SOIL SURVEY OF

Eastern Santa Clara Area, California

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

Issued September 1974

Major fieldwork for this soil survey was done in the period 1960–65. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the University of California Agricultural Experiment Station. It is part of the technical assistance furnished to the Evergreen, Loma Prieta, and part of the Bolado-Fairview 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 agriculture, industry, and recreation.

Locating Soils

All the soils of the Eastern Santa Clara Area are shown on the detailed map at the back of this survey. 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 symbol. 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 in the survey. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described, gives the page for the capability unit, wildlife group, and range site in which the soil has been placed, and lists the Storie index rating that applies to each soil.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and range sites.

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

Ranchers and others can find, under "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 and Classification of Soils."

Newcomers in the Eastern Santa Clara 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: **Prunes growing on soils in the Azule-Altamont association. Photo courtesy Sunsweet Growers.**

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SOIL SURVEY OF THE EASTERN SANTA CLARA AREA, CALIFORNIA

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THE EASTERN SANTA CLARA AREA is in Santa Clara County, which is located in the west-central part of California (fig. 1). The survey area has a total land area of 815 square miles, or 519,280 acres. The topography of Santa Clara County consists of three principal physiographic features: the Santa Clara Valley, the Santa Cruz Mountains, and the Diablo Range.

Figure 1.—Location of Eastern Santa Clara Area in California.

The survey area includes the southern part of Santa Clara Valley, from the town of Coyote south to the San Benito County line. This area is made up of deep, rich, alluvial soils. Along the edges of the valley on terraces are soils that have a clayey subsoil. Poorly drained soils are in a few areas throughout the valley. Because of its latitude, surrounding mountains, and proximity to the Pacific Ocean, the valley has a mild, equable climate most of the year.

The eastern part of the survey area includes that part of Santa Clara County that lies in the Diablo Range. These mountains comprise a number of parallel, well-rounded ridges. The vegetation is mainly grass and trees, but some areas are covered by brush. Pacheco and Coyote Creeks are practically the only streams draining into the southern part of Santa Clara Valley. This part of the survey area is used mostly for grazing. Average annual rainfall ranges from 15 to 30 inches.

The Santa Cruz Mountains separate the Santa Clara Valley from the sea. These mountains, from a point 4 miles north of Mt. Madonna, are included in this survey. Soils of this area have steep to very steep slopes. The natural vegetation is dense brush or trees. The lower foothills are used for range. Brush and timber areas are used mainly for recreation, wildlife, summer homesites, and watershed. Average annual rainfall is 20 to 50 inches. Drainage from this area is largely through tributaries of the Pajaro River and Llagas, Uvas, Little Arthur, and Bodfish Creeks.

As far as is known, the Indians that occupied Santa Clara Valley before the white man came practiced little or no farming. The mild climate and abundant game, fish, herbs, and berries made farming unnecessary. The earliest farming in the area was intended to make the newly established missions and the Spanish soldiers in the region independent of supplies from Mexico.

In recent years farm acreage in Santa Clara County has been reduced by residential and industrial development; however, agriculture is still of considerable importance. The principal crops are fruits, nuts, cut flowers, sugar beets, and fresh vegetables. The growing season is long enough for most crops, especially vegetables and cut flowers. In summer rainfall is limited and irrigation is needed for crops. Livestock is produced in the foothills and mountainous areas where forage is abundant.

The economy of Santa Clara County is mainly dependent on electronics and missile research, development, and production. The production of food processing equipment, nonelectrical machinery, and transportation equipment is also important.

San Jose, the county seat and largest city in Santa Clara County, is not in the survey area. Morgan Hill and Gilroy are the largest incorporated towns in the survey area. Gilroy, the larger of the two, ranks ninth among the cities of Santa Clara County and has an estimated population of 6,350.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in the Eastern Santa Clara Area, where they are located, and how they can be used. They went into the area knowing they likely would find many soils they had already seen and perhaps some they had not. They noted the steepness, length, and shape of slopes, the kinds of native plants or crops, the kinds of rock, and many other 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* (*10*) [1] are the categories of soil classification most used in local surveys.

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. Altamont and Campbell, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in surface soil texture and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Altamont clay, 15 to 30 percent slopes, is one of several phases within the Altamont series.

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

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

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units shown on the soil map of the Eastern Santa Clara Area are soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. The Gaviota-Los Gatos complex is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Zamora and Cropley soils 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. Rock land is a land type in the Eastern Santa Clara Area.

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

But only part of a soil survey is complete 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 needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then the scientists 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 Eastern Santa Clara 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

[1] Italic numbers in parentheses refer to Literature Cited, p. 88.

named for the major soils. The soils in one association may occur in another, but in a different pattern.

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

The eleven soil associations in the Eastern Santa Clara Area have been divided into three groups according to some dominant feature of texture, drainage, slope or landform, and position. The terms for texture used in the title for several of the associations apply to the surface layer. For example, in association 1 the words "loams and silty clay loams" refer to texture of the surface layer.

Areas Dominated by Very Deep, Well-Drained to Poorly Drained Soils on Alluvial Plains, Fans, and Stream Benches

This group consists of level to strongly sloping soils that developed in alluvium derived mainly from sedimentary rock. The vegetation consists of grasses, forbs, and scattered oak trees. Elevation ranges from 100 to 2,400 feet. Average annual rainfall is 15 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Most areas of these soils are in the Santa Clara Valley; smaller areas are in small valleys in the Diablo Range. Differences in characteristics of the soils in this group are caused by minor differences in parent material, stage of soil development, and drainage. These soils occupy about 13 percent of the survey area.

These intensively cultivated soils are used for row crops, sugar beets, orchards, vineyards, hay and pasture, and range. Housing and commercial developments are rapidly expanding on these soils.

1. *Yolo association*

Nearly level to sloping, well-drained loams and silty clay loams; on alluvial plains and fans

This association is on alluvial plains and fans of the Santa Clara Valley along the major drainageways. It consists of soils that developed in alluvium from sedimentary rock. These soils have slopes of 0 to 9 percent. Where these soils are not cultivated, the vegetation consists of annual grasses, forbs, and a few scattered oak trees. Elevation ranges from 400 to 1,000 feet. Average annual rainfall is 15 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 5 percent of the survey area. Yolo soils make up about 85 percent of this association. The remaining 15 percent consists of Campbell, Garretson, Cortina, and Esparto soils, and of Riverwash.

Yolo soils have a grayish-brown loam and silty clay loam surface layer and a brown silt loam substratum. The hazard of flooding generally does not exist on these soils, except for a few areas in lower positions along drainageways.

These soils are used for irrigated row crops, orchards, vineyards, dryland hay, and pasture. The principal crops are apricots, cherries, prunes, and walnuts. These are the most productive soils in the Eastern Santa Clara Area. The largest expansion of housing and related commercial developments has taken place on these soils.

2. *Arbuckle-Pleasanton association*

Nearly level to strongly sloping, well-drained gravelly loams and loams; on older alluvial fans

This association is along the edges of the Santa Clara Valley, around Morgan Hill and San Martin. It consists of soils that developed in alluvium from sedimentary rock. These soils have slopes of 0 to 15 percent. Where these soils are not cultivated, the vegetation consists of annual grasses, forbs, and scattered oaks. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 15 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 5 percent of the survey area. Arbuckle soils make up about 60 percent of this association, and Pleasanton soils 25 percent. The remaining 15 percent consists of San Ysidro and Hillgate soils.

The dominant soils in this association are well drained. The Arbuckle soils have a brown and pale-brown gravelly loam surface layer and a brown and yellowish-brown gravelly loam subsoil. The substratum is brown very gravelly sandy loam. Pleasanton soils have a grayish-brown loam and gravelly loam surface layer and a dark grayish-brown, brown, and yellowish-brown clay loam, gravelly clay loam, and gravelly sandy clay loam subsoil. The substratum of these soils is gravelly alluvium of variable texture.

These soils are used for irrigated row crops, orchards, dryland hay, pasture, and range. Some areas are also used for housing and commercial developments.

3. *Cropley-Rincon association*

Nearly level to sloping, well-drained clays and clay loams; on alluvial fans

This association is along the edges of Santa Clara Valley. It consists of soils that developed in calcareous alluvium from mixed sources. These soils have slopes of 0 to 9 percent. Where these soils are not cultivated, the vegetation consists of grasses, forbs, and a few scattered oak trees. Elevation ranges from 130 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 1 percent of the survey area. Cropley soils make up 60 percent of this association, and Rincon soils 25 percent. The remaining 15 percent consists of San Ysidro, Pleasanton, and Zamora soils.

The dominant soils of this association are well drained. The Cropley soils have a very dark gray clay surface layer and a dark grayish-brown clay substratum. Rincon soils have a dark gray clay loam surface layer and a grayish-brown gravelly clay and clay subsoil. The substratum of these soils is mixed alluvium that ranges from gravelly clay loam to clay and is commonly calcareous.

These soils are used for irrigated row crops, sugar beets, apricots, prunes, walnuts, grapes, dryland hay, and pasture. They are more difficult to manage than the soils in the valley, and productivity is lower. Well water is available for irrigation.

4. *Clear Lake-Pacheco-Sunnyvale association*

Nearly level, poorly drained clays to clay loams; in low positions on alluvial plains and fans

This association is on the valley floor near Soap Lake and Tulare Hill. It consists of soils that developed in mottled alluvium from sedimentary rock. These soils have slopes of less than 2 percent. Elevation ranges from 100 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 2 percent of the survey area. Clear Lake soils make up about 35 percent of this association, Pacheco soils 35 percent, and Sunnyvale soils 15 percent. The remaining 15 percent consists of areas of Campbell and Willows soils.

The dominant soils of this association are poorly drained. Clear Lake soils have a dark-gray clay surface layer and a grayish-brown, calcareous clay substratum. Pacheco soils have a grayish-brown fine sandy loam, silt loam, and clay loam surface layer and a mottled, light-gray, calcareous loam and very fine sandy loam substratum. Sunnyvale soils have a dark-gray, calcareous silty clay surface layer and a light-gray and gray, calcareous silty clay substratum. Free water generally occurs at a depth of 2½ to 5 feet, except where the soils are drained.

These soils are used for irrigated row crops, sugar beets, orchards, hay, and pasture.

Areas Dominated by Shallow to Moderately Deep, Well Drained to Moderately Well Drained Soils on Old Fans and Terraces

This group consists of nearly level to steep soils that have a clay subsoil and that developed in alluvium derived from sedimentary rock. These soils are on old fans and terraces that lie between the more recent alluvial soils of the valley floor and the soils of the uplands. The vegetation consists of grasses, forbs, and scattered oaks. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. These soils occupy about 3 percent of the survey area.

Nearly all of the soils are cultivated and are used for orchards, vineyards, hay, pasture, and range. Because of slope, clay subsoil, and cultivation practices, most areas of these soils are eroded. Limited water for irrigation is available.

5. *Hillgate-San Ysidro association*

Nearly level to steep, well drained to moderately well drained silt loams and loams having a clay and clay loam subsoil

This association is along the edges of Santa Clara Valley. It consists of soils that developed in alluvium from sedimentary rock. These soils have slopes of 0 to 50 percent. Where these soils are not cultivated, the vegetation consists of annual grasses and scattered oaks. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days.

This association occupies about 3 percent of the survey area. Hillgate soils make up about 50 percent of this association, and San Ysidro soils 35 percent. The remaining 15 percent consists of Keefers, Pleasanton, Arbuckle, Los Robles, and Zamora soils.

Hillgate soils are well drained and have slopes of 2 to 50 percent on the higher terraces. They have a pale-brown and brown silt loam surface layer and a strong-brown and brownish-yellow clay and clay loam subsoil. The underlying material is brownish-yellow gravelly clay loam alluvium. The San Ysidro soils are moderately well drained and have slopes of 0 to 5 percent on old fans. They have a light brownish-gray loam surface layer and a mottled, brown and yellowish-brown clay subsoil. The substratum is mottled light yellowish-brown clay loam and sandy clay loam.

These soils are used for irrigated apricots, prunes, and vineyards. Without irrigation, they are used primarily for grain hay, dryland pasture, and range. The limited irrigation water available is obtained mainly from wells.

Areas Dominated by Shallow to Deep, Well-Drained to Somewhat Excessively Drained Soils on Uplands

This group consists of gently sloping to very steep soils on mountainous uplands. Because of the wide variety of parent rock and the marked differences in climate, a relatively large number of soils is represented in this group. The vegetation is grasses, brush, woodland, or conifer forests. Elevation ranges from 200 to 4,000 feet. Average annual rainfall is 15 to 50 inches, and average annual temperature is 55° to 60° F. The growing season is 200 to 275 days. These soils occupy about 81 percent of the survey area.

Most of the soils in this group are used for vineyards, Christmas tree production, pasture, grain, hay, range, watershed, wildlife, and recreation. A few areas are used for the production of timber.

6. *Azule-Altamont association*

Strongly sloping to very steep, well-drained, moderately deep and deep clays and clay loams

This association is on the foothills around the edges of Santa Clara Valley. It consists of soils that developed on soft sediments. These soils have slopes of 9 to 75 percent. Vegetation is mostly annual and perennial grasses, forbs, and scattered oaks. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 250 days.

This association comprises about 2 percent of the survey area. Azule soils make up about 55 percent of this association, and Altamont soils about 30 percent. The remaining 15 percent consists of Diablo, Los Osos, and San Benito soils.

The dominant soils of this association are moderately deep to deep and are well drained. Azule soils have a dark grayish-brown clay loam surface layer and a brown and

yellowish-brown gravelly sandy clay subsoil. The substratum is light yellowish brown gravelly sandy clay loam sediments. Altamont soils have a dark grayish-brown and grayish-brown clay surface layer and a light-gray, calcareous clay substratum. They overlie fractured, calcareous shales.

These soils are used for dryland orchards, vineyards, grain hay, pasture, range, wildlife, and watershed. The soils of this association are the high forage-producing rangeland soils in the survey area.

7. Los Osos-San Benito association

Moderately steep to very steep, well-drained, moderately deep and deep clay loams

This association is east of Soap Lake and around Sargent oil fields. It consists of soils that developed on sandstone and shale. These soils have slopes of 15 to 75 percent. Vegetation is mostly annual and perennial grasses, forbs, and scattered oaks. Elevation ranges from 300 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 250 days.

This association occupies about 1 percent of the survey area. Los Osos soils make up 55 percent of this association, and San Benito soils about 30 percent. The remaining 15 percent consists of Diablo, Gaviota, and Vallecitos soils.

The dominant soils in this association are moderately deep to deep and are well drained. Los Osos soils have a dark grayish-brown clay loam surface layer and a dark-brown clay subsoil. The underlying material is sandstone bedrock. San Benito soils have a dark grayish-brown clay loam surface layer and a yellowish-brown, calcareous clay loam substratum. The underlying material is calcareous shale.

These soils are used for dryland hay, pasture, and range.

8. Los Gatos-Gaviota-Vallecitos association

Gently sloping to very steep, well-drained and somewhat excessively drained, shallow to deep gravelly loams and loams

This association is in the uplands on both sides of the Santa Clara Valley. It consists of soils that developed on hard sandstone and shale. These soils have slopes of 5 to 75 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs and some oak, Digger pine, and brush. Elevation ranges from 300 to 4,000 feet. Average annual rainfall is 15 to 40 inches, and average annual temperature is 55° to 60° F. The growing season is 200 to 250 days.

This association occupies about 37 percent of the survey area. Los Gatos soils make up 30 percent of the association, Gaviota soils 30 percent, and Vallecitos soils about 25 percent. The remaining 15 percent consists of Gilroy, Inks, Los Osos, Parrish, San Andreas, and Santa Lucia soils.

Los Gatos soils are moderately deep and deep and are well drained. They have a brown gravelly loam surface layer and a brown, reddish-brown, and yellowish-brown gravelly clay loam subsoil that is underlain by metamorphosed shale. Gaviota soils are shallow and are well drained and somewhat excessively drained. They have a pale-brown loam and light yellowish-brown gravelly loam surface layer underlain by hard sandstone. Vallecitos soils are shallow and moderately deep and are well drained. They have a brown loam surface layer and a dark-brown clay loam and reddish-brown clay subsoil underlain by metamorphosed hard shales. Some areas have rock outcrops, and some are moderately eroded to severely eroded.

These soils are used for vineyards, hay, pasture, range, wildlife, recreation, and watershed. This association comprises the largest area of range soils in the survey area.

9. Gaviota association

Steep to very steep, shallow, somewhat excessively drained, eroded gravelly loams

This association is in the Diablo Range just east of Mt. Hamilton and extends from the Alameda-Santa Clara County line south to Mustang Peak. It consists of soils that developed on hard sandstone and shales. These soils have slopes of 30 to 75 percent. Vegetation is low chamise with a scanty grass and forb understory. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is 15 to 30 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 250 days.

This association comprises about 31 percent of the survey area. Gaviota gravelly loam soils make up about 85 percent of this association. The remaining 15 percent consists of Vallecitos, Los Gatos, and Henneke soils.

Gaviota soils are shallow and are somewhat excessively drained. They have a pale-brown gravelly loam surface layer that is underlain by hard sandstone. Some areas have rock outcrops, and most areas are moderately to severely eroded.

These soils are used for range, wildlife, watershed, and recreation (fig. 2).

10. Felton-Maymen association

Moderately steep to very steep, well-drained and somewhat excessively drained, deep to shallow silt loams and fine sandy loams

This association is on uplands that extend along the Santa Cruz-Santa Clara County line. It consists of soils that developed on sandstone and shale. Vegetation is mainly redwood, Douglas-fir, coniferous forest, and associated hardwoods; brush is the dominant cover on the Maymen soils. These soils have slopes of 15 to 75 percent. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is 30 to 50 inches, and average temperature is 55° to 56° F. The growing season is 200 to 250 days.

This association occupies about 10 percent of the survey area. Felton soils make up 65 percent of this association, and Maymen soils about 20 percent. The remaining 15 percent consists of Ben Lomond and Madonna soils.

Felton soils are well drained and moderately deep and deep. They have a brown silt loam surface layer and a brown, light-brown, and light yellowish-brown clay loam subsoil that is underlain by interbedded shale and sandstone. Felton soils that have been logged show some sheet, gully, and rill erosion. Maymen soils are somewhat excessively drained and shallow. They have a brown fine sandy loam surface layer and a light-brown fine sandy loam subsoil that is underlain by hard sandstone. Maymen soils are commonly eroded, and 2 to 10 percent of their surface area is rock outcrops.

These soils are used mainly for grain hay, range, Christmas trees, wildlife, recreation, and watershed. Some timber is harvested on the Felton soils.

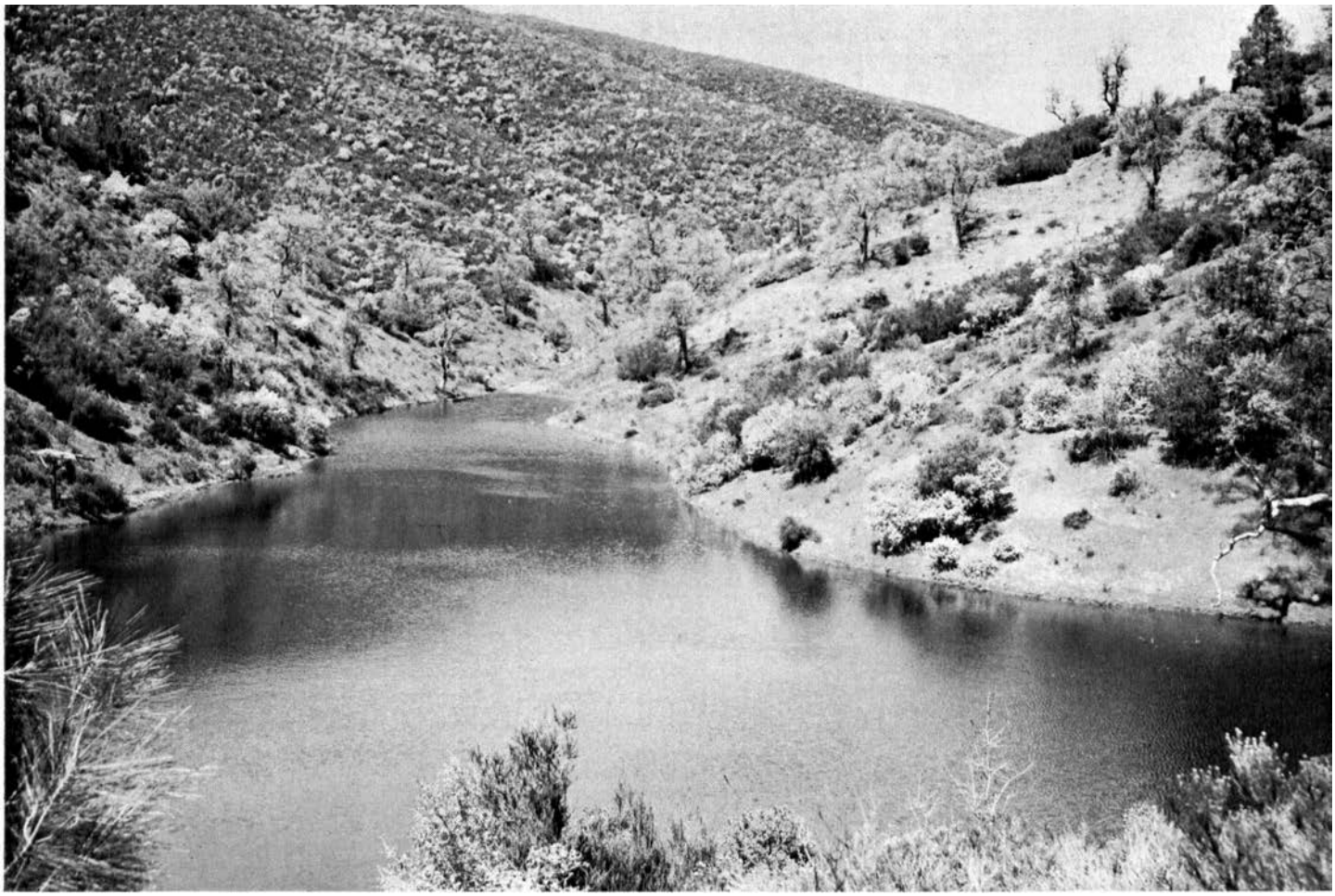

Figure 2.—**Area of eroded Gaviota soils that has limited use for range, wildlife, watershed, and recreation.**

11. Montara-Inks-Henneke association

Moderately steep to very steep, somewhat excessively drained, shallow clay loams and gravelly clay loams

This association is mainly on uplands along the foothills that extend from Tulare Hill to Anderson Lake and around Red Mountain; smaller areas are throughout the survey area. It consists of soils that developed on serpentine and metamorphosed basalt bedrock. These soils have slopes of 15 to 75 percent. Natural vegetation is grasses, forbs, and brush. Elevation ranges from 200 to 3,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 275 days.

This association occupies about 3 percent of the survey area. Montara soils make up about 45 percent of this association, Inks soils 20 percent, and Henneke soils 20 percent. The remaining 15 percent consists of Climara, Gilroy, Gaviota, Los Gatos, and Vallecitos soils.

The dominant soils of this association are shallow and somewhat excessively drained. Montara soils have a dark gray and very dark gray clay loam surface layer that is underlain by serpentine bedrock. About 5 to 10 percent of the surface is covered by rock outcrops. Inks soils have a brown gravelly clay loam surface layer and a dark reddish-brown gravelly clay loam subsoil that is underlain by hard, shattered, metamorphosed basalt. About 2 to 10 percent of the surface is covered by rock outcrops, and there is a variable amount of stones on the surface. Henneke soils have a reddish-brown gravelly clay loam surface layer and a dark reddish-brown very gravelly clay subsoil that is underlain by serpentine bedrock. About 2 to 10 percent of the surface is covered by rock outcrops. These soils are moderately eroded to severely eroded.

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

Descriptions of the Soils

This section provides detailed information about the soils in the survey area. It describes each soil series, and then each soil, or mapping unit. The soils are described in alphabetical order.

The description of a soil series mentions features that apply to all the soils of that series. Differences among the soils of one series are pointed out in the descriptions of the individual soils or are apparent in the name.

A profile representative of each series is described in detail in the first mapping unit. This profile is for scientists, engineers, and others who need to make highly technical soil interpretations. The layers, or horizons, are

designated by symbols such as A1, B21t, and C1. These symbols have special meaning for soil scientists. Many readers, however, need only remember that symbols beginning with "A" are for surface layer; those with "B" are for subsoil; those with "C" are for substratum, or parent material; and those with "R" are for bedrock. All measurements refer to depth from the surface.

The color of each horizon is described in words, such as yellowish brown, and is also indicated by symbols for hue, value, and chroma, such as 10YR 5/4. These symbols, which are called Munsell color notations, are used by soil scientists to evaluate the color of the soil precisely. Unless otherwise stated, all color terms in the survey are for dry soil.

The texture of the soil refers to the content of sand, silt, and clay. It is determined by the way the soil feels when rubbed between the fingers, and it is checked by laboratory analyses. Each mapping unit is identified by a textural class name, such as fine sandy loam. This name refers to the texture of the surface layer or A horizon.

The structure is indicated by the way the individual soil particles are arranged in larger grains, or aggregates, and by the amount of pore space between grains. The structure of the soil is described by terms that denote strength or grade, size, and shape of the aggregates. For example, a horizon may consist of soil materials that have weak, fine, blocky structure.

Boundaries between the horizons are described so as to indicate their thickness and shape. The terms for thickness are *abrupt*, *clear*, *gradual*, and *diffuse*. The shape of the boundary is described as *smooth*, *wavy*, *irregular*, or *broken*.

Other terms used for describing the soils are defined in the Glossary. 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. The approximate acreage and proportionate extent of the soils are given in table 1, and their location and extent are shown on the detailed soil map at the back of this survey.

