winter. The water areas at higher elevations and in areas where the water temperature rarely rises above 70° F. during summer are well suited to trout. At lower elevations where water is warm, the water areas are well suited to bass, bluegill, and channel catfish.

Production of fish in a pond or reservoir is dependent upon the fertility of the water it contains, which is influenced significantly by the fertility of the soils in the watershed and, to some extent, by the soil at the bottom of the pond or reservoir. Ponds on infertile soils produce less fish per acre. In general, the water areas in the survey area have good potential for economic return from fish production and from outdoor recreation, such as swimming, boating, camping, and picnicking.

In the El Dorado Area, black-tailed deer, valley quail, and trout are the most important wildlife species. Bear, raccoon, opossum, mourning dove, mountain quail, band-tailed pigeon, rabbit, gray squirrel, bass and bluegill, and wood duck also are important. These animals occupy a wide variety of habitats that are dependent upon the kinds of soil and the availability of water and suitable plants. The soils influence the quality of a habitat for any particular species, including the food and cover that characterize specific wildlife habitats.

The soils in the survey area have been placed in four wildlife suitability groups. Suitability of the wildlife groups for various kinds of plants is shown in table 4. Also shown in this table is suitability of the various plants listed for use by stated kinds of wildlife. The wildlife groups are discussed in the pages that follow. The soils in each group can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

WILDLIFE SUITABILITY GROUP 1

This group consists of soils in the Aiken, Auberry, Cohasset, Diamond Springs series, grayish subsoil variant, Holland, Horseshoe, Josephine, Mariposa, Musick, Perkins series, moderately deep variant, Shaver, Sierra, and Sites series and of Loamy alluvial land and Wet alluvial land. These soils are present throughout the survey area, but most of them are above an elevation of 2,000 feet. This group occupies approximately 140,000 acres. Most of the soils are deep, well drained, and on uplands, but included are small areas of moderately well drained to somewhat poorly drained alluvial land. The surface layer ranges from coarse sandy loam to clay loam. Many areas of these soils have rock outcrops and coarse fragments in the profile. Slopes are 3 to 70 percent.

The vegetation consists mainly of oak and grass, and there are scattered ponderosa pines at the lower elevations. Coniferous forest and associated hardwoods are at the higher elevations.

The soils in this group have no limitations for habitat development except where slopes are more than 30 percent. Water can be impounded on these soils where dam sites exist.

[5] By WENDELL MILLER, State biologist, Soil Conservation Service.

TABLE 4.—*Suitability of specified plants for wildlife groups of soils and for specified kinds of wildlife*

[An Arabic number 1 means the plant named is suited to the wildlife group or has high value for the kind of wildlife; 2 means suitability of the plant is fair to marginal for the wildlife group or kind of wildlife; dashes in the columns mean that the plant is not suited to soils of the wildlife group or its suitability is not known, or that the plant seldom is used by the particular kind of wildlife or its use is not known]

Plant	Wildlife group and rating				Kind of wildlife and rating								
	1	2	3	4	Black-tailed deer	California quail	Mountain quail	Dove	Band-tailed pigeon	Gray squirrel	Rabbit	Bear	Wood duck
Alfalfa	1	[1] 2			1	2					1		
Alta fescue	1	1	2		1						1	2	
Barley	1	1			1	1		2	1		1	2	1
Blackberries, wild	2	2	1		2	1	1		1		1	1	
Black walnut	1	2						2	2	1		1	2
Buckbrush (*Ceanothus cuneatus*)	1	1		2	1	2	1		2		1	2	
Burclover	1	1			1	1	2				1		
Chamise	2	1		2	1	2	2				2		
Clover, subterranean	1	1			1	1	2				1		
Coffee berry	2	1		2	2	2	1		1		2	1	2
Deerbrush (*Ceanothus integerrimus*)	1	2		2	1	2	1		2		1	2	
Filaree	2	1		2	2	1	1	2			1		
Hardinggrass	1	[2] 2			2	1	1	2			1		
Lemon ceanothus	2	1		2	1	2	1		2		1	2	
Manzanita	1	1		2	2	2	1		1		2	1	2
Multiflora rose	1	2	1			1					1		
Narrowleaf trefoil	1	2	2		1	2		2			2		
Oak, black	1	1			1	2	2		1	1		1	1
Oak, blue	1	1			1	2	2	1	1	1		1	1
Oak, live	1	1			1	1	1	2	1	1		1	1
Oak, valley	1	2	2	2	1	2	2	1	1	1		1	1
Pine, Digger		2		1		2	2		2	1		1	1
Pine, ponderosa	1	[1] 2				2	1		1	1		1	
Pyracantha	1	2	2			1			1		1	1	
Ryegrass, annual	1	2			1	2	2				1		
Ryegrass, perennial	1	2			1	2	2				1	2	
Soft chess (Blando brome)	1	1		2	1	2	2				1		
Spanish clover (deervetch)	2	1		2	1	1	1	2			2		
Toyon	2	1			2	2	1		1		2	1	
Turkeymullein	2	1		2		1	1	1					
Vetch, Lana	1	1		2	1	1	1	1	2		1		2
Vetch, purple	1	1		2	1	1	1	1	2		1		2
Wildoats	1	1			2	2	2	2			2		2

[1] Not suited on Argonaut and Auburn soils.
[2] Not suited on Auburn soils.

Deer present serious depredation problems in orchards and vineyards on these soils. They come in from the timber and brushland areas around the orchards. The most effective method of control is use of deer-proof fencing. Quail and many songbirds are present where there is suitable cover.

WILDLIFE SUITABILITY GROUP 2

This group consists of soils in the Ahwahnee, Argonaut, Auberry, Auburn, Boomer, Chaix, Chawanakee, Cohasset, Crozier, Delpiedra, Diamond Springs, Holland, Hotaw, Josephine, Mariposa, McCarthy, Perkins, Rescue, Sierra, Sites, and Sobrante series. These soils are present throughout the survey area. This group of soils is the largest in the area and occupies approximately 321,000 acres. The soils are shallow to deep, moderately well drained to excessively drained, and on uplands. The surface layer ranges from coarse sandy loam to loam. Some of the soils are gravelly, cobbly, stony, rocky, or very rocky. Slopes are 3 to 70 percent. The available water holding capacity is low to moderate.

The vegetation at lower elevations is mainly oak, grass, and brush. At the higher elevations, the vegetation is coniferous forest, associated hardwoods, and brush. The Auburn and Argonaut soils are not suited to coniferous trees.

Soils in this group present slight to moderate limitations to habitat development where slopes are less than 30 percent and severe limitations where slopes are more than 30 percent. Water can be impounded on most of these soils where suitable dam sites exist.

Because of the large areas of brush on these soils, they are well suited to browse and cover for deer. Population of deer ranges from 10 to 30 per square mile. Extensive stands of mature brush are not so productive as smaller stands of new brush interspersed with grass and other cover. Irrigated pastures and other irrigated crops attract large numbers of deer and need to be protected by use of deer-proof fences to prevent depredation by deer. Quail and nongame birds are abundant where suitable cover and food exist. The leasing of hunting rights on this habitat has a good potential for economic return to landowners.

WILDLIFE SUITABILITY GROUP 3

This group consists of soils in the Argonaut series, seeped variant, and the Rescue series, clayey variant, and of Mixed alluvial land. These soils are present in small scattered areas, and there is only about 3,000 acres in the survey area. The soils are poorly drained to somewhat poorly drained and generally are in swales and concave areas below seeps and springs. The surface layer ranges from loam to clay.

The vegetation on these soils consists of water-loving plants, such as wiregrass, sedges, and cattails. Deer feed on the green plants in summer, and the heavy cover provides nesting habitat for blackbirds and other nongame species. Because of the wetness, these soils commonly provide a good source of water for wildlife and ideal locations for fishponds. Drier areas are suitable for planting cover for quail, such as wild blackberries and multiflora rose. Care must be taken, however, to prevent these plants from becoming too numerous.

WILDLIFE SUITABILITY GROUP 4

This group consists of soils in the Auburn series, and Auburn Series, heavy subsoil variant, Iron Mountain, Maymen, and Whiterock series and of Acidic rock land, Gullied land, Metamorphic rock land, Placer diggings, Serpentine rock land, and Tailings. These soils are scattered throughout the survey area and occupy about 75,000 acres. They consist mainly of various types of rock land and mined areas, and the soils are either very shallow or are rocky.

The soils and land types in this group are severely limited for wildlife habitat development. The vegetation is mainly annual grasses, brush, and Digger pine, and there are some barren areas. These soils are used mainly as marginal habitat for deer, quail, doves, and such nongame birds as meadowlarks and blackbirds. The potential for water impoundment on these soils is extremely variable and depends on position and local conditions, which must be investigated onsite.

Engineering Uses of the Soils [6]

Engineering deals with soil as either a structural material or a foundation material upon which structures are built or as a building material itself. Much of the information in this subsection is in tables 5, 6, and 7. These tables are based on fieldwork done by soil scientists of the Soil Conservation Service. Although the purpose of the field surveys was to obtain soil characteristics important to farming, many of these same soil characteristics also are important to engineering. Therefore, the soil survey is useful to many branches of engineering, to builders, and to other nonfarm users. Some of the terms used by soil scientists differ from those used by engineers. These and other special terms are defined in the Glossary at the back of this survey.

The interpretations and information contained in this soil survey are not specific enough for all engineering purposes and should not be used in place of detailed investigations of the site. They are useful, however, in planning more detailed engineering field surveys to determine the in-place condition of the soils at the site of the proposed engineering structure. As a rule, the soil data in this survey apply to the developed soil and the underlying layers to a depth of about 5 feet.

[6] R. A. MILLER, argicultural engineer, Soil Conservation Service, helped to prepare this section.

Engineering classification systems

Most highway engineers classify soil materials in accordance with the system approved by the American Association of Highway Officials (AASHO) (*1*, *13*). In this system soil materials are classified in seven principal groups. The groups range from A–1 (gravelly soils that have high bearing capacity, the best soils for road fill) to A–7 (clayey soils that have low strength when wet, the poorest soils for road fill). Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best materials to 20 for the poorest. The group index number for the soils tested is shown in parentheses after the soil group symbol in table 5.

Some engineers prefer to use the Unified soil classification system (*13*, *24*). In this system soil materials are identified as coarse grained, 8 classes; fine grained, 6 classes; and highly organic.

Engineering test data

Engineering test data for three of the extensive soils in the survey area are given in table 5. The soils were tested in the laboratory of District III, California State Division of Highways. The data in this table show the moisture density, mechanical analyses, liquid limit, plasticity index, and the classification of the samples according to the system of the American Association of State Highway Officials (AASHO) and the Unified system. Additional engineering test data of seven soils important to this area are given in the Soil Survey of the Amador Area, California (*21*). These soils are the Aiken, Ahwahnee, Auburn, Josephine, Musick, Sierra, and Sites, and they are similar to the same soil series mapped within the El Dorado Area.

The relation of moisture content and the density to which a soil can be compacted are important for engineering purposes. If soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with an increase in moisture content. The moisture content at which the maximum dry density is obtained is the optimum moisture content.

Mechanical analysis shows the relative proportions of the different sized particles in the soil material. The size and proportions of the particles affect the behavior of soil material when it is used for engineering purposes.

The tests for liquid limit and plastic limit, or Atterberg values, measure the effect of water on consistency of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a 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 liquid limit and plastic limit. It indicates the range in moisture content within which a soil material is in a plastic condition.

TABLE 5.—*Engineering*

[Tests performed by District III, California Division of Highways, in accordance with

Soil name and location	Parent material	Report No.	Depth	Moisture-density data [1]	
				Maximum dry density	Optimum moisture
			Inches	*Lb. per cu. ft.*	*Percent*
Boomer:					
NE. corner of NW¼SW¼ sec. 33, T. 12 N., R. 9 E. (Modal).	Basic schist.	61–2882	0–5	116	16
		61–2874	24–37	114	16
		61–2872	37–52	130	10
Holland:					
NE¼SW¼ sec. 27, T. 9 N., R. 12 E. (Modal)	Granodiorite.	61–2871	2–10	121	13
		61–2868	21–30	126	12
Rescue:					
NE¼SE¼ sec. 19, T. 10 N., R. 9 E. (Modal)	Gabbrodiorite.	61–2875	0–5	133	11
		61–2870	14–26	124	14
		61–2877	34–55	140	10

[1] Based on AASHO Designation: T 99–57, Method A (*1*) and California Division of Highways test method No. 216E.

[2] Mechanical analyses according to AASHO Designation: T 88. Results by this procedure frequently may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser

TABLE 6.—*Estimated*

[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 soils in referring to other series in the first column

Soil series and map symbols	Depth to bedrock	Depth from surface of typical profile	Classification		
			USDA texture	Unified	AASHO
Acidic rock land: AaF. Properties too variable to be estimated.	*Feet*	*Inches*			
Ahwahnee: AcC, AdD, AdE	2. 0–3. 5	0–8	Coarse sandy loam	SM	A–2
		8–26	Heavy coarse sandy loam	SM	A–2
		26	Weathered granodiorite.		
Aiken: AfB, AfB2, AfC, AfC2, AfD, AgD	4. 0–5. 0	0–15	Loam	ML	A–4 or A–5
		15–35	Clay loam	CL	A–6 or A–7
		35–72	Clay	MH	A–7
Argonaut:					
AkC, AlD, AmD	1. 5–3. 5 (2.0–4.0 in AlD)	0–10	Gravelly loam and gravelly silt loam.	SM	A–4
		10–30	Clay	MH or CH	A–7
		30	Metaandesite.		

See footnote at end of table.

test data

standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [2]									Atterberg values		Classification	
Percentage passing sieve—							Percentage smaller than—		Liquid limit	Plasticity	AASHO [3]	Unified [4]
1 inch	¾ inch	⅜ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.005 mm.	0.002 mm.				
	100	92	84	75	55	45	16	7	39	10	A-4(2)	SM
			100	84	47	33	20	14	46	22	A-2-7(2)	SC
100	99	84	69	53	34	22	13	8	37	19	A-2-6(1)	SC
			100	98	77	45	18	9	31	[5]	A-4(2)	SM
				100	80	41	29	19	30	11	A-6(1)	SC
			100	97	73	47	18	8	27	7	A-4(2)	SM-SC
			100	98	76	54	33	23	30	23	A-6(9)	CL
			100	93	61	30	9	6	28	[5]	A-2-4(0)	SM

than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

[3] Based on AASHO Designation: M145-49 (*1*).

[4] Based on the Unified soil classification system (*24*).

[5] Nonplastic..

properties of the soils

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for of this table. The symbol < means less than]

Coarse fragments greater than 3 inches	Percentage passing sieve—				Atterberg values		Permeability	Available water holding capacity	Reaction	Shrink-swell potential	Corrosivity (uncoated steel)
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity					
							Inches per hour	*Inches per inch of soil*	*pH value*		
0	100	85–100	40–50	20–30	10–20	[1]	2. 00–6. 30	0. 11–0. 13	6. 1–7. 3	Low	Low.
0	100	85–100	50–60	25–35	20–30	0–10	2. 00–6. 30	0. 13–0. 15	6. 1–6. 5	Low	Low.
0 (15–30 in AgD)	100	95–100	75–85	50–60	35–50	0–10	0. 63–2. 00	0. 15–0. 17	5. 6–6. 0	Low	High.
0 (15–30 in AgD)	100	95–100	90–95	70–80	35–50	15–30	0. 63–2. 00	0. 17–0. 19	5. 6–6. 0	Moderate	High.
0 (15–30 in AgD)	100	95–100	90–95	75–85	50–60	15–30	0. 2–0. 63	0. 15–0. 17	5. 1–5. 5	Moderate	High.
0 (20–30 in AlD)	75–90	65–85	60–80	35–50	10–20	0–10	0. 63–2. 00	0. 10–0. 12	5. 6–6. 5	Low	Moderate.
0 (20–30 in AlD)	100	70–90	65–85	65–80	50–65	20–35	<0. 06	0. 14–0. 16	6. 1–6. 5	High	High.