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

Soil	Acres	Percent
Altamont clay, 30 to 50 percent slopes	1, 120	0. 2
Altamont clay, 15 to 30 percent slopes	580	. 1
Altamont clay, 50 to 75 percent slopes, eroded	190	(1)
Arbuckle gravelly loam, 0 to 2 percent slopes	4, 140	. 8
Arbuckle loam, deep, 5 to 9 percent slopes	610	. 1
Azule clay loam, 30 to 75 percent slopes	2, 240	. 4
Azule clay loam, 9 to 15 percent slopes, eroded	190	. 1
Azule clay loam, 15 to 30 percent slopes	1, 420	. 3
Azule clay loam, 15 to 30 percent slopes, eroded	640	. 1
Azule clay loam, 30 to 75 percent slopes, eroded	1, 970	. 4
Ben Lomond fine sandy loam, 50 to 75 percent slopes	520	. 1
Campbell silty clay loam	1, 560	. 3
Campbell silty clay loam, clay substratum	520	. 1
Campbell silty clay	2, 190	. 4
Campbell silty clay, muck substratum	440	. 1
Clear Lake clay, drained	1, 800	. 4
Clear Lake clay	1, 360	. 3
Clear Lake clay, saline	560	. 1
Climara stony clay, 15 to 50 percent slopes	2, 030	. 4
Climara clay, 9 to 30 percent slopes	1, 160	. 2
Cortina very gravelly loam, 0 to 5 percent slopes	1, 770	. 3
Cropley clay, 0 to 2 percent slopes	2, 540	. 5
Cropley clay, 2 to 9 percent slopes	920	. 2
Diablo clay, 9 to 15 percent slopes	210	(1)
Diablo clay, 30 to 50 percent slopes	150	(1)
Esparto loam, 0 to 2 percent slopes	250	. 1
Esparto loam, 2 to 9 percent slopes	580	. 1
Felton silt loam, 50 to 75 percent slopes	3, 080	. 6
Felton silt loam, 15 to 30 percent slopes	230	(1)
Felton silt loam, 30 to 50 percent slopes	330	. 1
Garretson loam, gravel substratum, 0 to 2 percent slopes	1, 770	. 3
Garretson gravelly loam, 0 to 5 percent slopes	1, 620	. 3
Gaviota loam, 30 to 75 percent slopes	43, 560	8. 4
Gaviota loam, 5 to 15 percent slopes, eroded	3, 550	. 7
Gaviota loam, 15 to 30 percent slopes	8, 310	1. 6
Gaviota gravelly loam, 30 to 75 percent slopes, eroded	68, 200	13. 7
Gaviota gravelly loam, 30 to 75 percent slopes, severely eroded	33, 560	6. 4
Gaviota rocky loam, 5 to 30 percent slopes, eroded	6, 250	1. 2
Gaviota-Los Gatos complex, 30 to 50 percent slopes	31, 800	6. 1
Gilroy clay loam, 30 to 50 percent slopes	7, 310	1. 2
Gilroy clay loam, 5 to 30 percent slopes	1, 690	. 3
Gilroy clay loam, 15 to 30 percent slopes, eroded	1, 200	. 2
Gilroy clay loam, 50 to 75 percent slopes	5, 590	1. 0
Henneke rocky clay loam, 30 to 75 percent slopes, severely eroded	2, 560	. 5
Hillgate silt loam, 9 to 15 percent slopes, eroded	1, 980	. 4
Hillgate silt loam, 2 to 9 percent slopes	3, 610	. 5
Hillgate silt loam, 15 to 30 percent slopes, eroded	1, 180	. 2
Hillgate silt loam, 30 to 50 percent slopes, eroded	1, 310	. 2
Inks rocky clay loam, 50 to 75 percent slopes, eroded	2, 060	. 4
Inks stony clay loam, 30 to 75 percent slopes, severely eroded	4, 960	. 9
Keefers clay loam, 2 to 9 percent slopes, eroded	2, 420	. 5
Keefers clay loam, 0 to 2 percent slopes	500	. 1
Landslides	1, 300	. 3
Los Gatos gravelly loam, 50 to 75 percent slopes	10, 430	2. 1
Los Gatos gravelly loam, 15 to 30 percent slopes, eroded	390	. 1
Los Gatos gravelly loam, 30 to 50 percent slopes	2, 130	(1)
Los Gatos-Gaviota complex, 50 to 75 percent slopes	57, 910	11. 0
Los Osos clay loam, 15 to 30 percent slopes	2, 610	. 5
Los Osos clay loam, 30 to 50 percent slopes	5, 170	1. 0
Los Osos clay loam, 50 to 75 percent slopes	3, 800	. 7
Los Robles clay loam, 0 to 2 percent slopes	1, 160	. 2
Los Robles clay loam, 2 to 9 percent slopes	850	. 3
Madonna loam, 30 to 50 percent slopes	1, 450	. 3
Madonna loam, 15 to 30 percent slopes	440	. 1
Madonna loam, 50 to 75 percent slopes	1, 490	. 3
Maxwell clay, 0 to 5 percent slopes	900	. 2
Maymen rocky fine sandy loam, 50 to 75 percent slopes, eroded	7, 040	1. 4
Maymen fine sandy loam, 15 to 50 percent slopes, eroded	550	. 1
Mantara rocky clay loam, 15 to 50 percent slopes, eroded	6, 360	1. 2
Pacheco clay loam	1, 490	. 3
Pacheco fine sandy loam	660	. 2
Pacheco silt loam, drained	870	. 2

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

Soil	Acres	Percent
Pacheco clay loam, gravelly substratum	330	0.1
Parrish gravelly clay loam, 9 to 30 percent slopes	760	.2
Parrish gravelly clay loam, 30 to 50 percent slopes	3,350	.6
Parrish gravelly clay loam, 50 to 75 percent slopes	7,340	1.4
Pleasanton loam, 0 to 2 percent slopes	5,650	1.1
Pleasanton loam, 2 to 9 percent slopes	1,800	.4
Pleasanton gravelly loam, 0 to 2 percent slopes	2,680	.5
Pleasanton gravelly loam, 2 to 9 percent slopes	2,680	.5
Pleasanton gravelly loam, 9 to 15 percent slopes, eroded	1,000	.2
Rincon clay loam, 0 to 2 percent slopes	610	.1
Rincon clay loam, 2 to 9 percent slopes, eroded	870	.2
Riverwash	4,550	.8
Rock land	2,710	.5
San Andreas fine sandy loam, 30 to 75 percent slopes, eroded	1,250	.2
San Andreas fine sandy loam, 15 to 30 percent slopes, eroded	440	(1)
San Benito clay loam, 50 to 75 percent slopes	430	(1)
San Benito clay loam, 15 to 30 percent slopes, eroded	160	(1)
San Benito clay loam, 30 to 50 percent slopes	710	.1
San Benito clay loam, 30 to 50 percent slopes, severely eroded	500	.1
Santa Lucia shaly loam, 50 to 75 percent slopes	1,470	0.3
Santa Lucia shaly loam, 30 to 50 percent slopes, eroded	560	.1
San Ysidro loam, 0 to 2 percent slopes	3,810	.7
San Ysidro loam, 2 to 5 percent slopes, eroded	400	.1
San Ysidro loam, acid variant, 0 to 2 percent slopes	900	.2
San Ysidro loam, acid variant, 2 to 9 percent slopes	800	.2
Sunnyvale silty clay, drained	820	.2
Sunnyvale silty clay	230	(1)
Terrace escarpments	460	.1
Vallecitos rocky loam, 15 to 30 percent slopes, eroded	46,290	8.9
Vallecitos rocky loam, 50 to 75 percent slopes, eroded	36,240	7.0
Willows clay	350	.1
Yolo loam, 0 to 2 percent slopes	3,710	.7
Yolo loam, 2 to 5 percent slopes	430	.1
Yolo silty clay loam, 0 to 2 percent slopes	1,940	.4
Yolo silty clay loam, 2 to 9 percent slopes	320	.1
Zamora clay loam, 0 to 2 percent slopes	2,740	.5
Zamora loam, 0 to 2 percent slopes	540	.1
Zamora loam, 2 to 9 percent slopes	860	.1
Zamora clay loam, 2 to 9 percent slopes	770	.1
Zamora and Cropley soils, 2 to 9 percent slopes, severely eroded	530	.1
Total	519,280	100.0

[1] Less than 0.05 percent.

Altamont Series

The Altamont series consists of well-drained clays that are underlain by sedimentary rock. These soils have slopes of 15 to 75 percent and are on uplands. The vegetation is mainly annual grasses, and there are a few scattered oak trees. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 200 to 250 days. Altamont soils are associated with Azule and Climara soils.

In a representative profile, the surface layer is dark grayish-brown and grayish-brown, neutral and moderately alkaline clay about 34 inches thick. The substratum is light-gray, calcareous, moderately alkaline clay about 10 inches thick. At a depth of 44 inches is light-gray, calcareous, fractured shale. Depth to shale ranges from 25 to 56 inches.

Altamont soils are used for dryland grain, hay, pasture, and range.

Altamont clay, 30 to 50 percent slopes (AcF).—This soil is on rounded hills. The average slope is about 40 percent.

Representative profile (on south-facing hillside about 2.5 miles from country club golf course gate, on road leading to Shingle Valley; in southwest corner of SE¼SW¼ sec. 29, T. 8 S., R., 3 E.):

A11—0 to 8 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong, coarse, prismatic structure parting to moderate, medium and coarse, angular blocky structure; very hard, very firm, sticky and plastic; common very fine roots; common very fine interstitial and tubular pores; many pressure faces and a few slickensides; neutral (pH 7.0); clear, wavy boundary. (4 to 10 inches thick.)

A12—8 to 20 inches, dark grayish-brown (2.5Y 4/2) clay; very dark grayish brown (2.5Y 3/2) moist; strong, coarse, prismatic structure; very hard, very firm, sticky and plastic; few very fine roots; common very fine interstitial and tubular pores; continuous slickensides along ped surfaces; few, soft, medium-sized lime masses; moderately alkaline (pH 8.0); clear, wavy boundary. (8 to 14 inches thick.)

A13ca—20 to 34 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; continuous slickensides along ped surfaces; calcareous, moderately alkaline (pH 8.0); clear, wavy boundary. (10 to 16 inches thick.)

Cca—34 to 44 inches, light-gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; massive; very hard, very firm, sticky and plastic; common very fine interstitial and tubular pores; calcareous; moderately alkaline (pH 8.0); clear, irregular boundary. (8 to 16 inches thick.)

R—44 inches, light-gray, calcareous, fractured shale.

The A horizon is commonly dark grayish brown, but in places it is dark brown or grayish brown. Its texture ranges from heavy clay loam to clay but it is commonly clay. Reaction is neutral to moderately alkaline. The Cca horizon is light gray, pale brown, or light yellowish brown to olive brown. Depth to lime in places is 10 inches or more, but the average depth is 30 to 40 inches. When this soil is dry, deep cracks develop that average ½ to 1½ inches in width and extend to an average depth of about 36 inches. Depth to bedrock ranges from 30 to 56 inches.

Included with this soil in mapping are small areas of Azule clay loam and Diablo clay, a few areas where lime is absent, and small areas of reddish-brown clay.

This soil has an available water holding capacity of 4 to 8 inches. Permeability is slow. Runoff is rapid, and the hazard of erosion is high. Natural fertility is high. Effective rooting depth is deep.

This soil is used for range. Capability unit VIe–5 (15); range site, Clayey.

Altamont clay, 15 to 30 percent slopes (AcE).—This soil has a profile that is similar to that of Altamont clay, 30 to 50 percent slopes.

Included with this soil in mapping are small areas of Diablo clay and areas subject to moderate or severe sheet erosion.

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

This soil is used mainly for dryland grain hay, pasture, and range. Capability unit IVe–5 (15); range site, Clayey.

Altamont clay, 50 to 75 percent slopes, eroded (AcG2).—This soil has a profile that is similar to that of Altamont clay, 30 to 50 percent slopes. Because of moderate sheet erosion, depth to bedrock is 25 to 35 inches and occasional rock outcrops are present.

Included with this soil in mapping are small areas of San Benito clay loam and Landslides, and areas where the lighter colored, calcareous substratum has been exposed by erosion.

Available water holding capacity is 3.5 to 4.5 inches. Effective rooting depth is moderately deep. The hazard of erosion is very high, and runoff is very rapid.

The soil is used for range. Capability unit VIIe–5 (15); range site, Clayey.

Arbuckle Series

The Arbuckle series consists of well-drained gravelly loams that have developed in alluvium from material derived from sedimentary rock. These soils are on old fans and terraces and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are a few, scattered, large oak trees. Elevation ranges from 200 to 800 feet. Average annual rainfall is 15 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Arbuckle soils are associated with the Pleasanton and San Ysidro soils.

In a representative profile, the surface layer is brown and pale-brown, medium acid and slightly acid gravelly loam about 10 inches thick. The subsoil is brown and yellowish-brown, slightly acid, gravelly loam about 30 inches thick. The substratum is brown, slightly acid very gravelly sandy loam that extends to a depth of more than 60 inches. In some places the subsoil is underlain by shale bedrock at a depth of 38 to 50 inches, and the surface layer is loam.

Arbuckle soils are used for irrigated row crops, orchards, dryland grain hay, and pasture.

Arbuckle gravelly loam, 0 to 2 percent slopes (ArA).—This soil has an average slope of less than 2 percent.

Representative profile (1.75 miles east on Dunn Avenue from Southern Pacific Railroad crossing and 200 yards north in field; NW¼SE¼ sec. 22, T. 9 S., R. 3 E.):

Ap—0 to 6 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; massive; hard, very friable, nonsticky and nonplastic; many very fine roots; many fine interstitial pores and few fine tubular pores; medium acid (pH 6.0); clear, smooth boundary. (4 to 7 inches thick.)

A1—6 to 10 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many fine interstitial pores and few fine tubular pores; slightly acid (pH 6.1); gradual, wavy boundary. (4 to 6 inches thick.)

B1—10 to 20 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many fine interstitial pores and few fine and medium tubular pores; few thin clay films in pores and on ped faces; slightly acid (pH 6.5); gradual, smooth boundary. (8 to 12 inches thick.)

B2t—20 to 32 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; many thin clay films in pores and on ped surfaces; slightly acid (pH 6.5); gradual, smooth boundary. (10 to 12 inches thick.)

B3—32 to 40 inches, yellowish-brown (10YR 5/4) gravelly loam, dark yellowish-brown (10YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores and few fine tubular pores; common thin clay films bridging mineral grains; slightly acid (pH 6.5); clear, smooth boundary. (8 to 10 inches thick.)

IIC—40 to 60 inches, brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; slightly acid (pH 6.5).

The A horizon ranges from brown to light brownish gray and pale brown. Its texture is commonly gravelly loam but in places is gravelly fine sandy loam or gravelly sandy loam. Content of gravel is 15 and 35 percent by volume. Texture of the B2t horizon ranges from loam to gravelly sandy clay loam. Reaction is medium acid to neutral in the A and B horizons.

Included with this soil in mapping are small areas of San Ysidro loam and Pleasanton loam.

The available water holding capacity is about 5 to 7 inches. Permeability in the subsoil is moderate. Runoff is very slow and the hazard of erosion is none to slight. Fertility is moderate. Effective rooting depth is very deep.

This soil is used for irrigated row crops, prunes, apricots, walnuts, and dryland grain hay. Capability unit IIs–4 (14).

Arbuckle loam, deep, 5 to 9 percent slopes (AkC).—This soil is on old stream benches near stream channels in the Isabel Valley area. A few acres of this soil are undulating, but most of it has smooth slopes that average about 5 percent. The surface layer averages less than 15 percent gravel by volume. Shale bedrock is at a depth of 38 to 50 inches.

Included with this soil in mapping are small areas of Hillgate silt loam, a few areas of soils that have slopes up to 12 percent, and some areas that have a calcareous substratum.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water holding capacity is about 5.5 to 7.5 inches. Effective rooting depth is deep to shale.

This soil is used for dryland grain hay and pasture. Capability unit IIIe–1 (15).

Azule Series

The Azule series consists of well-drained clay loams that are underlain by semiconsolidated sediments. These soils have slopes of 9 to 75 percent and are on uplands. The vegetation, when these soils are not cultivated, is chiefly annual grasses and forbs, but a few areas have an oak-grass or brush cover. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 200 to 250 days. Azule soils are associated with the Altamont, Montara, and Hillgrate soils.

In a representative profile, the surface layer is dark grayish-brown, medium acid clay loam about 12 inches thick. The subsoil is brown and yellowish-brown, medium acid gravelly sandy clay. It is underlain at a depth of 48 inches by light yellowish-brown, medium acid, soft sediments of gravelly sandy clay loam.

Azule soils are used for dryland orchards, vineyards, grain hay, pasture, range, wildlife, and watershed.

Azule clay loam, 30 to 75 percent slopes (AuG).—This soil is on hills along the eastern edge of the Santa Clara Valley. The average slopes range from 50 to 60 percent.

Representative profile (200 yards up, on hillside east of New Avenue, 1 mile east of Foothill Avenue intersection; NE¼SE¼ sec. 6, T. 10 S., R. 4 E.):

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; common very fine roots; many very fine interstitial pores, many fine tubular pores, and few medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (6 to 14 inches thick.)

B2t—12 to 28 inches, brown (7.5YR 5/4) gravelly sandy clay, dark brown (7.5YR 4/4) moist; weak, coarse, columnar structure parting to moderate, coarse and medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine interstitial pores and common fine tubular pores; many, thin and common, moderately thick clay films on ped surfaces and in pores; medium acid (pH 6.0); clear, smooth boundary. (12 to 20 inches thick.)

B3t—28 to 48 inches, variegated yellowish-brown (10YR 5/4) and brown (7.5YR 5/4) gravelly sandy clay, dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine interstitial pores and common very fine tubular pores; continuous, thin clay films on ped surfaces and in pores; medium acid (pH 6.0); gradual, smooth boundary. (12 to 24 inches thick.)

C—48 to 60 inches, light yellowish-brown (10YR 6/4) gravelly sandy clay loam, yellowish brown (10YR 5/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; common, thin, brown (7.5YR 5/4) colloid stains on mineral grains; medium acid (pH 6.0).

The A horizon is dark grayish brown, grayish brown, or dark gray. Reaction is neutral to medium acid. Texture is commonly clay loam but ranges to silt loam or gravelly clay. The B horizon is brown to yellowish brown or grayish brown. Reaction is medium acid to neutral. Texture is normally gravelly sandy clay but ranges from gravelly clay to heavy clay loam. Depth to the C horizon ranges from 30 to 58 inches. Very few roots reach this horizon, but it is not impervious. Seams of lime are present in a few places.

Included with this soil in mapping are small areas of Altamont clay along ridge crests and toe slopes, areas of Hillgate silt loam, small landslips, and a few areas that are severely gullied.

Available water holding capacity is about 8 to 9 inches. Permeability in the subsoil is slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Natural fertility is high. Effective rooting depth is very deep.

This soil is used for range, wildlife, and watershed. Capability unit VIIe-1 (15); range site, Fine Loamy.

Azule clay loam, 9 to 15 percent slopes, eroded (AuD2).—This soil is strongly sloping on ridgetops, toe slopes, or benches, and it is geographically associated with Hillgate soils. Average slope is about 12 percent. Texture is normally clay loam, but it ranges to silty clay. Sheet erosion is moderate, and 2 to 6 inches of the surface layer has been lost.

Included with this soil in mapping are small areas of Hillgate silty loam, small areas of soils that have a gravelly clay loam surface layer, and areas that have been subject to severe sheet and rill erosion.

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

This soil is used for dryland prunes, grapes, grain hay, and pasture. Capability unit IIIe-3(15).

Azule clay loam, 15 to 30 percent slopes (AuE).—This soil is on broad, rounded ridgetops and is moderately steep on rounded hills. Average slope is 25 percent.

Included with this soil in mapping are small areas of Hillgate silt loam and a few deeply cut gullies.

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

This soil is used for dryland pasture and range. Capability unit IVe-3(15); range site, Fine Loamy.

Azule clay loam, 15 to 30 percent slopes, eroded (AuE2).—This soil is moderately steep on ridgetops and toe slopes. It has an average slope of about 25 percent. Two to 6 inches of the surface layer has been removed by erosion.

Included with this soil in mapping are small areas of Hillgate silt loam, areas of soils that have a gravelly clay loam surface layer, and areas that have been subject to severe sheet and rill erosion or are severely gullied.

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

This soil is used for dryland prunes, vineyards, grain hay, and pasture. Capability unit IVe-3(15); range site, Fine Loamy.

Azule clay loam, 30 to 75 percent slopes, eroded (AuG2).—This soil has a profile that is similar to that of Azule clay loam, 30 to 75 percent slopes, except that 2 to 4 inches of the surface layer has been removed by erosion. This soil is steep and very steep and in broad areas on the hills along the eastern edge of the Santa Clara Valley. On the average, slopes range from 50 to 60 percent. Color is dominantly grayish brown, but in a few places it is brown or pale brown.

Included with this soil in mapping are some areas of Hillgate silt loam that have been subject to severe sheet and rill erosion, landslips, and gullied land.

The available water holding capacity is 7 to 8 inches.

This soil is used for range, wildlife, and watershed. Capability unit VIIe-1 (15); range site, Fine Loamy.

Ben Lomond Series

The Ben Lomond series consists of well-drained fine sandy loams that are underlain by soft sandstone at a depth of 33 to 60 inches. These soils have slopes of 50 to 75 percent and are on uplands. Vegetation is coniferous forest consisting mainly of redwood and Douglas-fir but including associated hardwoods. Elevation ranges from 500 to 2,200 feet. Average annual rainfall is 35 to 50 inches, and average annual temperature is 55° to 56° F. The growing season is 200 to 250 days. Ben Lomond soils are associated with the Felton and Madonna soils.

In a representative profile, a 2-inch litter of fresh and decomposed needles and leaves overlies a mineral surface layer of dark grayish-brown, slightly acid fine sandy loam about 6 inches thick. The subsoil is dark-brown, brown, and light-brown, medium acid to strongly acid fine sandy loam and very fine sandy loam. It is underlain at a depth of 43 inches by very pale brown, strongly acid, soft sandstone.

Ben Lomond soils are used for recreation, wildlife, and watershed. A few areas are used for timber production.

Ben Lomond fine sandy loam, 50 to 75 percent slopes (BeG).—This soil is very steep.

Representative profile (on east-facing slope 800 feet northeast of old Watsonville Road, 0.8 mile northeast of intersection with Loop Road; NE¼NE¼ sec. 35, T. 10 S., R. 2 E.):

O—2 inches to 0, fresh and partly decomposed redwood needles and other forest litter; abrupt, smooth boundary. (1 to 4 inches thick.)

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; strong, medium and fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots, and few medium roots; many very fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary. (4 to 10 inches thick.)

B1—6 to 15 inches, dark-brown (7.5YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak, medium and fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many very fine interstitial pores and common fine and medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (8 to 10 inches thick.)

B2—15 to 27 inches, brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 3/2) moist; weak, medium and fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots and few medium and coarse roots; many very fine interstitial pores and common fine and medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (11 to 20 inches thick.)

B3—27 to 43 inches, light-brown (7.5YR 6/4) very fine sandy loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and coarse roots and many medium roots; many very fine interstitial pores and fine tubular pores and few medium and coarse tubular pores; strongly acid (pH 5.5); clear, wavy boundary. (10 to 20 inches thick.)

C—43 to 60 inches, very pale brown (10YR 7/4) soft sandstone that is easily cut by hand tools, yellowish brown (10YR 5/4) moist; massive; strongly acid (pH 5.5).

The A horizon is commonly dark grayish brown or grayish brown, but in places it is dark brown. Texture is generally fine sandy loam to light loam. Depth to soft sandstone ranges from 33 to 60 inches.

Included with this soil in mapping are small areas of Felton, Los Gatos, and Maymen soils.

The available water holding capacity is 5 to 9 inches. Natural fertility is moderate. Permeability in the subsoil is moderately rapid. Runoff is very rapid, and the hazard of erosion is very high. Effective rooting depth is deep to soft sandstone.

This soil is used mainly for recreation, wildlife, and watershed. A few areas are used for timber production. The very steep slopes create a hazard of erosion where areas are logged. This soil is moderately productive, and the average site index is 120 (*3*). Hazard of windthrow is slight. Plant competition and seedling mortality are moderate. Capability unit VIIe-1 (4).

Campbell Series

The Campbell series consists of somewhat poorly drained, silty clay loams that have developed in alluvium from material derived from sedimentary rock. These soils have slopes of less than 2 percent and are on low valley bottoms and alluvial plains. The vegetation, where these soils are not cultivated, is chiefly annual grasses, perennial grasses, and forbs. Elevation ranges from 130 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is about 250 to 275 days. Campbell soils are associated with the Yolo and Clear Lake soils.

In a representative profile, the surface layer is dark-gray, mildly alkaline and moderately alkaline silty clay loam about 40 inches thick. It is mottled, slightly calcareous, and moderately alkaline below 27 inches. The substratum is light olive-brown, mottled, calcareous, moderately alkaline silty clay loam and extends to a depth of 60 inches or more. In some places the substratum is clay or muck. In other places the surface layer is silty clay.

The Campbell soils are used for irrigated row crops, sugar beets, orchards, and hay.

Campbell silty clay loam (Ca).—This soil is nearly level and has less than 1 percent slope.

Representative profile (in first row of trees on south side of road, in orchard 0.5 mile west on Laguna Avenue from Southern Pacific Railroad tracks; NW¼SW¼ sec. 35, T. 8 S., R. 2 E.):

Ap—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, slightly sticky and plastic; common fine and very fine roots; many fine and very fine interstitial pores and few fine and very fine tubular pores; mildly alkaline (pH 7.5); abrupt, smooth boundary. (6 to 8 inches thick.)

A11—8 to 27 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, slightly sticky and plastic; few fine roots and common medium roots; many very fine and fine interstitial pores, many very fine and fine tubular pores, and a few medium tubular pores; mildly alkaline (pH 7.5); gradual, smooth boundary. (16 to 20 inches thick.)

A12—27 to 40 inches, dark-gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) moist; common, fine, distinct, light olive-brown (2.5Y 5/4) mottles, olive brown (2.5Y 4/4) moist; weak, medium and fine, subangular blocky structure; hard, friable, slightly sticky and plastic; few, very fine, fine, and medium roots; many very fine and fine tubular pores and few medium tubular pores; slightly calcareous, moderately alkaline (pH 8.0); diffuse, smooth boundary. (12 to 15 inches thick.)

C—40 to 68 inches, light olive-brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; common, fine,

faint, light yellowish-brown (10YR 6/4) mottles, dark yellowish brown (10YR 4/4) moist, and few very thin bands of light gray (10YR 6/1), gray (10YR 5/1) moist; massive; hard, friable, slightly sticky and plastic; few, very fine, fine, and medium roots; many very fine and fine tubular pores and few medium tubular pores; slightly calcareous, moderately alkaline (pH 8.0).

The A horizon color is commonly dark gray but in places is dark grayish brown or grayish brown. Texture is silty clay loam or clay loam. The C horizon in places is light olive brown, light brownish gray, or grayish brown and contains common to many, fine to medium, light yellowish-brown to light-gray mottles. Texture is dominantly silty clay loam but in places is stratified silty clay. Secondary lime accumulations lies at an average depth of 30 inches but occasionally are below a depth of 60 inches.

Included with this soil in mapping are some areas of Clear Lake clay and Yolo silty clay loam.

Drainage of these soils has been improved as the water table has been lowered by pumping and by the natural deepening of drainageways. Available water holding capacity is 11 to 12 inches. Permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Natural fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated row crops, sugar beets, prunes, walnuts, apricots, and pears. Capability unit I–1 (14).

Campbell silty clay loam, clay substratum (Cc).—This soil is in small to medium-sized areas south of Pacheco Pass Highway, just east of Miller Slough, and it may be flooded about once every 10 years. The surface layer is silty clay loam, clay loam, or silty clay. The color ranges from dark gray to dark grayish brown, and mottling occurs just below a depth of 18 inches. The substratum at an average depth of 36 inches is dark gray clay. The water table is at a depth of 36 to 60 inches.

Included with this soil in mapping are areas of gravelly clay loam and areas where depth to very dark gray clay is only 20 inches.

Available water holding capacity is 10 to 11 inches. Permeability is slow. Effective rooting depth is restricted by the seasonal water table.

This soil is used for irrigated row crops and sugar beets. Capability unit IIIw-5 (14).

Campbell silty clay (Cd).—The upper 8 inches of this soil is a silty clay, but otherwise it has a profile similar to that of Campbell silty clay loam. Areas of this soil are flooded about once every 5 years.

Included with this soil in mapping are small areas of Clear Lake clay and areas of soils that have a calcareous surface layer. Also included are some areas that have about 6 percent medium and fine gravel in the surface layer.

This soil is used for irrigated row crops, sugar beets, prunes, walunts, apricots, and pears. Capability unit IIs–5 (14).

Campbell silty clay, muck substratum (Ce).—The surface layer of this soil consists mainly of silty clay but is clay loam in places. Color is dark gray, dark grayish brown, or grayish brown. Mottling occurs below a depth of 18 inches. The substratum, at an average depth of 38 inches, consists of about 70 percent mucky material and 30 percent gleyed clay. When the levees along Llagas Creek break, resultant flooding may cause deposition.

Included with this soil in mapping are areas of a grayish-brown clay loam that is 3 to 15 inches thick over dark-gray silty clay loam, areas of soils that are calcareous in the surface layer, and areas of soils that contain slight concentrations of neutral salts.

Permeability is slow. The available water holding capacity is 12 to 13 inches. Effective rooting depth is restricted by a seasonal water table at a depth of 30 to 40 inches.

This soil is used for irrigated row crops and sugar beets. Capability unit IIIw–5 (14).

Clear Lake Series

The Clear Lake series consists of poorly drained clays that have developed in alluvium from material derived from sedimentary sources. These soils have slopes of less than 2 percent and lie on low alluvial plains. The vegetation, where these soils are not cultivated, is chiefly annual grasses, perennial grasses, and forbs. Elevation ranges from 130 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is about 250 to 275 days. Clear Lake soils are associated with Campbell and Yolo soils.

In a representative profile, the surface layer is dark-gray, neutral clay about 26 inches thick. The substratum is mottled, grayish-brown, calcareous, moderately alkaline clay to a depth of 60 inches or more. Some areas are drained, and in a few places there are slight concentrations of salts.

Clear Lake soils are used for irrigated row crops, orchards, and dryland grain hay.

Clear Lake clay, drained (Ch).—This soil has slopes of less than 2 percent and lies on low alluvial plains.

Representative profile (400 feet southwest of Hale and Palm Avenue intersection, north of Morgan Hill):

Ap—0 to 6 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong, fine, granular structure; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial and tubular pores; neutral (pH 7.0); clear, smooth boundary (4 to 7 inches thick.)

A1—6 to 26 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, coarse and medium, prismatic structure; very hard, firm, sticky and plastic; common very fine roots; many very fine interstitial and tubular pores; common slickensides on prism faces, and common vertical cracks ¼ to ½ inch wide when dry; neutral (pH 7.0); clear, wavy boundary. (18 to 22 inches thick.)

C1—26 to 36 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; many, fine, faint, light olive-brown (2.5Y 5/4) mottles, olive brown (2.5Y 4/4) moist; strong, coarse, prismatic structure; extremely hard, firm, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; common slickensides on prism faces, and common vertical cracks ¼ to ½ inch wide when dry; slightly calcereous, moderately alkaline (pH 8.0); clear, wavy boundary. (10 to 20 inches thick.)

C2ca—36 to 60 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; many, fine, distinct yellowish-brown (10YR 5/4) mottles, dark yellowish-brown (10 YR 4/4) moist; massive; very hard, firm, sticky and plastic; many very fine interstitial and tubular pores; moderately calcareous, moderately alkaline (pH 8.0).

The A horizon is dark gray or very dark gray. Reaction ranges from neutral to moderately alkaline. The C horizon in places is grayish brown, olive brown, or olive mixed with many, fine,

faint, light olive-brown to distinct yellowish-brown mottles. Lime accumulations generally occur within the C horizon, but the lower part of the horizon is not calcareous in all places. When this soil is dry, deep cracks develop in the A horizon and the upper part of the C horizon that average from ¼ to 1½ inches in width.

Included with this soil in mapping are areas of grayish-brown clay loam that is 10 to 20 inches deep over the original dark-gray clay surface layer as a result of land leveling or deposition of overwash material. There are also small areas of Campbell silty clay loam and Sunnyvale silty clay.

Available water holding capacity is 8 to 10 inches. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Depth to water table is more than 60 inches because of the general lowering of the ground water level in the valley as a result of pumping and stream cutting. Effective rooting depth is very deep. Natural fertility is high.

This soil is used for irrigated row crops, prunes, walnuts, apricots, pears, and dryland grain hay. Capability unit IIs–5 (14).

Clear Lake clay (Cg).—This soil has a profile that is similar to that of Clear Lake clay, drained, but it has a seasonal water table at a depth of 30 to 48 inches. It is more difficult to drain, and drainage systems are more difficult to maintain. Elevations are lower, and drainage outlets are not practical. Flooding occurs about once every 5 years along Llagas Creek, Pajaro River, and Fisher Creek.

Included with this soil in mapping are a few areas that are slightly calcareous in the surface layer. About 50 percent of this soil has a buried horizon of very dark gray clay. In a few places, at a depth of more than 40 inches, the substratum is loamy sand.

Available water holding capacity is 8 to 10 inches. Effective rooting depth is restricted by the seasonal water table.

This soil is used for irrigated row crops and pears. Capability unit IIIw–5 (14).

Clear Lake clay, saline (Ck).—This soil has a profile that is similar to that of Clear Lake clay, drained, but the surface layer contains slight concentrations of salts. Drainage is more difficult to provide and maintain because the soil is at elevations lower than the drainage channels. Flooding occurs about once every 5 years.

Included with this soil in mapping are small areas of Willows clay and areas that are calcareous in the surface layer.

Because of the salts in this soil, available water holding capacity is about 6 to 8 inches. Effective rooting depth is restricted by a seasonal water table at a depth ranging from 30 to 48 inches. Fertility is moderate.

This soil is used mainly for dryland pasture. A few areas are used for irrigated row crops. Capability unit IIIw–5 (14).

Climara Series

The Climara series consists of well-drained stony clays that are underlain by metamorphosed basic igneous rock at a depth of 20 to 40 inches. These soils are on the uplands and have slopes of 9 to 50 percent. Vegetation is mainly annual grasses and a few scattered oaks. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 200 to 250 days. Climara soils are associated with the Azule and Montara soils.

In a representative profile, the surface layer is a dark-gray, neutral stony clay and clay about 19 inches thick. In some places there are no stones on the surface. The substratum is dark grayish-brown, calcareous, moderately alkaline clay underlain at a depth of 27 inches by calcareous, hard metamorphosed basic igneous rock.

Climara soils are used for dryland pasture and range.

Climara stony clay, 15 to 50 percent slopes (CmE).—This soil has slopes that average about 30 percent.

Representative profile (on Roop Road 0.5 mile from the intersection with New Avenue; NW¼NW¼ sec. 22, T. 10 S., R. 4 E.):

A11—0 to 5 inches, dark-gray (10YR 4/1) stony clay, very dark gray (10YR 3/1) moist; strong, medium and fine, granular structure; hard, friable, sticky and plastic; many very fine roots; many very fine insterstitial and tubular pores; neutral (pH 7.0); clear, smooth boundary. (5 to 12 inches thick.)

A12—5 to 19 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, coarse, angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; few slickensides on ped surfaces, and few vertical cracks ¼ to ½ inch wide when dry; neutral (pH 7.0); clear, irregular boundary. (8 to 18 inches thick.)

Cca—19 to 27 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong, coarse, prismatic structure; extremely hard, firm, sticky and plastic; few fine roots; many very fine interstitial and tubular pores; many slickensides on prism faces, and many vertical cracks ¼ to ½ inch wide when dry; slightly calcareous, moderately alkaline (pH 8.0); clear, wavy boundary. (7 to 10 inches thick.)

R—27 inches, calcareous, hard, metamorphosed basic igneous rock.

The A horizon is dark gray or gray. Texture is typically clay but ranges to heavy clay loam. Reaction is neutral to moderately alkaline. The C horizon is grayish brown or dark grayish brown. Depth to bedrock is typically 27 inches but ranges from 20 to 40 inches. About 0.01 to 0.1 percent of the surface area is covered by stones.

Included with this soil in mapping are small areas of Montara rocky clay loam along the ridge crests and fault lines, a few areas of soils that are calcareous in the surface layer, a few eroded areas that have numerous gullies, and areas of rock outcrops.

This soil has an available water holding capacity of 3 to 7 inches. Permeability is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Natural fertility is moderate. Effective rooting depth is moderately deep.

This soil is used for range. Capability unit VIe–5 (15); range site, Clayey.

Climara clay, 9 to 30 percent slopes (ClD).—This soil has a profile that is similar to that of Climara stony clay, 15 to 50 percent slopes, but it has less than 0.01 percent stones on the surface. It is on rounded ridgetops or in small, less sloping areas near the steeper Climara soils. The average slope is about 15 percent.

Included with this soil in mapping are small areas of Montara rocky clay loam, severely eroded areas, small landslips, and gullied land.

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

This soil is used for dryland pasture and range. Capability unit IVe–5 (15); range site, Clayey.

Cortina Series

The Cortina series consists of somewhat excessively drained, very gravelly loams that are underlain by alluvium from mixed sources. These soils are on stream benches along major drainageways and have slopes of 0 to 5 percent. Vegetation, where these soils are not cultivated, is grasses, forbs, brush, and scattered sycamore and oak trees. Elevation ranges from 100 to 2,400 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Cortina soils are associated with the Esparto and Yolo soils.

In a representative profile, the surface layer is pale-brown and brown, slightly acid very gravelly loam and very gravelly fine sandy loam about 28 inches thick. The substratum is pale-brown, slightly acid very gravelly sandy loam to a depth of 60 inches or more.

Cortina soils are used mainly for dryland pasture. A few areas are used for irrigated prunes.

Cortina very gravelly loam, 0 to 5 percent slopes (CoB).—This nearly level to gently sloping soil is on stream benches along major drainageways. It is subject to overflow from adjacent streams.

Representative profile (100 yards south of Isabel Valley Ranch gate on road to China Grade; SW¼SE¼ sec. 14, T. 7 S., R. 4 E.):

A1—0 to 8 inches, pale-brown (10YR 6/3) very gravelly loam containing 60 percent (by volume) medium and fine gravel, dark brown (10YR 4/3) moist; massive; hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary. (8 to 12 inches thick.)

IIAb—8 to 28 inches, brown (10YR 5/3) very gravelly fine sandy loam containing 80 percent (by volume) medium and fine gravel, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine interstitial pores and common fine and few medium tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary. (20 to 30 inches thick.)

IIC—28 to 60 inches, pale-brown (10YR 6/3) very gravelly sandy loam containing 90 percent (by volume) medium and fine gravel, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine interstitial pores, common fine tubular pores, and few medium tubular pores; slightly acid (pH 6.5).

The A horizon ranges from brown to grayish brown, pale brown, or light brownish gray. Reaction is slightly acid to neutral in both the A and C horizons. Texture is sandy loam, fine sandy loam, or loam, and these horizons are gravelly or very gravelly. At a depth of 12 to 40 inches, both the A and C horizons are very gravelly sandy loam to very gravelly loam. These soils are subject to flooding, washout, or channeling about three times every 10 years.

Included with this soil in mapping are small areas of Riverwash and Garretson gravelly loam, and small areas that have no gravel in the upper few inches of the surface layer.

This soil has low natural fertility, and available water holding capacity is 2.5 to 4 inches. Permeability is rapid. Runoff is very slow. Effective rooting depth is very deep, but root density is limited by the droughty, very gravelly substratum.

This soil is used mostly for dryland pasture, wildlife, and recreation. A few areas are used for irrigated prunes. Capability units IVw–4 (14) and VIw–4 (15).

Cropley Series

The Cropley series consists of well-drained clays that are underlain by alluvium from mixed sources. These soils lie on fans and terraces and have slopes of 0 to 9 percent. Vegetation, where these soils are not cultivated, is annual grasses, perennial grasses, and forbs. Elevation ranges from 130 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is about 260 to 275 days. Cropley soils are associated with the Clear Lake and Pleasanton soils.

In a representative profile, the surface layer is very dark gray, neutral to mildly alkaline clay about 36 inches thick. The substratum is a dark grayish-brown, calcareous, moderately alkaline clay to a depth of 60 inches or more. When these soils are dry, deep cracks develop. Slickensides that intersect are present in the surface layer and in the upper part of the substratum.

Cropley soils are used for irrigated row crops, orchards, dryland grain hay, and pasture.

Cropley clay, 0 to 2 percent slopes (CrA).—This soil averages about 1 percent slope and occupies alluvial fans.

Representative profile (in a field 0.2 mile south of Foothill Road from Tennant Avenue intersection and 0.1 mile east):

Ap—0 to 7 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak, medium, subangular blocky structure and strong, medium and fine, granular structure; very hard, very firm, very sticky and very plastic; many very fine roots; many fine and very fine interstitial pores and few medium tubular pores; neutral (pH 7.0); clear, smooth boundary. (5 to 10 inches thick.)

A11—7 to 14 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, coarse, prismatic structure; very hard, very firm, very sticky and very plastic; few very fine roots and few coarse woody roots; common very fine interstitial pores and few fine tubular pores; small, numerous slickensides on ped surfaces; neutral (pH 7.0); gradual, wavy boundary. (7 to 12 inches thick.)

A12—14 to 36 inches, very dark gray (10YR 3/1) to dark-gray (10YR 4/1) clay, black (10YR 2/1) and very dark gray (10YR 3/1) moist; coarse, strong, prismatic structure; very hard, very firm, very sticky and very plastic; few fine interstitial pores and fine tubular pores; numerous slickensides and pressure cutans on ped surfaces; mildly alkaline (pH 7.5); gradual, wavy boundary. (15 to 30 inches thick.)

Cca—36 to 60 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; massive; hard, firm, sticky and plastic; many, very fine, interstitial pores and common, very fine, tubular pores; calcareous, moderately alkaline (pH 8.0).

The A horizon ranges from dark gray to very dark gray and nearly black. Texture is typically clay but in places is heavy clay loam. Segregated lime is at a depth ranging from 20 to 60 inches but commonly is at about 36 inches. The C horizon is dark grayish brown, grayish brown, or brown. Texture is stratified clay and silty clay loam that averages clay to a depth of more than 40 inches. When this soil is dry, deep cracks develop that range from ½ to 1½ inches in width and extend to an average depth of 36 inches.

Included with this soil in mapping are small areas of Clear Lake clay in low depressions and areas of gravelly

clay loam overwash that ranges from 12 to 30 inches in thickness.

The available water holding capacity is 8.5 to 10 inches. Permeability is slow. Runoff is very slow, and the erosion hazard is none to slight. Fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated prunes, apricots, pears, walnuts, row crops, sugar beets, dryland hay, and pasture. Capability unit IIs–5 (14).

Cropley clay, 2 to 9 percent slopes (CrC).—This soil has a profile that is similar to that of Cropley clay, 0 to 2 percent slopes, but slopes average 6 percent.

Included with this soil in mapping are soils that have a gravelly heavy clay loam or gravelly clay texture in the surface layer.

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

This soil is used for irrigated prunes, pears, apricots, walnuts, row crops, dryland hay, and pasture. Capability unit IIe–5 (14).

Diablo Series

The Diablo series consists of well-drained clays that are underlain by fine-grained sandstone at a depth of 26 to 56 inches. These soils are on the uplands and have slopes of 9 to 50 percent. The vegetation, where these soils are not cultivated, is annual grasses and a few scattered oak trees. Elevation ranges from 400 to 2,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Diablo soils are associated with the Azule and Los Osos soils.

In a representative profile (fig. 3), the surface layer is very dark gray and dark gray, mildly alkaline and moderately alkaline clay about 30 inches thick. The substratum is olive-gray, calcareous, moderately alkaline clay that is underlain at a depth of 40 inches by light olive-gray, soft, calcareous, moderately alkaline, fine-grained sand-soft, calcareous, moderately alkaline, fine-grained sandstone.

Diablo soils are used for dryland grain hay, pasture, and range.

Diablo clay, 9 to 15 percent slopes (DaD).—This soil is on uplands. Average slope is about 12 percent.

Representative profile (1,400 feet up jeep trail off East Fork Coyote Creek toward Rock House Ridge; SW¼NE¼ sec. 31, T. 8 S., R. 5 E.):

A11—0 to 2 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, medium and fine, subangular blocky structure; very hard, very firm, sticky and very plastic; common fine roots; many very fine interstitial and tubular pores; mildy alkaline (pH 7.6); clear, smooth boundary. (1 to 3 inches thick.)

A12—2 to 20 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, coarse, angular blocky structure; very hard, very firm, sticky and very plastic; few fine and medium roots; many very fine interstitial pores and few medium tubular pores; common slickensides on ped surfaces, and vertical cracks ¼ to ½ inch wide when dry; mildly alkaline (pH 7.6); clear, wavy boundary. (5 to 20 inches thick.)

A13ca—20 to 30 inches, dark-gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; strong, coarse, prismatic structure; very hard, very firm, sticky and very plastic; few medium roots; many very fine interstitial and tubular pores and few medium tubular pores; common slickensides on prism surfaces, and vertical cracks ¼ to ½ inch wide when dry; calcareous, moderately alkaline (pH 8.0); diffuse, wavy boundary. (10 to 13 inches thick.)

C—30 to 40 inches, olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and very plastic; few medium and coarse roots; many very fine interstitial and tubular pores and few medium tubular pores; calcareous, moderately alkaline (pH 8.4); diffuse, wavy boundary. (10 to 20 inches thick.)

R—40 inches, light olive-gray, soft, calcareous, fine-grained sandstone.

Figure 3.—Profile of Diablo clay, 9 to 15 percent slopes.

The A horizon typically is clay but is heavy clay loam or silty clay in places. The C horizon in places is grayish brown, olive gray, or light olive gray. It is moderately calcareous to strongly calcareous and contains lime in soft masses and in seams. Lime is typically present in the lower part of the A horizon or the upper part of the C horizon, but in some places lime occurs at a depth of 10 to 50 inches. When this soil is dry, cracks averaging ¼ to 1½ inches in width develop and extend to an average depth of about 40 inches. Depth to bedrock ranges from 26 to 56 inches and averages about 40 inches.

Included with this soil in mapping are small areas of Climara clay, Los Osos clay loam, areas where lime is absent and the soils have a slightly acid surface layer, a few small areas of severely gullied land, and a few small landslips.

The available water holding capacity of this soil is 3 to 7 inches. Permeability is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is high. Effective rooting depth is moderately deep to deep.

This Diablo soil is used for dryland grain hay, pasture, and range. Capability unit IIIe–5 (15); range site, Clayey.

Diablo clay, 30 to 50 percent slopes (DaF).—This soil has a profile similar to that of Diablo clay, 9 to 15 percent slopes.

Included with this soil in mapping are small areas that have been subject to moderate to severe sheet erosion, and areas where lime is absent. In a few areas are soils that have slopes of 15 to 30 percent.

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

This soil is used for pasture and range. Capability unit VIe–5 (15); range site, Clayey.

Esparto Series

The Esparto series consists of moderately well drained loams that are underlain by alluvium from material derived from sedimentary rocks. They lie on fans and stream benches and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, is annual grasses, forbs, and scattered large oak trees. Elevation ranges from 1,500 to 2,400 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Esparto soils are associated with the Gaviota and Yolo soils.

In representative profile, the surface layer is pale-brown, medium acid loam about 14 inches thick. The subsoil is a light brownish-gray and light yellowish-brown, slightly acid and neutral, light clay loam and silt loam about 34 inches thick. The substratum is mottled, brownish-yellow, neutral gravelly clay loam to a depth of 60 inches or more.

Esparto soils are used for dryland grain hay and pasture.

Esparto loam, 0 to 2 percent slopes (EsA).—This soil is level to nearly level.

Representative profile (in dryland pasture northeast of large dam on Isabel Valley Ranch; NW¼SE¼ sec. 16, T. 7 S., R. 4 E.):

A1—0 to 14 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; very hard, friable, nonsticky and nonplastic; many very fine roots; many very fine, interstitial pores, common fine tubular pores and few medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (10 to 16 inches thick.)

B2t—14 to 28 inches, light brownish-gray (10YR 6/2) light clay loam, dark grayish-brown (10YR 4/2) moist; moderate, medium, subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many, very fine and fine tubular pores, few medium tubular pores, and few coarse tubular pores; continuous, thin clay films in pores and on ped surfaces; slightly acid (pH 6.5); gradual, wavy boundary. (12 to 20 inches thick.)

B3t—28 to 48 inches, light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; many, fine, faint, dark-brown (10YR 4/3) mottles; weak, medium, subangular blocky structure; very hard, friable, nonsticky and nonplastic; many very fine tubular pores; common, thin clay films in pores and on ped surfaces; neutral (pH 7.0); clear, smooth boundary (18 to 22 inches thick.)

IIC—48 to 60 inches, brownish-yellow (10YR 6/6) gravelly clay loam (18 percent fine gravel), yellowish brown (10YR 5/6) moist; many, fine, distinct, light yellowish-brown (10YR 6/4) mottles, yellowish brown (10YR 5/8) moist; massive; very hard, friable, sticky and plastic; many very fine and fine tubular pores; neutral (pH 7.0.)

The A horizon ranges from light brownish gray to pale brown, and in a few areas it is grayish brown in the upper few inches. Reaction is slightly acid to medium acid and ranges to neutral in the B horizon. The B horizon is light brownish gray to light yellowish brown. Texture of the B horizon is typically light clay loam but ranges to loam or gravelly loam. Mottling starts in the lower part of the B horizon, and the contrast in colors increases with depth. The C horizon is mottled brownish yellow or very pale brown. In a few places lime occurs at a depth of more than 40 inches.

Included with this soil in mapping are small areas of Pleasanton loam and a few areas that have outcrops of rock.

The available water holding capacity is 10 to 12 inches. Permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. This soil is moderately fertile. Effective rooting depth is very deep.

This soil is used for dryland grain hay and pasture. Capability unit IIIc–1 (15).

Esparto loam, 2 to 9 percent slopes (EsC).—This soil is on small fans that extend into narrow drainageways. Slope generally is about 5 percent. Texture is loam, and most profiles contain 2 to 3 percent medium and fine gravel.

Included with this soil in mapping are areas of gravelly loam and seepage spots along drainage channels.

Hazard of erosion is slight to moderate, and runoff is slow to medium.

This soil is used for dryland grain hay and pasture. Capability unit IIIe–1 (15).

Felton Series

The Felton series consists of well-drained silt loams that are underlain by interbedded shales and sandstone at a depth of 20 to 59 inches. These soils lie on uplands and have slopes of 15 to 75 percent. Where these soils have not been cleared for farming, vegetation is redwood, Douglas-fir, and associated hardwoods. Elevation ranges from 500 to 2,200 feet. Average annual rainfall is 40 to 50 inches, and average annual temperature is 55° to 56° F. The growing season is about 200 to 250 days. Felton soils are associated with the Ben Lomond, Madonna, and Los Gatos soils.

In a representative profile, the surface layer is brown, medium acid silt loam about 2 inches thick. The subsoil is brown, light-brown, and light yellowish-brown, medium acid and strongly acid clay loam about 37 inches thick. The substratum is light yellowish-brown, strongly acid, shaly clay loam about 9 inches thick over interbedded shale and sandstone.

Felton soils are used for dryland grain hay, pasture, range, timber, Christmas trees, recreation, and watershed.

Felton silt loam, 50 to 75 percent slopes (FaG).—This very steep soil is on the uplands.

Representative profile (1.9 miles above Sprig Lake on Watsonville Road, 200 yards uphill on old skid trail; SW¼NW¼ sec. 6, T. 11S., R. 3E.):

O1—1 inch to 0, leaves, needles, and twigs, some partially decomposed; abrupt, smooth boundary. (1 to 2 inches thick.)

A1—0 to 2 inches, brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure, parting to medium and fine granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial and tubular pores; medium acid (pH 6.0); clear, smooth boundary. (2 to 6 inches thick.)

B1t—2 to 10 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; common fine roots and few medium roots; many very fine interstitial and tubular pores; common thin clay films on ped surfaces and in pores; medium acid (pH 6.0); clear, wavy boundary. (4 to 9 inches thick.)

B2t—10 to 23 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots and many medium and coarse roots; many very fine interstitial and tubular pores and few, fine, medium, and coarse tubular pores; many thin clay films lining pores and on ped surfaces; medium acid (pH 6.0); clear, wavy boundary. (10 to 14 inches thick.)

B3t—23 to 39 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/6) moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; many very fine interstitial and tubular pores and few medium and coarse tubular pores; common, thin clay films lining pores and on ped surfaces; strongly acid (pH 5.5); gradual, wavy boundary. (10 to 18 inches thick.)

C1—39 to 48 inches, light yellowish-brown (10YR 6/4) shaly clay loam, about 25 percent (by volume) shale fragments ½ to 1 inch in diameter, yellowish brown (10YR 5/6) moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; many very fine and fine tubular pores and few medium and coarse tubular pores; few thin clay films in pores and on ped surfaces; strongly acid (pH 5.5); gradual, wavy boundary. (9 to 12 inches thick.)

C2—48 inches, interbedded shale and sandstone mixed with yellowish-brown (10YR 5/6) clay loam, dark yellowish brown (10YR 4/4) moist; massive; strongly acid (pH 5.5).

The A horizon commonly is brown or grayish brown, but on concave slopes it is very dark grayish brown in the upper few inches. Texture is silt loam or light silty clay loam. Reaction is slightly acid to medium acid in the A horizon. The B horizon is brown or light brown in the upper part and ranges to very pale brown, light brown, light yellowish brown, and, in a few places, pinkish gray in the lower part. Texture is clay loam or silty clay loam. Depth to the C2 horizon of soft, fine-grained sandstone and shale ranges from 35 to 59 inches.

Included with this soil in mapping are small areas of Ben Lomond sandy loam and, along ridge crests, Madonna loam.

The available water holding capacity of this soil is 6 to 10 inches, depending on the depth of the soil. Permeability in the subsoil is moderately slow. Runoff is very rapid, and the hazard of erosion is very high. Natural fertility is moderate. Effective rooting depth is moderately deep to deep.

This soil is used mainly for timber production, recreation, and watershed. It is moderately productive; site index averages about 130 (*3*). Plant competition is moderate, equipment limitation is severe, seedling mortality is moderate, and windthrow hazard is slight. Capability unit VIIe–1 (4).

Felton silt loam, 15 to 30 percent slopes (FaE).—This soil is on the crests of broad ridges and on footslopes along drainageways. Depth to the substratum is 20 to 36 inches.

Included with this soil in mapping are small areas of Maymen rocky fine sandy loam and areas of moderately eroded and severely eroded soils.

Runoff is medium, and hazard of erosion is moderate. The available water holding capacity is 4 to 7 inches. The effective rooting depth of this soil is moderately deep to sandstone.

Most areas of this soil have been cleared and are used for dryland pasture or grain hay. It is well suited to Christmas tree production. Capability unit IVe–1 (4); range site, Fine Loamy.

Felton silt loam, 30 to 50 percent slopes (FaF).—This soil has an average slope of 40 percent.

Included with this soil in mapping are a few areas of Madonna loam and areas that have been subject to moderate sheet erosion.

This soil is used mainly for the production of timber. A few areas have been cleared and used for range. This soil is moderately productive. Site index averages about 130 (*3*). Seedling mortality is moderate, and windthrow hazard is slight. Because of steep slopes, runoff is rapid and the hazard of erosion is high after areas of this soil have been logged. Capability unit VIe–1 (4); range site, Fine Loamy.

Garretson Series

The Garretson series consists of well-drained loams that are underlain by alluvium from material derived from sedimentary rock. These soils lie on stream benches and fans along drainageways and have slopes of 0 to 5 percent. The vegetation, where these soils are not cultivated, is annual grasses and forbs, and there are a few scattered oak trees. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Garretson soils are associated with the Esparto, Yolo, and Zamora soils.

In a representative profile, the surface layer is a grayish-brown, neutral loam about 19 inches thick. The substratum is a brown, neutral very fine sandy loam that is underlain at a depth of 40 inches by stratified sand and gravel. In some places the surface layer and substratum are gravelly loam to a depth of 60 inches or more.

Garretson soils are used for irrigated grapes, row crops, orchards, dryland grain hay, and pasture.

Garretson loam, gravel substratum, 0 to 2 percent slopes (GaA).—This soil is on stream benches along the larger drainageways.

Representative profile (in walnut grove, 0.6 mile south of Coyote, 50 feet north off farm road, and 0.2 mile east, off U.S. Highway 101):

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam containing about 3 to 5 percent (by volume) gravel, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; neutral (pH 7.0); clear, smooth boundary. (4 to 10 inches thick.)

A1—6 to 19 inches, grayish-brown (10YR 5/2) loam containing about 2 to 3 percent medium and fine gravel (by volume), very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; many very fine tubular pores and few medium tubular pores; neutral (pH 7.0); clear, smooth boundary. (12 to 18 inches thick.)

C1—19 to 40 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; neutral (pH 7.0); clear, smooth boundary. (20 to 32 inches thick.)

IIC2—40 to 60 inches, stratified sands and gravels.