TABLE 6.—*Estimated properties of*

Soil series and map symbols	Depth to bedrock	Depth from surface of typical profile	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Argonaut—Continued					
AnB	2. 0–3. 5	0–11	Clay loam	CL	A–6
		11–40	Clay	MH or CH	A–7
		40	Gabbrodiorite.		
Argonaut, seeped variant: AoB	2. 0–3. 5	0–8	Loam	ML or CL	A–4
		8–17	Silty clay loam	CL	A–7
		17–32	Clay	MH or CH	A–7
		32	Slate.		
Auberry: ArB, ArC, ArD, AsC, AtD, AtE, AuD.	3. 5–5. 0+ (2.0–3.5 in AuD).	0–13	Coarse sandy loam	SM	A–2
		13–36	Coarse sandy clay loam	SC	A–4 or A–6
		36–56	Coarse sandy loam	SM	A–2
		56	Granodiorite.		
Auburn: AwD, AxD, AxE, AyF	1. 0–2. 0	0–14	Silt loam	ML or CL	A–4
		14	Metamorphic rock.		
Auburn, heavy subsoil variant: AzE	0. 5–2. 0	0–27	Cobbly clay loam and very cobbly clay loam.	SC	A–6
		27	Slate.		
*Boomer: BhC, BhD, BkD, BkE, BkF, BpC, BpD, BrE.	2. 0–4. 5	0–13	Gravelly loam	SM	A–4
		13–52	Gravelly clay loam and gravelly sandy clay loam.	SC	A–2
For properties of Sites soil in BpC, BpD, and BrE, refer to SkC, SkD, SkE, SoE, SrE, SrF in the Sites series.		52	Basic schist.		
Chaix: CcE, CcF	2. 0–3. 5	0–34	Coarse sandy loam	SM	A–2
		34	Granodiorite.		
Chawanakee: ChE	1. 0–2. 0	0–16	Coarse sandy loam	SM	A–2
		16	Granodiorite.		
Cohasset:					
CkD, ClE	3. 5–5. 0+	0–15	Sandy loam or cobbly sandy loam.	SM	A–2
		15–46	Loam or cobbly loam	SM or SC	A–4 or A–6
		46	Andesite.		
CmB, CmC, CmD, CoC, CoE	3. 5–5. 0+	0–14	Cobbly loam or loam	ML	A–4
		14–46	Cobbly clay loam or clay loam.	CL	A–7
		46	Andesite.		
Crozier: CrE	2. 0–3. 5	0–16	Cobbly loam	ML	A–4
		16–36	Cobbly clay loam	CL	A–6
		36	Andesite.		
Delpiedra: DeE	1. 0–2. 0	0–12	Clay loam	CL	A–6
		[1] 12	Serpentine.		
Diamond Springs: DfB, DfC, DfD, DgE	2. 0–4. 0	0–9	Very fine sandy loam and loam.	ML or CL	A–4
		9–40	Clay loam	ML	A–6
		40	Metadacite.		

See footnote at end of table.

the soils—Continued

Coarse fragments greater than 3 inches	Percentage passing sieve—				Atterberg values		Permeability	Available water holding capacity	Reaction	Shrink-swell potential	Corrosivity (uncoated steel)
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity					
							Inches per hour	*Inches per inch of soil*	*pH value*		
0	100	95–100	85–95	70–80	30–40	15–25	0. 63–2. 00	0. 18–0. 20	6. 1–6. 5	Moderate	Moderate.
0	100	95–100	80–90	75–80	50–65	20–35	<0. 06	0. 14–0. 16	6. 1–6. 5	High	High.
0	95–100	80–90	70–80	50–60	15–25	0–10	0. 63–2. 00	0. 13–0. 15	5. 6–6. 5	Low	High.
0	100	95–100	90–95	70–90	40–50	15–30	0. 20–0. 63	0. 18–0. 20	5. 6–6. 0	Moderate	High.
0	100	100	95–100	70–90	50–65	20–35	<0. 06	0. 14–0. 16	6. 1–7. 3	High	High.
0	100	85–95	60–70	25–35	(1)	(1)	2. 00–6. 30	0. 11–0. 13	6. 1–6. 5	Low	Low.
0	100	90–100	80–90	40–50	20–30	5–15	0. 63–2. 00	0. 14–0. 16	6. 1–6. 5	Moderate	Moderate.
0	100	85–95	60–70	25–35	(1)	(1)	2. 00–6. 30	0. 11–0. 13	6. 1–6. 5	Low	Low.
0–15	90–100	85–95	75–85	70–80	20–30	5–10	0. 63–2. 00	0. 16–0. 20	6. 1–7. 3	Low	Low.
20–40	75–85	55–70	50–65	35–50	30–40	10–20	0. 63–2. 00	0. 08–0. 10	5. 6–6. 5	Low	Low.
0–10	80–90	70–80	50–70	40–50	30–40	5–10	0. 63–2. 00	0. 15–0. 17	5. 6–6. 5	Low	Low.
0–10	65–90	50–85	30–50	25–35	35–50	15–25	0. 2–0. 63	0. 15–0. 17	5. 6–6. 5	Moderate	Moderate.
0	90–100	75–85	50–60	25–35	(1)	(1)	2. 00–6. 30	0. 10–0. 12	5. 1–6. 5	Low	Low.
0	90–100	75–85	40–50	25–35	(1)	(1)	2. 00–6. 30	0. 10–0. 12	5. 6–6. 5	Low	Low.
0–30	85–95	80–90	55–65	25–35	10–20	(1)	2. 00–6. 30	0. 10–0. 12	5. 6–6. 5	Low	Moderate.
0–35	85–95	75–85	55–65	35–50	30–40	5–20	0. 63–2. 00	0. 14–0. 18	5. 1–6. 0	Moderate	Moderate.
0–30	85–95	80–90	75–85	50–60	10–20	0–10	0. 63–2. 00	0. 13–0. 17	5. 6–6. 5	Low	Moderate.
0–35	90–100	85–95	75–85	65–75	40–50	15–25	0. 63–2. 00	0. 14–0. 18	5. 1–6. 0	Moderate	Moderate.
10–30	95–100	85–95	70–80	60–70	20–30	5–10	2. 00–6. 30	0. 13–0. 15	5. 6–6. 5	Low	Moderate.
20–35	95–100	85–95	75–85	65–75	30–40	15–25	0. 63–2. 00	0. 14–0. 18	5. 1–6. 0	Low	Moderate.
0–5	95–100	90–95	75–85	70–80	30–40	10–20	0. 63–2. 00	0. 16–0. 18	6. 1–7. 3	Moderate	Moderate.
0	100	95–100	80–90	60–75	20–30	5–10	0. 63–2. 00	0. 13–0. 16	4. 5–6. 0	Low	High.
0	100	100	80–90	70–80	30–40	10–20	0. 20–0. 63	0. 17–0. 19	4. 5–5. 5	Low	High.

TABLE 6.—*Estimated properties of*

Soil series and map symbols	Depth to bedrock	Depth from surface of typical profile	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Diamond Springs, grayish subsoil variant: DmD, DmE.	3. 0–5. 0.	0–5	Gravelly sandy loam	SM	A–2
		5–25	Loam	ML	A–4
		25–48	Gravelly loam and gravelly sandy loam.	SM or SC	A–4
		48	Rhyolitic tuff.		
Gullied land: GuF. Properties too variable to be estimated.					
Holland: HgB, HgC, HgD, HhC, HkE, HkF	3. 5–5. 0+	0–21	Coarse sandy loam	SM	A–4
		21–45	Sandy clay loam	SC	A–6
		45–59	Coarse sandy loam	SM	A–4
		59	Granodiorite.		
Horseshoe: HrC, HsE	5. 0	0–30	Gravelly loam (gravelly mucky loam surface layer in places).	CL	A–6
		30–50	Gravelly clay loam	CL	A–6
		50–70	Very gravelly clay loam	GC	A–6
Hotaw: HtE	2. 0–3. 5	0–22	Coarse sandy loam	SM	A–4
		22–35	Sandy clay loam	SC	A–6
		35	Granodiorite.		
Iron Mountain: ImE	0. 5–2. 0	0–12	Cobbly sandy loam	SM	A–2
		12	Andesite.		
Josephine: JrC, JrD, JsE, JtC, JtD, JtE, JuE, JuF, JvD.	3. 5–5. 0	0–14	Silt loam (gravelly loam in places).	ML or CL	A–4
		14–33	Silty clay loam	CL	A–6
		33–50	Very gravelly silt loam	GM	A–1 or A–2
		50	Slate.		
Loamy alluvial land: LaB. Properties too variable to be estimated.					
*Mariposa: MaD, MbE, MbF, McE, McF. For properties of the Josephine soils in McE and McF, refer to the Josephine series.	1. 5–2. 5	0–26	Gravelly silt loam	SM or ML	A–4
		26	Slate.		
Maymen: MfF	0. 5–1. 5	0–9	Gravelly loam	SM or SC	A–4
		9	Slate.		
McCarthy: MhE	2. 0–3. 5	0–38	Very cobbly loam	SC or SM	A–4
		38	Andesite.		
Metamorphic rock land: MmF. Properties too variable to be estimated.					
Mixed alluvial land: MpB. Properties too variable to be estimated.					
Musick: MrC, MrD, MsC, MtE	4. 0–5. 0+	0–12	Sandy loam	SM	A–4
		12–42	Heavy clay loam and sandy clay.	SM or ML	A–7
		42–60	Sandy loam	SM	A–4
Perkins: PeD	4. 0–5. 0+	0–13	Gravelly loam and cobbly loam.	SM or SC	A–4 or A–6
		13–46	Cobbly clay loam and cobbly clay.	SC or CL	A–6
		46	Weathered granodiorite.		

See footnote at end of table.

the soils—Continued

Coarse fragments greater than 3 inches	Percentage passing sieve—				Atterberg values		Permeability	Available water holding capacity	Reaction	Shrink-swell potential	Corrosivity (uncoated steel)
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity					
							Inches per hour	*Inches per inch of soil*	*pH value*		
0	80–90	60–75	40–50	20–30	(1)	(1)	2. 00–6. 30	0. 09–0. 11	6. 1–6. 5	Low	Low.
0	95–100	90–100	80–90	60–75	20–30	5–10	0. 63–2. 00	0. 15–0. 17	5. 6–6. 5	Low	Moderate.
0	80–90	70–80	50–70	35–50	10–30	5–10	0. 63–6. 30	0. 10–0. 14	5. 1–6. 0	Low	Moderate.
0	100	90–100	70–80	40–50	25–35	(1)	2. 00–6. 30	0. 10–0. 12	5. 6–6. 0	Low	Low.
0	100	95–100	75–85	40–50	25–35	10–20	0. 20–0. 63	0. 14–0. 16	5. 1–6. 0	Moderate	Moderate.
0	100	90–100	60–70	40–50	25–35	(1)	2. 00–6. 30	0. 10–0. 12	5. 6–6. 0	Low	Low.
0–10	85–95	70–90	60–85	50–60	20–30	10–20	0. 63–2. 00	0. 13–0. 15	5. 1–6. 5	Low	Low.
0–10	85–95	70–90	65–90	55–65	30–40	20–30	0. 63–2. 00	0. 15–0. 17	4. 5–5. 5	Moderate	Moderate.
10–20	45–55	40–50	40–50	35–45	40–50	20–30	0. 63–2. 00	0. 08–0. 10	4. 5–5. 0	Low	Moderate.
0	100	90–100	70–80	40–50	25–35	0–10	2. 00–6. 30	0. 10–0. 12	5. 6–6. 5	Low	Low.
0	100	95–100	75–85	40–50	25–35	10–20	0. 20–0. 63	0. 14–0. 16	5. 1–6. 0	Moderate	Moderate.
10–20	75–95	65–90	45–65	25–35	20–30	0–10	2. 00–6. 30	0. 08–0. 10	5. 6–6. 0	Low	Low.
0	95–100	95–100	80–90	70–80	20–30	0–10	0. 63–2. 00	0. 16–0. 18	5. 1–6. 0	Low	Moderate.
0	100	95–100	85–95	75–85	30–40	20–30	0. 63–2. 00	0. 16–0. 18	4. 5–6. 0	Moderate	Moderate.
0–5	35–45	30–40	25–40	20–35	20–30	0–5	0. 63–2. 00	0. 07–0. 09	4. 5–5. 0	Low	Moderate.
0	60–90	55–85	50–80	40–70	20–30	0–5	0. 63–2. 00	0. 12–0. 14	5. 1–6. 5	Low	Low.
0–5	60–90	50–80	45–65	35–50	10–20	0–10	0. 63–2. 00	0. 12–0. 14	4. 5–5. 5	Low	Low.
15–65	70–80	65–75	55–70	35–50	20–30	5–10	0. 63–2. 00	0. 10–0. 12	5. 1–6. 5	Low	Moderate.
0	100	95–100	80–90	40–50	30–40	0–10	2. 00–6. 30	0. 12–0. 14	5. 6–6. 0	Low	Low.
0	100	95–100	80–90	45–60	40–50	10–20	0. 20–0. 63	0. 16–0. 18	5. 1–5. 5	High	High.
0	100	95–100	75–85	35–45	30–40	0–10	0. 63–2. 00	0. 11–0. 13	4. 5–5. 0	Low	Low.
5–15	75–85	70–80	55–65	40–50	20–30	5–15	0. 63–2. 00	0. 12–0. 14	6. 1–6. 5	Low	Low.
20–25	85–95	80–90	60–70	40–60	30–40	15–25	0. 06–0. 20	0. 15–0. 17	6. 1–7. 3	High	High.

TABLE 6.—*Estimated properties of*

Soil series and map symbols	Depth to bedrock	Depth from surface of typical profile	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Perkins, moderately deep variant: PgB	2. 0–3. 5	0–12	Gravelly loam	SM or SC	A–4
		12–37	Very gravelly sandy clay loam.	GC	A–2
		37	Metabasic rock.		
Placer diggings: PrD. Properties too variable to be estimated.					
Rescue: ReB, ReC, ReD, RfC, RfD, RfE, RgE2.	3. 5–5. 0+	0–10	Sandy loam	SM or SC	A–4
		10–34	Sandy clay loam	SC or CL	A–6
		34–66	Weathered gabbrodiorite.		
Rescue, clayey variant: Rk	3. 5–5. 0+	0–40	Clay	CH	A–7
Serpentine rock land: SaF. Properties too variable to be estimated.					
Shaver: SbB, SbC, SbD, ScC, SdE	3. 5–5. 0+	0–51	Coarse sandy loam	SM	A–2
		51	Granodiorite.		
Sierra: SfC2, SfD2, SgC, ShD, ShE	3. 5–5. 0+	0–22	Sandy loam and loam	ML	A–4
		22–44	Clay loam	CL	A–6 or A–7
		44–72	Sandy clay loam	SC or CL	A–6
Sites: SkC, SkD, SkE, SoE, SrE, SrF	3. 5–5. 0+	0–14	Loam and stony loam	ML	A–4
		14–21	Clay loam	ML or CL	A–4 or A–6
		21–53	Clay	CL	A–7
		53–69	Clay loam	ML or CL	A–4 or A–6
		69	Schist.		
SsC, SsD, SsE	3. 5–5. 0+	0–12	Clay loam	ML or CL	A–4 or A–6
		12–70	Clay	CL	A–7
Sobrante: SuC, SuD, SwD	2. 0–3. 0	0–11	Silt loam	ML or CL	A–4
		11–24	Clay loam	CL	A–6
		24	Basic schist.		
Tailings: TaD. Properties too variable to be estimated.					
Wet alluvial land: WaB. Properties too variable to be estimated.					
Whiterock: WhE	0. 5–1. 0	0–8	Gravelly silt loam	SM	A–4
		8	Slate.		