The A horizon is brown or grayish brown. Texture typically is loam but in some places is clay loam. Reaction in the A and C horizons is slightly acid or neutral to moderately alkaline. The C1 horizon is brown, pale brown, or yellowish brown. Texture is dominantly very fine sandy loam or loam but in places is gravelly loam, loam, or gravelly clay loam. Clay

content of the C1 horizon averages between 18 and 25 percent. Depth to stratified sand and gravel is 36 to 60 inches. The C1 horizon in places is calcareous below 36 inches.

Included with this soil in mapping are some areas of Cortina very gravelly loam and a few areas of soils that have a sand and gravel substratum within 20 inches of the surface.

This soil has about 7.5 to 11 inches of available water holding capacity, the amount depending on depth to sand and gravel. Permeability is moderate in the horizons above the very rapidly permeable gravel. Runoff is slow, and the hazard of erosion is none to slight. Fertility is moderate. Effective rooting depth is very deep.

This soil is used for irrigated apricots, grapes, prunes, row crops, walnuts, and dryland hay and pasture. Capability unit I–1 (14) and IIIc–1 (15).

Garretson gravelly loam, 0 to 5 percent slopes (GbB).—This soil has a profile that is similar to that of Garretson loam, gravel substratum, 0 to 2 percent slopes, but it has more slope in places and the texture is gravelly loam or gravelly clay loam. This soil is 15 to 30 percent gravel to a depth of 60 inches or more.

Included with this soil in mapping are some areas of soils that have slopes of up to 9 percent, and a soil that has a dark grayish-brown, granular surface layer formed on basic igneous rock alluvium.

The available water holding capacity is 7 to 8 inches. Runoff is very slow to slow, and the hazard of erosion is none to slight.

This soil is used for irrigated apricots, prunes, vineyards, row crops, walnuts, and dryland hay or pasture. There is enough gravel present in the surface layer to interfere slightly with tillage. Capability unit IIe–1 (14) and IIIe–1 (15).

Gaviota Series

The Gaviota series consists of well-drained and somewhat excessively drained loams that are underlain by hard sandstone and shale bedrock at a depth of 6 to 20 inches. These soils are on the uplands and have slopes of 5 to 75 percent. The vegetation is annual grasses and forbs, oak trees, and brush. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is 15 to 30 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Gaviota soils are associated with the Los Gatos and Vallecitos soils.

In a representative profile, the surface layer is pale-brown and light yellowish-brown, slightly acid loam and gravelly loam that is about 19 inches thick and is underlain by hard sandstone. There are rock outcrops in some areas, and other areas are moderately eroded or severely eroded.

Gaviota soils are used for dryland hay, pasture, and range. They are also used for wildlife, recreation, and watershed.

Gaviota loam, 30 to 75 percent slopes (GcG).—This steep soil is on the uplands and has slopes that average about 60 percent.

Representative profile (on south-facing hillside above Mt. Hamilton Road about 3 miles above Kincaid Road intersection at road stake number B–8.70; NW¼NW¼ sec. 9, T. 9 S. R. 3 E.):

A11—0 to 5 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; moderate, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores, common very fine tubular pores, and few medium tubular pores; slightly acid (pH 6.5); clear wavy boundary. (4 to 6 inches thick.)

A12—5 to 19 inches, light yellowish-brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores and few medium tubular pores; slightly acid (pH 6.5); clear, wavy boundary. (6 to 14 inches thick.)

R—19 inches, yellowish-brown, hard, fractured sandstone bedrock.

The A horizon is pale brown, light brownish gray, grayish brown, brown, or light yellowish brown. Reaction is slightly acid to neutral and changes very little with increasing depth. Rock fragments in the A12 horizon consist mostly of coarse gravel, but some fine to medium gravel and a few stones are present in places. Depth to bedrock ranges from 10 to 20 inches. There is little evidence of sheet erosion, but there are occasional shallow gullies.

Included with this soil in mapping are some areas of Vallecitos rocky loam and a few areas of Rock land.

This somewhat excessively drained soil has low fertility. The available water holding capacity is 2 to 3 inches. Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Effective rooting depth is shallow.

This soil is used for range, wildlife, watershed, and recreation. Capability unit VIIe–8 (15); range site, Shallow Loamy.

Gaviota loam, 5 to 15 percent slopes, eroded (GcD2).—This soil has a profile that is similar to that of Gaviota loam, 30 to 75 percent slopes, but it is less sloping. Erosion has removed up to 4 inches of the surface layer. The depth to standstone is 6 to 16 inches.

Included with this soil in mapping are small areas of Hillgate silt loam and Pleasanton loam along drainageways, areas of Vallecitos rocky loam along ridge crests, and places where the soils have slopes of up to 20 percent.

This soil is well drained. Available water holding capacity is 1 to 2.5 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for pasture and range. Capability unit VIe–8 (15); range site, Shallow Loamy.

Gaviota loam, 15 to 30 percent slopes (GcE).—This soil has a profile that is similar to that of Gaviota loam, 30 to 75 percent slopes.

Included with this soil in mapping are areas of Vallecitos rocky loam and Rock land.

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

This soil is used for range. Capability unit VIe–8 (15); range site, Shallow Loamy.

Gaviota gravelly loam, 30 to 75 percent slopes, eroded (GhG2).—This soil is on uplands and has an average slope of 45 percent. The surface layer is gravelly loam; it is about 20 percent (by volume) medium and fine gravel. Because of sheet erosion, depth to sandstone is 7 to 16 inches.

Included in mapping with this soil are areas of Vallecitos rocky loam that are severely eroded and Rock land.

This soil is somewhat excessively drained. The available water holding capacity is 1 to 2 inches. Natural fertility is very low.

This soil is used for limited range, recreation, and watershed. The brush cover limits the amount of available

forage. Many areas have been burned, and they now support scattered brush and a scanty grass cover. Capability unit VIIe–8(15); range site, Shallow Gravelly Loam.

Gaviota gravelly loam, 30 to 75 percent slopes, severely eroded (GhG3).—This soil is on uplands. It has a profile that is similar to that of Gaviota loam, 30 to 75 percent slopes, but erosion has removed 75 percent of the surface layer and exposed the gravelly loam subsoil. Depth to bedrock is 6 to 10 inches.

Included with this soil in mapping are some areas of Rock land and of Vallecitos rocky loam, and areas where slopes exceed 75 percent.

This soil is somewhat excessively drained. The available water holding capacity is about 1 inch. Natural fertility is very low.

This brush-covered soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe–8(15); range site, Shallow Gravelly Loam.

Gaviota rocky loam, 5 to 30 percent slopes, eroded (GkE2).—This soil is on uplands and has slopes that average about 25 percent. Texture is loam or shaly loam. Rock outcrops cover 2 to 10 percent of the surface. Because of sheet erosion, depth to sandstone is 10 to 17 inches.

Included with this soil in mapping are some areas of Vallecitos loam, and small areas that are severely eroded. In the San Antonio and Isabel Valleys, sloping areas of this soil are intermingled with fingerlike fans on which the Esparto soils are included.

This soil is well drained. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for range. Capability unit VIe–7(15); range site, Shallow Loamy.

Gaviota-Los Gatos complex, 30 to 50 percent slopes (GmF).—This complex consists of about 50 percent Gaviota loam, 35 percent Los Gatos gravelly loam, and 15 percent included soils. These soils are on uplands having an annual grass-woodland cover. Gaviota soils occupy the ridges and south slopes and Los Gatos soils occupy areas on the north slopes.

The Gaviota soils have a profile similar to that of Gaviota loam, 30 to 75 percent slopes. The available water holding capacity is 2 to 3 inches. Permeability is moderate. Effective rooting depth is 10 to 19 inches. Natural fertility is low.

The Los Gatos soils have a profile similar to that of Los Gatos gravelly loam, 50 to 75 percent slopes. The available water holding capacity is 4 to 7 inches. Permeability is moderately slow. Effective rooting depth is 25 to 50 inches. Natural fertility is moderate.

Included with these soils in mapping are some areas of Los Osos clay loam and Vallecitos rocky loam.

Runoff on these soils is rapid, and the hazard of erosion is high.

These soils are used for range. This complex is in capability unit VIIe–8 (15). Gaviota soil: range site, Shallow Loamy. Los Gatos soil: range site, Loamy.

Gilroy Series

The Gilroy series consists of well-drained clay loams that are underlain by basic igneous bedrock at a depth of 18 to 36 inches. These soils are on uplands and have slopes of 5 to 75 percent. The vegetation, where these soils are not cultivated, is annual grasses and forbs, oak trees, and brush. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is about 20 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Gilroy soils are associated with the Los Gatos, Maymen, and Henneke soils.

In a representative profile, the surface layer is a brown, medium acid clay loam about 8 inches thick. The subsoil is reddish-brown, medium acid clay loam that is underlain at 21 inches by brown, weathered basic igneous rock. In a few places these soils are eroded.

Gilroy soils are used for dryland vineyards, hayland, pasture, and range.

Gilroy clay loam, 30 to 50 percent slopes (GoF).—This soil is on well-rounded ridges and steep side slopes in the uplands.

Representative profile (0.4 mile east of Castro Valley Ranch gate on hillside northeast of Castro Valley Road; NE¼SW¼ sec. 18, T. 11 S., R. 4 E.):

A1—0 to 8 inches, brown (7.5YR 5/4) clay loam containing about 5 percent gravel (by volume), dark-brown (7.5 YR 3/2) moist; moderate, medium and fine, granular structure; hard, very friable, sticky and plastic; common, very fine roots; many very fine interstitial pores and common very fine tubular pores; medium acid (pH 6.0); clear, wavy boundary. (8 to 10 inches thick.)

B2t—8 to 21 inches, reddish-brown (5YR 4/3) clay loam containing about 5 percent (by volume) gravel, dark reddish brown (5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, very friable, sticky and plastic; few very fine roots; many very fine interstitial pores and few fine and medium tubular pores; common thin clay films on ped surfaces and in pores; medium acid (pH 6.0); abrupt, irregular boundary. (12 to 26 inches thick.)

R—21 inches, brown, metamorphosed basic igneous rock (greenstone) with moderately thick clay films and black manganese stains on rock surfaces.

The A horizon typically is brown, but in some places it is dark brown, dark reddish brown, or reddish brown. Texture is clay loam that commonly contains 5 to 8 percent (by volume) medium and fine gravel. The B horizon is generally reddish brown, but in some places it is brown or dark brown. Texture is clay loam or gravelly clay loam. In a few places the B horizon tongues into fracture planes of the bedrock. Soft to hard greenstone is at a depth of 20 to 36 inches.

Included with this soil in mapping are a few areas of Los Gatos gravelly loam and small areas of clay.

The available water holding capacity of this soil is 4 to 7.5 inches. Runoff is rapid, and the hazard of erosion is high. Permeability in the subsoil is moderately slow. This soil is moderately fertile. Effective rooting depth is moderately deep.

This soil is used for range. Capability unit VIe–1 (15); range site, Loamy.

Gilroy clay loam, 5 to 30 percent slopes (GoD).—This soil is on uplands that have well-rounded ridges and footslopes. The average slope is about 20 percent.

Included with this soil in mapping are Los Gatos gravelly loam and areas of rock outcrops.

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

This soil is used for dryland pasture and range. Capability unit IVe–1 (15); range site, Loamy.

Gilroy clay loam, 15 to 30 percent slopes, eroded (GoE2).—This soil has a profile that is similar to that of Gilroy clay loam, 30 to 50 percent slopes, but is less sloping. Sheet erosion has removed an average of 2 to 3 inches of the surface layer. Depth to basic igneous bedrock is 18 to 33 inches.

Included with this soil in mapping are areas that have been subject to severe rill and sheet erosion and small areas of shallow soils. Tillage has mixed the soft, weathered bedrock with the surface layer and subsoil in a few areas.

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

Most of the acreage of this soil in the past was planted to grapes or was used for dryland grain hay, but now most of it is used for pasture or range. Capability unit IVe–1 (15); range site, Loamy.

Gilroy clay loam, 50 to 75 percent slopes (GoG).—This soil has a profile that is similar to that of Gilroy clay loam, 30 to 50 percent slopes, but it is steeper. The surface layer is dark brown or dark reddish brown on the north slopes.

Included with this soil in mapping are a few areas of Los Gatos gravelly loam and Maymen rocky fine sandy loam, areas of rock outcrops, and some places where depth to bedrock is 40 to 50 inches.

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

This soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe–1 (15); range site, Loamy.

Henneke Series

The Henneke series consists of somewhat excessively drained gravelly clay loams that are underlain by serpentine bedrock at a depth of 11 to 18 inches. These soils are on uplands and have slopes of 30 to 75 percent. The vegetation is brush and some Digger pines. Elevation ranges from 1,600 to 2,500 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Henneke soils are associated with the Gaviota, Los Gatos, and Vallecitos soils.

In a representative profile, the surface layer is reddish-brown, neutral gravelly clay loam about 1 inch thick. The subsoil is dark reddish brown, neutral very gravelly clay that is underlain at a depth of 15 inches by serpentine bedrock. Rock outcrops are on 2 to 10 percent of the surface.

Henneke soils are used mainly for watershed, recreation, and wildlife.

Henneke rocky clay loam, 30 to 75 percent slopes, severely eroded (HeG3).—This soil lies on uplands and has slopes that average 60 percent.

Representative profile (from intersection of Mines and Blackbird Valley roads, up hillside about 200 yards from "S" turn on Mines road, in northwest corner of SE¼ sec. 11, T. 6 S., R. 4 E.):

A1—0 to 1 inch, reddish-brown (5YR 4/3) gravelly clay loam, dark reddish brown (5YR 2/2) moist; strong, fine, granular structure; slightly hard, very friable, sticky and plastic; few very fine, fine, medium, and coarse roots; many very fine interstitial pores; neutral (pH 7.0); clear, smooth boundary. (1 to 4 inches thick.)

B2t—1 to 15 inches, dark reddish-brown (5YR 3/3) very gravelly clay containing 55 percent (by volume) medium and fine gravel, dark reddish brown (5YR 2/2) moist; strong, fine and medium, subangular blocky structure; hard, friable, sticky and plastic; few, very fine, medium, and coarse roots; many very fine interstitial and tubular pores and few medium and coarse tubular pores; many moderately thick clay films on ped surfaces and in pores; neutral (pH 7.0); clear, smooth boundary.

R—15 inches, serpentine rock.

The A horizon is strong brown or reddish brown. Reaction is slightly acid to neutral. Texture is clay loam, gravelly clay loam, or loam. The B horizon is slightly acid to neutral. Depth to bedrock ranges from 11 to 18 inches. This soil is severely eroded. Rock outcrops cover about 2 to 10 percent of the surface.

Included with this soil in mapping are small areas of Gaviota loam, Vallecitos rocky loam, and Rock land. Also included are areas that have less than 30 percent gravel throughout the profile.

The available water holding capacity of this soil is 1 to 2 inches. Permeability is slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Natural fertility is low. Effective rooting depth is shallow.

This soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe–9 (15); range site, Serpentine.

Hillgate Series

The Hillgate series consists of well-drained silt loams that have developed in alluvial materials from mixed sources. These soils are on terraces and have slopes of 2 to 50 percent. The vegetation, where these soils are not cultivated, is annual grasses, forbs, and scattered oak trees. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 260 to 275 days. Hillgate soils are associated with the Azule, Pleasanton, and San Ysidro soils.

In a representative profile, the surface layer is pale-brown and brown, medium acid silt loam about 10 inches thick. The subsoil is strong-brown and brownish-yellow, medium acid clay and clay loam that are underlain at a depth of 40 inches by brownish-yellow, medium acid gravelly clay loam.

Hillgate soils are used for irrigated apricots, vineyards, prunes, and dryland hay, pasture, and range.

Hillgate silt loam, 9 to 15 percent slopes, eroded (HfD2).—This soil is on terraces.

Representative profile (from intersection of Church and New Avenues, 200 yards east and 200 yards south in field; SW¼NW¼ sec. 8, T. 10 S., R. 4 E.):

Ap—0 to 5 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; many fine and very fine roots; many very fine interstitial pores and few very fine and fine tubular pores; medium acid (pH 5.8); abrupt, smooth boundary. (4 to 7 inches thick.)

A1—5 to 10 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; very hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores, many very fine tubular pores, and few medium tubular pores; medium acid (pH 5.8); abrupt, smooth boundary. (4 to 19 inches thick.)

B2t—10 to 26 inches, strong-brown (7.5YR 5/6) clay, dark brown (7.5YR 4/4) moist; moderate, coarse, prismatic structure parting to strong, coarse and medium, angular blocky structure; extremely hard, very firm, sticky and very plastic; few very fine roots; many very fine interstitial pores, common very fine tubular pores, and few fine tubular pores; many, moderately thick, reddish-brown (5YR 5/4) moist clay films on ped surfaces and in pores; medium acid (pH 5.8); gradual, wavy boundary. (14 to 24 inches thick.)

B3t—26 to 40 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/4) moist; moderate, coarse, angular blocky structure; very hard, firm, sticky and very plastic; many very fine interstitial pores, common very fine tubular pores, and a few fine tubular pores; common, thin, reddish-yellow (7.5YR 6/6), strong-brown (7.5YR 5/6), moist clay films on ped surfaces and in pores; medium acid (pH 5.8); clear, smooth boundary. (12 to 20 inches thick.)

IIC—40 to 60 inches, brownish-yellow (10YR 6/6) gravelly clay loam, yellowish brown (10YR 5/4) moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine interstitial pores and a few very fine and fine tubular pores; few, thin, reddish-yellow (7.5YR 6/6), strong-brown (7.5YR 5/6) moist clay films on ped surfaces and in pores; medium acid (pH 5.8).

The A horizon ranges from pale brown to brown, or grayish brown. Reaction is neutral to medium acid. Texture is silt loam or fine sandy loam. The B horizon is brown, strong brown, or brownish yellow. Texture is clay or gravelly clay and ranges to clay loam in the lower part of the B horizon. Depth to the clay B2t horizon averages 10 inches but it ranges from 8 to 20 inches.

Included with this soil in mapping are 40 acres of soils along Little Arthur Creek that are underlain by sandstone bedrock at a depth of 20 to 40 inches. Also included are small areas of Pleasanton gravelly loam and San Ysidro loam. Other included areas have a yellowish-red and reddish-brown B horizon or a calcareous substratum.

The available water holding capacity of this soil is 4 to 7 inches. Permeability is very slow. Runoff is medium, and the hazard of erosion is moderate. Natural fertility is low. Effective rooting depth is very deep.

This soil is used for dryland hay, pasture, and range. Capability unit VIe–3 (15); range site, Claypan.

Hillgate silt loam, 2 to 9 percent slopes (HfC).—This soil is on terraces. It has a profile that is similar to that of Hillgate silt loam, 9 to 15 percent slopes, eroded, but the surface layer is 20 to 26 inches thick. Erosion is none to slight.

Included with this soil in mapping are small areas of Pleasanton gravelly loam and San Ysidro loam.

Natural fertility of this soil is moderate. Effective rooting depth is very deep.

This soil is used for irrigated prunes, apricots, and grapes, and for dryland hay and pasture. Capability unit IIIe–3 (14).

Hillgate silt loam, 15 to 30 percent slopes, eroded (HfE2).—This soil has a profile that is similar to that of Hillgate silt loam, 9 to 15 percent slopes, eroded, but has a surface layer 10 to 20 inches thick.

Included with this soil in mapping are small areas of Azule clay loam and areas that have been subject to severe sheet and gully erosion. Also included in the San Antonio Valley are areas of a soil that is moderately alkaline and is calcareous in the substratum.

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

This soil is used for range. Capability unit VIe–3 (15); range site, Claypan.

Hillgate silt loam, 30 to 50 percent slopes, eroded (HfF2).—This soil has a profile that is similar to that of Hillgate silt loam, 9 to 15 percent slopes, eroded, but it is more sloping and depth to the clay subsoil is 10 to 20 inches. Texture of the subsoil ranges from heavy clay loam to clay, and in some places it is gravelly.

Included with this soil in mapping are areas of Azule clay loam and small areas that have been subject to severe sheet and gully erosion.

The available water holding capacity is 2 to 4 inches for the 10- to 20-inch rooting depth. Runoff is rapid, and the hazard of erosion is high.

This soil is used for range. Capability unit VIIe–1 (15); range site, Claypan.

Inks Series

The Inks series consists of somewhat excessively drained gravelly clay loams that are underlain by metamorphosed basic igneous bedrock at a depth of 11 to 19 inches. They are on uplands and have slopes of 30 to 75 percent. The vegetation mainly is brush, but there are a few open areas of annual grasses and forbs. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 20 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Inks soils are associated with the Los Gatos and Montara soils.

In a representative profile, the surface layer is brown, slightly acid gravelly clay loam about 1 inch thick. In some places it is stony clay loam. The subsoil is dark reddish-brown, slightly acid gravelly clay loam that is underlain at a depth of 15 inches by hard, shattered metamorphosed basalt.

Inks soils are used for range, wildlife, recreation, and watershed.

Inks rocky clay loam, 50 to 75 percent slopes, eroded (InG2).—This soil is on uplands.

Representative profile (near Morgan Hill, about 1 mile north of Pigeon Point on road along ridge):

A1—0 to 1 inch, brown (7.5YR 5/4) gravelly clay loam, 20 percent (by volume) gravel, ¼ to 1 inch in diameter, dark brown (7.5YR 3/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary. (1 to 4 inches thick.)

B2t—1 to 15 inches, dark reddish-brown (5YR 3/3) gravelly clay loam, dark reddish brown (5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; continuous thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, irregular boundary. (11 to 15 inches thick.)

R—15 inches, hard metamorphosed basalt.

The A horizon is brown or dark brown. Reaction is slightly acid to neutral and changes little with depth. Texture is gravelly loam or gravelly clay loam. Percentage of gravel by volume generally is between 20 and 40 percent. The B horizon is typically dark reddish brown but in places is brown or dark brown. Texture is gravelly clay loam that contains 30 to 40 percent rock fragments 1 to 6 inches in diameter. Depth to hard bedrock ranges from 11 to 19 inches. About 2 to 10 percent of the surface is covered by rock outcrops, and variable amounts of stones are on the surface.

Included with this soil in mapping are some areas of Montara rocky clay loam and Henneke rocky clay loam, small areas of Rock land, and areas of soils that have steep and moderately steep slopes.

The available water holding capacity of this soil is 1 to 2 inches. Permeability in the subsoil is moderately slow. Runoff is very rapid, and the hazard of erosion is very high.

Fertility is low. Effective rooting depth is shallow to bedrock.

This soil is used for range, wildlife, and watershed. Capability unit VIIe–7 (15); range site, Shallow Loamy.

Inks stony clay loam, 30 to 75 percent slopes, severely eroded (IsG3).—This soil is on uplands and has slopes that average about 60 percent. Stones and rock outcrops cover about 3 to 10 percent of the surface. The surface layer has been removed in most places by erosion. Depth to bedrock is 11 to 15 inches.

Included with this soil in mapping are small areas of Henneke rocky clay loam and areas of soils that have slopes of 15 to 30 percent.

This soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe–7 (15); range site, Shallow Gravelly Loam.

Keefers Series

The Keefers series consists of well-drained clay loams that are underlain by alluvium from basic igneous rock. These soils lie on old fans and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, is annual grasses, forbs, and scattered oak trees. Elevation ranges from 200 to 800 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 260 to 275 days. Keefers soils are associated with the Cropley and Los Robles soils.

In a representative profile, the surface layer is brown, slightly acid clay loam about 12 inches thick. The subsoil is reddish-brown and brown, slightly acid to mildly alkaline gravelly clay loam, very gravelly clay loam, and gravelly clay to a depth of 60 inches or more.

Keefers soils are used for irrigated row crops, orchards, vineyards, pasture, and dryland hay.

Keefers clay loam, 2 to 9 percent slopes, eroded (KeC2).—This soil is on smooth, old fans and has slopes that average 5 percent.

Representative profile (off California Avenue, about 20 feet north and 100 yards east of its intersection with Cooledge Avenue):

Ap—0 to 5 inches, brown (7.5YR 5/4) clay loam containing 10 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/3) moist; moderate, medium and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; many fine interstitial and tubular pores; slightly acid (pH 6.5); clear, smooth boundary. (5 to 7 inches thick.)

A1—5 to 12 inches, brown (7.5YR 5/4) clay loam containing 10 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; few fine roots; many very fine interstitial pores and few medium tubular pores; slightly acid (pH 6.5); clear, wavy boundary. (7 to 9 inches thick.)

B1t—12 to 23 inches, reddish-brown (5YR 5/3) gravelly clay loam containing 20 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, very friable, sticky and plastic; few fine and medium roots; many very fine interstitial and tubular pores; few thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, wavy boundary. (10 to 12 inches thick.)

B2t—23 to 38 inches, reddish-brown (5YR 4/3) very gravelly heavy clay loam containing about 60 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine interstitial and tubular pores; many moderately thick clay films on ped surfaces and in pores; neutral (pH 7.0); clear, irregular boundary. (14 to 18 inches thick.)

IIB3t—38 to 60 inches, brown (7.5YR 5/4) gravelly clay containing about 20 percent (by volume) fine gravel, dark brown (7.5YR 4/4) moist; massive; very hard, firm, sticky and plastic; many very fine interstitial pores; common thin clay films lining pores and coating the fine gravel; some manganese coatings on gravel; mildly alkaline (pH 7.5).

The A horizon is typically brown but in places is dark brown or reddish brown. Texture is clay loam, and this horizon contains up to 15 percent (by volume) medium and fine gravel. The B2t horizon is very gravelly heavy clay loam or very gravelly clay. The gravel is generally fine but ranges to medium or coarse and averages a little more than 50 percent by volume. In most areas this soil overlies unrelated gravelly clay or clay in the IIB3t or IIC horizons at a depth of 36 to 60 inches.

Included with this soil in mapping are small seep and marsh areas and a few areas of Cropley clay.

The available water holding capacity of this soil is 6.5 to 8 inches. Permeability in the subsoil is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Natural fertility is moderate. Effective rooting depth is very deep.

This soil is used for irrigated row crops, prunes, grapes, and walnuts. A few areas are used for dryland pasture or grain hay. Capability unit IIIe–3 (14).

Keefers clay loam, 0 to 2 percent slopes (KeA).—This soil lies on smooth, old fans. Hazard of erosion is slight.

Included with this soil in mapping are small areas of Cropley clay and San Ysidro loam, small seep and marsh areas, and areas of gravelly clay loam and gravelly loam.

Runoff is very slow, and water tends to pond during the rainy season. The hazard of erosion is none to slight.

This soil is used for irrigated row crops, prunes, walnuts, and pasture. A few areas are used for dryland pasture or grain hay. Capability unit IIIs–3 (14).

Landslides

Landslides (LaF) consists of areas of soils that have moved downslope and have an uneven or broken surface as a result of slippage. Soil material is generally fine textured and ranges from clay loam to clay. The soil mantle and water regime have been disturbed so much that the soil characteristics are unpredictable. Landslides occur on slopes of 30 to 50 percent and are associated mainly with Altamont, Azule, Climara, and Diablo soils.

This well-drained land type is moderately fertile. Available water holding capacity is 5 to 8 inches. Runoff is rapid, and the hazard of erosion is high.

This land type is used for range. Capability unit VIIe–5 (15); range site, Clayey.

Los Gatos Series

The Los Gatos series consists of well-drained gravelly loams that are underlain by metamorphosed shale at a depth of 25 to 50 inches. These soils have slopes of 15 to 75 percent and are on uplands. Vegetation consists mainly of oaks that have an understory of brush, grass, and forbs. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is about 25 to 40 inches, and average temperature is about 55° to 56° F. The growing season is 200 to 250

days. Los Gatos soils are associated with the Gaviota, Gilroy, and Maymen soils.