[1] Nonplastic.

the soils—Continued

Coarse fragments greater than 3 inches	Percentage passing sieve—				Atterberg value:		Permeability	Available water holding capacity	Reaction	Shrink-swell potential	Corrosivity (uncoated steel)
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plas-ticity					
							Inches per hour	*Inches per inch of soil*	*pH value*		
0–5	75–85	70–80	55–65	40–50	20–30	5–10	0. 63–2. 00	0. 12–0. 14	6. 1–6. 5	Low	Low.
10–20	40–50	30–40	25–35	15–25	20–30	10–20	0. 20–0. 63	0. 08–0. 10	6. 1–7. 8	Low	Low.
0–15 (0 in ReB, ReC, ReD)	100	90–100	65–75	40–50	20–30	5–10	0. 63–2. 00	0. 12–0. 14	5. 6–6. 5	Low	Low.
0	100	95–100	70–80	45–55	30–40	20–30	0. 20–0. 63	0. 15–0. 17	6. 1–6. 5	Moderate	Moderate.
0	100	100	90–100	75–95	50–60	30–40	0. 06–0. 20	0. 16–0. 18	6. 1–7. 8	High	High.
0	100	85–95	40–50	25–35	(1)	(1)	2. 00–6. 30	0. 10–0. 12	5. 6–6. 0	Low	Low.
0	100	95–100	85–95	60–70	25–40	5–10	0. 63–2. 00	0. 15–0. 17	5. 6–6. 0	Low	Low.
0	100	95–100	75–85	65–75	35–45	15–25	0. 20–0. 63	0. 18–0. 20	6. 1–6. 5	Moderate	Moderate.
0	100	90–95	75–85	45–55	25–35	10–20	0. 20–0. 63	0. 14–0. 16	6. 1–6. 5	Moderate	Moderate.
0 (15–35 in SoE)	90–100	80–95	60–70	50–65	20–35	0–10	0. 63–2. 00	0. 14–0. 16	5. 6–6. 0	Low	Moderate.
0 (15–35 in SoE)	90–100	85–95	80–90	60–70	25–35	5–15	0. 63–2. 00	0. 16–0. 18	5. 6–6. 0	Low	Moderate.
0 (5–10 in SoE)	100	95–100	80–95	70–85	40–50	20–30	0. 20–0. 63	0. 15–0. 17	4. 5–6. 0	Moderate	High.
0 (5–10 in SoE)	90–100	85–95	80–90	60–70	25–35	5–15	0. 20–0. 63	0. 16–0. 18	4. 5–5. 0	Low	Moderate.
0	90–100	85–95	80–90	60–70	25–35	5–15	0. 63–2. 00	0. 16–0. 18	5. 6–6. 0	Low	Moderate.
0	100	95–100	80–95	70–85	40–50	20–30	0. 20–0. 63	0. 15–0. 17	4. 5–5. 5	Moderate	High.
0	100	95–100	80–90	70–80	20–30	0–10	0. 63–2. 00	0. 18–0. 20	5. 6–6. 5	Low	Low.
0	95–100	90–95	80–90	70–80	30–40	10–20	0. 63–2. 00	0. 18–0. 20	6. 1–6. 5	Moderate	Moderate.
0–30	55–70	50–65	40–55	35–50	25–35	0–10	0. 63–2. 00	0. 12–0. 14	5. 1–6. 0	Low	Low.

TABLE 7.—*Estimated 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 soils in for referring to other series in

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location
Acidic rock land: AaF. Interpretations not made; properties too variable.				
Ahwahnee: AcC, AdD, AdE.	Fair to poor: mostly sandy loam; rock outcrops.	Poor for sand: 20 to 30 percent fines. Unsuitable for gravel: 15 to 25 percent gravel.	Good	Cut and fill slopes are easily eroded; moderate to high potential frost action; rock outcrops on steeper slopes.
Aiken: AfB, AfB2, AfC, AfC2, AfD, AgD.	Fair: loam over clay loam; clay at depth of 35 inches.	Unsuitable: more than 50 percent fines.	Fair to poor: A–4, A–5, A–6, or A–7.	Bare slopes are erodible; moderate potential frost action; moderately slow permeability; on broad, gently rolling ridgetops.
Argonaut: AkC, AlD, AmD, AnB.	Poor: clay at depth of 10 inches.	Unsuitable: mostly more than 50 percent fines.	Fair to poor: A–4, A–6, or A–7.	Rock outcrops cover from 5 to 25 percent of surface; moderate potential frost action; very slow permeability; on undulating to hilly uplands.
Argonaut, seeped variant: AoB.	Poor: clay at depth of 17 inches.	Unsuitable: more than 50 percent fines.	Fair to poor: A–4 or A–7.	Small spring and seep areas occur in slightly sloping areas; drainageways and waterways needed.
Auberry: ArB, ArC, ArD, AsC, AtD, AtE, AuD.	Fair to poor: coarse sandy clay loam at depth of 13 inches. AsC: rocky. AtD, AtE, AuD: very rocky.	Poor for sand: limited amount of material; 25 to 50 percent fines. Unsuitable for gravel: 0 to 15 percent gravel.	Good to poor: A–2, A–4, or A–6.	Bare slopes easily eroded; rock outcrops occupy up to 25 percent of surface; slight potential frost action; moderate permeability; on gently rolling uplands.
Auburn: AwD, AxD, AxE, AyF.	Poor: silt loam 1 to 2 feet deep over bedrock. AxD, AxE: very rocky. AyF: extremely rocky.	Unsuitable: more than 50 percent fines.	Fair: A–4	Up to 50 percent outcrops of amphibolite schist; shallow over bedrock; moderate to high potential frost action; moderate permeability; bare slopes are erodible.
Auburn, heavy subsoil varient: AzE.	Poor: cobbly and very cobbly clay loam; cobbly subsoil.	Unsuitable for sand: limited sand. Poor to unsuitable for gravel: 50 to 80 percent slate fragments.	Poor: A–6	Moderate to high potential frost action; moderate permeability; subsoil very cobbly.
*Boomer: BhC, BhD, BkD, BkE, BkF, BpC, BpD, BrE. For properties of Sites soils in BpC, BpD, BrE, refer to the Sites series.	Fair: gravelly loam over gravelly clay loam. BkD, BkE, BkF, BrE: very rocky.	Poor to unsuitable for sand: 25 to 50 percent fines. Poor to unsuitable for gravel: 20 to 50 percent gravel.	Good to fair: A–2 or A–4.	Slight to high potential frost action; moderate permeability; up to 50 percent of the soil mass consists of gravel-sized fragments; rock outcrops cover from 0 to 25 percent of the surface; undulating to steep.

interpretations of the soils

such mapping units may have different properties and limitations, and for this reason, it is necessary to follow carefully the instructions the first column of this table]

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil group
Water retention		Irrigation		
Embankments	Reservoir areas			
Moderate shear strength; semipervious to impervious when compacted; slight to medium compressibility; moderate stability; low to moderate resistance to piping.	High seepage rate; underlying granitic rock is weathered, fractured, and fairly porous.	Low available water holding capacity; rapid intake rate; 9 to 50 percent slopes. AdD, AdE: very rocky.	Severe: 2.0 to 3.5 feet to bedrock; slopes are more than 15 percent in places.	C.
Low shear strength; semipervious when compacted; medium compressibility; low stability; low to moderate resistance to piping.	Moderately slow permeability; deep, weathered bedrock.	High available water holding capacity; moderate intake rate; 3 to 30 percent slopes. AgD: cobbly.	Severe: moderately slow permeability; slopes are more than 15 percent in places.	B.
Low shear strength; impervious when compacted; medium to high compressibility; low stability; cracks when dry.	Very slow permeability	Moderate available water holding capacity; slow intake rate; 2 to 30 percent slopes. AlD: extremely stony. AmD: very rocky.	Severe: very slow permeability; slopes are more than 15 percent in places.	D.
Low shear strength; impervious when compacted; medium compressibility; low stability; cracks when dry.	Very slow permeability	Moderate available water holding capacity; moderate intake rate; 0 to 5 percent slopes.	Severe: very slow permeability; poorly drained; bedrock.	D.
Moderate shear strength; semipervious to impervious when compacted; slight compressibility; moderate stability; low to moderate resistance to piping.	Moderately slow permeability; underlying bedrock is strongly weathered.	Moderate available water holding capacity; moderate intake rate; 5 to 50 percent slopes. AsC: rocky. AtD, AtE, AuD: very rocky.	Severe: moderately slow permeability.	B (ArB, ArC, ArD, AsC, AtD, AtE). C (AuD).
Low to moderate shear strength; semipervious to impervious when compacted; medium compressibility; moderate to low stability; cracks when dry; moderate resistance to piping.	Moderate permeability, which varies according to degree of fracturing of parent material; shallow over bedrock.	Low available water holding capacity; moderate intake rate; 2 to 70 percent slopes. AxD, AxE: very rocky. AyF: extremely rocky.	Severe: 1 to 2 feet to bedrock; slopes are more than 15 percent in many places.	D.
Moderate shear strength; semipervious to impervious when compacted; medium compressibility; moderate stability.	Moderate permeability; weathered slate at shallow depth.	Low available water holding capacity; moderate intake rate; 9 to 50 percent slopes.	Severe: slopes; 0.5 to 2.0 feet to bedrock.	D.
Moderate shear strength; impervious when compacted; slight to medium compressibility; moderate stability; moderate resistance to piping.	Moderate permeability; underlain by fractured bedrock	Low available water holding capacity; moderately rapid intake rate; 3 to 70 percent slopes. BkD, BkE, BkF, BrE: very rocky.	Severe: slopes; 2.0 to 4.5 feet to bedrock.	B (More than 40 inches to bedrock). C (24 to 40 inches to bedrock).

TABLE 7.—*Estimated engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location
Chaix: CcE, CcF	Fair: coarse sandy loam.	Fair to poor for sand: 25 to 35 percent fines. Unsuitable for gravel: 15 to 25 percent gravel.	Good	Rolling to very steep on uplands; 24 to 40 inches to well-weathered granitic rock; 5 to 25 percent of surface contains rock outcrops; high erosion hazard.
Chawanakee: ChE	Poor: coarse sandy loam; weathered bedrock at depth of 16 inches; very rocky.	Poor for sand: limited amount of material; 25 to 35 percent fines. Unsuitable for gravel: 15 to 25 percent gravel.	Good	Bare slopes are easily erodible; moderate to high potential frost action; moderately rapid permeability; shallow over decomposed bedrock; contains 5 to 25 percent rock outcrops.
Cohasset: CkD, ClE	Fair to poor: sandy loam or cobbly sandy loam over loam or cobbly loam; bedrock at depth of 40 inches to more than 60 inches; very rocky.	Poor to unsuitable for sand: 25 to 50 percent fines. Unsuitable for gravel: 10 to 25 percent gravel; 0 to 35 percent cobblestones.	Good to poor: A–2, A–4, or A–6.	Slight to high potential frost action; moderate permeability; soils contain 0 to 35 percent cobblestones; moderately sloping to steep on side slopes.
CmB, CmC, CmD, CoC, CoE.	Fair to poor: cobbly loam or loam over cobbly clay loam or clay loam; bedrock at depth of 40 inches to more than 60 inches.	Unsuitable for sand: more than 50 percent fines. Unsuitable for gravel: 5 to 20 percent gravel; 0 to 35 percent cobblestones.	Fair to poor: A–4 or A–7.	Moderate to very high potential frost action; moderate permeability; moderately sloping on ridgetops and steep on side slopes of andesitic ridges; 0 to 35 percent cobblestones.
Crozier: CrE	Fair: cobbly loam over cobbly clay loam; bedrock at depth of 24 to 40 inches.	Unsuitable for sand: more than 60 percent fines. Unsuitable for gravel: 5 to 15 percent gravel; 10 to 35 percent cobblestones.	Fair to poor: A–4 or A–6.	Moderate to very high potential frost action; moderate permeability; strongly sloping to steep on side slopes of andesitic ridges; shallow over hard conglomerate bedrock.
Delpiedra: DeE	Poor: clay loam; bedrock at depth of 10 to 24 inches; very rocky.	Unsuitable: more than 70 percent fines.	Poor: A–6	Moderate to high potential frost action; moderate permeability; shallow over serpentine bedrock; 2 to 25 percent of surface is covered with rock outcrops.
Diamond Springs: DfB, DfC, DfD, DgE.	Fair: very fine sandy loam and loam over clay loam; bedrock at depth of 24 to 50 inches. DgE: very rocky.	Unsuitable: more than 60 percent fines.	Fair to poor: A–4 or A–6.	Moderate to high potential frost action; moderately slow permeability; bare slopes are erodible; on ridges and side slopes.
Diamond Springs; grayish subsoil variant: DmD, DmE.	Fair: gravelly loam, loam, and gravelly sandy loam; bedrock at depth of 36 to 60 inches.	Unsuitable for sand: 20 to 75 percent fines. Unsuitable for gravel: 0 to 40 percent gravel.	Good to fair: A–2 or A–4.	Slight to high potential frost action; moderate permeability; steep on side slopes of rhyolitic ridges; highly erodible.

interpretations of the soils—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil group
Water retention		Irrigation		
Embankments	Reservoir areas			
Moderate shear strength; impervious when compacted; slight to medium compressibility; moderate stability; too steep for embankments; moderate resistance to piping.	Moderately rapid permeability; underlain by deeply weathered bedrock.	Moderate available waterholding capacity; moderately rapid intake rate; 9 to 70 percent slopes; very rocky.	Severe: slopes; 2.0 to 3.5 feet to bedrock at depth of 24 to 40 inches.	C.
Moderate shear strength; semipervious when compacted; very slight compressibility; moderate stability; moderate resistance to piping.	Moderately rapid permeability; shallow over weathered bedrock.	Low available water holding capacity; moderately rapid intake rate; 9 to 50 percent slopes; very rocky.	Severe: slopes; 1 to 2 feet to bedrock.	C.
Moderate shear strength; semipervious to impervious when compacted; very slight compressibility; moderate stability: low to moderate resistance to piping.	Moderate permeability; generally too steep for water storage.	Moderate to high available water holding capacity; moderate intake rate; 9 to 50 percent slopes. ClE: cobbly.	Severe: slopes----	B.
Moderate shear strength; semipervious to impervious when compacted; medium compressibility; moderate to high stability; moderate to high resistance to piping.	Moderate permeability; generally too steep for water storage.	Moderate to high available water holding capacity; moderate intake rate; 3 to 50 percent slopes. CoC, CoE: cobbly.	Moderate for CmB: slopes. Severe for all other units: slopes.	B.
Low to moderate shear strength; semipervious to impervious when compacted; medium compressibility; low to moderate stability; low to moderate resistance to piping.	Moderate permeability; too steep for water storage.	Moderate available water holding capacity; moderate intake rate; 9 to 50 percent slopes; cobbly.	Severe: slopes; 2.0 to 3.5 feet to bedrock at depth of 24 to 40 inches.	C.
Low to moderate shear strength; semipervious to impervious when compacted; medium compressibility; low to moderate stability; moderate shrink-swell potential.	Moderate permeability; 10 to 24 inches to decomposed bedrock.	Low available water holding capacity; moderate intake rate; 3 to 50 percent slopes; very rocky.	Severe: 1 to 2 feet to bedrock; slopes are more than 10 percent in most places.	D.
Low to moderate shear strength; semipervious to impervious when compacted; medium compressibility; low to moderate stability; low to moderate resistance to piping.	Moderately slow permeability.	Moderate available water holding capacity; moderate intake rate; 3 to 50 percent slopes. DgE: very rocky.	Severe: moderately slow permeability; slopes are more than 10 percent in many places; 2 to 4 feet to bedrock.	C.
Moderate shear strength; semipervious to impervious when compacted; slight compressibility; moderate stability; low to moderate resistance to piping.	Moderate permeability; generally too steep for water storage.	Moderate available water holding capacity; moderate intake rate; 9 to 50 percent slopes.	Severe: slopes----	B.