In a representative profile, the surface layer is brown, slightly acid gravelly loam about 10 inches thick. The subsoil is brown, reddish-brown, and yellowish-brown, medium acid gravelly clay loam underlain at a depth of 35 inches by moderately hard, shattered metamorphosed shale.

Los Gatos soils are used for dryland vineyards, hay, pasture, range, wildlife, recreation, and watershed.

Los Gatos gravelly loam, 50 to 75 percent slopes (LfG).—This soil is on uplands.

Representative profile (from Uvas Dam, 0.7 mile north on Uvas Road, in road cut 295 feet west on dirt road; SW¼SE¼ sec. 12, T. 10 S., R. 2 E.):

A11—0 to 3 inches, brown (7.5YR 5/4) gravelly loam containing about 15 percent (by volume) medium and fine angular gravel, dark brown (7.5YR 3/2) moist; strong, medium and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine interstitial pores; slightly acid (ph 6.5); clear, smooth boundary. (0 to 6 inches thick.)

A12—3 to 10 inches, brown (7.5YR 5/4) gravelly loam containing about 15 percent (by volume) medium and fine angular gravel, dark brown (7.5YR 3/3) moist; moderate, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots and few coarse roots; many very fine interstitial pores and few medium and coarse tubular pores; slightly acid (pH 6.1); clear, smooth boundary. (6 to 10 inches thick.)

B1t—10 to 16 inches, brown (7.5YR 5/4) gravelly clay loam containing about 16 percent medium and fine gravel, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots, and few coarse roots; many very fine interstitial and tubular pores and few medium and coarse tubular pores; common thin clay films on ped surfaces and in pores; medium acid (pH 6.0); clear, wavy boundary. (5 to 12 inches thick.)

B2t—16 to 27 inches, reddish-brown (5YR 5/4) gravelly clay loam containing about 11 percent medium and fine gravel, dark reddish brown (5YR 3/4) moist; medium, moderate, subangular blocky structure; hard, friable, sticky and plastic; few fine, medium, and coarse roots; many very fine interstitial and tubular pores and few medium and coarse tubular pores; continuous thin clay films on ped surfaces and in pores; medium acid (pH 6.0); diffuse, smooth boundary. (8 to 12 inches thick.)

B3t—27 to 35 inches, yellowish-brown (10YR 5/6) gravelly clay loam containing about 11 percent medium and fine gravel, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and plastic; few fine, medium and coarse pores; many thin clay bridges between sand grains and many thin clay films in pores; medium acid (pH 6.0); abrupt, irregular boundary. (6 to 10 inches thick.)

R—35 inches, shattered, hard metamorphosed shale rock with few clay films along cracks; becomes massive with increasing depth.

The A horizon is brown or dark brown. Reaction is slightly acid to neutral. Texture is dominantly loam but in places is clay loam, and this horizon contains 15 to 20 percent (by volume) gravel. The B horizon is brown, strong brown, reddish brown, or yellowish brown. The lower part of the B horizon is heavy gravelly loam or gravelly clay loam. Depth to hard shale rock is 25 to 50 inches.

Included with this soil in mapping are areas that have been subject to moderate sheet erosion; Maymen rocky fine sandy loam, generally on south slopes and along ridge crests; and Gilroy clay loam, located mainly along fault lines.

This soil is moderately fertile. Available water holding capacity is about 4 to 8 inches, depending on depth to shale. Permeability of the subsoil is moderately slow. Runoff is very rapid, and the hazard of erosion is very high. Effective rooting depth is moderately deep to deep.

This soil is used mostly for wildlife, recreation, and watershed. A few areas are used for range. Capability unit VIIe-1 (15); range site, Loamy.

Los Gatos gravelly loam, 15 to 30 percent slopes, eroded (LfE2).—This soil is on the uplands, mainly on the crests of well-rounded ridges and footslopes. The typical slope is about 20 percent. About 2 to 8 inches of the topsoil has been removed by sheet and rill erosion. In a few small areas the subsoil has been exposed by erosion.

Included with this soil in mapping are a few areas of Maymen rocky fine sandy loam and areas that are severely eroded.

This soil has an available water holding capacity of about 4 to 7 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The effective rooting depth is moderately deep.

Most of this soil is used for dryland grain hay, grapes, pasture, and range. Capability unit IVe-1 (15); range site, Loamy.

Los Gatos gravelly loam, 30 to 50 percent slopes (LfF).—This soil is on uplands and has slopes that average about 35 percent. It has a profile that is similar to that of Los Gatos gravelly loam, 50 to 75 percent slopes except the surface layer generally is dark brown on the north slopes.

Included with this soil in mapping are some areas of Maymen rocky fine sandy loam and Gilroy clay loam, and areas of a calcareous soil.

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

This soil is used for range. Capability unit VIe-1 (15); range site, Loamy.

Los Gatos-Gaviota complex, 50 to 75 percent slopes (LhG).—This complex consists of about 60 percent Los Gatos gravelly loam, 25 percent Gaviota loam, and 15 percent included soils. These soils are on uplands under a cover of grass and woodland. Los Gatos soils are on the north slopes. Gaviota soils are on the ridges and south slopes.

Included in mapping are areas of Vallecitos rocky loam, Los Osos clay loam, and Altamont clay; areas of Rock land; areas of soils that have slopes that range to 80 percent; and areas of soils that have been subject to moderate sheet erosion.

The Los Gatos soils have a profile similar to that of Los Gatos gravelly loam, 50 to 75 percent slopes. Permeability is moderately slow. Available water holding capacity is 4 to 8 inches. Effective rooting depth is 25 to 50 inches. Natural fertility is moderate.

The Gaviota soils have a profile similar to that of Gaviota loam, 30 to 75 percent slopes. Permeability is moderate. Available water holding capacity is 2 to 3 inches. Effective rooting depth is 10 to 19 inches. Natural fertility is low.

Both of these soils have very rapid runoff and a very high hazard of erosion.

These soils are used for range. This complex is in capability unit VIIe-8 (15). Los Gatos soil: range site, Loamy. Gaviota soil: range site, Shallow Loamy.

Los Osos Series

The Los Osos series consists of well-drained clay loams that are underlain by sedimentary rock at a depth of 26 to 40 inches. These soils have slopes of 15 to 75 percent and are on uplands. The vegetation, where these soils are not cultivated, is annual grasses and forbs, oak trees, and brush. Elevation ranges from 300 to 1,200 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Los Osos soils are associated with the Azule and Los Gatos soils.

In a representative profile, the surface layer is a dark grayish-brown, slightly acid clay loam about 10 inches thick. The subsoil is dark-brown, slightly acid clay that is underlain at a depth of 36 inches by moderately hard, fine-grained sandstone and shale.

Los Osos soils are used for dryland hay, pasture, and range.

Los Osos clay loam, 15 to 30 percent slopes (LoE).—This soil is on uplands and has slopes that average about 20 percent.

Representative profile (0.7 mile east on Highway 152 from San Felipe Road, 0.5 mile up old Pacheco Pass Road. 0.5 mile north on ridge by old corral):

A1—0 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial pores, common very fine tubular pores, and few fine tubular pores; slightly acid (pH 6.1); gradual, smooth boundary. (8 to 12 inches thick.)

B21t—10 to 23 inches, dark-brown (10YR 4/3) clay, very dark grayish brown (10YR 3/2) moist; strong, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; many thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, wavy boundary. (9 to 14 inches thick.)

B22t—23 to 36 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; weak, coarse, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common fine tubular pores; continuous thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, wavy boundary. (9 to 14 inches thick.)

R—36 inches, yellowish-brown, moderately hard, fine-grained sandstone and shale.

The A horizon is grayish brown or dark grayish brown. Reaction is neutral to medium acid. Texture is typically clay loam but ranges to loam. The B horizon is brown, dark brown, or yellowish brown. Texture is heavy clay loam or clay. Reaction is slightly acid to neutral. Depth to parent bedrock ranges from 26 to 40 inches. Lime is present in seams of the bedrock in a few places.

Included with this soil in mapping are some areas of Gaviota loam and Los Gatos gravelly loam, areas of rock outcrop, and areas that are moderately eroded to severely eroded.

Available water holding capacity is 4 to 8 inches, depending on depth to bedrock. Permeability in the subsoil is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil is highly fertile. Effective rooting depth is moderately deep.

This soil is used for dryland hay, pasture, and range. Capability unit IVe–3 (15); range site, Fine Loamy.

Los Osos clay loam, 30 to 50 percent slopes (LoF).—This soil lies on uplands. The slopes are generally complex and average about 40 percent.

Included with this soil in mapping are areas of Diablo clay and areas that have been subject to moderate to severe sheet erosion.

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

This soil is used for range. Capability unit VIe–3 (15); range site, Fine Loamy.

Los Osos clay loam, 50 to 75 percent slopes (LoG).—This soil is on uplands. The slopes are generally complex and average about 55 percent. Vegetation on the northerly slopes consists of oak trees that have an understory of brush, grasses, and forbs. On the southerly slopes are mostly open stands of grasses and forbs.

Included with this soil in mapping are small areas of Altamont clay and San Benito clay loam, areas of Rock land, and areas that have been subject to moderate to severe sheet erosion.

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

This soil is used for range. Capability unit VIIe–1 (15); range site, Fine Loamy.

Los Robles Series

The Los Robles series consists of well-drained clay loams that are underlain by stratified basic igneous rock alluvium. These soils are on alluvial fans and have slopes of 0 to 9 percent. Vegetation, where these soils are not cultivated, is annual grasses, forbs and scattered large oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 260 to 275 days. Los Robles soils are associated with the Cropley and Keefers soils.

In a representative profile, the surface layer is dark-brown neutral clay loam about 9 inches thick. The subsoil is dark-brown and brown, neutral clay loam and gravelly clay loam that is underlain at a depth of 58 inches by yellowish-brown, neutral gravelly fine sandy clay loam.

Los Robles soils are used for irrigated row crops, orchards, vineyards, dryland hay, and pasture.

Los Robles clay loam, 0 to 2 percent slopes (LrA).—This soil is on smooth fans.

Representative profile (about 1,000 feet north on Turlock Avenue from intersection with Fitzgerald Road, in prune orchard about 12 tree rows south from driveway and 6 tree rows east from loading area):

Ap1—0 to 5 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, very friable, sticky and plastic; many very fine roots; many very fine interstitial pores; neutral (pH 7.0); abrupt, smooth boundary. (4 to 6 inches thick.)

Ap2—5 to 9 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, very friable, sticky and plastic; common very fine roots; many very fine interstitial and tubular pores and few medium tubular pores; neutral (pH 7.0); clear, wavy boundary. (4 to 6 inches thick.)

B1t—9 to 14 inches, dark-brown (7.5YR 4/2) clay loam containing 8 percent (by volume) medium and the gravel, dark brown (7.5YR 3/2) moist; moderate, medium,

subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores and few fine and medium tubular pores; common thin clay films on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (4 to 8 inches thick.)

B2t—14 to 28 inches, dark-brown (10YR 4/3) gravelly clay loam containing about 15 percent (by volume) fine gravel, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many very fine interstitial and tubular pores and few medium tubular pores; continuous thin clay films on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (12 to 16 inches thick.)

B3t—28 to 58 inches, brown (10YR 5/3) gravelly clay loam containing about 20 percent (by volume) fine gravel, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (20 to 30 inches thick.)

C—58 to 60 inches, yellowish-brown (10YR 5/4) gravelly fine sandy clay loam containing about 40 percent (by volume) fine gravel, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, sticky and plastic; many very fine interstitial and tubular pores; neutral (pH 7.0).

The A horizon is commonly dark brown or brown but ranges to dark grayish brown. It contains less than 1.2 percent organic matter below a depth of 5 inches. Reaction is slightly acid to neutral. The B horizon is dark-brown to brown clay loam containing 5 to 45 percent gravel, and content of gravel increases with depth. There is a slight increase in the content of clay in the B horizon. Reaction is slightly acid to mildly alkaline.

Included with this soil in mapping are some areas of Cropley clay and Keefers clay loam, small areas of gravelly loam, and some seep areas.

The available water holding capacity is about 9 to 11 inches. Runoff is very slow, and the hazard of erosion is none to slight. Permeability in the subsoil is moderately slow. Fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated row crops, apricots, dryland hay, and pasture. Capability unit I–3 (14).

Los Robles clay loam, 2 to 9 percent slopes (LrC).—This soil is on small alluvial fans that extend up into narrow drainageways. The average slope is about 5 percent.

Included with this soil in mapping are small areas of Cropley clay, stringers of gravelly clay loam, and soils that developed from serpentine rock alluvium.

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

This soil is used for irrigated prunes, row crops, grapes, apricots, walnuts, dryland hay, and pasture. Capability unit IIe–1 (14).

Madonna Series

The Madonna series consists of well-drained loams that are underlain by sedimentary bedrock at a depth of 20 to 28 inches. These soils have slopes of 15 to 75 percent and lie on uplands. The vegetation, where these soils are not cultivated, is oak trees, some brush, grasses, and forbs. Elevation ranges from 1,500 to 3,500 feet. Average annual rainfall is 35 to 50 inches, and average annual temperature is about 55° to 56° F. The growing season is about 200 to 250 days. Madonna soils are associated with the Maymen, Ben Lomond, and Los Gatos soils.

In a representative profile, the surface layer is pale-brown, medium acid loam about 7 inches thick. The subsoil is brown, medium acid loam. At a depth of 25 inches is light yellowish-brown, strongly acid sandstone.

Madonna soils are used for dryland hay, pasture, range, recreation, and watershed.

Madonna loam, 30 to 50 percent slopes (MbF).—This soil is on uplands and has slopes that average about 35 percent.

Representative profile (on west-facing slope 50 feet from intersection of old Watsonville Road, just below fence in the southeast corner; NW¼NW¼ sec. 21, T. 10 S., R. 2 E.):

A1—0 to 7 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; moderate, medium and fine, granular structure; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial and tubular pores; medium acid (pH 5.6); clear, wavy boundary. (8 to 10 inches thick.)

B2—7 to 25 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores and few medium tubular pores; medium acid (pH 5.6); clear, wavy boundary. (12 to 18 inches thick.)

R—25 inches, light yellowish-brown (10YR 6/4), strongly acid sandstone.

The A horizon generally is pale brown, light brownish gray, or brown. In a few areas, however, it is grayish brown in the upper 4 inches. Texture is loam, light loam, or fine sandy loam. The B horizon is pale brown, brown, light yellowish brown, or very pale brown. Texture is loam, light loam, or fine sandy loam. Reaction is medium acid to strongly acid. Depth to the strongly acid hard sandstone bedrock ranges from 20 to 28 inches.

Included with this soil in mapping are small areas of Maymen rocky fine sandy loam along the ridge crests, small areas that have been subject to moderate to severe sheet erosion, and areas of rock outcrop.

The available water holding capacity of this soil is about 3 to 5 inches. Permeability is moderate. Runoff is rapid, and the hazard of erosion is high. Natural fertility is moderate. Effective rooting depth is moderately deep to bedrock.

This soil is used for range, recreation, and watershed. Capability unit VIe–8 (4); range site, Loamy.

Madonna loam, 15 to 30 percent slopes (MbE).—This soil is on uplands, mainly on top of the round, broad ridges or on footslopes.

Included with this soil in mapping are some areas that have been subject to moderate and severe sheet erosion, and areas of rock outcrop.

Runoff is medium to rapid. The hazard of erosion is moderate to high.

This soil is used for dryland grain hay, pasture, and range. Capability unit IVe–8 (4); range site, Loamy.

Madonna loam, 50 to 75 percent slopes (MbG).—This soil has very steep slopes that average about 55 percent.

Included with this soil in mapping are some areas of Los Gatos gravelly loam, Maymen rocky fine sandy loam, and Rock land.

Runoff is very rapid. The hazard of erosion is very high.

This soil has limited use for range. It is used for recreation and watershed. Capability unit VIIe–8 (4); range site, Loamy.

Maxwell Series

The Maxwell series consists of moderately well drained clays that are underlain by serpentine alluvium. These soils are on alluvial fans and have slopes of 0 to 5 percent. The vegetation, where these soils are not cultivated, is annual grasses and scattered oaks. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 260 to 275 days. Maxwell soils are associated with the Climara and Montara soils.

In a representative profile, the surface layer is very dark gray, neutral and mildly alkaline clay about 25 inches thick. The next layer is dark-gray, moderately alkaline clay that is underlain at a depth of 46 inches by dark grayish-brown, calcareous, moderately alkaline gravelly clay loam that extends to a depth of 60 inches or more. When these soils are dry, deep cracks develop in the surface layer and in the upper part of the substratum.

Maxwell soils are used for irrigated orchards, dryland grain hay, and pasture.

Maxwell clay, 0 to 5 percent slopes (McB).—This soil is on alluvial fans.

Representative profile (in field by fence corner on south side of road, 1,400 feet west on Llagas Avenue from intersection with Orchard Avenue):

Ap—0 to 7 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, medium and fine, granular structure; very hard, very firm, sticky and very plastic; many very fine roots; many very fine interstitial pores; neutral (pH 7.0); abrupt, smooth boundary. (4 to 10 inches thick.)

A1—7 to 25 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and very plastic; few very fine roots; many very fine interstitial pores; common fine and medium slickensides; mildly alkaline (pH 7.5); clear, wavy boundary. (20 to 30 inches thick.)

C1—25 to 46 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; massive; hard, firm, sticky and very plastic; many very fine interstitial and tubular pores; common fine and medium slickensides; moderately alkaline (pH 8.0); clear, smooth boundary. (12 to 24 inches thick.)

C2—46 to 60 inches, dark grayish-brown (2.5Y 4/2) gravelly clay loam, very dark grayish brown (2.5Y 3/2) moist; massive; hard, friable, sticky and plastic; many very fine interstitial and tubular pores; calcareous, moderately alkaline (pH 8.0).

The A horizon is dark gray or very dark gray. Reaction is neutral to mildly alkaline. Depth to lime ranges from 24 to 48 inches. When the soil is dry, deep cracks develop that average from ½ to 1½ inches in width in the A horizon and in the upper part of the C horizon.

Included with this soil in mapping are small areas of gravelly clay texture and a few areas of buried soils that have characteristics similar to those of the Hillgate and Pleasanton soils.

The available water holding capacity of this soil is 8 to 10 inches. Permeability is slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. This soil has low natural fertility because of an unfavorable calcium-magnesium ratio. Effective rooting depth is very deep.

This soil is used for irrigated prunes, dryland grain hay, and pasture. Capability unit IVs–9 (14).

Maymen Series

The Maymen series consists of somewhat excessively drained fine sandy loams that are underlain by sedimentary rock at a depth of 11 to 19 inches. These soils lie on uplands and have slopes of 15 to 75 percent. Vegetation is mainly brush or hardwoods that have an understory of dense brush. Elevation ranges from 1,600 to 4,000 feet. Average annual rainfall is 30 to 50 inches, and average annual temperature is 55° to 56° F. The growing season is about 200 to 250 days. Maymen soils are associated with the Los Gatos and Madonna soils.

In a representative profile, the surface layer is brown, medium acid fine sandy loam about 3 inches thick. The subsoil is light-brown, strongly acid fine sandy loam that is underlain at a depth of 14 inches by very pale brown, strongly acid, hard, fractured sandstone. In some areas rock outcrops cover 5 to 10 percent of the surface.

Maymen soils are used for range, wildlife, recreation, and watershed.

Maymen rocky fine sandy loam, 50 to 75 percent slopes, eroded (MfG2).—This soil is on uplands and has slopes that average about 60 percent.

Representative profile (on ridge between Eastman and Murphy Canyons, 2 miles east of Mt. Madonna Road; SW¼SW¼ sec. 15, T. 10 S., R. 2 E.):

01—1 inch to 0, undecomposed leaves, pine needles, and twigs; abrupt, smooth boundary. (1 to 2 inches thick.)

A1—0 to 3 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine interstitial pores; medium acid (pH 5.6); abrupt, smooth boundary. (1 to 4 inches thick.)

B2—3 to 14 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, medium and fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few, fine, medium, and coarse roots; many very fine interstitial pores and few medium and fine tubular pores; strongly acid (pH 5.1); clear, wavy boundary. (10 to 15 inches thick.)

R—14 inches, very pale brown, strongly acid, hard, fractured sandstone.

The A horizon is brown, pale brown, or yellowish brown. Reaction is medium acid to strongly acid. Texture is fine sandy loam, loam, or sandy loam. About 5 to 10 percent of the surface is rock outcrops. Depth to sandstone or shale ranges from 11 to 19 inches.

Included with this soil in mapping are some areas of Los Gatos gravelly loam, small areas of Rock land, and a few areas that have slopes ranging to 80 percent.

This soil has an available water holding capacity of 1 to 3 inches. Permeability is moderately rapid. Runoff is very rapid, and the hazard of erosion is moderate or severe. Effective rooting depth is shallow. Fertility is low.

This soil is used for wildlife, recreation, and watershed. Vegetation is mostly brush, but there are a few trees near the drainage channels or on north slopes. Capability unit VIIe–7 (15); range site, Shallow Gravelly Loam.

Maymen fine sandy loam, 15 to 50 percent slopes, eroded (MeF2).—This soil is along ridgetops and has an average slope of about 35 percent. Rock outcrops cover less than 5 percent of the surface.

Included with this soil in mapping are small areas of Ben Lomond fine sandy loam and Madonna loam.

The available water holding capacity of this soil is 1 to 3 inches. Runoff is medium to rapid, and the hazard of erosion is high. Effective rooting depth is 13 to 19 inches.

This soil is used mainly for limited range, wildlife, and watershed. A few acres on the lesser slopes have been cultivated to grain hay. A number of summer cabins and mountain homes have been built on this soil. Capability unit VIIe–8 (15); range site, Shallow Gravelly Loam.

Montara Series

The Montara series consists of somewhat excessively drained clay loams that are underlain by serpentine bedrock at a depth of 10 to 16 inches. These soils are on uplands and have slopes of 15 to 50 percent. Vegetation is annual grasses, forbs, and scattered dwarf oaks and Digger pines. Elevation ranges from 800 to 3,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 200 to 275 days. Montara soils are associated with the Azule, Climara, and Inks soils.

In a representative profile, the soil is dark gray and very dark gray, moderately alkaline clay loam about 13 inches thick that is underlain by greenish gray serpentine bedrock. Rock outcrops cover 5 to 10 percent of the surface.

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

Montara rocky clay loam, 15 to 50 percent slopes, eroded (MwF2).—This soil is on broad, well-rounded ridges of the uplands. Average slope is about 30 percent.

Representative profile (in road cut 0.5 mile north of Pigeon Point; T. 8 S., R. 3 E.):

A11—0 to 2 inches, dark-gray (10YR 4/1) clay loam, black (10YR 2/1) moist; moderate, fine and medium, granular structure; hard, friable, sticky and plastic; few fine roots; many fine and very fine tubular pores; moderately alkaline (pH 8.0); clear, wavy boundary. (0 to 2 inches thick.)

A12—2 to 6 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate, medium, subangular blocky structure; hard, very friable, sticky and plastic; common, very fine roots; many very fine and fine tubular pores; moderately alkaline (pH 8.0); clear, wavy boundary. (4 to 6 inches thick.)

A13—6 to 13 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate, fine, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common fine and very fine tubular pores; moderately alkaline (pH 8.0); abrupt, irregular boundary. (6 to 8 inches thick.)

R—13 inches, greenish-gray serpentine rock.

The A horizon is dark gray to very dark gray. Five to 10 percent of the surface is covered by rock outcrops. Depth to rock is 10 to 16 inches. Reaction is neutral to moderately alkaline and changes little with increasing depth.

Included with this soil in mapping are areas of Inks rocky clay loam and Rock land and areas of soils that are clay throughout the profile.

Available water holding capacity is 2 to 3 inches. Permeability is moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is low because of an unfavorable calcium-magnesium ratio. Effective rooting depth is shallow to bedrock.

This soil is used for range, wildlife, recreation, and watershed. Capability unit VIIe–9 (15); range site, Serpentine.

Pacheco Series

The Pacheco series consists of poorly drained clay loams that are underlain by sedimentary alluvium. These soils are on low alluvial plains and have slopes of less than 2 percent. The vegetation, where these soils are not cultivated, is annual grasses and forbs. Elevation ranges from 150 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Pacheco soils are associated with the Clear Lake, Yolo, and Willows soils.

In a representative profile, the surface layer is grayish-brown, moderately alkaline clay loam about 16 inches thick. In some places the surface layer is fine sandy loam or silt loam. The surface layer is underlain by mottled, light-gray, moderately alkaline loam and very fine sandy loam to a depth of more than 60 inches. In places the substratum is gravelly. The profile is calcareous in the lower part.

Pacheco soils are used for irrigated sugar beets, row crops, orchards, pasture, and hay.

Pacheco clay loam (Pd).—This soil is level and is in low positions on the alluvial plains. Average slope is less than 2 percent.

Representative profile (in a field 0.1 mile west of pump number 1 on Taix Company ranch):

Ap—0 to 7 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; hard, friable, sticky and plastic; many fine interstitial pores and many fine tubular pores; moderately alkaline (pH 8.0); clear, smooth boundary. (6 to 8 inches thick.)

A1—7 to 16 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many fine interstitial and tubular pores; moderately alkaline (pH 8.0); clear, smooth boundary. (8 to 10 inches thick.)

C1g—16 to 35 inches, light-gray (10YR 6/1) loam, gray (10YR 5/1) moist; many, fine, distinct, brown (10YR 5/3) mottles, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; moderately alkaline (pH 8.3); clear, smooth boundary. (18 to 25 inches thick.

C2g—35 to 60 inches, light-gray (10YR 6/1) very fine sandy loam, gray (10YR 5/1) moist; many, coarse, distinct, brown (10YR 5/3) mottles, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky and nonplastic; slightly calcareous, moderately alkaline (pH 8.0).

The A horizon is grayish brown to dark gray. Reaction is mildly alkaline to moderately alkaline. Texture is clay loam or silty clay loam. Structure is fine or medium granular or subangular blocky. The C horizon is light brownish gray, light gray, or gray and contains common to many mottles. It is stratified sandy loam to silty clay loam that averages between 10 and 40 percent clay and more than 15 percent sand. Mottling is generally present at an average depth of slightly more than 16 inches.

Included with this soil in mapping are small areas of Clear Lake clay and of soils similar to the Pacheco soils that are calcareous in the surface layer.

The available water holding capacity is 9 to 11 inches. Permeability is moderate. Runoff is very slow, and this soil is flooded about twice every 10 years. The hazard of erosion is none to slight. Fertility is moderate. Effective rooting depth is restricted to a depth of 36 to 50 inches by a seasonal water table.

This soil is used for irrigated row crops, pears, and sugar beets. Capability unit IIw–2 (14).

Pacheco fine sandy loam (Pa).—This soil is in low positions southeast of Gilroy. The surface layer is grayish brown and in places is sandy loam or silt loam.

Included with this soil in mapping are small areas of Clear Lake clay and small spots where neutral salts have accumulated. Along Carnadero Creek, east of Miller railroad siding, about 100 acres of this soil has a muck substratum.

Available water holding capacity is about 9 to 11 inches. This soil is subject to flooding about twice every 10 years.

This soil is used for irrigated row crops, pears, and sugar beets. Capability unit IIw–2 (14).

Pacheco silt loam, drained (Pb).—This soil has a profile that is similar to that of Pacheco clay loam, but the surface layer is silt loam.

Included with this soil in mapping are small areas of Yolo loam and Garretson gravelly loam.

Available water holding capacity is 9 to 11 inches. The effective rooting depth is more than 60 inches, because the water table that existed during soil development has been lowered by irrigation pumping. This soil is flooded about once every 25 years.

This soil is used for irrigated row crops, sugar beets, cherries, prunes, walnuts, hay, and pasture. Capability unit I–1 (14).