TABLE 7.—*Estimated engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location
Gullied land: GuF. Interpretations not made; properties too variable.				
Holland: HgB, HgC, HgD, HhC, HkE, HkF.	Fair: coarse sandy loam over sandy clay loam; bedrock at depth of 40 inches to more than 60 inches. HhC: rocky. HkD, HkF: very rocky.	Unsuitable for sand: 40 to 50 percent fines. Unsuitable for gravel: 0 to 10 percent gravel.	Good to poor: A–4 or A–6.	Slight to high potential frost action; moderately slow permeability; highly erodible; rock outcrops cover 0 to 25 percent of surface; hilly to very steep.
Horseshoe: HrC, HsE.	Fair: gravelly sandy loam and gravelly loam over gravelly clay loam; very gravelly clay loam at depth of 50 inches.	Unsuitable for sand: 35 to 65 percent fines. Poor to unsuitable for gravel: 10 to 60 percent gravel.	Poor: A–6	Slight to moderate potential frost action; moderate permeability; profile contains 5 to 30 percent gravel and cobblestones rolling to very steep on terraces formed from old river deposits.
Hotaw: HtE	Fair: coarse sandy loam over sandy clay loam; bedrock at depth of 24 to 40 inches; very rocky.	Unsuitable for sand: 40 to 50 percent fines. Unsuitable for gravel: 0 to 10 percent gravel.	Fair to poor: A–4 or A–6.	Slight to high potential frost action; moderately slow permeability; rock outcrops cover 5 to 25 percent of the surface; 2 to 3½ feet deep to deeply weathered granitic rock; rolling to steep; high erodibility.
Iron Mountain: ImE	Poor: cobbly sandy loam; 5 to 20 inches deep to bedrock; very rocky.	Unsuitable for sand: limited amount of material; 25 to 35 percent fines. Unsuitable for gravel: 10 to 35 percent gravel; 10 to 20 percent cobblestones.	Good	Slight to moderate potential frost action; moderately rapid permeability; shallow over hard cemented conglomerate bedrock; 35 percent of soil mass consists of gravel and cobblestones.
*Josephine: JrC, JrD, JsE, JtC, JtD, JtE, JuE, JuF, JvD. For properties of Mariposa part of JvD, see Mariposa series.	Fair: gravelly loam, silt loam, and silty clay loam over very gravelly silt loam; bedrock at depth of 3½ to 5 feet. JuE, JuF: very rocky.	Poor to unsuitable for sand: 25 to 85 percent fines. Poor to unsuitable for gravel: 5 to 70 percent gravel; 0 to 5 percent cobblestones.	Good to poor: A–2, A–4, or A–6.	Moderate to high potential frost action; moderate permeability; road cuts are erodible; 0 to 25 percent rock outcrops.
Loamy alluvial land: LaB. Interpretations not made; properties too variable.				
*Mariposa: MaD, MbE, MbF, McE, McF. For properties of Josephine part of McE, McF, see Josephine series.	Poor: gravelly silt loam; bedrock at depth of 15 to 30 inches. MbE, MbF, McE, McF: very rocky.	Unsuitable for sand: 40 to 70 percent fines. Poor to unsuitable for gravel: 15 to 45 percent gravel.	Fair: A–4	Moderate to very high potential frost action; moderate permeability; rock outcrops are common; gravel makes up 15 to 45 percent of soil mass; rolling to very steep; erodible.

interpretations of the soils—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil group
Water retention		Irrigation		
Embankments	Reservoir areas			
Moderate shear strength; semipervious to impervious when compacted; slight compressibility; moderate stability; low to moderate resistance to piping.	Moderately slow permeability; bedrock is deeply weathered.	High available water holding capacity; moderately rapid intake rate; 5 to 70 percent slopes. HhC: rocky; HkD, HkF: very rocky.	Severe: moderately slow permeability; slopes are more than 10 percent in many places.	B.
Moderate to low shear strength; semipervious to impervious when compacted; slight compressibility; moderate to low stability.	Moderate permeability; parent material is stratified; steep.	High available water holding capacity; moderate intake rate; 9 to 50 percent slopes.	Severe: slopes	B.
Moderate shear strength; semipervious to impervious when compacted; slight compressibility; moderate stability; low to moderate resistance to piping.	Moderately slow permeability; 2 to 3½ feet to deeply weathered granitic bedrock.	Moderate available water holding capacity; moderately rapid intake rate; 15 to 50 percent slopes; very rocky.	Severe: moderately slow permeability; slopes are more than 15 percent.	C.
Moderate shear strength; semipervious to impervious when compacted; very slight compressibility; moderate stability; low to moderate resistance to piping.	Moderately rapid permeability; bedrock is impervious.	Low available water holding capacity; moderately rapid intake rate; 3 to 50 percent slopes; very rocky.	Severe: 5 to 20 inches to bedrock; slopes in places.	D.
Very low to moderate shear strength; semipervious to impervious when compacted; medium compressibility; moderate to low stability; moderate shrink-swell potential; low to moderate resistance to piping.	Moderate permeability; bedrock is fractured and vertically tilted.	High available water holding capacity; moderate to moderately slow intake rate; 5 to 70 percent slopes. JuE, JuF: very rocky.	Moderate where slopes are 5 to 10 percent. Severe where slopes are 10 to 70 percent.	B.
Low to moderate shear strength; semipervious to impervious when compacted; medium compressibility; low to moderate stability; moderate to high resistance to piping.	Moderate permeability; 15 to 30 inches to bedrock; bedrock is fractured and vertically tilted.	Moderate available water holding capacity; moderate intake rate; 3 to 70 percent slopes, MbE, MbF, McE, McF: very rocky.	Severe: slopes; 15 to 30 inches to bedrock.	C.

TABLE 7.—*Estimated engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location
Maymen: MfF	Poor: gravelly loam; bedrock at depth of 6 to 16 inches; very rocky.	Unsuitable for sand: 35 to 50 percent fines. Unsuitable for gravel: 20 to 50 percent gravel; 0 to 50 percent cobblestones.	Fair: A–4	Moderate to high potential frost action; moderate permeability; shallow over bedrock; 20 to 50 percent of soil volume is gravel; 5 to 25 percent rock outcrops; hilly to very steep on uplands.
McCarthy: MhE	Poor: very cobbly loam; bedrock at depth of 24 to 40 inches.	Unsuitable for sand: 35 to 50 percent fines. Poor for gravel: 25 to 35 percent gravel; 15 to 65 percent cobblestones.	Fair: A–4	Slight to moderate potential frost action; moderate permeability; profile contains 15 to 65 percent cobblestones; road cuts erodible.
Metamorphic rock land: MmF. Interpretations not made; properties too variable.				
Mixed alluvial land: MpB. Interpretations not made; properties too variable.				
Musick: MrC, MrD, MsC, MtE.	Poor: sandy loam over heavy clay loam and sandy clay. MsC: rocky. MtE: very rocky.	Unsuitable: 35 to 60 percent fines.	Fair to poor: A–4 or A–7.	Gently rolling to very steep on uplands; 0 to 25 percent rock outcrops; high erodibility.
Perkins: PeD	Poor: gravelly loam and cobbly loam over cobbly clay loam and cobbly clay.	Poor to unsuitable for sand: 40 to 60 percent fines. Poor to unsuitable for gravel: 10 to 30 percent gravel; 5 to 25 percent cobblestones.	Fair to poor: A–4 or A–6.	Slight to moderate potential frost action; slow permeability; gravel and cobblestones make up 10 to 50 percent of the soil profile; on terraces above valley floor.
Perkins, moderately deep variant: PgB.	Poor: gravelly loam over very gravelly sandy clay loam; bedrock at depth of 30 to 40 inches.	Poor for sand: 15 to 50 percent fines. Poor to unsuitable for gravel: 20 to 70 percent gravel; 0 to 20 percent cobblestones.	Good to fair: A–2 or A–4.	Moderate potential frost action; moderately slow permeability; below depth of 12 inches, 60 to 70 percent of soil volume is gravel; drainageways necessary; nearly level to gently sloping on gravelly stream terraces.
Placer diggings: PrD. Interpretations not made; properties too variable.				
Rescue: ReB, ReC, ReD, RfC, RfD, RfE, RgE2.	Fair: sandy loam and sandy clay loam; bedrock at depth of 40 inches to more than 60 inches. RfC, RfD: very stony. RgE2: extremely stony.	Unsuitable for sand: 40 to 55 percent fines. Unsuitable for gravel: 0 to 10 percent gravel; 0 to 15 percent stones.	Good to poor: A–2, A–4, A–6.	Slight to high potential frost action; moderately slow permeability; 1 to 15 percent of the surface is covered with stones; undulating to steep; erodible.

interpretations of the soils—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil group
Water retention		Irrigation		
Embankments	Reservoir areas			
Moderate shear strength; semipervious to impervious when compacted; medium compressibility; moderate stability; shallow over bedrock; low to moderate resistance to piping.	Moderate permeability; 6 to 16 inches to vertically tilted slate bedrock.	Low available water holding capacity; moderate intake rate; 15 to 70 percent slopes; very rocky.	Severe: 0.5 to 1.5 feet to bedrock; slopes.	D.
Moderate shear strength; semipervious to impervious when compacted; very slight compressibility; moderate stability.	Moderate permeability; material is very cobbly.	Low to moderate available water holding capacity; moderate intake rate; 9 to 50 percent slopes; cobbly.	Severe: slopes; 2.0 to 3.5 feet to bedrock.	C.
Moderate shear strength; semipervious to impervious when compacted; slight compressibility; moderate stability; high shrink-swell potential; moderate to high resistance to piping.	Moderately slow permeability; underlying bedrock is deeply weathered.	High available water holding capacity; moderately rapid intake rate; 5 to 50 percent slopes. MsC: rocky. MtE: very rocky.	Severe: moderately slow permeability; slopes are more than 10 percent in places.	C.
Moderate shear strength; semipervious to impervious when compacted; slight compressibility; moderate stability; high shrink-swell potential.	Slow permeability; clay layer rests on weathered granodiorite.	High available water holding capacity; moderate intake rate; 3 to 30 percent slopes.	Severe: slow permeability; slopes are 10 to 30 percent in places.	C.
Moderate to high shear strength; impervious when compacted; slight compressibility; moderate to high stability.	Moderately slow permeability; clay layer rests on bedrock.	Moderate available water holding capacity; moderate intake rate; 2 to 5 percent slopes.	Severe: moderately slow permeability.	C.
Moderate shear strength; semipervious to impervious when compacted; slight compressibility; moderate stability.	Moderately slow permeability; bedrock is deeply weathered granitic material.	Moderate to high available water holding capacity; moderately rapid intake rate; 3 to 50 percent slopes. RfC, RfD, RfE: very stony; RgE2: extremely stony.	Severe: moderately slow permeability; slopes are 10 to 50 percent in many places.	B.

TABLE 7.—*Estimated engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location
Rescue, clayey variant: Rk.	Poor: clay	Unsuitable: more than 75 percent fines.	Poor: A–7	Subject to infrequent flooding; high water table during winter season; beside slow-flowing creeks; drainageways and watercourses needed.
Serpentine rock land: SaF. Interpretations not made; properties too variable.				
Shaver: SbB, SbC, SbD, ScC, SdE.	Fair: coarse sandy loam, bedrock at depth of 40 inches to more than 60 inches. ScD: rocky. SdE: very rocky.	Fair to poor for sand: 25 to 35 percent fines. Unsuitable for gravel: 5 to 15 percent gravel.	Good	Slight to high potential frost action; moderately rapid permeability; road cuts very erodible; 0 to 25 percent of the surface is rock outcrops; deeply weathered granitic bedrock; gently sloping to steep.
Sierra: SfC2, SfD2, SgC, ShD, ShE.	Fair: sandy loam and loam over clay loam and sandy clay loam. SgC: rocky. ShD, ShE: very rocky.	Unsuitable: mostly more than 50 percent fines.	Fair to poor: A–4, A–6, or A–7.	Moderate to high potential frost action; moderately slow permeability; 5 to 25 percent rock outcrops in places; deeply weathered granitic bedrock; hilly; highly erodible.
Sites: SkC, SkD, SkE, SoE, SrE, SrF, SsC, SsD, SsE.	Poor: loam and clay loam over clay; bedrock at depth of 40 inches to more than 60 inches. SoE: stony. SrE, SrF: very rocky.	Unsuitable for sand: more than 50 percent fines. Unsuitable for gravel: mostly 0 to 20 percent gravel. SoE: 5 to 35 percent stones.	Fair to poor: A–4, A–6, or A–7.	Slight to high potential frost action; moderately slow permeability; bedrock is vertically tilted slates; rock outcrops and slate fragments occupy 0 to 25 percent of soil surface.
Sobrante: SuC, SuD, SwD.	Fair: silt loam over clay loam; bedrock at depth of 22 to 36 inches. SwD: very rocky.	Unsuitable: more than 70 percent fines.	Fair to poor: A–4 or A–6.	Moderate to high potential frost action; moderate permeability; 22 to 36 inches to hard bedrock; rock outcrops cover 0 to 25 percent of the surface.
Tailings: TaD. Interpretations not made; properties too variable.				
Wet alluvial land: WaB. Interpretations not made; properties too variable.				
Whiterock: WhE	Poor: gravelly silt loam; bedrock at depth of 5 to 12 inches.	Unsuitable: 5 to 12 inches to bedrock.	Fair: A–4	Slight to high potential frost action; moderate permeability; very shallow soils underlain by hard slate; occasional rock outcrops.

interpretations of the soils—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil group
Water retention		Irrigation		
Embankments	Reservoir areas			
Low to very low shear strength; impervious when compacted; medium to very high compressibility; low to very low stability; high shrink-swell potential.	Slow permeability; broad, nearly level on bottom land.	Moderate available water holding capacity; slow intake rate; 0 to 2 percent slopes.	Severe: slow permeability; poorly drained.	D.
Moderate shear strength; semipervious when compacted; very slight compressibility; low stability; highly erodible; high resistance to piping.	Moderately rapid permeability; high seepage loss because of very porous underlying material.	Moderate available water holding capacity; rapid intake rate; 5 to 50 percent slopes. ScD: rocky. SdE: very rocky.	Moderate for SbB: slopes; 3.5 to 5 feet to bedrock. Severe for all other units; slopes.	B.
Low to moderate shear strength; semipervious to impervious when compacted; medium compressibility; moderate to low stability; moderate to low resistance to piping.	Moderately slow permeability, but underlying bedrock is deeply weathered and porous.	High available water holding capacity; moderate intake rate; 5 to 50 percent slopes.	Severe: moderately slow permeability; slopes in places.	B.
Low to moderate shear strength; semipervious to impervious when compacted; slight to medium compressibility; low to moderate stability; low to moderate resistance to piping.	Moderately slow permeability, but bedrock is fractured vertically tilted slates and schists.	High available water holding capacity; moderate to slow intake rate; 9 to 70 percent slopes. SoE: stony. SrE, SrF: very rocky.	Severe: moderately slow permeability; slopes in places.	B.
Moderate to low shear strength; impervious when compacted; medium compressibility; moderate to low stability; low to moderate resistance to piping.	Moderate permeability; 22 to 36 inches to hard bedrock.	Moderate available water holding capacity; moderate intake rate; 3 to 30 percent slopes. SwD: very rocky.	Severe: slopes; 2 to 3 feet to bedrock.	C.
Moderate shear strength; semipervious to impervious when compacted; slight compressibility; moderate stability; very shallow to rock; moderate resistance to piping.	Moderate permeability, depending on amount of fracturing of bedrock; 5 to 12 inches deep to bedrock.	Low available water holding capacity; rapid intake rate; 3 to 50 percent slopes.	Severe: 0.5 to 1.0 foot to bedrock; slopes in places.	D.

Engineering properties

Table 6 lists the soils in the survey area, lists the map symbols for each mapping unit, and gives estimates of soil properties significant to some engineering work. It also gives the textural classification of the U.S. Department of Agriculture and estimates of the Unified classification and the AASHO classification. In addition, estimates of the Atterberg values, permeability (*17*), available water holding capacity, reaction, shrink-swell potential, and corrosivity are given. The estimates are based partly on examinations made in the field, partly on results of test data shown in table 5, and partly on information on soils from other survey areas. Since the estimates are mainly for typical soils, some variations from these values should be anticipated. More information on the range of properties and qualities of the soils can be obtained in other parts of this survey.

Depth to bedrock is of interest to the engineer. Generally, the soils are shallow to underlying bedrock in the western part of the survey area and are increasingly deeper to the east.

The available water holding capacity, expressed in inches per inch of soil depth, is the capacity of a soil to retain water that can be readily absorbed by plants. It is the estimated amount of moisture held in soil between field capacity and the permanent wilting point of plants.

None of the soils in the survey area are saline or alkali to an extent that would affect their use for engineering.

The column showing reaction gives the estimated acidity or alkalinity of the soil expressed in pH value. A pH value of more than 7.3 indicates the soil is alkaline (basic), a pH value of less than 6.6 indicates an acid soil, and a pH value between 6.6 and 7.3 indicates a neutral soil.