Pacheco clay loam, gravelly substratum (Pe).—This soil occurs as gravelly stringers that are intermingled with Pacheco and Campbell soils. The surface layer commonly is grayish brown or dark gray but in places is loam, clay loam, or gravelly clay loam. The water table generally is below a depth of 5 feet as a result of pumping for irrigation. The substratum, below a depth of 36 to 40 inches, is stratified sand and gravel.

Included with this soil in mapping are small areas that have sand and gravel within 20 inches of the surface, and a few areas of pale brown loam overwash 10 to 15 inches thick. A few of these areas have a seasonal water table within 3 feet of the surface that restricts rooting depth.

The available water holding capacity is 7.5 to 9.5 inches. This soil is moderately permeable and has a rapidly permeable substratum. The effective rooting depth is very deep.

This soil is used for irrigated row crops, prunes, and pasture. Capability unit I–1 (14).

Parrish Series

The Parrish series consists of well-drained gravelly clay loams that are underlain by shale at a depth of 24 to 42 inches. These soils are on uplands and have slopes of 9 to 75 percent. The vegetation is grasses, forbs, oak trees, and a few scattered stands of ponderosa pine. Elevation ranges from 1,000 to 3,000 feet. Average annual rainfall is 20 to 30 inches, and average annual temperature is about 54° to 56° F. The growing season is about 200 to 250 days. Parrish soils are associated with the Gaviota and Los Gatos soils.

In a representative profile, the surface layer is reddish-brown, medium acid gravelly light clay loam about 8 inches thick. The subsoil is reddish-brown, strongly acid gravelly clay loam and gravelly clay that are underlain at a depth of 38 inches by weathered, acid, metamorphosed shale.

Parrish soils are used for dryland pasture and range.

Parrish gravelly clay loam, 9 to 30 percent slopes (PfE).—This soil is on uplands and has slopes that average about 20 percent.

Representative profile (in road cut 2.4 miles above Coe Park gate, Pine Ridge; sec. 31, T. 8 S., R. 4 E.):

A1—0 to 8 inches, reddish-brown (5YR 5/3) gravelly light clay loam containing about 15 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores and few medium and fine tubular pores; medium acid (pH 6.0); clear, smooth boundary. (4 to 10 inches thick.)

B1t—8 to 19 inches, reddish-brown (5YR 4/3) gravelly clay loam containing 30 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores and few medium and fine tubular pores; common thin clay films on ped surfaces and in pores; strongly acid (pH 5.1); gradual, smooth boundary. (8 to 12 inches thick.)

B2t—19 to 38 inches, reddish-brown (2.5YR 5/4) gravelly clay containing 35 percent (by volume) medium and fine gravel, dark reddish brown (5YR 3/4) moist; weak, medium, subangular blocky structure; very hard, friable, sticky and plastic; many very fine interstitial and tubular pores; continuous, moderately thick clay films on ped surfaces and in pores; strongly acid (pH 5.1); gradual, irregular boundary. (12 to 20 inches thick.)

R—38 inches, weathered, acid metamorphosed shale with reddish-brown, moderately thick clay films along some cleavage planes.

The A horizon commonly is brown or reddish-brown but in places is pale brown. Texture is gravelly clay loam or gravelly loam that contains about 15 to 20 percent (by volume) medium and fine gravel. Reaction is slightly acid to medium acid. The B horizon is reddish brown or yellowish red. Texture is gravelly clay loam or gravelly clay that contains 30 to 40 percent gravel. Reaction is generally strongly acid but ranges to medium acid. Depth to shale ranges from 24 to 42 inches.

Included with this soil in mapping are small areas of Los Gatos gravelly loam along drainageways and of Gaviota loam on the ridges and south slopes.

The available water holding capacity of this soil is about 4 to 6 inches. Permeability in the subsoil is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is moderately fertile. Effective rooting depth is moderately deep.

This soil is used for dryland pasture and range. Capability unit IVe–3 (15); range site, Loamy.

Parrish gravelly clay loam, 30 to 50 percent slopes (PfF).—This soil is on uplands and has slopes that average about 35 percent.

Included with this soil in mapping are areas of Gaviota loam and Los Gatos gravelly loam.

Runoff is rapid, and the hazard of erosion is high. Effective rooting depth is 24 to 38 inches.

This soil is used for range. Capability unit VIe–3 (15); range site, Loamy.

Parrish gravelly clay loam, 50 to 75 percent slopes (PfG).—This soil has slopes that average about 50 percent. Depth to bedrock ranges from 24 to 38 inches.

Included with this soil in mapping are areas of Gaviota loam and areas of Rock land.

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

This soil is used for range. Capability unit VIIe–1 (15); range site, Loamy.

Pleasanton Series

The Pleasanton series consists of well-drained loams that are underlain by old gravelly sedimentary alluvium. These soils are on fans and terraces and have slopes of 0 to 15 percent. The vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are scattered oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 260 to 275 days. Pleasanton soils are associated with the Arbuckle and Hillgate soils.

In a representative profile, the surface layer is grayish-brown, slightly acid loam about 18 inches thick. In some places the surface layer is gravelly loam. The subsoil is dark grayish-brown, brown, and yellowish-brown, neutral clay loam, gravelly heavy clay loam, and gravelly sandy clay loam.

Pleasanton soils are used mainly for irrigated row crops, orchards, vineyards, dryland hay, pasture, and range. They are also used for housing and commercial development.

Pleasanton loam, 0 to 2 percent slopes (PoA).—This soil is on broad, old fans.

Representative profile (about 10 feet off north side of road on Dryden Avenue, 700 feet east of New Avenue):

Ap—0 to 5 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial pores and common very fine tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary. (0 to 6 inches thick.)

A1—5 to 18 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and medium roots; many very fine interstitial pores, common fine tubular pores, and few medium tubular pores; slightly acid (pH 6.5); clear, wavy boundary. (12 to 14 inches thick.)

B1t—18 to 23 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few medium roots; many very fine interstitial and tubular pores; common thin clay films line pores; neutral (pH 7.0); clear, smooth boundary. (4 to 6 inches thick.)

B2t—23 to 44 inches, brown (10YR 5/3) gravelly heavy clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine and fine tubular pores and few medium tubular pores; many moderately thick clay films on ped surfaces and in pores; neutral (pH 7.0); clear, smooth boundary. (20 to 24 inches thick.)

B3t—44 to 66 inches, yellowish-brown (10YR 5/4) gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and plastic; few medium roots; many very fine and fine interstitial and tubular pores and few medium tubular pores; common thin clay films in pores; neutral (pH 7.0).

The A horizon ranges from brown or grayish brown to dark grayish brown. Texture is typically loam but ranges to a light clay loam that contains 3 to 5 percent (by volume) medium and fine gravel. Reaction is slightly acid to neutral and changes little with depth. The B horizon is brown, grayish brown, dark grayish brown, or yellowish brown. Texture is clay loam, gravelly clay loam, or gravelly sandy clay loam. The C horizon, where present, is lighter and more yellowish than the B horizon. Lime is present in places in the substratum.

Included with this soil in mapping are small areas of Hillgate silt loam and San Ysidro loam and a few areas of soils that are similar to Pleasanton loam and have a medium acid subsoil.

The available water holding capacity of this soil is 9 to 11 inches. Permeability in the subsoil is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. This soil is moderately fertile. Effective rooting depth is very deep.

This soil is used mainly for irrigated row crops, apricots, prunes, walnuts, and grapes, and for dryland hay and pasture. Large areas are also used for housing and commercial developments. Capability unit I–3 (14).

Pleasanton loam, 2 to 9 percent slopes (PoC).—This soil is on fans. Slope ranges from 3 to 5 percent but is dominantly 2 to 9 percent.

Included with this soil in mapping are areas that have been subject to moderate sheet erosion.

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

This soil is used mainly for irrigated row crops, prunes, apricots, grapes, walnuts, dryland hay, and pasture. Large areas of this soil are also used for housing and commercial development. Capability unit IIe–1 (14).

Pleasanton gravelly loam, 0 to 2 percent slopes (PpA).—This soil has a profile similar to that of Pleasanton loam, 0 to 2 percent slopes, except that it has a gravelly loam surface layer. The content of gravel averages between 15 to 20 percent by volume.

Included with this soil in mapping are small areas of Cropley clay and San Ysidro loam.

The available water holding capacity of this soil is about 8 to 9 inches.

This soil is used mainly for irrigated row crops, apricots, prunes, walnuts, grapes, dryland hay, and pasture. It is also used for housing and commercial development. Capability unit IIs–4 (14).

Pleasanton gravelly loam, 2 to 9 percent slopes (PpC).—This soil is in small to medium-sized areas on the upper parts of older alluvial fans. Average slope is 3 to 5 percent. Content of gravel averages between 15 to 25 percent by volume.

Included with this soil in mapping are small areas of Cropley clay, Hillgate silt loam, and Garretson gravelly loam.

The available water holding capacity of this soil is 8 to 9 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Except for areas in small upland valleys, most of this soil is cultivated. It is used for row crops, irrigated prunes, apricots, grapes, walnuts, dryland hay, and pasture. Capability unit IIe–1 (14).

Pleasanton gravelly loam, 9 to 15 percent slopes, eroded (PpD2).—This soil is on terraces on uplands. Average slope is 12 percent. Content of gravel is 15 to 25 percent by volume.

Included with this soil in mapping are small areas of Hillgate silt loam, and areas that have been subject to severe sheet erosion.

The available water holding capacity is 6 to 7 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dryland hay, pasture, and range. Capability unit IVe–1 (15); range site, Loamy.

Rincon Series

The Rincon series consists of well-drained clay loams that are underlain by sedimentary alluvium. These soils are on fans and have slopes of 0 to 9 percent. Vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are scattered large oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is about 58° to 60° F. The growing season is 250 to 275 days. The Rincon soils are associated with the Cropley and Pleasanton soils.

In a representative profile, the surface and subsurface layers are dark-gray, neutral and mildly alkaline clay loam about 19 inches thick. The subsoil is grayish-brown, mildly alkaline and moderately alkaline gravelly clay and clay and is underlain at a depth of 50 inches by light yellowish-brown, moderately alkaline, calcareous clay loam.

Rincon soils are used for irrigated row crops, apricots, prunes, walnuts, grapes, dryland hay, and pasture.

Rincon clay loam, 0 to 2 percent slopes (RaA).—This soil is on broad fans.

Representative profile (about 126 feet south on Ferguson Road from the intersection with Godfrey Road):

Ap—0 to 6 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial and tubular pores; neutral (pH 7.0); clear, smooth boundary. (6 to 7 inches thick.)

A1—6 to 12 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; massive; very hard, friable, sticky and plastic; few very fine and fine roots; many fine and very fine interstitial pores and many fine tubular pores; neutral (pH 7.0); clear, wavy boundary. (6 to 7 inches thick.)

A3—12 to 19 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; massive; hard, friable, sticky and plastic; few fine and medium roots; many fine and very fine interstitial pores and many fine tubular pores; many thin clay bridges between sand grains; mildly alkaline (pH 7.5); clear, wavy boundary. (7 to 8 inches thick.)

B2t—19 to 37 inches, grayish-brown (2.5Y 5/2) gravelly clay, dark grayish brown (2.5Y 4/2) moist; strong, coarse, prismatic structure; very hard, firm, sticky and plastic; few fine roots; many very fine interstitial and tubular pores and many fine interstitial pores; continuous thin and moderately thick clay films on ped surfaces and in pores; mildly alkaline (pH 7.5); clear, wavy boundary. (16 to 20 inches thick.)

B3t—37 to 50 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong, medium, subangular blocky structure; very hard, firm, sticky and plastic; many very fine interstitial and tubular pores; many thin and moderately thick clay films on ped surfaces and in pores; slightly calcareous; moderately alkaline (pH 8.0); clear, wavy boundary. (12 to 16 inches thick.)

Cca—50 to 72 inches, light yellowish-brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; many very fine and fine interstitial and tubular pores; calcareous; moderately alkaline (pH 8.0).

The A horizon is typically dark gray but ranges to dark grayish brown and grayish brown. Texture is clay loam or silty clay loam, and the reaction is slightly acid to mildly alkaline. The B horizon is dark grayish brown or grayish brown. Texture is clay, gravelly clay, or gravelly heavy clay loam, and the reaction is mildly alkaline to moderately alkaline. The C horizon is yellowish-brown or light yellowish-brown gravelly clay loam or clay loam.

Included with this soil in mapping are a few areas of Pleasanton gravelly loam and Hillgate silt loam, and a few small areas of brown clay loams that are similar to the Rincon soils.

The available water holding capacity is about 9 to 11 inches. Permeability in the subsoil is slow. Runoff is very slow, and erosion is not a hazard. Fertility is high. Effective rooting depth is very deep but is somewhat restricted by the clay subsoil.

This soil is used for irrigated row crops, grapes, apricots, prunes, walnuts, dryland hay, and pasture. Capability unit IIs–3 (14).

Rincon clay loam, 2 to 9 percent slopes, eroded (RaC2).—This soil is on fans and has dominantly 3 to 6 percent slopes. The surface layer is grayish brown.

Included with this soil in mapping are a few areas of Rincon soils that have a gravelly clay loam surface layer, Cropley clay, and Hillgate silt loam.

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

This soil is used for irrigated row crops, prunes, apricots, walnuts, grapes, dryland hay, and pasture. Capability unit IIe–3 (14).

Riverwash

Riverwash (Rg) is a mixture of sand, gravel, and cobblestones that contains little or no silt and clay. It is the loose mass of material that occupies stream channels and is exposed at low water. Riverwash is subject to movement in spring during periods of runoff and during stream flooding. The vegetation consists of willows, sycamore trees, oak trees, herbs, and clumps of perennial and annual grasses.

Included with this land type along the major drainageways are fine-textured to medium-textured materials of very steep to vertical streambanks that are actively eroding and sloughing.

Riverwash has little value for farming; however, a few areas may have limited use as wildlife habitat. A few areas along the larger streams are used as a source of sand and gravel. Capability unit VIIIw–4 (14, 15).

Rock Land

Rock land (RnG) consists of areas in which outcroppings of sedimentary or igneous rock cover 25 percent or more of the surface. Thickness and texture of the soil material between the rock outcroppings is variable. Slopes are 50 to 75 percent. Vegetation is mainly brush.

Included with this land type are areas of Vallecitos rocky loam, Gaviota loam, and Montara rocky clay loam.

This land type is used mainly for wildlife, recreation, and watershed. Capability unit VIIIs–1 (15).

San Andreas Series

The San Andreas series consists of well-drained fine sandy loams that are underlain by sandstone bedrock at a depth of 22 to 30 inches. These soils lie on uplands and have slopes of 15 to 75 percent. The vegetation, where these soils are not cultivated, is annual grasses and forbs, scattered live oak trees, and patches of coastal sage. Eleva-

tion ranges from 400 to 2,500 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. San Andreas soils are associated with the Los Osos and San Ysidro soils.

In a representative profile, the surface layer is grayish-brown, medium acid fine sandy loam about 14 inches thick. The subsoil is light brownish-gray, medium acid sandy loam that is underlain at a depth of about 23 inches by pale-brown, coarse-grained soft sandstone.

San Andreas soils are used for dryland vineyards and range.

San Andreas fine sandy loam, 30 to 75 percent slopes, eroded (SaG2).—This soil is on uplands, and in places some slopes are more than 75 percent.

Representative profile (about 100 feet up on south-facing hillside from intersection of Burchell Road and State Highway 152, Hecker Pass):

01—1 inch to 0, partially decomposed leaves, needles, and twigs; abrupt, smooth boundary.

A11—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; strong, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores and common fine tubular pores; medium acid (pH 6.0); clear, wavy boundary. (4 to 8 inches thick.)

A12—5 to 14 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few medium and coarse roots; many very fine interstitial and tubular pores, and few medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (8 to 10 inches thick.)

B2—14 to 23 inches, light brownish-gray (10YR 6/2) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few medium and coarse roots; many very fine interstitial and tubular pores and few medium tubular pores; few thin clay coatings on sand grains and clay films in pores; medium acid (pH 6.0); clear, regular boundary. (10 to 12 inches thick.)

C—23 inches, pale-brown, coarse-grained soft sandstone.

The A horizon is commonly grayish brown but ranges to brown. North slopes are generally dark grayish brown. Reaction is slightly acid to medium acid. Texture of the A horizon is commonly fine sandy loam but ranges from sandy loam to very fine sandy loam. The B horizon is light brownish gray or pale brown. Reaction is slightly acid to medium acid. Texture of the B horizon is similar to that of the A horizon, but it commonly contains slightly more clay; however, the increase is less than 3 percent. Soft sandstone is at depth of 22 to 30 inches.

Included with this soil in mapping are small areas that have been subject to severe sheet and rill erosion, areas of rock outcrops, and areas of loamy sand.

The available water holding capacity is 3 to 4.5 inches. Permeability is moderately rapid. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil is moderately fertile. Effective rooting depth is moderately deep to soft sandstone.

This soil is used for range. Capability unit VIIe–1 (15); range site, Loamy.

San Andreas fine sandy loam, 15 to 30 percent slopes, eroded (SaE2).—This soil has an average slope of about 20 percent.

452-859—74——3

Included with this soil in mapping are some areas that have many shallow gullies and areas where the substratum is exposed.

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

This soil is used for dryland grapes and range. Capability unit VIe–1 (15); range site, Loamy.

San Benito Series

The San Benito series consists of well-drained clay loams that are underlain by calcareous interbedded sandstone and shale at a depth of 20 to 48 inches. These soils lie on uplands and have slopes of 15 to 75 percent. The vegetation is annual grasses and forbs, oak trees, and some brush. Elevation ranges from 400 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. San Benito soils are associated with the Los Osos and Gaviota soils.

In a representative profile, the surface layer is dark grayish-brown, neutral clay loam about 26 inches thick. The substratum is yellowish-brown, calcareous, moderately alkaline clay loam that is underlain at a depth of 39 inches by yellowish-brown, calcareous shale. In some places these soils are eroded.

San Benito soils are used for watershed, dryland hay, pasture, and range.

San Benito clay loam, 50 to 75 percent slopes (SbG).—This soil is on side slopes in areas of moderately steep soils or in areas of narrow, winding ridgetops. Slopes are dominantly between 50 and 55 percent.

Representative profile (0.7 mile east on Highway 152 from San Felipe Road and about 200 feet north on hillside):

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; strong, medium, subangular blocky structure, parting to moderate, medium, granular structure; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial and tubular pores and few fine tubular pores; neutral (pH 7.0); clear, wavy boundary. (6 to 8 inches thick.)

A12—5 to 26 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; moderate, coarse, subangular blocky structure; very hard, friable, sticky and plastic; common very fine roots; many very fine tubular and interstitial pores and few very fine tubular pores; neutral (pH 7.0); diffuse, wavy boundary. (14 to 22 inches thick.)

Cca—26 to 39 inches, yellowish-brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, sticky and plastic; few very fine roots; many fine and very fine tubu'ar and interstitial pores; calcareous, moderately alkaline (pH 8.0); diffuse, wavy boundary. (4 to 18 inches thick.)

R—39 inches, yellowish-brown, calcareous shale.

The A horizon is grayish brown or dark grayish brown to brown. Reaction is neutral to mildly alkaline. Texture of the A horizon is typically clay loam but in places is silty clay loam. The C horizon is pale brown or yellowish brown. Texture is clay loam or silty clay loam. Depth to bedrock ranges from 24 to 48 inches.

Included with this soil in mapping are small areas of Altamont clay, Los Gatos gravelly loam, and Vallecitos rocky loam, and of a soil that is calcareous in the surface layer.

The available water holding capacity of this soil is 5 to 10 inches, depending on depth to bedrock. Permeability

is moderately slow. Runoff is very rapid, and the hazard of erosion is very high. This soil has high fertility. Effective rooting depth is moderately deep to deep.

This soil is used for range and watershed. Capability unit VIIe–1 (15); range site, Clayey.

San Benito clay loam, 15 to 30 percent slopes, eroded (SbE2).—This soil is moderately steep and lies on rounded ridgetops on uplands. Depth to shale ranges from 32 to 43 inches.

Included with this soil in mapping are a few areas of Altamont clay and Los Gatos gravelly loam, a few areas of soils that are calcareous in the surface layer, and a few severely eroded areas.

Available water holding capacity is 6 to 9 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used for dryland hay, pasture, and range. Capability unit IVe–1 (15); range site, Clayey.

San Benito clay loam, 30 to 50 percent slopes (SbF).—This soil is on uplands and has an average slope of 35 percent.

Included with this soil in mapping are small areas of Diablo clay that occur in a complex pattern. Runoff is rapid, and the hazard of erosion is high.

This soil is used for range. Capability unit VIe–1 (15); range site, Clayey.

San Benito clay loam, 30 to 50 percent slopes, severely eroded (SbF3).—This soil is along drainageways. Sheet and rill erosion has been severe, and about 4 to 10 inches of the topsoil has been lost. Depth to shale is 20 to 36 inches. Vegetation is mostly grasses, brush, or moderately thick stands of oak trees and brush.

Included with this soil in mapping are some areas of Rock land and landslips.

The available water holding capacity is 4 to 7.5 inches. Runoff is rapid, and the hazard of erosion is high. Natural fertility is moderate.

This soil is used for range. Capability unit VIIe–1 (15); range site, Clayey.

Santa Lucia Series

The Santa Lucia series consists of well-drained shaly loams that are underlain by hard, shattered shale at a depth of 20 to 32 inches. These soils lie on uplands and have slopes of 30 to 75 percent. Vegetation is annual grasses and forbs, oak trees, and brush. Elevation ranges from 500 to 2,000 feet. Average annual rainfall is 20 to 35 inches, and average annual temperature is about 58° to 60° F. The growing season is 200 to 250 days. Santa Lucia soils are associated with the Felton, Los Osos, and Madonna soils.

In a representative profile, the surface layer is gray, medium acid shaly loam and shaly clay loam about 14 inches thick. The subsoil is gray, medium acid very shaly clay loam that is underlain at a depth of about 23 inches by very pale brown fractured shale.

Santa Lucia soils are used for range, wildlife, and watershed.

Santa Lucia shaly loam, 50 to 75 percent slopes (ScG).—This soil is on uplands that have narrow ridgetops. The slope averages between 55 to 75 percent.

Representative profile (1 mile down jeep trail toward Pescadero Creek from Atherton Peak):

A11—0 to 4 inches, gray (10YR 5/1) shaly loam containing 35 percent (by volume) shale fragments, very dark gray (10YR 3/1) moist; strong, medium and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots, and few medium and coarse roots; many very fine interstitial pores, common fine tubular pores, and few medium tubular pores; medium acid (pH 5.6); clear, smooth boundary. (3 to 6 inches thick.)

A12—4 to 14 inches, gray (10YR 5/1) shaly clay loam containing 40 percent (by volume) medium and fine weathered shale fragments, very dark gray (10YR 3/1) moist; moderate, medium, subangular blocky structure; common very fine and medium roots and few coarse roots; many very fine interstitial pores, common fine tubular pores, and few medium tubular pores; medium acid (pH 5.6); clear, wavy boundary. (9 to 14 inches thick.)

B2—14 to 23 inches, gray (10YR 6/1) very shaly heavy clay loam containing about 60 percent (by volume) medium and fine weathered shale fragments and 10 percent (by volume) larger than 1 inch; dark gray (10YR 4/1) moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; many very fine interstitial pores, common fine pores, and few medium tubular pores; medium acid (pH 5.6); abrupt, irregular boundary. (8 to 12 inches thick.)

R—23 inches, very pale brown, hard, fractured Monterey shale.

The A horizon is gray or dark gray. Reaction ranges from strongly acid to medium acid and changes little with depth. Texture is shaly loam or shaly clay loam, and 15 to 60 percent (by volume) is weathered shale fragments. The shale fragments, on working, readily break down to silt and clay-sized materials. Below a depth of 10 inches, the average content of shale fragments is more than 50 percent. Depth to hard, shattered shale bedrock ranges from 20 to 32 inches.

The dark colors in this soil are not so deep in the profile as in the Santa Lucia soils elsewhere in California, but this does not affect its use and management.

Included with this soil in mapping are some areas of Felton silt loam, areas that have been subject to severe sheet erosion, and a few areas where slopes range to 80 percent.

The available water holding capacity is 2 to 4 inches. Permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. This soil is moderately fertile. Effective rooting depth is moderately deep.

This soil is used for range, wildlife, and watershed. Most of this soil has a dense cover of brush and hardwood. Capability unit VIIe–1 (15); range site, Loamy.

Santa Lucia shaly loam, 30 to 50 percent slopes, eroded (ScF2).—This soil is on uplands and has an average slope of about 35 percent. Most areas of this soil are located in the southwestern part of the survey area, along the Santa Cruz-Santa Clara County line. Because of moderate sheet erosion, the average depth to bedrock is about 21 inches. Vegetation consists of areas of grass, of grass and oak trees, or of brush.

Included with this soil in mapping are areas of Rock land and small areas of shallow, shaly soils. There are also a few areas of soils that have slopes of 15 to 30 percent.

Runoff is rapid, and the hazard of erosion is high. Available water holding capacity averages 2 to 3 inches.

This soil is used for range. Capability unit VIe–1 (15); range site, Loamy.

San Ysidro Series

The San Ysidro series consists of moderately well drained loams that are underlain by old alluvium from material derived from sedimentary rock. These soils are on fans and terraces and have slopes of 0 to 5 percent. The vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are scattered oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. San Ysidro soils are associated with the Pleasanton and Hillgate soils.

In a representative profile, the surface layer is light brownish-gray, medium acid loam that is about 18 inches thick and is underlain by 2 inches of light-gray, slightly acid, mottled loam. The subsoil is mottled, brown and yellowish-brown, slightly acid and neutral clay that is 16 inches thick over light yellowish-brown, calcareous, moderately alkaline clay loam. At a depth of 50 inches, the substratum is mottled, light yellowish-brown, calcareous, moderately alkaline sandy clay loam.

San Ysidro soils are used for irrigated row crops, apricots, prunes, vineyards, dryland hay, and pasture.

San Ysidro loam, 0 to 2 percent slopes (SdA).—This soil is in depressional areas and has smooth slopes.

Representative profile (two tree rows west and nine tree rows south of shop in prune orchard on Alfred Angelino ranch, about 1,500 feet east on Godfrey Avenue from intersection with Furlong Avenue):

Ap—1 to 5 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial pores; medium acid (pH 6.0); abrupt, smooth boundary. (5 to 10 inches thick.)

A1—5 to 18 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, nonsticky and slightly plastic; few very fine and fine roots; many very fine interstitial and tubular pores and few medium tubular pores; medium acid (pH 6.0); clear, wavy boundary. (12 to 14 inches thick.)

A2—18 to 20 inches, light-gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; common, fine, distinct, pale brown (10YR 6/3) mottles, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial and tubular pores and few medium tubular pores; slightly acid (pH 6.5); abrupt, wavy boundary (1 to 6 inches thick.)

B21t—20 to 28 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; few, medium, faint, yellowish-brown (10YR 5/4) mottles, dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure; very hard, firm, sticky and plastic; many very fine interstitial and tubular pores and few medium tubular pores; many moderately thick clay films on ped surfaces and in pores; slightly acid (pH 6.5); clear, wavy boundary. (8 to 10 inches thick.)

B22t—28 to 36 inches, yellowish-brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and plastic; many fine tubular pores; continuous, moderately thick and thick clay films on ped surfaces and in pores; neutral (pH 7.0); clear, wavy boundary. (8 to 10 inches thick.)

B3t—36 to 50 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/6) moist; weak, medium, subangular blocky structure; very hard, firm, sticky and plastic; many very fine and fine tubular pores and few medium tubular pores; common thin clay films in pores and on ped surfaces; slightly calcareous, moderately alkaline (pH 8.0); gradual, wavy boundary. (12 to 16 inches thick.)

C—50 to 60 inches, light yellowish-brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/6) moist; massive; hard, friable, sticky and plastic; many very fine interstitial and tubular pores and few medium tubular pores; slightly calcareous, moderately alkaline (pH 8.0).