The degree of limitations indicated for the soils in the columns in table 6 giving shrink-swell potential and corrosivity (untreated steel) are low, moderate, and high.

Shrink-swell potential refers to the change in volume of the soil material that results from a change in content of moisture. It is estimated on the basis of the kind and amount of clay in the soil layers. In general, soils that have a high content of clay have high shrink-swell potential, and coarser textured soils that contain less clay have a low shrink-swell potential. The soil that contains the most clay generally shrinks and swells the most, but in some soils the kind of clay in the soil may be more important than the amount.

Much damage to building foundations, roads, and other structures is caused by the shrinking and swelling of soils as they become dry or wet. Soils that have a low shrink-swell potential are suitable for building sites if other factors are favorable. As the shrink-swell potential increases, the soil is increasingly less suitable for buildings and roads. More detailed investigation of a site is needed where the soils have moderate or high shrink-swell potential. If large housing developments are placed on soils that have moderate or high shrink-swell potential, applying large amounts of water to lawns, shrubs, and other plants could cause ground water to accumulate in the subsurface and cause land slippage. Land slippage is particularly a hazard on the steeper slopes.

The ratings for corrosivity (*23*) in table 6 are based strictly on soil characteristics. Most materials used in construction, such as metal and concrete, corrode or deteriorate when buried in soil. The rate at which a material deteriorates depends largely upon the physical, chemical, and biological characteristics of the soil, and a given material corrodes more rapidly in some soils than in others. The corrosion probability generally is greater for extensive installations that intersect soil boundaries or soil horizons than for installations in one kind of soil or soil horizon. The range of characteristics between the layers in the profile of some soils is wide. As a result, the depth that a pipe or other structural material is buried can affect the degree of corrosion. A soil that has a more strongly developed subsoil, for example, has a different corrosivity rating for structural material laid near the surface than for such material laid just above or in the subsoil layer.

Construction of buildings and of pavements, fill and compaction operations, adding material to the surface soil, and other measures that alter soil permeability increase the probability of corrosion. In addition, mechanical agitation or excavation that results in nonuniform mixing of soil horizons is likely also to increase the probability of corrosion. Corrosivity, particularly for steel pipes or other structures, is also likely to be increased by electrical leaks from underground cables and by electrical charges resulting from dissimilar metal composition. Other factors likely to increase corrosivity are the quality of water used for watering plants, differences in the water content along conduits or structures, and the adding of fertilizer and of large amounts of organic matter.

Several soil characteristics affect the rate of corrosion of untreated steel. The most important of these are (1) electrical resistance to flow of current, (2) total acidity, (3) soil drainage, and (4) soil texture.

Engineering interpretations

Estimated engineering interpretations are listed in table 7. Each soil is given a broad relative rating as to its suitability as a source of topsoil, sand and gravel, and road fill. The criterion used in rating suitability as a source of sand and gravel was that these materials would be used as concrete aggregate with a minimum of preparation. The soil features that affect the use of the soils as sites for roads, embankments, reservoir areas, and irrigation are discussed.

The soils in the Area are highly susceptible to erosion when exposed on embankment faces and outslopes. At the lower elevations in the western part of the survey area, soils that are shallow over bedrock present problems in constructing roadways and laying pipelines. In these areas the construction and operation of septic tanks and of beds for the disposal of effluent also are complicated by the shallow depth to bedrock. The location of roads is difficult because of the steeply sloping rocky ridges separated by narrow, deep stream channels. Because of the numerous rock outcrops of tilted and fractured slate and schist, dam foundations and reservoirs may require special treatment to prevent excessive seepage. Flooding does not appear to be a limitation except in scattered areas located adjacent to stream courses. The need for agricultural drainage, other than disposal of surface water, is minor.

The factors considered for interpretating the soil limitations for septic tank filter fields are depth to bedrock, slope, permeability, percolation rate, water table, soil drainage, and flooding hazard. Assumptions were based on the amount of filter material, diameter of the lines, and

the depth of the earth cover. The ratings are moderate and severe.

Hydrologic soil groups are used in watershed planning to estimate runoff from rainfall. Soil properties and qualities are considered that influence the minimum rate of infiltration obtained for a bare soil after prolonged wetting. These properties are depth to seasonally high water table, intake rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The influence of ground cover is treated independently, not in hydrologic soil groupings. The soils have been classified into four groups:

Group A consists of soils that have a high infiltration rate when thoroughly wetted. These soils have a high rate of water transmission and low runoff potential. They are deep, are well drained or excessively drained, and consist chiefly of sand, gravel, or both. No soils in the El Dorado Area are in group A.

Group B soils have a moderate infiltration rate when thoroughly wetted. These soils have a moderate rate of water transmission and moderate runoff potential. They are moderately deep or deep, are moderately well drained or well drained, and are medium textured to moderately coarse textured.

Group C soils have a slow infiltration rate when thoroughly wetted. These soils have a slow rate of water transmission and high runoff potential. They have a layer that impedes downward movement of water, or they are moderately fine textured or fine textured and have a slow infiltration rate.

Group D soils have a slow infiltration rate when thoroughly wetted. The rate of water transmission is very slow, and runoff potential is very high. In this group are (1) clay soils that have high shrink-swell potential, (2) soils that have a permanent high water table, (3) soils that have a claypan or clay layer at or near the surface, and (4) soils that are shallow over nearly impervious material.

Formation, Morphology, and Classification of the Soils [7]

In this section the factors that affect the formation of the soils in the El Dorado Area are discussed and important processes in the morphology of the soils are described. Then the classification of the soils by higher categories is given.

Factors of Soil Formation

Soil is a natural formation on the surface of the earth in which plants grow; it is composed of organic and mineral material (*18*). Soils differ in their appearance, composition, management requirements, and productivity in different localities or even within short distances in the same locality. The factors that cause soils to differ are: (1) the relief, or lay of the land, and drainage; (2) the physical and chemical composition of the parent material; (3) the climate under which the soil material has accumulated and existed since accumulation; (4) the biological activity, including plant and animal life in and on the soil; and (5) the length of time the forces of formation have acted on the soil material. Each soil is affected by all five factors, but the relative effect and importance of each varies from one soil to another.

Relief

The survey area is drained by deeply entrenched streams that flow in a westerly direction to form V-shaped canyons. There are remnant ridges of andesite that are tabular and slope slightly to the west. The areas of metamorphic rocks are complex and steep, and there are many narrow ridges that lie in a northwesterly direction and have a dendritic drainage pattern. The relief is less rugged in the foothills. The areas of gabbrodiorite and granodiorite are smooth and rounded. Some areas of granodiorite appear as if they were in a basin, because they are rimmed by more resistant metamorphic rocks. There are a few alluvial bottoms and terraces along present-day and Tertiary streams. Most of these areas have been mined for gold.

Parent material

Parent material exerts one of the strongest influences on soil formation in the survey area. Most of the soils are on uplands and formed in place in material weathered from metamorphic rock, granitic rock, or andesitic conglomerate.

Following is a list of the types of parent material in the survey area and the soils formed on them.

Type of parent material	*Soil series*
Stratified mixed alluvium (Recent.)	Loamy alluvial land; Mixed alluvial land; Perkins; Perkins, moderately deep variant.
Stratified mixed alluvium (Teritary river gravels.)	Horseshoe.
Andesitic conglomerate (Merhrten Formation.)	Aiken; Cohasset; Crozier; McCarthy.
Welded tuff breccia (Merhrten Formation.)	Iron Mountain.
Granodiorite and mica schist	Ahwahnee; Auberry; Chaix; Chawanakee; Holland; Hotaw; Musick; Shaver; Sierra.
Gabbrodiorite	Rescue; Rescue, clayey variant.
Metadacite	Diamond Springs.
Serpentine	Delpiedra.
Slate (Mariposa Group.)	Mariposa; Whiterock.
Metamorphosed volcanic rock greenstone, amphibolite schist. (Amador Group.)	Argonaut; Auburn; Boomer; Rescue, clayey variant; Sobrante.
Schists and slates (Calaveras Group.)	Argonaut, seeped variant; Auburn; Auburn, heavy subsoil variant; Boomer; Josephine; Mariposa; Maymen; Sites.
Rhyolitic tuff (Valley Spring Formation.)	Diamond Springs, grayish subsoil variant.

Metamorphic rocks generally are not easily weathered. They commonly form shallow, gravelly soils that have many outcrops. The metamorphic rocks are fine grained and form soils that have a surface texture of loam and silt loam. Some of these soils are low in mineral nutrients, probably because the sediments from which these rocks formed were previously weathered in an earlier erosion cycle. For example, the Josephine soils contain fewer mineral nutrients than the adjacent Cohasset soils, which formed in material from andesitic rock.

[7] By GRANT M. KENNEDY, soil scientist, Soil Conservation Service.

At the lower elevations, amphibolite schist, greenstone, and schists and slates of the Calaveras Formation form the Auburn soils. The Auburn soils are shallow silt loams that have many rock outcrops. The Calaveras and Mariposa Formations are folded so that they are vertically tilted. The bedding planes of schists and slates are exposed at the surface of these formations. The variability in the composition of these strata is reflected in the difference between the soils within short horizontal distances. The depth and other soil characteristics change rapidly. Examples are Mariposa, Josephine, and Sites soils.

The soils that formed on andesitic conglomerate are in the Aiken, Cohasset, Crozier, and McCarthy series. The andesitic conglomerate is deeply weathered, especially in the Aiken soils because this material is porous and weathers easily. The andesite is moderately fine grained and forms soils that have a surface layer of loam and sandy loam. If the parent rock is welded tuff breccia, the rock is hard, massive, and nonporous and shows only slight signs of weathering. The shallow soils that formed on this parent material are in the Iron Mountain series.

Soils underlain by granitic rocks occupy places where the overlying rocks were stripped away and the Sierra Nevada batholith is exposed. These are soils of the Auberry, Holland, Musick, Shaver, and Sierra series. The parent rock is weathered to a considerable depth, and the soils are 3½ feet to more than 5 feet deep. The weathered rocks contain many angular coarse grains of sand, mainly quartz, that form soils that have a surface layer of coarse sandy loam. The abrasive action of the grains of sand carried by runoff water accounts for the susceptibility of these soils to erosion. The rounded topography and the depth of the soils indicate that geologic erosion also is relatively rapid.

Narrow bands of ultrabasic rocks, mainly serpentine, underlie some areas. The ultrabasic rocks contain a large amount of magnesium in relation to the amount of calcium. Consequently, the Delpiedra soils are very low in fertility.

The relationship of parent material to soil patterns show up on the general soil map at the back of this survey. The major difference between groups of soil associations is parent material, and many of the soil boundaries are closely related to the boundaries between different geologic formations.

Climate

Climate has a marked influence on soil formation. Heat and moisture strongly influence the kind and amount of vegetation that grows, the rate at which organic matter decomposes, the rate at which minerals weather, and the rate at which material moves from some soil horizons and accumulates in others.

Temperature and precipitation in the survey area vary according to elevation. In the western part of the area, near the Sacramento County line, the elevation is about 500 to 700 feet. The precipitation there is about 23 to 25 inches, and the average annual temperature is 60° F. The precipitation increases and the temperature decreases regularly with an increase in elevation. At an elevation of 5,000 feet, the annual precipitation is 50 to 60 inches and the average annual temperature is 55°. At an elevation of more than 3,000 feet, much of the precipitation falls as snow.

Summers in the survey area are hot and dry, and winters are cool and moist. There is no appreciable rainfall in summer, except for a few thundershowers in the mountains. Significant rainfall generally starts early in fall, reaches a maximum in midwinter, and stops late in spring.

The content of organic matter in the soils is highest at high elevations, where the climate is cool and moist. At elevations of more than 4,800 feet, growth is not so rapid as at lower elevations, because of cool temperatures and the short growing season. Nevertheless, the soils are high in content of organic matter because the roots of the plants are generally coarse and the cool temperatures do not favor rapid decomposition.

At intermediate elevations, the soils have a moderate content of organic matter even though decomposition is rapid. The rainfall is abundant, and the temperatures are moderate. The vegetation is abundant, and large amounts of plant residue are returned to the soil.

At lower elevations, the soils contain a small amount or organic matter. The vegetation consists mainly of annual grasses and forbs. Even though the soils are dry in summer and early in fall, the warm and moist weather in spring and late in fall favors rapid decomposition of the very fine grass roots.

Rainfall in the survey area is sufficient to leach the soils of lime and other water-soluble material. Surplus water in the soil during the wettest season ranges from 11 inches to more than 30 inches (*2*). The surplus water is retained by the soil, percolates through it, or is lost through runoff. Surface runoff, however, does not cause major loss of water in the area. Thus, even at low elevations there is enough rainfall to leach the soils of carbonates and soluble salts. Evidences of leaching are the absence of lime in most soil profiles, the presence of clay films at considerable depths within many of the soils or within the weathered rock, and the consistent or decreasing pH value as depth increases.

Between elevations of 2,000 and 5,000 feet, the soils appear to undergo the most intensive weathering because they are still moist when they are warm in summer. In general, the soils at these elevations have a thicker profile and a redder, finer textured Bt horizon than soils at higher or lower elevations. Examples are the Aiken, Musick, and Sites soils. At lower elevations lack of moisture when the soils are warm limits the rate of weathering. On the other hand, cooler temperatures at the higher elevations, along the eastern boundary of the survey area, slow chemical reactions and thus also limit weathering.

The Argonaut soils seem to be an exception. These soils occur at the lower elevations but have a Bt horizon of clay associated with rapid weathering. There are two reasons for this. First, there is some translocation of clay from the A horizon to the B horizon. Second, these soils formed on relatively massive rocks where slopes are gentle and commonly concave. The bedrock is impermeable, and the relief is such that water is trapped above the bedrock. These soils stay moist longer in summer, and the rock weathers in place to clay.

Biological activity

The vegetation from the western boundary of the survey area eastward consists, in progression, of (1) grass, (2) oak and grass intermingled in places with brush, (3) oak and grass that are transitional to coniferous forest,

and (4) coniferous forest. The pattern of vegetation has been affected somewhat because of changes caused by fires, grazing practices, clearing, and short periods of cultivation.

Soils such as the Auburn and Sobrante formed under grass and under oak and grass. They have a thin A horizon about 3 to 9 inches thick and contain a relatively low amount of organic matter. Most of these soils have been used for grazing for more than 100 years. The amount of plant residue left after grazing each year varies greatly according to grazing practices and seasonal growth. Under average grazing, yearly additions of organic residue to the soils are estimated to be between 400 and 1,500 pounds per acre of stems and leaves and an equivalent weight of roots. Thus, about 800 to 3,000 pounds of organic matter is returned to the soil each year, mainly in the A horizon. Most of the soils contain between 1 and 2 percent organic matter in the A horizon; thus, between 30,000 and 60,000 pounds would accumulate in the upper 9 inches of the soils in 20 to 40 years if no decomposition occurred. There is no evidence to indicate that the organic-matter content of the soils is increasing. Consequently, it is assumed that micro-organisms cause the decomposition of the annual additions of organic matter.

Near Shingle Springs on some of the Rescue soils, there are extensive areas of brush. The soils in these areas are susceptible to erosion. The brush cover does not adequately protect the soil from erosion, because brush has few fine surface roots even though the overstory is thick. Also, grass does not grow well enough under brush to leave a residue. Consequently, erosion is active under the brush. Additions of organic matter to the soils therefore are low, and the relatively coarse roots probably account for a carbon-nitrogen ratio of 15 to 18 in comparison to less than 15 under grass.

Soils in the transition zone between areas of oak and grass and areas of coniferous forest have an A horizon that is somewhat thicker and is higher in content of organic matter than soils at lower elevations.

The soils that formed under coniferous forest have a mat of litter and duff from ½ inch to more than 6 inches thick. Such material is acid and contributes to the acidity of the soils. The roots of the trees follow cracks and fracture planes in the parent rock and help to alter the rocks. Roots in the upper 2 or 3 feet of the soil make up more than 20 percent of the total volume in places, and their growth and decomposition make the soil more porous. The Aiken, Musick, and Sites soils formed under forest and have a carbon-nitrogen ratio that exceeds 20.