The A1 horizon is light brownish gray or pale brown. Texture is loam or very fine sandy loam. Reaction is medium acid to strongly acid and increases with depth. The A2 horizon ranges from 1 to 6 inches in thickness. The B2t horizon is heavy clay loam or clay. Reaction is slightly acid to mildly alkaline. The C horizon is stratified but is commonly sandy clay loam or gravelly clay loam. It is slightly calcareous in places.

Included with this soil in mapping are small areas of Arbuckle gravelly loam and Pleasanton loam, and about 90 acres, south of Highland Avenue along the west branch of Llagas Creek, that is covered by grayish-brown clay loam overwash.

The available water holding capacity of this soil is 7 to 8 inches. It has a very slowly permeable clay subsoil. During the winter months it becomes ponded. The hazard of erosion is none to slight. Fertility is low. Effective rooting depth generally is very deep.

This soil is used for irrigated row crops, apricots, prunes, and grapes. A few acres are used for dryland grain hay and pasture. Because of the clay subsoil, this soil is best suited to shallow-rooted crops. Capability unit IIIs–3 (14).

San Ysidro loam, 2 to 5 percent slopes, eroded (SdB2).—This soil is on fans and has an average slope of about 4 percent.

Included with this soil in mapping are small areas of Arbuckle gravelly loam and Pleasanton loam.

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

This soil is used for dryland grain hay and pasture. Capability unit IIIe–3 (14).

San Ysidro Series, Acid Variant

The San Ysidro series, acid variant, consists of moderately well drained loams formed in old alluvium from sedimentary rock. These soils are on fans and terraces and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, consists chiefly of annual grasses and forbs, and there are scattered oak trees. Elevation ranges from 200 to 2,000 feet. Average annual rainfall is 16 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is 260 to 275 days. These soils are associated with the Hillgate and Pleasanton soils.

In a representative profile, the surface layer is light brownish-gray, medium acid loam about 15 inches thick. It is underlain by a subsurface layer of light-gray, mottled, medium acid loam. At a depth of about 20 inches is a band of mottled and mixed yellowish-brown, pale-brown, and light-gray, medium acid clay loam 9 inches thick. The subsoil is light yellowish-brown and strong-brown, strongly acid clay and gravelly clay loam to a depth of more than 60 inches.

The San Ysidro variant is used for irrigated row crops, apricots, prunes, grapes, and dryland hay and pasture.

San Ysidro loam, acid variant, 0 to 2 percent slopes (SfA).—This soil is on old fans. It is similar to San Ysidro loam, 0 to 2 percent slopes, but has a strongly acid subsoil.

Representative profile (250 feet west of Center Road,

0.6 mile south of Church Street and about 2.25 miles southeast of San Martin):

Ap—0 to 4 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores and common fine and medium tubular pores; medium acid (pH 6.0); clear, smooth boundary. (4 to 5 inches thick.)

A11—4 to 10 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, coarse, angular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial pores and common fine and medium tubular pores; slightly compacted because of tillage; medium acid (pH 6.0); gradual, smooth boundary. (6 to 8 inches thick.)

A12—10 to 15 inches, light brownish-gray (10YR 6/2) heavy loam with common, fine, distinct, brown (7.5YR 5/4) mottles, dark grayish brown (10YR 4/2) moist; massive; very hard, friable, sticky and plastic; very few very fine and medium roots; many very fine interstitial pores and common fine and medium tubular pores; few reddish-brown manganese and iron concretions 1 to 2 millimeters thick; medium acid (pH 6.0); clear, smooth boundary. (4 to 6 inches thick.)

A2—15 to 20 inches, light-gray (10YR 7/2) heavy loam with common, fine, distinct, brown (10YR 5/3) mottles; brown (10YR 5/3, 7.5YR 4/2) moist; massive; very hard, friable, sticky and plastic; very few, very fine and medium roots; many very fine interstitial pores and common fine and medium tubular pores; common, fine, very dark reddish-brown manganese and iron concretions 1 to 2 millimeters thick; medium acid (pH 6.0); gradual, wavy boundary. (2 to 8 inches thick.)

B&A—20 to 29 inches, mottled and mixed yellowish-brown, pale-brown, and light-gray (10YR 5/4, 6/3, 7/2) clay loam, dark grayish brown, dark brown, and brown (10YR 4/2, 4/3, 5/3) moist; massive; very hard, firm, sticky and plastic; very few very fine roots; common very fine interstitial pores, common very fine tubular pores, and few fine tubular pores; common, thin clay bridges between sand grains in brownish parts; common, fine, dark reddish-brown to black manganese and iron concretions 1 millimeter thick, mainly in upper part that has mostly light-gray color; medium acid (pH 6.0); gradual, smooth boundary. (2 to 8 inches thick.)

B2t—29 to 42 inches, light yellowish-brown (10YR 6/4) light clay, brown (10YR 5/5, 4/4 rubbed) moist; massive; very hard, firm, and somewhat brittle, sticky and plastic; common very fine interstitial pores, common fine tubular pores, and few very fine and medium tubular pores; many thin clay bridges between sand grains; a few prominent joints that suggest very coarse polygonal prisms have moderately thick yellowish-brown (10YR 5/4) clay films and black manganese stains in a dendritic pattern; strongly acid (pH 5.2); gradual, smooth boundary. (14 to 20 inches thick.)

B3t—42 to 60 inches, strong-brown (7.5YR 5/6) gravelly heavy clay loam, dark brown (7.5YR 4/4) moist; massive; hard, firm, and slightly brittle, sticky and plastic; many very fine interstitial pores and few fine tubular pores; continuous moderately thick clay bridges between sand grains; some joints have moderately thick dark-brown (7.5YR 4/4) clay films, and black manganese veins ⅛ to ¾ inch across and several inches long; many sandstone pebbles are strongly weathered and are yellowish when cut; strongly acid (pH 5.4); gradual, smooth boundary.

The A horizon is light brownish gray and light gray or grayish brown. Texture is loam or very fine sandy loam but ranges to sandy loam. The B horizon is light yellowish brown, strong brown, or brown. The texture is heavy clay loam or clay. Depth to the very slowly permeable B2t horizon is 18 to 35 inches.

Included with this soil in mapping are a few areas of Hillgate silt loam and Pleasanton loam.

The available water holding capacity is 6 to 9 inches. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is low. Effective rooting depth generally is very deep.

This soil is used for irrigated row crops, apricots, prunes, grapes, dryland hay, and pasture. Capability unit IIIs–3 (14).

San Ysidro loam, acid variant, 2 to 9 percent slopes (SfC).—This soil has an average slope of 5 percent.

Included with this soil in mapping are areas that have been subject to moderate sheet erosion and areas of Hillgate silt loam.

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

This soil is used for irrigated row crops, apricots, prunes, and grapes. A few areas are used for dryland hay and pasture. Capability unit IIIe–3 (14).

Sunnyvale Series

The Sunnyvale series consists of poorly drained silty clays that are underlain by alluvium from material derived from sedimentary rock. These soils are in low positions on the alluvial plains and have slopes of less than 2 percent. The vegetation, where these soils are not cultivated, is plants that require much water, annual grasses, and forbs. Elevation ranges from 100 to 300 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is 250 to 275 days. Sunnyvale soils are associated with the Campbell and Clear Lake soils.

In a representative profile, the surface layer is dark-gray, calcareous, moderately alkaline silty clay about 14 inches thick. It is underlain by light-gray and gray, calcareous, moderately alkaline silty clay to a depth of 60 inches or more. In some places these soils are drained.

Sunnyvale soils are used for irrigated row crops, orchards, and pasture.

Sunnyvale silty clay, drained (Sv).—This soil is on low alluvial plains and has slopes of less than 2 percent.

Representative profile (100 feet west of intersection of Santa Teresa and Laguna Roads, two tree rows north in a prune orchard):

Ap—0 to 6 inches, dark-gray (N 4/0) silty clay, very dark gray (N 3/0) moist; strong, fine, granular structure; hard, very friable, sticky and plastic; common very fine and fine roots; many very fine interstitial pores; slightly calcareous, moderately alkaline (pH 8.0); clear, smooth boundary. (6 to 8 inches thick.)

A1ca—6 to 14 inches, dark-gray (N 4/0) silty clay, very dark gray (N 3/0) moist; strong, fine, subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many very fine interstitial and tubular pores and few fine tubular pores; calcareous, with soft, medium, irregular lime masses; moderately alkaline (pH 8.0); gradual, wavy boundary. (6 to 10 inches thick.)

C1ca—14 to 34 inches, light-gray (N 7/0) silty clay, dark gray (N 4/0) moist; strong, medium, subangular blocky structure; very hard, friable, sticky and plastic; few fine roots; many very fine interstitial and tubular pores; very strongly calcareous, with many, large, irregularly shaped, soft lime masses and few hard lime concretions; moderately alkaline (pH 8.0); gradual, wavy boundary. (18 to 22 inches thick.)

C2gca—34 to 42 inches, gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; many, fine, distinct, light yellowish-brown (2.5Y 6/4) mottles, light olive brown (2.5Y 5/4) moist; strong, medium, subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many very fine interstitial and tubular pores; strongly calcareous, with many large, irregularly shaped, soft lime masses; moderately alkaline (pH 8.0); clear, smooth boundary. (8 to 10 inches thick.)

C3g—42 to 60 inches, light-gray (5Y 7/1) silty clay, gray (5Y 5/1) moist; many, fine, distinct, light yellowish-brown (2.5Y 6/4) mottles, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; many very fine interstitial and tubular pores; weakly calcareous; moderately alkaline (pH 8.0).

The A horizon is silty clay or heavy silty clay loam. The C horizon is typically gray to white, and texture is silty clay or silty clay loam. Lime is disseminated, but there are few to many lime masses and few to common hard lime concretions.

Included with this soil in mapping are some areas of Clear Lake clay and a few small areas that are strongly calcareous in the surface layer.

Available water holding capacity of this soil is 9 to 10 inches. Drainage has been improved because of the general lowering of the water table in the valley. Permeability is slow, and water sometimes is ponded during winter months. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated row crops, sugar beets, prunes, and pears. Where orchard crops are grown, definite symptoms of chlorosis are present because of the lime content of the soil. Capability unit IIs–5 (14).

Sunnyvale silty clay (Su).—This nearly level soil has a profile similar to that of Sunnyvale silty clay, drained, but it has a seasonal water table at a depth of 30 to 60 inches. Near Tulare Hill this soil has been flooded twice in about 10 years.

Included with this soil in mapping are a few small areas that are highly calcareous, a few areas that are salty in the surface layer, about 5 acres of Pacheco silt loam, just south of Tulare Hill, and a few acres of Willows clay. About 20 acres of this soil has buried black clay at a depth of 2 to 3 feet.

Effective rooting depth of this soil is very deep but is restricted by the seasonal water table. Available water holding capacity is 9 to 10 inches where this soil is drained. Natural fertility is moderate.

This soil is used for irrigated row crops and pasture. Capability unit IIIw–5 (14).

Terrace Escarpments

Terrace escarpments (TeF) consists of areas of steep, old terraces and generally has slopes of 30 to 50 percent. This land type is associated with the Hillgate, Keefers, and Pleasanton soils. It has not developed distinct horizons, but it generally consists of material of gravelly loam or clay loam texture. Vegetation is mostly annual grasses, forbs, and scattered oak trees.

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

This land type is used for limited range, wildlife, and watershed Capability unit VIIe–1 (15); range site, Loamy.

Vallecitos Series

The Vallecitos series consists of well-drained loams that are underlain by sedimentary and metasedimentary bedrock at depths of 13 to 30 inches. These soils are on uplands and have slopes of 15 to 75 percent. Vegetation is annual grasses, forbs, and oak trees. Elevation ranges from 300 to 3,500 feet. Average annual rainfall is about 16 to 25 inches, and average annual temperature is about 58° to 60° F. The growing season is about 200 to 250 days. Vallecitos soils are associated with the Gaviota and Los Gatos soils.

In a representative profile, the surface layer is brown, slightly acid and medium acid loam about 10 inches thick. The subsoil is dark-brown and reddish brown, medium acid clay loam and clay. It is underlain at a depth of 19 inches by bluish-gray metamorphosed shale. Rock outcrops cover 2 to 10 percent of the surface.

Vallecitos soils are used for range, wildlife, recreation, and watershed.

Vallecitos rocky loam, 15 to 30 percent slopes, eroded (VaE2).—This soil is in large areas of steeper soils on hills that have broad, rounded ridges. Slopes average slightly less than 30 percent.

Representative profile (175 feet west from intersection of the county line road from Pacheco Pass Highway):

A11—0 to 2 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial and tubular pores; slightly acid (pH 6.5); clear, smooth boundary. (1 to 2 inches thick.)

A12—2 to 10 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores and few fine and medium tubular pores; medium acid (pH 6.0); abrupt, smooth boundary. (7 to 8 inches thick.)

B1t—10 to 16 inches, dark-brown (7.5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine interstitial and tubular pores and few fine and medium tubular pores; common thin clay films on bridges between sand grains and clay films in pores; medium acid (pH 6.0); abrupt, broken boundary. (0 to 8 inches thick.)

B2t—16 to 19 inches, reddish-brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; many very fine and fine tubular pores; continuous, moderately thick clay films on ped surfaces and in pores; medium acid (pH 6.0); abrupt, broken boundary. (0 to 12 inches thick.)

R—19 inches, bluish-gray, metamorphosed shale.

The A horizon is brown or grayish brown. Reaction is medium acid to neutral. The texture is loam or light clay loam. Rock outcroppings cover 2 to 10 percent of the surface. The B2t horizon is typically reddish brown but ranges to dark brown or dark reddish brown. Reaction is medium acid to neutral. The texture is clay loam or clay. The Bt horizon is missing in places or is only in fracture planes of the bedrock. Depth to bedrock is 16 to 30 inches.

Included with this soil in mapping are similar soils that have a brown subsoil, small areas of Rock land, areas that have been subject to severe sheet and rill erosion, and small areas of Montara rocky clay loam and Gaviota rocky loam. Also included are areas along drainageways where slopes range up to 45 percent, a few areas of a gray, moderately alkaline soil, and areas that have soft serpentine shale at a depth of 4 feet or more.

The available water holding capacity is 3 to 6 inches, depending on depth to bedrock. Permeability in the subsoil is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Natural fertility is moderate. Effective rooting depth is shallow to moderately deep to bedrock.

This soil is used for range. Natural vegetation is mostly grasses, forbs, and scattered oak trees. The surface over much of the area is crusted from being trampled by livestock. Capability unit VIe–7 (15); range site, Shallow Loamy.

Vallecitos rocky loam, 50 to 75 percent slopes, eroded (VaG2).—This soil is on uplands that have narrow, somewhat angular to rounded, winding ridgetops. Slopes generally range from 50 to 60 percent. This soil has a profile similar to that of Vallecitos rocky loam, 15 to 30 percent slopes, eroded, but it is more shallow. It averages about 16 inches to bedrock but ranges from 13 to 24 inches.

Included with this soil in mapping are some areas of Gaviota rocky loam and, on the north slopes, Los Osos clay loam.

The available water holding capacity is 2 to 5 inches. Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for range, wildlife, recreation, and watershed. Natural vegetation is generally grasses, forbs, and scattered oak and Digger pine trees, but some of the more eroded areas have a thin brush cover. Capability unit VIIe–7 (15); range site, Shallow Loamy.

Willows Series

The Willows series consists of poorly drained clays that are underlain by alluvium from material derived from sedimentary rock. These soils are in low positions on the alluvial plains and have slopes of less than 2 percent. The vegetation, where these soils are not cultivated, consists of saline-alkali tolerant grasses and forbs. Elevation ranges from 100 to 400 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Willows soils are associated with the Clear Lake and Pacheco soils.

In a representative profile, the surface layer is dark-gray, moderately alkaline, calcareous clay about 12 inches thick. The substratum is mottled, olive-gray and light olive-gray, strongly alkaline, calcareous clay to a depth of 60 inches or more. Deep cracks develop in the surface layer and upper part of the substratum when these soils are dry. The soils contain slight to moderate concentrations of soluble salts and alkali salts.

Willows soils are used for irrigated row crops and pasture.

Willows clay (Wa).—This soil is in low positions on alluvial plains. It has no well-defined drainage channels. Slopes are less than 2 percent.

Representative profile (south on Frazer Lake Road, ⅜ of a mile from Bloomfield Avenue intersection and ⅜ of a mile north into field, toward the Pajaro River):

Ap—0 to 6 inches, dark-gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; moderate, medium and fine, granular structure; very hard, firm, sticky and very plastic; few very fine and medium roots; many very fine interstitial and tubular pores and few medium tubular pores; slightly calcareous, moderately alkaline (pH 8.0); abrupt, smooth boundary. (4 to 7 inches thick.)

A1—6 to 12 inches, dark-gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; few, fine, distinct, light brownish-gray (2.5Y 6/2) mottles, light olive brown (2.5Y 5/4) moist; strong, coarse, angular, blocky structure; extremely hard, very firm, sticky and very plastic; many very fine roots and few medium roots; many very fine interstitial and tubular pores and few medium tubular pores; many intersecting slickensides; slightly calcareous, moderately alkaline (pH 8.0); clear, smooth boundary. (6 to 8 inches thick.)

C1ca—12 to 31 inches, olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; many, fine, distinct, brown (10YR 5/3) mottles, dark brown (10YR 4/3) moist; strong, coarse, prismatic structure; extremely hard, very firm, sticky and very plastic; common very fine and medium roots; many very fine interstitial and tubular pores and few medium tubular pores; many intersecting slickensides; strongly effervescent, with lime in seams and soft masses; few medium-sized gypsum crystals lining some pores; strongly alkaline (pH 8.5); clear, smooth boundary. (18 to 25 inches thick.)

C2—31 to 60 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; common, fine, distinct, brown (10YR 5/3) mottles, dark brown (10YR 4/3) moist, and few, medium, distinct, gray (5Y 5/1) mottles; massive; very hard, firm, sticky and plastic; many very fine interstitial and tubular pores and few medium tubular pores; many intersecting slickensides in the upper 10 inches; strongly effervescent; strongly alkaline (pH 8.5).

The A horizon is commonly dark gray or dark grayish brown. Lime is generally present. Few to many medium-sized salt crystals commonly are in the A and C horizons. When this soil is dry, deep cracks develop that ordinarily are ½ to 1½ inches in width. The C horizon is olive gray, light olive gray, or light yellowish brown. Distinct mottles start at an average depth of 12 inches and are light brownish gray, brown, or gray.

Included with this soil in mapping are some areas of Clear Lake clay and a few areas of a soil that has 2 to 5 percent slopes. About 20 percent of this acreage is covered by overwash material, 10 to 20 inches thick, of sandy clay loam texture.

The natural fertility of this soil is affected by moderate concentrations of soluble salts. Effective rooting depth is restricted by a water table that fluctuates seasonally between depths of 20 and 40 inches. The soil generally is ponded during winter. The available water holding capacity is 6 to 7.5 inches. Permeability is slow, and erosion is not a problem.

This soil is used mostly for pasture. A few areas are used for irrigated row crops. Capability unit IVw–6 (14).

Yolo Series

The Yolo series consists of well-drained loams that are underlain by alluvium from sedimentary rock. These soils are on alluvial plains and fans and have slopes of 0 to 9 percent. The vegetation, where these soils are not cultivated, is mainly annual grasses and forbs, and there are a few scattered oak trees. Elevation ranges from 400 to 2,400 feet. Average annual rainfall is 15 to 25 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Yolo soils are associated with the Campbell, Esparto, and Zamora soils.

In a representative profile, the surface layer is grayish-brown, neutral and mildly alkaline loam about 29 inches thick. The substratum is brown, mildly alkaline silt loam to a depth of 60 inches or more. In some places the surface layer is silty clay loam.

Yolo soils are used mainly for irrigated row crops, orchards, vineyards, dryland hay, and pasture. Large areas are also used for housing and commercial development. These are the most productive soils in the Santa Clara Valley.

Yolo loam, 0 to 2 percent slopes (YaA).—This soil is on alluvial plains and fans. Representative profile (in field 20 feet east of San Antonio Creek, 0.25 mile north of Harney School, in San Antonio Valley in northwest corner of NW¼NE¼ sec. 1, T. 7 S., R. 4 E.):

Ap—0 to 7 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; neutral (pH 6.6); clear, smooth boundary. (6 to 8 inches thick.)

A1—7 to 29 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial and tubular pores and few fine and medium tubular pores; mildly alkaline (pH 7.5); clear, smooth boundary. (20 to 24 inches thick.)

C—29 to 60 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores and few medium and fine tubular pores; mildly alkaline (pH 7.5).

The A horizon is grayish brown or brown. Texture is commonly loam but in places is silt loam or light clay loam. Reaction is mildly alkaline to slightly acid. The C horizon is brown, yellowish brown, or light yellowish brown. Reaction is neutral to mildly alkaline. The C horizon is stratified and is silt loam, silty clay loam, clay loam, or loam in texture. This horizon has an average texture of silt loam or loam and is 10 to 40 inches deep. Lime is present in the C horizon below a depth of 40 inches in places.

Included with this soil in mapping are areas of Yolo silty clay loam, areas of a soil that is pale brown in the surface layer, areas of Zamora clay loam, and areas of Garretson soils.

Available water capacity is about 10 to 11 inches. Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is high. The effective rooting depth is very deep.

This soil is used partly for irrigated row crops, prunes, apricots, walnuts, pears, dryland hay, and pasture. About 50 percent of the acreage of this soil is used for housing and commercial development. Capability unit I–1 (14) and IIIc–1 (15).

Yolo loam, 2 to 5 percent slopes (YaB).—This soil is on small to medium-sized fans. It has a profile similar to that of Yolo loam, 0 to 2 percent slopes, except that the texture of the surface layer is loam or light clay loam.

Included with this soil in mapping are areas of Garretson gravelly loam and Yolo loam that have slopes that range to 9 percent.

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

This soil is used for irrigated row crops, prunes, apricots, walnuts, dryland hay, and pasture. Capability unit IIe–1 (14) and IIIe–1 (15).

Yolo silty clay loam, 0 to 2 percent slopes (YeA).—This soil is on alluvial plains. Texture of the surface layer and substratum is silty clay loam or clay loam.

Included with this soil in mapping are small areas of Garretson gravelly loam, narrow areas of slope breaks, and areas of Campbell silty clay loam.

Available water holding capacity is 11 to 12 inches. Permeability is moderately slow. Runoff is very slow, and erosion is not a problem.

This soil is used partly for irrigated row crops, prunes, apricots, walnuts, pears, grapes, and dryland hay and pasture. About 50 percent of the acreage of this soil is used for housing and commercial development. Capability unit I–1 (14).

Yolo silty clay loam, 2 to 9 percent slopes (YeC).—This soil is on alluvial fans and has slopes that average 5 percent. It has a profile similar to that of Yolo loam, 0 to 2 percent slopes, but the surface layer and substratum are silty clay loam or clay loam.

Included with this soil in mapping are some areas of Garretson gravelly loam and Pleasanton gravelly loam.

Available water holding capacity is 11 to 12 inches. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for irrigated row crops, prunes, apricots, walnuts, pears, grapes, and dryland pasture. Capability unit IIe–1 (14).

Zamora Series

The Zamora series consists of well-drained clay loams that are underlain by alluvium of mixed origin. These soils have slopes of 0 to 9 percent and are on alluvial fans. The vegetation, where these soils are not cultivated, is chiefly annual grasses and forbs, and there are scattered oak trees. Elevation ranges from 200 to 1,000 feet. Average annual rainfall is 16 to 20 inches, and average annual temperature is 58° to 60° F. The growing season is about 250 to 275 days. Zamora soils are associated with the Pleasanton and Yolo soils.

In a representative profile, the surface layer is dark grayish-brown, neutral clay loam about 15 inches thick. In some places the surface layer is loam. The subsoil is dark-brown and brown, neutral clay loam that is underlain at a depth of 35 inches by brown and pale-brown, neutral sandy clay loam and gravelly sandy clay loam that extend to a depth of 60 inches or more.

Zamora soils are used mainly for irrigated row crops, orchards, vineyards, and dryland hay and pasture. A few areas are used for housing and commercial development.

Zamora clay loam, 0 to 2 percent slopes (ZbA).—This soil is on alluvial fans in the Paradise Valley area and in smaller areas throughout the survey area.

Representative profile (in prune orchard about 30 feet southwest of intersection of Bowden Avenue and Watsonville Road):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial pores; neutral (pH 7.0); abrupt, smooth boundary. (6 to 8 inches thick.)

A1—7 to 15 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; few very fine and medium roots; neutral (pH 7.0); clear, smooth boundary. (6 to 12 inches thick.)

B21t—15 to 26 inches, dark-brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; few very fine and medium roots; many very fine interstitial and tubular pores and few medium tubular pores; continuous, thick clay film on ped sur-

faces and in pores; neutral (pH 7.0); clear, wavy boundary. (11 to 14 inches thick.)

B22t—26 to 35 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles, dark yellowish brown (10YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine interstitial and tubular pores and few medium tubular pores; many thin clay films on ped surfaces and in pores; neutral (pH 7.0); clear, smooth boundary. (9 to 16 inches thick.)

C1—35 to 58 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, sticky and plastic; many very fine interstitial and tubular pores; neutral (pH 7.0); clear, smooth boundary. (20 to 30 inches thick.)

C2—58 to 70 inches, pale-brown (10YR 6/3) gravelly sandy clay loam containing about 30 percent (by volume) gravel, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine interstitial pores; neutral (pH 7.0).

The A horizon is commonly dark grayish brown but in places is grayish brown or dark brown. Texture of the A and B horizons is clay loam or silty clay loam. There is a slight increase in the content of clay from the A horizon to the B horizon. Reaction is neutral to slightly acid and changes little with depth.

Included with this soil in mapping are some areas of Pleasanton loam and small bodies of Yolo loam.

Available water holding capacity is 11 to 12 inches. Runoff is very slow, and the hazard of erosion is none to slight. Permeability in the subsoil is moderately slow. Fertility is high. Effective rooting depth is very deep.

This soil is used for irrigated row crops, prunes, apricots, walnuts, grapes, and dryland hay and pasture. Capability unit I–3 (14).

Zamora loam, 0 to 2 percent slopes (ZaA).—This soil is on small fans throughout the survey area. The surface layer is grayish brown, and the texture is loam or light clay loam that contains about 3 to 8 percent (by volume) medium and fine gravel.

Included with this soil in mapping are areas of Pleasanton loam and Yolo loam.

This soil is used mainly for irrigated row crops, apricots, prunes, walnuts, grapes, and dryland hay and pasture. A few acres are used for housing and commercial development. Capability unit I–3 (14).

Zamora loam, 2 to 9 percent slopes (ZaC).—This soil has an average slope between 3 to 6 percent. The surface layer is grayish brown. Texture is loam or light clay loam that contains about 3 to 8 percent (by volume) medium and fine gravel.

Included with this soil in mapping are areas of Hillgate silt loam and Pleasanton loam.

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

This soil is used for irrigated row crops, apricots, prunes, walnuts, grapes, and dryland pasture and hay. Capability unit IIe–1 (14).

Zamora clay loam, 2 to 9 percent slopes (ZbC).—This soil is in small to medium-sized areas on fans. Average slope is 3 to 5 percent. Texture is silty clay loam, clay loam, or gravelly clay loam.

Included with this soil in mapping are areas of gravelly clay loam and gravelly loam.

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

This soil is used for irrigated row crops, prunes, apricots, walnuts, grapes, and dryland pasture and hay. Capability unit IIe–1 (14).

Zamora and Cropley soils, 2 to 9 percent slopes, severely eroded (ZeC3).—These soils are on fans and toe slopes. Slopes are mostly short and run toward deeply cut channels. These soils have been damaged by severe gully and sheet erosion.