Burning has also influenced the soils in many ways. Man and lightning are the main causes of fires. Repeated burning depletes the organic matter and thus influences the characteristics of the surface soil. Fire upsets the ecological balance, and different plant communities result. Thus, one of the soil-forming factors is altered by fire.

Time

The geologic age of the parent rock is not necessarily related to the age of the soils. None of the soils in the survey area show signs of being old. Because of slope, geologic erosion progresses at about the same rate as the soils form.

The oldest soils in the survey area are those in relatively undissected areas, and the youngest soils are those on narrow steep divides, on very steep slopes, or in other areas that are subject to erosion. The Aiken soils formed from remnants of the volcanic plain as tabular ridges and are considered to be the oldest soils. Younger soils formed in materials that were exposed after the volcanic plains were dissected or stripped away by erosion.

An example of the sequence of soil formation in the survey area is illustrated by the Maymen, Mariposa, Josephine, and Sites soils. The Maymen soils are on narrow ridge crests or adjacent steep slopes. These soils are very shallow to shallow over hard bedrock and lack a B2t horizon. The Mariposa soils are on broader divides and less erodible side slopes than Maymen soils. They are shallow to moderately deep and have a weak B2t horizon. The Josephine soils are on long, stable slopes or lower, gently sloping divides. They are deep and have a distinct B2t horizon of clay loam. The Sites soils are in the most stable positions on the landscape and have a B2t horizon of red clay. Some of the differences in the accumulation of silicate clays in these soils, however, may be related to the degree of weatherability of the stratified parent rock.

Morphology of the Soils

Because the influence of the soil-forming factors varies greatly within the survey area, many different kinds of soil have formed. Many soils in the area have several prominent horizons, some have only one horizon, and others have several faint horizons. Soils that have prominent horizons may occur adjacent to those that have less distinct horizons. The processes that have had the greatest influence in forming the different soil horizons are (1) weathering of parent materials, (2) accumulation of organic matter, (3) formation and translocation of clays, and (4) the influence of iron oxides.

Some of the distinguishing features of the soils formed from bedrock are related to the degree of weathering of the parent material. For example, where weathering has been slight, the soils have few horizons and generally have distinguishing features that come from their parent material. The soils of the Whiterock series are slightly weathered. They have thin, indistinct horizons, and their pale color, silt loam texture, and strongly acid reaction are related to the underlying Mariposa slates. As weathering increases, horizon differences are less directly related to the parent material but are products of alteration. The deep Aiken soils have a subsoil of red clay, and their horizons contrast strongly with the underlying brownish-yellowish andesitic conglomerate.

In all soils of the survey area, enough organic matter has accumulated on the surface to form an A1 horizon. This horizon ranges from thin, faint, and pale in color to thick, distinct, and dark in color. At the lower elevations the soils have an A1 horizon that is about 3 to 8 inches thick and contains about 2 percent or less organic matter. Organic matter does not accumulate in large quantities, because of warm temperatures. In the eastern part of the survey area, cooler temperatures and higher rainfall prevail and the A1 horizon is thicker, darker, and higher in content of organic matter. The Aiken soils have a thick, dark A1 horizon that has about 6 percent organic matter in the upper 15 inches.

The translocation of silicate clay minerals has taken place in many soils in the Area. The clay films on ped faces and in root channels, as well as colloidal bridges between the sand grains, indicate the movement of clay minerals from the A horizon to the B2t horizon. The Auburn soils have little or no translocated clay. The Musick soils have large amounts of translocated clay, and there is 20 percent more clay in the B2t horizon than in the A1 horizon. Evidence of clay movement is the many, moderately thick, continuous clay films in the Bt horizon.

Iron affects the color of many soils. In well-drained soils, iron is oxidized and produces yellow and red colors. Where the iron has been translocated in the profile, the colors are more intense, as in the Aiken, Musick, and Sites soils. The translocation of iron is greatest in soils at elevations of 2,000 to 4,000 feet. Here, the temperatures favor a high degree of weathering, and a considerable amount of water percolates through the soil. Forest litter on the surface produces organic acids that help to release iron from downward migration. This increase is indicated in the redder color of the B2t horizon in such soils as the Aiken and Sites soils. The reduction of iron is not an important process in the area, but it does take place in such poorly drained soils as Rescue clay, clayey variant. This gives rise to black, gray, and blue-green colors. This process is called gleying.

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 (*18*) and was later revised. The system currently used was adopted by the National Cooperative Soil Survey in 1965 (*20*). It is under continual study (*15*).

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 8 shows the classification of each soil series of the El Dorado Area by family, subgroup, and order, according to the current system. The classes in the current system are briefly described in the following paragraphs. Following these descriptions, the soil orders represented in the El Dorado Area are discussed.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions, Entisols and Histosols, occur in many different climates. Five soil orders are represented in the survey area—Alfisols, Entisols, Inceptisols, Mollisols, and Ultisols.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes that have the greatest genetic similarity. The suborders have a narrower climatic range than the orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or soil differences that result from the climate or vegetation.

GREAT GROUP: Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons.

SUBGROUP: Each great group is subdivided into subgroups. One of these subgroups represents the central (typic) segment of the great group, and the others, called intergrades, contain those soils that have properties of soils in another group, suborder, or order.

FAMILY: Each subgroup is divided into families, primarily on the basis of properties important to the growth of plants. Among the properties considered are texture, mineralogy, reaction, soil temperature, and thickness of horizons.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and that have genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, consistence, reaction, and mineralogical and chemical composition.

Soil orders in the area

Five soil orders are represented in the survey area—Alfisols, Entisols, Inceptisols, Mollisols, and Ultisols. These soil orders are discussed in the following paragraphs.

Alfisols are soils that lack a mollic epipedon and have an argillic horizon. These soils have base saturation greater than 35 percent at a depth of 50 inches below the top of the argillic horizon or in the subhorizon above a lithic contact. All the Alifisols in this survey area are seasonally dry for 60 consecutive days or more in most years except for the Argonaut series, seeped variant. None of these soils has a 15 percent clay increase within 1 inch of the upper boundary of the argillic horizon. Many of the Alfisols in the survey area have some properties that are similar to those of Mollisols and Ultisols.

The Ahwahnee, Argonaut, Delpiedra, Perkins, Rescue, and Sobrante soils and the Perkins soils, moderately deep variant, have an argillic horizon with a base saturation of 75 percent or more and an ochric epipedon with a moist color value of 3.5 or darker, and they have more than 1.2 percent organic matter in the upper 4 inches of the surface layer. Laboratory data for the Rescue soils are given in the table in the section "Laboratory Analyses." These data show that the organic carbon in the upper 4 inches of the surface layer is high enough to be equivalent to more than 1 percent organic matter. All of these soils are classified in the subgroup Mollic Haploxeralfs, but they differ at the family level. The Ahwahnee soils have a coarse-loamy argillic horizon. The Argonaut and Perkins soils have a

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Ahwahnee	Coarse-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Aiken	Clayey, kaolinitic, mesic	Xeric Palehumults	Ultisols.
Argonaut	Fine, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Argonaut, seeped variant.	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Auberry	Fine-loamy, mixed, thermic	Ultic Haploxeralfs	Alfisols.
Auburn	Loamy, mixed, thermic	Ruptic-Lithic Xerochrepts	Inceptisols.
Auburn, heavy subsoil variant.	Loamy-skeletal, mixed, thermic	Ruptic-Lithic-Xerochreptic Haploxeralfs.	Alfisols.
Boomer	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Chaix	Coarse-loamy, mixed, mesic	Dystric Xerochrepts	Inceptisols.
Chawanakee	Loamy, mixed, mesic, shallow	Dystric Xerochrepts	Inceptisols.
Cohasset	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Crozier	Fine-loamy, mixed, mesic	Xeric Haplohumults	Ultisols.
Delpiedra	Loamy, serpentinitic, thermic, shallow	Mollic Haploxeralfs	Alfisols.
Diamond Springs	Fine-loamy, mixed, mesic	Typic Haploxerults	Ultisols.
Diamond Springs, grayish subsoil variant.	Ashy, mesic	Typic Vitrandepts	Inceptisols.
Holland	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Horseshoe	Fine-loamy, mixed, mesic	Xeric Haplohumults	Ultisols.
Hotaw	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Iron Mountain	Loamy, mixed, mesic	Lithic Ultic Haploxerolls	Mollisols.
Josephine	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Mariposa	Fine-loamy, mixed, mesic	Ruptic-Lithic-Xerochreptic Haploxerults.	Ultisols.
Maymen	Loamy, mixed, mesic	Dystric Lithic Xerochrepts	Inceptisols.
McCarthy	Loamy-skeletal, mixed, mesic	Dystric Xerochrepts	Inceptisols.
Musick	Clayey, kaolinitic, mesic	Ultic Haploxeralfs	Alfisols.
Perkins	Fine, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Perkins, moderately deep variant.	Loamy-skeletal, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Rescue	Fine-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Rescue, clayey variant.	Fine, montmorillonitic, noncalcareous, thermic	Typic Haplaquolls	Mollisols.
Shaver	Coarse-loamy, mixed, mesic	Pachic Ultic Haploxerolls	Mollisols.
Sierra	Fine-loamy, mixed, thermic	Ultic Haploxeralfs	Alfisols.
Sites	Clayey, kaolinitic, mesic	Xeric Haplohumults	Ultisols.
Sobrante	Fine-loamy. mixed, thermic	Mollic Haploxeralfs	Alfisols.
Whiterock	Loamy, mixed, acid, thermic	Lithic Xerorthents	Entisols.

fine argillic horizon. The Delpiedra soils have a loamy argillic horizon and are serpentinitic. The Rescue and Sobrante soils have a fine-loamy argillic horizon. The Perkins soils, moderately deep variant, have more than 35 percent gravel, by volume, in the argillic horizon and are considered to be loamy-skeletal.

The Auberry, Boomer, Cohasset, Josephine, Musick, and Sierra soils have an ochric epipedon and an argillic horizon with a base saturation of less than 75 percent in some part. The Boomer soils have a base saturation of less than 75 percent in the upper part of the argillic horizon. All of these soils are classified in the subgroup Ultic Haploxeralfs, but they differ at the family level. They all have a fine-loamy argillic horizon. The Auberry and Sierra soils are in the thermic temperature zone, the Boomer, Cohasset, Josephine, and Musick soils are in the mesic temperature zone.

The Holland and Hotaw soils are also classified as Ultic Haploxeralfs. They differ from Auberry, Boomer, and Sierra soils in having an umbric epipedon instead of an ochric epipedon. The Holland and Hotaw soils differ at the series level.

The Auburn series, heavy subsoil variant, has an ochric epipedon and an argillic horizon that is interrupted by bedrock and also contains more than 35 percent coarse fragments. These soils are classified in the subgroup Ruptic-Lithic-Xerochreptic Haploxeralfs.

The Argonaut series, seeped variant, is never dry for 60 consecutive days. These soils have an ochric epipedon and an argillic horizon. They are classified in the subgroup Typic Hapludalfs.

Entisols are soils without natural genetic horizons. They are generally recently formed, so that not enough time has elapsed to form soil horizons, or they formed in materials that are resistant to weathering. The Entisols have few morphological features.

The Whiterock soils are shallow gravelly silt loams that formed on hard metasedimentary rock. They have an ochric epipedon and lithic contacts of hard metasedimentary rock within 12 inches of the surface. They are seasonally dry for 60 consecutive days or more in most years. The Whiterock soils are classified in the subgroup Lithic Xerorthents.

Inceptisols are soils that have one or more diagnostic horizons that formed in the early stages of weathering. They do not have significant eluviation or illuviation. Except for darkening of the epipedon, they lack prominent morphological features. The conductivity of the saturated extract is less than 1 millimho at 25° C.

The Auburn, Chaix, Chawanakee, Maymen, and Mc-

Carthy soils and the Diamond Springs soils, grayish subsoil variant, are Inceptisols. All of these soils are seasonally dry for 60 consecutive days or more in most years.

The Auburn soils are shallow silt loams that formed on hard metabasic rock. They have a pale ochric epipedon and a redder cambic horizon. The cambic horizon is interrupted by ledges of bedrock. There also is a lithic contact to hard rock within 12 to 26 inches of the surface. The Auburn soils are classified in the subgroup Ruptic-Lithic Xerochrepts.

The Chaix soils are moderately deep coarse sandy loams that formed in material weathered from granitic rocks. They have an ochric epipedon and a cambic horizon. The base saturation is less than 60 percent within 30 inches of the surface. The Chaix soils are classified in the subgroup Dystric Xerochrepts.

The Chawanakee soils are similar to the Chaix soils, but they differ in being shallow to weathered granitic rock. They have a paralithic contact at a depth of 10 to 24 inches. The Chawanakee soils also are classified in the subgroup Dystric Xerochrepts.

The Diamond Springs soils, grayish subsoil variant, are deep gravelly loams that formed in material weathered from rhyolitic tuff. They have an ochric epipedon, a cambic horizon, and more than 60 percent vitric volcanic ash or other vitric pyroclastic material in the silt, sand, and gravel fractions. These soils are classified in the subgroup Typic Vitrandepts.

The Maymen soils are shallow gravelly loams that formed in material weathered from hard metasedimentary rock. They have an ochric epipedon, a cambic horizon, and lithic contacts within 6 to 16 inches of the surface. The base saturation also is less than 60 percent. The Maymen soils are classified in the subgroup Dystric Lithic Xerochrepts.

The McCarthy soils are moderately deep cobbly loams that formed on andesitic rock. They have a dark-colored surface layer that is less than 10 inches thick and a cambic horizon. The base saturation also is less than 60 percent within 30 inches of the surface. The McCarthy soils are classified in the subgroup Dystric Xerochrepts.

Mollisols are soils that have a soft to slightly hard, dark-colored surface horizon that has more than 1 percent organic matter and more than 50 percent base saturation. This dark-colored surface horizon is called a mollic epipedon.

The Iron Mountain and Shaver soils and the Rescue soils, clayey variant, are classified as Mollisols. The Iron Mountain and Shaver soils are seasonally dry for 60 consecutive days or more in most years. The Rescue soils, clayey variant, are saturated with water for a part of the year and show characteristics of wetness.

The Iron Mountain soils are shallow soils that formed in material weathered from hard volcanic breccia. They have a mollic epipedon that lies abruptly on lithic contacts within 5 to 20 inches of the surface. They have a base saturation of less than 75 percent above the lithic contact. The Iron Mountain soils are classified in the subgroup Lithic Ultic Haploxerolls.

The Rescue soils, clayey variant, are deep, wet, fine-textured soils that formed in material weathered from basic rock. They have a mollic epipedon and lack an argillic horizon. They are classified in the subgroup Typic Haplaquolls.

The Shaver soils are deep coarse sandy loams that formed in material weathered from granitic rock. They have a mollic epipedon that is more than 20 inches thick, a cambic horizon, and a base saturation of less than 75 percent throughout the upper 30 inches of the soil. The Shaver soils are classified in the subgroup Pachic Ultic Haploxerolls.

Ultisols are highly weathered soils that formed under a humid climate. They all have an argillic horizon. The base saturation is less than 35 percent at a depth of 50 inches below the top of the argillic horizon. In the survey area, all Ultisols are seasonally dry for 60 consecutive days or more in summer between depths of 7 and 20 inches in most years.

The Aiken soils are considered to be the oldest soils in the survey area. They have a thick, dark umbric epipedon. They have an argillic horizon that is more than 50 inches thick, they have less than 10 percent weatherable minerals in the 20- to 200-micron fraction in the upper 40 inches of the argillic horizon, and they have more than 1.5 percent organic matter in the upper 6 inches of the argillic horizon. The Aiken soils are classified in the subgroup Xeric Palehumults.

The Crozier soils formed in parent material similar to that in which the Aiken soils formed, but they are not so weathered. They have an umbic epipedon and an argillic horizon that is more than 1.5 percent organic matter in the upper 6 inches, but they have more than 10 percent weatherable minerals in the 20- to 200-micron fraction in the upper 40 inches and are less than 50 inches thick. The Crozier soils are classified in the subgroup Xeric Haplohumults. The soils differ at the series level.

The Horseshoe and Sites soils also are classified in the subgroup Xeric Haplohumults. Their epipedon is variable. Sites soils have an umbric epipedon. Horseshoe soils have an ochric epipedon because it is too thin to be umbric. The argillic horizon has more than 1.5 percent organic matter in the upper 6 inches, is thicker than 50 inches, and has more than 10 percent weatherable minerals of the 20- to 200-micron fraction in the upper 40 inches. These soils differ at the family and series level. The Horseshoe soils have a fine-loamy argillic horizon. The Sites soils have a clayey, kaolinitic argillic horizon.

The Diamond Springs and Mariposa soils have less than 1.5 percent organic matter in the upper 6 inches of the argillic horizon. The Diamond Springs soils are classified in the subgroup Typic Haploxerults. The Mariposa soils have an argillic horizon that is interrupted by ledges of bedrock. They are classified in the subgroup Ruptic-Lithic-Xerochreptic Haploxerults.

Laboratory Analyses

Three of the important soils in the El Dorado Area were sampled for laboratory analyses, and the data are presented in table 9. Each soil was sampled at two places, but only the modal profile for the survey area is given in the table. Additional laboratory analyses on the Ahwahnee, Aiken, Argonaut, Auburn, Josephine, Mariposa, Musick, Sierra, and Sites soils can be found in the soil survey of the Amador Area, California (*21*).

The methods and procedures used to obtain the laboratory analyses reported are as follows: All samples were collected from pits. Fragments larger than 1 inch were discarded. Samples were air dried, crushed with a rubber-tipped pestle, and then screened through a 2-millimeter, round-holed sieve. After they had been rubbed relatively clean, the coarse fragments larger than 2-millimeters in diameter were weighed to determine the percentage of gravel and were then discarded. The material that passed through the sieve was thoroughly mixed, and subsamples of this were used for the laboratory analyses. Methods used in obtaining the data are described in the paragraphs that follow. All results in table 9 are expressed on an ovendry basis.

Particle-size distribution.—Separation of particles into size classes and ranges of diameters for data on particle-size distribution were made by pipette and sieve analyses. After treatment of the sample to remove organic matter and soluble salts, particles were dispersed with sodium hexametaphosphate and mechanical shaking (*8, 9*).

Reaction.—Soil reaction, expressed in pH value, was obtained by glass electrode pH meter using 1:1 soil-water and soil-potassium chloride saturated pastes (*11, 14*).

Organic carbon.—The percentage of organic carbon was determined by acid-dichromate digestion and ferrous sulfate titration, a modification of the Walkley-Black method (*11*).

C/N ratio.—The C/N ratio was determined by dividing the percentage of organic carbon by the percentage of nitrogen (*3*).

Free iron oxide.—The percentage of free iron oxide was determined by the dithonite reduction method (*7*).

Bulk density.—Bulk density, expressed in grams per cubic centimeter, was determined on core samples of the size of 4.7 by 3.5 centimeters. The samples were taken with the Salinity Laboratory modified Uhland core samples (*14*). The bulk density is presumed to be equal to the horizon density at field moisture.

Moisture retention.—Moisture retained at a tension of 15 atmospheres was determined by using the pressure membrane apparatus on the fragmented samples (*22*). Moisture retained at 15 atmospheres pressure corresponds fairly closely to the permanent wilting point.

Cation exchange capacity.—The cation exchange capacity was determined by saturating the samples with sodium by mixing the samples with a solution of sodium acetate. The amount of exchangeable sodium displaced by ammonium acetate extraction represents the cation exchange capacity. The exchangeable sodium was determined by flame analysis (*6*).

Extractable cations.—The extractable cations, calcium, magnesium, sodium, and potassium, were extracted with neutral, normal ammonium acetate. Calcium was precipitated as an oxalate and titrated, magnesium was determined gravimetrically as magnesium pyrophosphate, and sodium and potassium were analyzed by flame photometer. Extractable acidity, or exchangeable hydrogen, was displaced from the soil with triethanolamine and barium chloride at pH 8.2 (*11, 22*).

Base saturation.—The percent base saturation (table 9) was determined by dividing the sum of the extractable bases by the cation exchange capacity and multiplying the result by one hundred.

General Nature of the Area

This section describes the physiography, relief, and drainage and the geology and geomorphic history of the survey area. It also gives some important facts about the development, water supply, and climate.

Physiography, Relief, and Drainage

The El Dorado Area is in the western part of the Central Sierra Nevada. It is dominated by steeply dipping, faulted and folded metamorphic rocks that have been intruded by several types of igneous rocks. Overlying the bedrock in many places are mantles of river gravel and volcanic debris.

The ascent from the Central Valley is gentle, and the average slope through a west-to-east transect is about 5 percent. In general, the trend of the ridges and rock formations is northwest by southeast. Drainage is generally toward the southwest, and the drainage channels have cut through geologic formations and followed the westward tilting of the Sierran fault block. The headward parts of the major streams and rivers are more deeply gouged by river canyons and drainageways than the rolling foothills, where river cutting is less. Typically, the folded and faulted areas of metamorphic rocks are steep and angular, the granitic areas are rounded and smooth and have a basin-like apearance, and the volcanic areas are flat topped and smooth.

The survey area is drained mainly by the Middle and South Forks of the American River and the Cosumnes River. These rivers join the Sacramento River in Sacramento County and flow into the San Francisco Bay. There are many major perennial streams in these major drainage areas.

Geology and Geomorphic History

The El Dorado Area is in the Sierra Nevada geomorphic province. It is on the western slope of the Sierra Nevada. Early in geologic time, in the late Paleozoic period, this area was covered by a vast inland sea in which large amounts of various kinds of sediments were deposited (*4*). The sediments of this sea were uplifted and folded to form the metamorphic rocks of the Calaveras Group.

Later, in the Late Jurassic period, the sea advanced over the Area again. Sediments and volcanic rocks were deposited in this sea. These sediments formed the Amador Group. The fine-grained marine deposits that followed formed the Mariposa Formation. Intense folding and metamorphism followed the retreat of the sea again. As a result, nearly continuous belts of vertically tilted rocks with ridges that extend generally northwestward were formed. The fine-grained sedimentary rocks were changed to slate; the siliceous sediments to quartzites and metacherts; the volcanic rocks to amphibolite schists and greenstone; and the calcareous ooze to crystalline limestone.

The Area was then intruded by ultrabasic rocks, most of which were altered to serpentine. Soon thereafter a sequence of granitic-type rocks was emplaced on a major scale, beginning with the more basic gabbrodiorite and followed by the more acid granodiorite. During all that time, the survey area sloped more gently westward than

TABLE 9.—*Laboratory analyses*

[Analyses by Soil Survey

Soil and sample number	Depth	Horizon	Particle-size distribution							
			Very coarse sand (2.0–0.1 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)	0.2–0.02 mm.
Boomer gravelly loam: S61–Calif–9–3.	*Inches*		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
	0–5	A1	6.9	14.1	5.7	9.0	5.1	39.4	19.8	23.0
	5–13	A3	5.0	11.8	4.9	8.5	5.4	39.5	24.9	22.4
	13–24	B21t	5.1	13.5	5.1	7.6	4.3	31.4	33.0	18.4
	24–37	B22t	10.7	22.7	6.2	7.9	3.9	20.2	28.4	14.8
	37–52	B31t	19.6	21.0	4.9	5.3	2.8	20.4	26.0	10.6
Holland coarse sandy loam: S61–Calif–9–5.	0–2	A11	7.6	19.6	9.2	18.4	7.6	26.4	11.2	28.2
	2–10	A12	7.0	18.5	8.5	20.0	8.2	25.4	12.4	28.5
	10–21	B1	4.5	19.5	8.2	19.3	8.0	25.1	15.4	27.5
	21–30	B21t	6.3	17.7	6.8	16.6	6.8	24.1	21.7	24.4
	30–36	B22t	5.1	17.6	7.5	17.1	6.5	21.7	24.5	22.5
	36–45	B3t	6.2	18.7	8.8	18.6	7.2	20.4	20.1	23.8
	45–54	C1	8.8	21.3	10.6	20.7	7.3	17.7	13.6	24.4
Rescue sandy loam: S61–Calif–9–1.	0–5	A1	6.8	16.1	8.1	16.1	9.0	29.8	14.1	29.1
	5–10	A3	7.7	16.2	8.4	15.0	8.5	29.1	15.1	27.3
	10–14	B1t	9.2	18.6	6.8	12.0	7.4	25.7	20.3	21.8
	14–26	B2t	9.4	12.1	4.2	13.3	8.6	21.3	31.1	23.6
	26–34	B3t	10.1	10.6	5.9	21.1	11.7	20.4	20.2	31.6
	34–55	C1	13.9	13.8	7.6	25.0	12.2	17.3	10.2	35.5
	55–66	C2	23.0	14.8	7.2	24.5	11.0	15.2	4.3	33.4

it does today, although the crest of the Sierra Nevada was approximately in its present location. Then the surface of the folded sedimentary and volcanic rocks was lowered throughout a long period of erosion. Large areas of the granitic batholith were exposed.

The volcanic activity began in the Sierra Nevada in the late Eocene period. Rhyolitic ash fell at the lower elevations, and at the higher elevations both flows and ash falls were deposited. These ash falls and flows formed the Valley Springs Formation. This choked the stream channels, and the drainage system was completely changed. Following the rhyolitic emissions, the volcanoes began to discharge andesitic materials, mostly mudflows, dust, and some lava flows. These flows formed the Mehrten Formation. A volcanic plain was formed that again choked the streams, and new drainageways were formed. The Logtown Ridge, from the Amador County line to near Placerville, blocked the westward movement of the andesitic material. East of the Logtown Ridge, only the prominent peaks remained as islands above the volcanic plain. The geologic activity of this time marked the beginning of the present landforms and had a strong influence in forming the soil patterns of the survey area (*12*).

In early Pleistocene times, there was a major uplift of the Sierra Nevada. This was caused by faulting along the eastern flank of the mountains. The western slope was uniformly tilted upwards. The west-flowing rivers and streams in the newly uplifted area removed much of volcanic debris and cut deep canyons into the underlying material. This left long, tabular volcanic ridges and exposed Tertiary river gravel, rhyolitic tuff, and granitic and metamorphic rocks.

Development

In 1848 gold was discovered on the South Fork of the American River at Coloma, California. News of this discovery started the Gold Rush, which was probably the most rapid migration of a large number of people in the history of this country. Previously, the Sierra Nevada foothills had been unattractive to settlers and had been entered only by hunters, trappers, and a transcontinental expedition or two.

The Gold Rush marked the beginning of settlement and development in and around Placerville. Gold was the first desire of the new arrivals; few thought of other occupations. Poor transportation facilities and high prices for even the simpler necessities, however, soon led an increasing number of individuals to engage in farming and lumbering. With the passage of the years, these two occupations became more and more important.

By 1863, more acres of land were under cultivation in El Dorado County than have been at any time since. A large additional acreage also was used for hay and forage for livestock. It was not until 1883 that fruit production became important, at which time the area around Placerville was described as one continuous orchard.

Livestock generally continued a steady rise (*25*). Growing of grain decreased in the early 1920's. The trend then was away from general ranching and toward fruit grow-

of three representative soils

Laboratory, Riverside, California]

Particle-size distribution—Continued		Reaction		Organic carbon	Nitrogen	C/N ratio	Free iron oxide	Bulk density	Moisture held at tension of 15 atmospheres	Cation exchange capacity (Na)	Extractable cations (Meq. per 100 grams of soil)					Base saturation
0.02–0.002 mm.	Coarse fragments (greater than 2 mm.)	Water (1:1 ratio)	KCl (1:1 ratio)								Ca	Mg	H	Na	K	
Percent	*Percent*	*pH*	*pH*	*Percent*	*Percent*		*Percent*	*Gm./cc.*	*Percent*							*Percent*
26. 5	26	6. 6	5. 4	2. 52	0. 137	18. 4	7. 6	1. 28	12. 8	26. 9	11. 9	6. 1	8. 2	0. 2	0. 9	70
27. 4	21	6. 2	4. 7	. 99	. 056	17. 7	8. 5	1. 37	13. 2	20. 4	9. 7	6. 0	9. 1	. 2	. 6	65
21. 4	31	5. 9	4. 4	. 60	. 036	16. 7	8. 7	1. 47	16. 8	27. 7	11. 7	7. 1	8. 7	. 2	. 3	69
13. 6	40	5. 8	4. 0	. 26	. 015	------	6. 2	1. 53	16. 9	36. 0	7. 2	12. 6	7. 7	. 2	. 2	72
15. 4	64	6. 1	4. 1	. 10	------	------	5. 5	------	13. 7	24. 3	14. 3	11. 7	5. 9	. 2	. 2	82
16. 3	0	6. 0	5. 0	2. 77	. 203	13. 6	. 7	------	7. 0	14. 6	5. 8	1. 1	6. 0	. 2	. 8	57
16. 6	0	5. 9	4. 6	1. 08	. 085	12. 7	. 9	1. 57	5. 8	9. 7	3. 5	. 8	5. 4	. 2	. 7	49
16. 6	0	6. 0	4. 5	. 36	. 033	10. 9	1. 1	1. 54	6. 8	9. 1	3. 1	1. 0	3. 9	. 2	. 4	55
16. 0	0	6. 1	4. 6	. 18	. 019	------	1. 5	1. 80	9. 9	11. 5	4. 5	1. 8	3. 8	. 2	. 3	64
15. 4	0	6. 3	4. 7	. 10	------	------	1. 5	1. 86	10. 5	11. 3	4. 7	2. 4	3. 3	. 2	. 2	69
15. 0	0	6. 5	4. 7	. 07	------	------	1. 0	1. 89	10. 6	11. 9	4. 8	2. 6	2. 5	. 2	. 1	76
12. 5	0	6. 6	4. 7	. 06	------	------	. 5	------	7. 8	9. 1	4. 7	2. 3	2. 0	. 2	. 1	79
19. 3	8	6. 4	5. 0	1. 21	. 094	12. 9	3. 6	1. 75	7. 5	14. 1	7. 8	2. 5	4. 5	. 1	. 2	70
19. 1	5	6. 4	5. 0	. 77	. 057	13. 5	4. 1	1. 78	7. 9	14. 2	8. 3	2. 8	4. 0	. 2	. 2	74
18. 3	4	6. 4	4. 9	. 41	. 034	12. 1	4. 4	1. 81	10. 0	18. 1	9. 7	3. 9	4. 0	. 2	. 1	78
14. 8	4	6. 5	5. 0	. 26	. 024	------	4. 0	1. 86	13. 9	23. 4	11. 0	5. 8	4. 1	. 2	. 1	81
14. 1	6	6. 6	4. 7	. 14	------	------	2. 3	1. 98	10. 7	19. 6	8. 7	5. 0	3. 0	. 3	. 1	83
9. 9	6	6. 6	4. 5	. 07	------	------	1. 3	1. 87	6. 6	16. 4	7. 1	4. 1	2. 3	. 2	. 1	83
8. 9	14	6. 7	4. 4	. 02	------	------	. 9	1. 78	4. 4	14. 5	6. 6	3. 6	1. 8	. 2	. 1	85

ing. A half century after the discovery of gold, a specialized one-crop system of farming, based on shipment of fresh pears and other deciduous fruits to eastern markets, was developing.

Prior to 1915, pears were packed on the ranches, but the Placerville Fruitgrowers Association, a cooperative, was formed in that year and greatly facilitated the packing and shipping of fruit. About 80 percent of the plantings of fruit trees are Bartlett pears.

The development of this Area as a fruit growing and shipping point was favored by several circumstances. During the height of gold mining, an extensive system of ditches was constructed to provide adequate supplies of water for the hydraulic, placer, and other mining operations. The system of ditches and the water rights were taken over by the orchardists, and these provided the irrigation used in the vicinity of Placerville, Coloma, Camino Ridge, Georgetown, Penobscot, Cool, and Pilot Hill. Since that time the Georgetown Divide Public Utility District and the Lotus-Coloma Ditch Company were formed, and the El Dorado Irrigation District took the place of the El Dorado Corporation and improved old facilities and constructed new ones.

The soils and the climate in the survey area are favorable for fruit production. The irregular relief of the western foothills of the Sierra Nevada provides unexcelled air drainage. The wide range in elevation, from about 1,500 feet in the western part to nearly 4,000 feet at Pollock Pines on Camino Ridge, provides a later and more extended marketing season and assures less competition from other producing areas. Adequate transportation facilities, both railroads and highways, permit the shipping of fruit to all parts of the country.

Water Supply [8]

Water development in the El Dorado Area began with the influx of people in the days of the Gold Rush. A long history of expenditures in time and money to bring water from available sources in mountain lakes and river bottoms for use on high ridges is shown in the minor ditches that even today provide a good part of the water used in the El Dorado Area. In the past 20 years, there has been a marked upswing in water resources development. At this time there is a temporary surplus of water available in the Area.

With the decline in gold mining at the turn of the century, water was used increasingly for farming. Mining ditches that served the more productive farmlands now provide water service to areas that have greater farming potential. Those systems that served areas of poorer potential are no longer used.

The American and Cosumnes Rivers generally divide the El Dorado Area for purposes of water service into the Georgetown Ridge, Placerville Ridge, and Somerset and Fair Play service areas in the Cosumnes River Basin. In each of these areas distance from existing distribution facilities is a major element that determines cost.

[8] By HARRY DUNLOP, manager, El Dorado Irrigation District.

The water service areas in the El Dorado Area are discussed in the following paragraphs.

Georgetown Ridge service area.—Water service in this area generally is provided by a public district, the Georgetown Divide Public Utility District. Recent construction of Stumpy Meadows Reservoir and enlargement of the district's canal system provide the Georgetown Ridge with a water supply that is greater than that presently used. Stumpy Meadows Reservoir has adequate water for double the present farm use on the Georgetown Ridge.

Placerville Ridge service area.—During World War II, and for about a decade after it, lack of water was a factor that limited farm production on the Placerville Ridge. Construction of the Sly Park Unit of the Central Valley Project in 1955 removed this limitation. The El Dorado Irrigation District provides most of the water service to farms in the Placerville Ridge area. Because of the availability of water from Sly Park, and because of limitations in the capacity of the distribution system, the district constructed a piped distribution system, which was completed in 1963. This district can now provide piped water service to a major part of Placerville Ridge west to Shingle Springs. Existing supplies from Sly Park and other sources are adequate to irrigate an additional 2,500 acres.

Somerset and Fair Play service areas (Cosumnes River Basin).—Water for irrigated farming generally is not available in this area. Water that is used for irrigation normally comes from irrigation reservoirs constructed on individual ranches. However, the entire Cosumnes River Basin has been the subject of an intensive study by the U.S. Bureau of Reclamation. It is anticipated that in due time facilities proposed in reports on the Cosumnes River Division will be constructed. This will provide water for irrigated farming in the Somerset and Fair Play service areas.

Areas outside the water districts have little water available for irrigation. The sources of water are springs, shallow wells, and small reservoirs. The supply of water in these areas is critical after a series of dry years.

Climate [9]

The El Dorado Area is an Area of abundant sunshine in summer, moderate to heavy precipitation in winter, and wide temperature ranges. The Area is subject to strong flows of marine air from the Pacific Ocean in winter, which result in heavy precipitation, particularly at intermediate levels in the mountains. At high elevations much of the precipitation falls as snow, providing a water supply that lasts into summer. Precipitation in summer is light and generally is limited to a few scattered thundershowers.

Temperatures range from very warm in summer near the Sacramento Valley to very cold in some of the high mountain areas during midwinter. All of the survey area experiences freezing temperatures at some time during the year.

The Sierra Nevada Range plays a dominant role in determining the climate of the El Dorado Area. Differences in elevation affect both temperatures and precipitation. On the western slopes of the mountains, precipitation tends to increase with elevation up to about 6,000 feet but decreases slowly above that level. Temperature also decreases with elevation, except that some of the valleys are cooler than the slopes above them at night because of cold-air drainage.

The average annual temperature in the El Dorado Area ranges from above 60° F. at the lower elevations to about 55° at the higher elevations toward the east. The average minimum temperatures in January decrease from about 36° at the lower elevations to about 30° at the higher elevations. Minimum temperatures are affected by local differences in the terrain. Placerville, which is at the bottom of a narrow valley, has a lowest temperature of 8°, while the Placerville Institute of Forest Genetics, which is on a nearby ridgetop, has a lowest temperature of 16°.

Average maximum temperatures in July are in the 90's, and they range from about 90° at the higher elevations to nearly 95° at the lower elevations. The highest temperatures recorded range from 107° to 114°.

The growing season, which is the interval between the last temperature of 32° or lower in spring and first in fall, ranges from 150 to 275 days. The average date of the last freezing temperature in spring is about the first of March at the lower elevations and about the last of April at the higher elevations. In fall the average date of the first freezing temperature ranges from the last of October in the cooler parts of the survey area to the first of December in the warmer parts. The growing season also is affected by local variations in terrain. The average length of the growing season is shown in figure 13.

Precipitation in the driest part of the survey area, the southwest corner, is about 23 inches. Precipitation at the upper end of the Area toward the east, on the other hand, averages about 50 inches per year (fig. 14).

[9] By ROBERT ELFORD, climatologist for California, National Weather Service, U.S. Department of Commerce.

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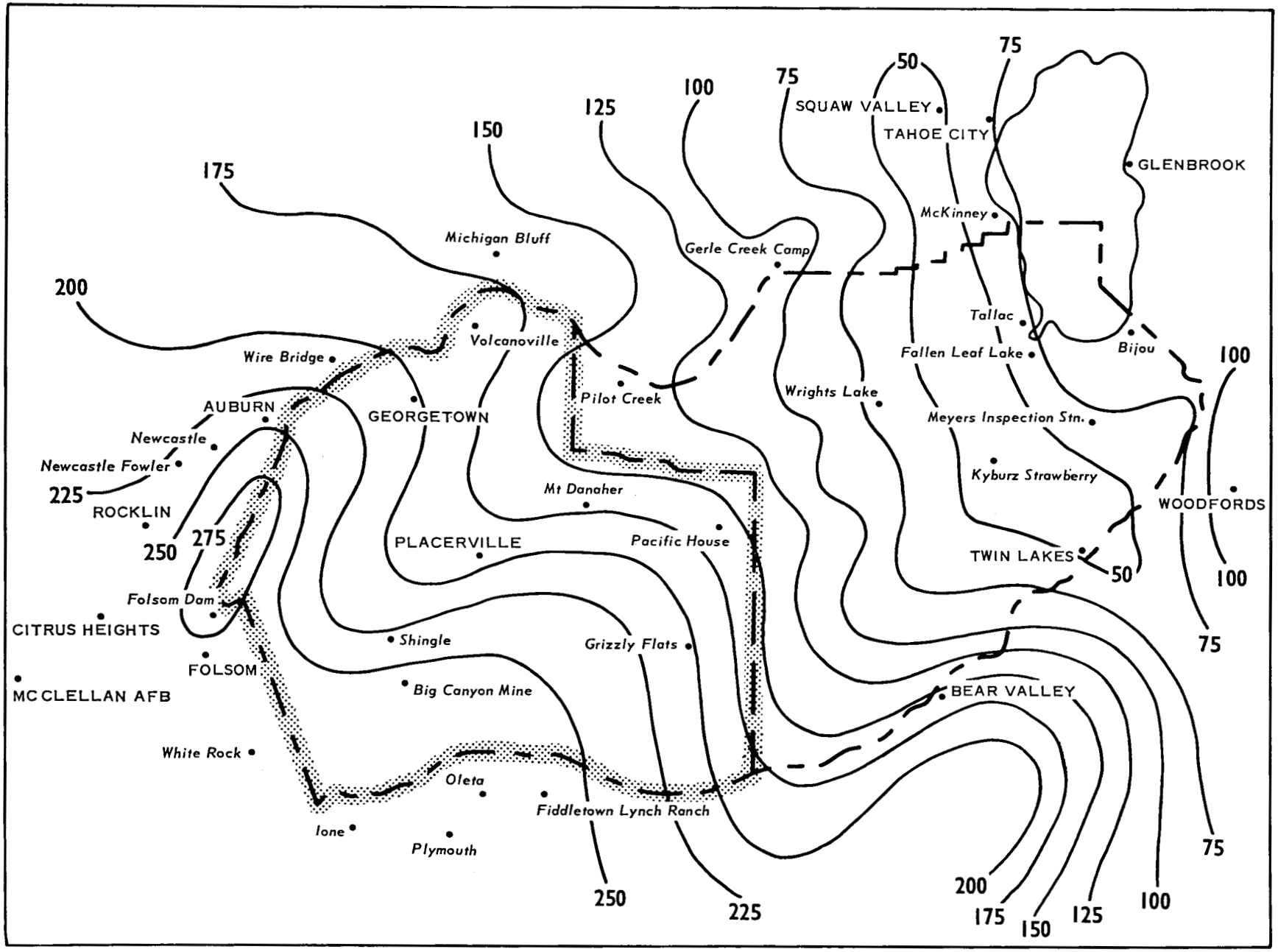

Figure 13.—**Average length of growing season.**

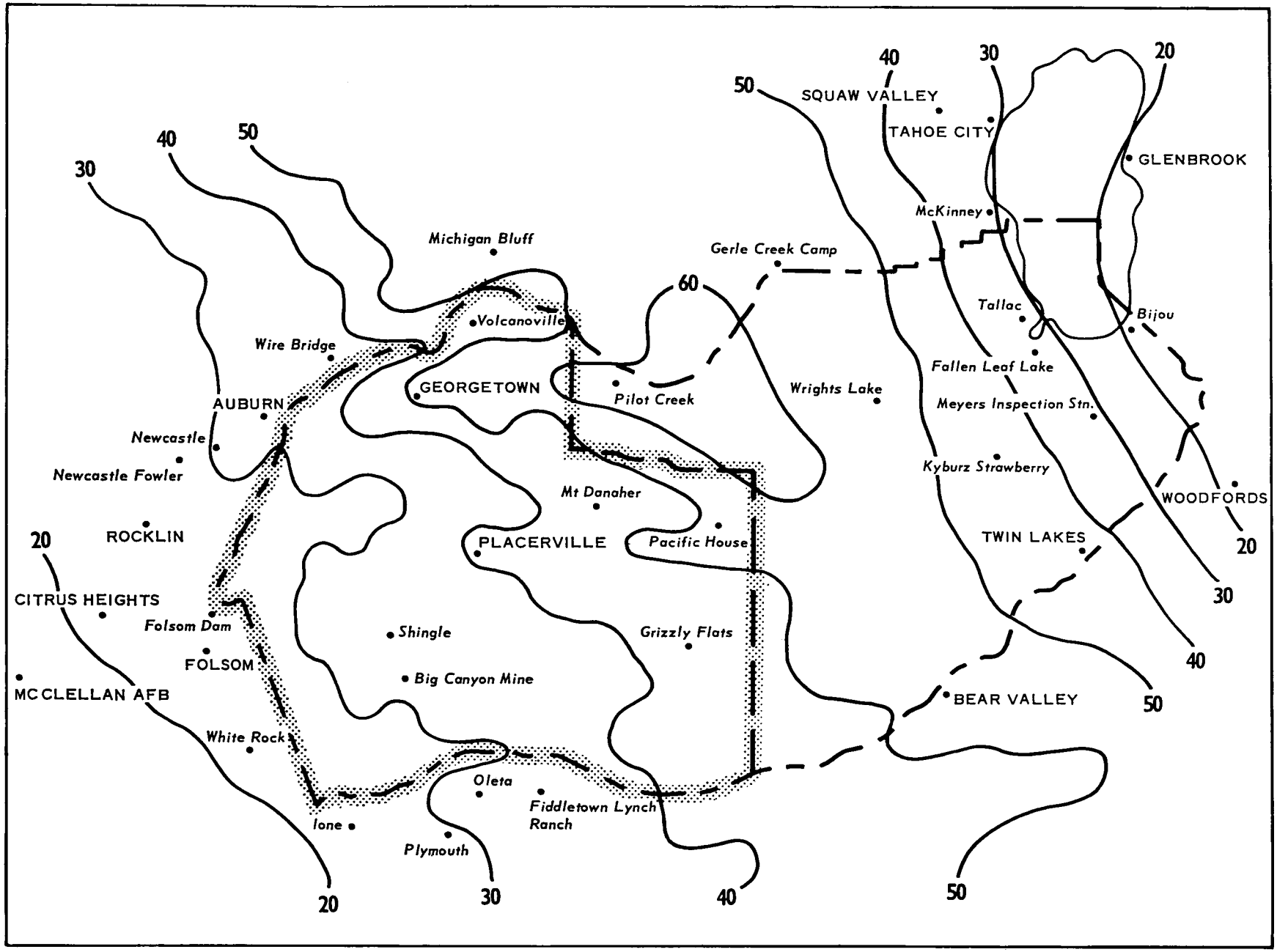

Figure 14.—**Average annual precipitation.**

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Glossary

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where it flows out onto a level plain or meets a slower stream.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available moisture capacity (also termed available moisture holding capacity or available water holding 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.

Calcareous soil. A soil that contains enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

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 aggregrate. Synonyms: clay coat, clay skin.

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.

Drainage, altered. Changes in drainage commonly as the result of reclamation through artificial drainage or irrigation, but also because of natural deepening of the stream channels, the filling of depressions, or from wetness caused by seepage from drainage ditches or irrigation channels.

Drainage, natural. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil. 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 holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in some soils commonly have mottlings at a depth below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

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.

Effective rooting depth. Depth to a claypan, bedrock, or any other layer in the soil that would stop or would hinder the penetration of roots. It is the depth of soil readily penetrated by roots. Depth classes are: *Very deep*, more than 60 inches; *deep*, 40 to 60 inches; *moderately deep*, 20 to 40 inches; *shallow*, 10 to 20 inches; and *very shallow*, less than 10 inches.

Effervescence. The fizz observed when dilute hydrochloric acid is applied to a soil containing free carbonates. The amount of effervescence is divided into four classes—*very slightly ef-*

fervescent, slightly effervescent, strongly effervescent, and *violently effervescent.*

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and physical condition of the soil are favorable. For the purpose of this survey, fertility is based on the content of organic matter as follows: *Very low,* less than 0.6 percent; *low,* 0.6 to 1.2 percent, *moderate,* 1.2 to 2.0 percent; *high,* 2.0 to 4.0 percent; *very high,* more than 4.0 percent.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry 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.*

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 substances.

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 residue.

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 horizon.—Consolidated rock beneath the soil. The rock generally underlies a C horizon but may be immediately beneath an A or B horizon.

Igneous rock. A rock produced by the cooling of melted mineral material, such as granite, andesite, diorite, and basalt.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation commonly used in this survey area 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.

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.

Leaching. The removal of soluble materials from the soil by percolating water.

Leveling (of land). The reshaping, or modification of the soil surface to a planned grade to permit uniform distribution of irrigation water without erosion or to provide proper surface drainage.

Lime. Chemically, lime is calcium oxide, but as the term is commonly used, it is also calcium carbonate and calcium hydroxide. Agricultural lime refers to ground limestone, hydrated lime, or burned lime, with or without magnesium minerals.

Metamorphic rocks. Rocks of any origin that have been completely changed physically by pressure, heat, and movement. Such rocks are nearly always crystalline. Examples: Mica schist and serpentine.

Microrelief. Minor surface irregularities of the land, such as low mounds or pits.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils generally indicates poor aeration and lack of drainage.

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.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are:

	Inches per hour
Very slow	Less than 0.06
Slow	0.06–0.20
Moderately slow	0.20–0.63
Moderate	0.63–2.00
Moderately rapid	2.00–6.30
Rapid	6.30–20.0
Very rapid	More than 20.0

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

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. In words, the degree of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Sand. As a soil separate, the individual rock or mineral fragments in soils range from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but they may be any mineral composition. As a soil textural class, soil material that contains 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. A rock largely composed of particles deposited from suspension in water. The chief sedimentary rocks are conglomerate, from gravel; sandstone, from sand; shale, from clay; and limestone, from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sands have been consolidated into sandstone.

Silt. As a soil separate, 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). As a soil textural class, soil material that is 80 percent or more silt and less than 12 percent clay.

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.

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 (1) *single grain* (each grain by itself, as in dune sand) or (2) *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 or layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

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.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

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