The Zamora clay loam has a profile similar to that of Zamora clay loam, 0 to 2 percent slopes, and the Cropley clay has a profile similar to that of Cropley clay, 0 to 2 percent slopes.

Included with this mapping unit are areas of Azule clay loam, Diablo clay, and Los Osos clay loam.

Zamora and Cropley soils are used for dryland pasture. Uneven surfaces, gullies, and deposition make cultivation of these soils difficult. Capability unit IVe–5 (15).

Use and Management of the Soils

Soil productivity depends on the characteristics of the soils, the climate of the area in which they occur, and the management they receive. The characteristics of the soils and the climate generally cannot be changed. Management, however, can be controlled, and changes in the systems of management can cause the productivity and quality of crops or livestock products to vary greatly. Changes in management systems are made by varying one or more of many practices, including crop rotation, irrigation, land leveling, fertilization, tillage, erosion control, and drainage.

In this section the system of capability grouping used by the Soil Conservation Service is explained and suggestions for managing soils in each capability group are given. Following this, the Storie Index rating is discussed and the yields of the soils for the more important crops in the survey area are given. This is followed by subsections on range, wildlife, and engineering uses of the soils.

Capability Groups of Soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The classification does not apply to rice and other crops having special requirements. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

Class I. Soils that have few limitations that restrict their use.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III. Soils that have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Class IV. Soils that have very severe limitations that restrict the choice of plants or require very careful management, or both.

Class V. Soils subject to little or no erosion but that have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover. (None in the Eastern Santa Clara Area)

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 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 the Eastern Santa Clara Area but not in all parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

Capability units in California 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. The numerals used to designate units within the classes and subclasses are these:

0. A problem or limitation caused by sand and gravel in the substratum.
1. An erosion hazard, actual or potential.
2. A problem or limitation of wetness caused by poor drainage or flooding.
3. A problem or limitation caused by slow or very slow permeability of the subsoil or substratum.
4. A problem or limitation caused by coarse soil texture or excessive gravel.
5. A problem or limitation caused by a fine textured or moderately fine textured surface soil.
6. A problem of limitation caused by salt or alkali.
7. A problem or limitation caused by cobbles, stones, or rock outcrop.
8. A problem or limitation caused by shallow depth of soil over bedrock.
9. A problem or limitation caused by low fertility or by toxicity.

Land resource areas

In the Eastern Santa Clara Area, capability classification is further refined by designating the land resource area in which the soils in a unit lie. A land resource area is a broad geographic area that has a distinct combination of climate, soils, management needs, and cropping systems. Parts of three of these areas lie in the survey area. These areas and their members are the forested upland soils along the Santa Clara-Santa Cruz County line (4), the Santa Clara Valley (14), and the upland pasture and range soils on both sides of the valley (15).

This section includes a description of each resource area of which part lies in the survey area and assumptions made by land resource areas for capability groupings. Soils in two resource areas may be similar and have the same capability unit and symbol, but use and management may differ. For these reasons capability unit symbols are followed by resource area numbers in parentheses.

Land Resource Area 4 covers the western part of the survey area along the crest of the Santa Cruz Mountains and extends generally 2 to 6 miles eastward. The natural cover is Douglas-fir and redwood. A few areas have been logged. The elevation of this resource area ranges from 500 to 3,500 feet, and the average annual rainfall is 35 to 50 inches.

Major conservation problems in the use of these soils are steep slopes, shallowness to bedrock and a slight to severe hazard of erosion. Fire control, proper logging methods, and sustained yield practices reduce erosion.

Basic facts and assumptions considered in establishing the capability classification for this land resource area are as follows:

1. Climate is characterized by warm summers and cool, moist, mild winters; the frost-free season lasts 200 to 250 days, and the beneficial moisture effects of fog on the plants is equivalent to about 4 inches of annual rainfall.
2. Irrigation is not required, because the soils are mainly managed as forest land.
3. Crops consist primarily of Douglas-fir, redwood, and Christmas trees.
4. Control of flooding is not practical for individual farms and ranches.
5. A moderately high level of management is used.
6. A soil depth of 20 inches and an available water holding capacity of 3 inches are sufficient for annual forage plants.

Land Resource Area 14 consists of the valley bottoms, alluvial fans, and low terraces along the edges of the Santa Clara Valley. This area is level to moderately sloping. The elevation ranges from 100 to 2,400 feet, and the average annual rainfall is 15 to 25 inches.

Many of the soils in this resource area require intensive conservation and management practices if their full potential is to be utilized. The soils at the lower end of the Santa Clara Valley are poorly drained. Flooding and deposition occur along the major streams. Generally the soils do not seriously erode. Maintenance of soil structure requires careful attention on the intensively managed soils. There is a growing shortage of water for irrigation.

Basic facts and assumptions considered in establishing the capability classification for this land resource area are as follows:

1. Climate is characterized by warm summers and cool, moist, mild winters; the frost-free season lasts 250 to 275 days; and beneficial coastal fogs occur over most of the area.
2. Irrigation water is or will be available for all irrigable soils in the area.
3. Land damage by flooding has been greatly reduced, but flooding still occurs in some areas.
4. Drainage has been improved, but more is needed on some soils.
5. A wide variety of the commonly cultivated field, truck, forage, fruit, and nut crops are grown, subject to limitations imposed by individual soils.
6. A moderately high level of management is used.
7. Erosion on the steeper slopes needs to be reduced.

Land Resource Area 15 covers the eastern part of the county that is part of the Diablo Range and the lower foothill areas of the Santa Cruz Mountains. The soils are rolling on hills and are moderately steep to very steep on mountainous uplands. The elevation ranges from 100 to 4,000 feet, and the average annual rainfall is 15 to 50 inches. Natural vegetation is generally grass or oak-grass, but the north slopes are wooded. Most areas of these soils are used for range, wildlife, recreation, and watershed. This is the largest land resource area of the county.

The major conservation needs of this land resource area have been caused by overgrazing and the farming of steep, shallow soils. The soils on the steep slopes have moderate to high erosion hazard and are eroded in many places. Many of the soils are shallow to bedrock, and some are stony and rocky. The low available water holding capacity of many of the soils is caused by shallowness and gravel. Some of the soils derived from serpentine rock have very low fertility.

Basic assumptions considered in establishing the capability classification for the soils in this land resource area are as follows:

1. Irrigation water is not available for any of the soils in the area.
2. Crops are limited and consist primarily of pasture, range, and dryland grain hay.
3. Control of flooding is not practical for individual farms and ranches.
4. A moderately high level of management is used.
5. Soils that have an available water holding capacity of 3 inches are suited to annual forage plants.
6. The evapotranspiration rate, which is the computed amount of water loss under existing conditions of temperature and precipitation for a 12-month period, is 12 to 14 inches.

Management by capability units

In the following pages, the capability units in the Eastern Santa Clara Area are described and suggestions for the 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 in the series are in that particular capability unit.

The soils in each unit are listed in the "Guide to Mapping Units" at the back of this soil survey, and they are more fully described in the section "Descriptions of the Soils."

CAPABILITY UNIT I-1 (14)

This unit consists of very deep, well-drained, nearly level soils on alluvial plains and fans, and soils formed under conditions of poor or somewhat poor drainage that has been altered by pumping for irrigation. Slopes are less than 2 percent. These soils are in the Campbell, Garretson, Pacheco, and Yolo series. They have a loam, silt loam, clay loam, or silty clay loam surface layer and substratum. Also in this unit are the Garretson and Pacheco soils, gravelly substratum, which have stratified sand and gravel at a depth of 36 to 60 inches. Campbell silty clay loam and Pacheco silt loam that have been drained are also in this unit because the seasonal water table that existed during their development is now below the 60-inch root zone.

The soils in this unit are neutral to moderately alkaline throughout the profile. In places the moderately alkaline soils are calcareous in the substratum. Favorable rooting depth is 60 inches or more. Permeability is moderate to moderately slow. Runoff is very slow, and hazard of erosion is none to slight. Fertility is moderate to high. The available water holding capacity is about 7.5 to 12 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

The soils in this unit are the most productive in the survey area and permit a wide range of climatically adapted crops to be grown. These soils are used for orchards, vineyards, dryland hay, pasture, and row crops, including beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. The orchard crops are pears, apricots, cherries, prunes, and walnuts.

The soils of this unit have almost no permanent limitations, but leveling cuts must be restricted on Garretson and Pacheco soils, gravelly substratum. It is important to maintain organic-matter content by using green-manure crops, growing crops in suitable rotations, and turning under all crop residue. A good crop rotation for the soils in this unit includes a green-manure crop every 3 to 5 years interchanged with pasture or alfalfa and row crops. In orchards, the green-manure crops need to be planted in fall.

These soils may be irrigated by furrow, border, contour-basin, or sprinkler methods. They can be leveled or graded without difficulty to improve methods of irrigation management where needed. All crops respond well to fertilizer, and a nitrogen fertilizer is especially beneficial for most crops; however, fertilizer needs vary according to the crop.

CAPABILITY UNIT I-3 (14)

This unit consists of very deep, well-drained, nearly level soils that have a moderately fine textured subsoil and are on fans. Slopes average less than 2 percent. These soils are in the Los Robles, Pleasanton, and Zamora series. They have a loam or clay loam surface layer and a gravelly clay loam or clay loam subsoil. The substratum is gravelly sandy clay loam.

The soils in this unit are slightly acid to neutral throughout the profile. Favorable rooting depth is more than 60 inches. Permeability in the subsoil is moderately slow. Runoff is very slow, and erosion is not a hazard. Fertility is moderate or high. The available water holding capacity is 8 to 12 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

These soils are suited to a wide range of climatically adapted crops. They are used for row crops, orchards, vineyards, dryland hay, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, and tomatoes. Principal orchard crops are apricots, prunes, and walnuts.

Organic-matter content of these soils can be maintained by including a green-manure crop in the rotation every 3 to 5 years, by returning all crop residue to the soil, and by growing irrigated pasture or alfalfa in rotation with row crops.

These soils may be irrigated by furrow, border, contour-basin, or sprinkler methods. All crops respond well to fertilizer, and a nitrogen fertilizer is especially beneficial for most corps; however, fertilizer needs vary according to the crop. Care must be taken in leveling or smoothing these soils to avoid exposing the subsoil, which is more difficult to manage than the surface layer.

CAPABILITY UNIT IIe-1 (14)

This unit consists of very deep, well-drained, gently sloping to moderately sloping soils that lie on alluvial plains and fans. Slopes range from 2 to 9 percent. These soils are in the Garretson, Los Robles, Pleasanton, Yolo, and Zamora series. They have a loam, gravelly loam, clay loam, and silty clay loam surface layer. Texture of the subsoil or substratum is silt loam, silty clay loam, clay loam, gravelly loam, or gravelly clay loam.

The soils in this unit are slightly acid to mildly alkaline throughout the profile. Favorable rooting depth is 60 inches or more. Permeability is moderately rapid to moderately slow. Runoff is very slow to medium, and the hazard of erosion is none to moderate. Fertility is moderate to high. The available water holding capacity is about 7 to 12 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

These soils are suited to a wide range of climatically adapted crops grown in the survey area. They are used for orchards, row crops, vineyards, dryland hay, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Principal orchard crops are apricots, prunes, and walnuts.

The soils in this unit can be protected from sheet and gully erosion by tilling across the slope, planting a cover crop, and rotating crops with pasture every 3 to 5 years. Cover crops and all crop residue should be turned under as a green-manure crop to help maintain organic-matter content and improve soil structure.

Because of slopes, these soils are limited to furrow and sprinkler irrigation systems. Where slopes are long or runoff water from higher areas crosses fields, diversions should be provided to convey all excess water to controlled outlets. A nitrogen fertilizer is beneficial to most crops, but need for fertilizer varies according to the crop grown.

CAPABILITY UNIT IIe-3 (14)

Rincon clay loam, 2 to 9 percent slopes, eroded, is the only soil in this unit. This is a very deep, well-drained, gently sloping to moderately sloping soil on fans. It has a clay loam surface layer, a gravelly clay subsoil, and a clay loam substratum.

This soil is neutral in the surface layer and is moderately alkaline and calcareous in the lower part of the subsoil and in the substratum. Roots penetrate to a depth of more than 60 inches. Permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Natural fertility is high. The available water holding capacity is 9 to 11 inches. The average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

This soil is suited to almost all climatically adapted crops. It is used for irrigated row crops, prunes, apricots, walnuts, grapes, dryland hay, and pasture. Walnuts are not so well suited as other tree crops because of the slowly permeable clay subsoil.

To slow runoff water and control erosion, all cultivation or tillage should be across the slope. Cover crops in orchards also help to control erosion. Cover crops, green-manure crops, crop residue, or other sources of organic matter should be returned to the soil to improve soil structure and increase the infiltration rate.

Sprinklers are the best method of applying irrigation water, although furrows laid out on the contour or across the slope are also satisfactory.

Applications of a nitrogen fertilizer generally benefit most crops; however, fertilizer needs vary according to the crop and should be determined by soil or plant tissue tests.

CAPABILITY UNIT IIe-5 (14)

Cropley clay, 2 to 9 percent slopes, is the only soil in this unit. This is a very deep, well-drained, gently sloping to moderately sloping soil on fans. It has a clay surface layer and substratum. This soil is neutral to moderately alkaline and is calcareous in the substratum. Favorable rooting depth is more than 60 inches. Permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Natural fertility is high. The available water holding capacity is about 8.5 to 10 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 260 to 275 days.

The soil in this unit is suited to a wide range of climatically adapted crops grown in the survey area. It is used for row crops, orchards, vineyards, dryland hay, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Principal orchard crops are apricots, pears, prunes, and walnuts.

The clay surface layer makes this soil difficult to till unless the content of soil moisture is right. This soil can be protected from sheet and gully erosion by tilling and planting across the slope and by rotating crops with pasture every 3 to 5 years. A fall cover crop should be planted in orchards. Cover crops and all crop residue should be returned to the soil to help maintain organic-matter con-

tent and improve soil structure. This soil is limited to furrow and sprinkler irrigation systems because of slope.

Fertilizer needs vary according to the crop grown.

CAPABILITY UNIT IIw-2 (14)

This unit consists of deep, poorly drained, nearly level soils on alluvial flood plains. Slopes average less than 2 percent. These soils are in the Pacheco series. They have a fine sandy loam or clay loam surface layer. They have a calcareous, mottled, stratified substratum that is mainly loam and very fine sandy loam in texture.

The soils in this unit are moderately alkaline. Favorable rooting depth is restricted by a seasonal water table at a depth of 3 to 4 feet. Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. A few areas are subject to flooding (fig. 4) about twice in 10 years, which may destroy early crops. Fertility is moderate. The available water holding capacity is 9 to 11 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

These soils are suited to a wide range of climatically adapted shallow-rooted crops. They are used for row crops and pears. Principal row crops grown are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Except for pears, orchard crops are not well suited unless drainage is improved.

To maintain soil fertility and good soil structure, a crop rotation that includes a grass-legume crop every 3 to 4 years should be used. Also, green-manure crops add needed organic matter.

Because of the low position and poor drainage of these soils, excess water collects on the surface from higher lying areas. Such water should be diverted into suitable outlets. Mole drains, open drains, and tile drains can be used to lower the water table and remove excess water. Irrigation must be controlled to prevent ponding and waterlogging; sprinkler irrigation is the best system for controlling the quantity of water applied. Furrow irrigation should be carefully managed.

All crops respond readily to fertilization, but fertilizer needs vary according to the crop grown.

CAPABILITY UNIT IIs-3 (14)

Rincon clay loam, 0 to 2 percent slopes, is the only soil in this unit. This is a well-drained, nearly level soil on fans. It has a clay loam surface layer, a gravelly clay subsoil, and a clay loam substratum.

This soil is neutral in the upper part and is moderately alkaline and calcareous in the lower part of the subsoil and in the substratum. The favorable rooting depth is more than 60 inches. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is high. The available water holding capacity is 9 to 11 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

Figure 4.—**Flooded area of Pacheco clay loam about 5 miles south of Gilroy.**

This soil is suited to a wide variety of climatically adapted crops. It is used for irrigated row crops, grapes, apricots, prunes, walnuts, and dryland hay and pasture. Pears are a well suited tree crop, although other trees do well on this soil. Walnuts are not so well suited as other tree crops because of the slowly permeable gravelly clay subsoil.

Green-manure crops, crop residue, or other sources of organic matter should be returned to the soil to improve soil structure, increase the infiltration rate, and maintain the organic-matter content.

This soil is difficult to till except at the proper moisture content. Water from adjacent areas tends to collect on this soil unless it is protected. All methods of irrigation are suited to this soil; however, furrows need to be carefully managed to assure proper water distribution throughout the profile.

Fertilizer needs vary according to the crop grown and should be determined by plant tissue or soil tests.

CAPABILITY UNIT IIs-4 (14)

This unit consists of very deep, well-drained, nearly level, gravelly soils on fans. Slopes range from 0 to 2 percent. These soils are in the Arbuckle and Pleasanton series. They have a gravelly loam surface layer and a gravelly loam, gravelly clay loam, and gravelly sandy clay loam subsoil. Some areas of these soils have a substratum of very gravelly sandy loam.

The soils in this unit are medium acid to moderately alkaline in both the surface layer and the subsoil. Favorable rooting depth is more than 60 inches. Permeability in the subsoil is moderate to moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is moderate. The available water holding capacity is 5 to 8 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

The soils of this unit are suited to a wide range of climatically adapted crops grown in the survey area. Dry-farmed crops, however, are limited because of the moderate to high available water holding capacity. These soils are used for limited row crops, orchards, vineyards, grain hay, and pasture. Principal row crops grown are beans, peppers, and tomatoes. Principal orchard crops are apricots, prunes, and walnuts.

Cover crops and green-manure crops help to maintain soil structure and organic-matter content. All crop residue should be returned to the soil.

There is generally enough gravel present to interfere slightly with tillage operations. Applications of irrigation water must be light and frequent to prevent loss of water by deep percolation. Water can best be applied by using a sprinkler irrigation system. If furrow or border irrigation is used, short runs should be used to prevent excessive percolation and leaching of nutrients from the soil. All crops respond to nitrogen fertilizers, and some crops respond to phosphorus.

CAPABILITY UNIT IIs-5 (14)

This unit consists of very deep, well-drained to poorly drained, nearly level soils on alluvial plains and fans. Slopes average less than 2 percent. These soils are in the Campbell, Clear Lake, Cropley, and Sunnyvale series. They have a clay or silty clay surface layer and substratum.

The soils in this unit are neutral to moderately alkaline in both the surface layer and substratum. In some places the soils are calcareous in the lower part of the surface layer or in the substratum. Favorable rooting depth is more than 60 inches. Permeability in the subsoil is moderately slow to slow. Runoff is very slow, but a few areas of these soils may be ponded during the winter. Fertility is high. The available water holding capacity is about 8 to 12 inches. The water table that existed during the development of the poorly drained and somewhat poorly drained soils is now below the zone that will affect plant roots. The present drainage has been brought about by pumping water for irrigation. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

These soils are suited to a wide range of climatically adapted crops grown in the survey area. They are used for row crops, orchards, vineyards, dryland hay, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Orchard crops are apricots, prunes, pears, and walnuts. Of the deciduous fruit trees grown in the area, pears are best suited to these soils.

The silty clay or clay surface layer of these soils is difficult to till unless soil moisture is right. To maintain soil fertility and soil structure, a crop rotation should be used. Also, green-manure crops will add needed organic matter.

Because of very slow runoff, excess water from higher lying areas tends to collect on these soils. Such water should be diverted into suitable outlets. Irrigation must be controlled to prevent ponding and waterlogging. Sprinkler irrigation systems can best control the quantity of water applied. Furrow irrigation should be carefully managed.

All crops respond readily to application of fertilizer on these soils; however, fertilizer needs vary according to the crop.

CAPABILITY UNIT IIIe-1 (15)

This unit consists of deep and very deep, well drained and moderately well drained, nearly level to moderately sloping soils on alluvial fans. Slopes range from 0 to 9 percent. These soils are in the Arbuckle, Esparto, Garretson, and Yolo series. They have a gravelly loam and loam surface layer, a gravelly loam, silt loam, and clay loam subsoil, and a very gravelly sandy loam, gravelly clay loam, and silt loam substratum.

Reaction in the surface layer is slightly acid to mildly alkaline. Favorable rooting depth is 38 inches to more than 60 inches. Permeability in the subsoil is moderate to moderately slow. Runoff is very slow to medium, and the hazard of erosion is none to moderate. Fertility is moderate to high. The available water holding capacity is about 5.5 to 12 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

Because irrigation water is not available, the soils in this unit are better suited to climatically adapted dryland crops than to crops requiring irrigation. They are used for dryland grain hay and pasture.

Tillage and planting should be across the slope to slow runoff during rainy seasons. A crop rotation that provides plants with many roots and incorporates crop residue is needed to increase the water infiltration rate and to improve the soil structure. Where slopes are long, or runoff water from higher areas crosses fields, diversions should be provided to convey all water to controlled outlets.

Applications of nitrogen and phosphorus fertilizers generally benefit most crops, except in years when rainfall is below average.

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CAPABILITY UNIT IIIe-3 (14)

This unit consists of very deep, well drained and moderately well drained, gently sloping to moderately sloping soils on old terraces and fans. Slopes range from 2 to 9 percent. These soils are in the Hillgate and San Ysidro series and San Ysidro variant. They have a silt loam, clay loam, and loam surface layer and a clay or very gravelly clay subsoil. The substratum consists of sandy clay loam or clay loam. Keefers clay loam, 2 to 9 percent slopes, is included with this unit because its use and management are similar to that of the other soils in the unit.

The soils in this unit are strongly acid to moderately alkaline. Depth to the clay subsoil is 19 to 36 inches. Permeability in the subsoil is slow to very slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Fertility is low to moderate. The available water holding capacity is about 6.5 to 9 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 200 to 275 days.

These soils are suited to shallow-rooted crops. They are used for orchards, vineyards, dryland hay, and pasture. Principal orchard crops are apricots and prunes.

The major restrictions in the use of these soils result from slope and limited soil depth. All tillage and planting should be on the contour or across the slope. In orchards, an annual cover crop should be planted and fertilized. Cover crops help to prevent erosion during the rainy season, and in spring they should be turned under as a green-manure crop to add needed organic matter.

Irrigation must be carefully controlled to avoid saturation of the soil above the very slowly and slowly permeable subsoil. These soils are best suited to sprinkler irrigation systems; however, furrow irrigation is satisfactory where the grade is about 0.5 percent. Waterways and protected outlets should be provided for runoff water.

Fertilizer applications should be based on individual crop needs.

CAPABILITY UNIT IIIe-3 (15)

Azule clay loam, 9 to 15 percent slopes, eroded, is the only soil in this unit. This is a very deep, well-drained, strongly sloping soil on uplands. It has a clay loam surface layer, a gravelly sandy clay subsoil, and a gravelly sandy clay loam substratum.

This soil is medium acid throughout the profile. Roots can penetrate to a depth of 60 inches. Permeability is slow. Runoff is medium, and the hazard of erosion is moderate. Fertility is high. The available water holding capacity is 7 to 8 inches. The average annual rainfall is 16 to 25 inches, and the growing season is 200 to 250 days.

Because irrigation water is not available, this soil is better suited to climatically adapted dryland crops than to crops requiring irrigation. It is used for dryland prunes, grapes, grain hay, and pasture.

To reduce runoff and control erosion, tillage operations should be across the slope or on the contour. A crop rotation that includes plants that produce fine roots helps to improve soil structure, to increase the water infiltration rate, and to maintain the organic-matter content. Returning crop residue or adding organic matter to the soil also helps to maintain the organic-matter content. Where slopes are long, or where runoff water from higher areas crosses this soil, diversions should be provided to convey all excess water to controlled outlets. Fertilizer should be applied according to crop needs, as determined by soil or plant tissue tests.

CAPABILITY UNIT IIIe-5 (15)

Diablo clay, 9 to 15 percent slopes, is the only soil in this unit. This is a moderately deep to deep, well-drained, strongly sloping soil on uplands. It has a clay surface layer and substratum and is underlain by soft calcareous sandstone. This soil is mildly alkaline to moderately alkaline and is calcareous in the substratum. Favorable rooting depth is 26 to 56 inches. Permeability in the subsoil is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is high. Available water holding capacity is about 3 to 7 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

Because irrigation water is not available, this soil is better suited to climatically adapted dryland crops than to crops requiring irrigation. It is used for dryland orchards, vineyards, grain hay, pasture, and range. Prunes are the principal orchard crop.

The clay surface layer is difficult to till if the moisture content is not right. To slow runoff water during the rainy season and to decrease the risk of sheet, rill, and gully erosion, tillage and planting should be across the slope. Using a crop rotation that includes plants that provide many roots and plowing under crop residue are needed to increase the water infiltration rate and to improve soil structure. Where slopes are long, or runoff water from higher areas crosses fields, diversions should be provided to convey all excess water to controlled outlets.

Applications of nitrogen and phosphorus fertilizers generally benefit most crops, except in years where rainfall is below average.

CAPABILITY UNIT IIIw-5 (14)

This unit consists of deep, somewhat poorly drained and poorly drained soils on alluvial flood plains. Slopes average less than 2 percent. These soils are in the Campbell, Clear Lake, and Sunnyvale series. They have a silty clay loam, clay, and silty clay surface layer and substratum. The lower part of the substratum of some of these soils consists of clay and muck.

The soils in this unit are neutral to moderately alkaline in the surface layer and substratum. A few of these soils are calcareous in the surface layer and substratum, and slight concentrations of soluble salts are present in places. Rooting depth is restricted by a seasonal water table that is at a depth of 30 to 60 inches. Permeability is slow or moderately slow. The hazard of erosion is none to slight. Runoff is very slow and may be ponded in some areas. A few areas are subject to flooding, and early crops may be destroyed. Fertility is moderate to high. The available water holding capacity is 6 to 13 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

The soils of this unit are suited to the shallow-rooted, climatically adapted crops grown in the area. These soils are used for row crops, limited orchards, and pasture. Principal row crops are beans, garlic, onions, peppers, lettuce, tomatoes, and sugar beets. Pears are the principal orchard crop. Except for pears, orchard crops are not well suited.

These soils are difficult to till except at the proper moisture content. Because of their low position and somewhat

poor to poor drainage, these soils tend to collect excess water from higher lying areas. Open drains and tile drains may be used to remove excess water and lower the water table. Irrigation must be controlled to prevent ponding and waterlogging. Sprinkler irrigation systems can best control the quantity of water applied. Furrow irrigation should be carefully managed. To maintain soil fertility and soil structure, a crop rotation that includes a grass-legume crop every 3 to 4 years should be used.

All crops respond readily to fertilizer, but fertilizer needs vary according to the crop grown. Soils that have a high lime content, combined with poor drainage, often cause lime-induced chlorosis. Where chlorosis is a problem, improved drainage and application of iron compounds directly to the crop are beneficial.

CAPABILITY UNIT IIIs-3 (14)

The unit consists of very deep, moderately well drained and well drained, nearly level soils on fans and terraces. Slopes average less than 2 percent. These soils are in the San Ysidro series and the San Ysidro series, acid variant. They have a loam and clay loam surface layer and a clay or very gravelly clay loam subsoil. The substratum consists of sandy clay loam. Keefers clay loam, 0 to 2 percent slopes, is deeper than normal for the soils in this unit but is included with this unit because it has similar use and management problems.

The soils in the unit are strongly acid to moderately alkaline. Depth to the very slowly to slowly permeable subsoil is 18 to 35 inches. Runoff is normally very slow, but some ponding may occur during winter months. The hazard of erosion is none to slight. Fertility is low to moderate. The available water holding capacity is about 5 to 9 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 250 to 275 days.

The soils of this capability unit are suited to shallow-rooted crops such as grain hay and pasture. They are used for orchards, vineyards, dryland grain hay, and pasture. Apricots, prunes, and walnuts are the principal orchard crops grown. Orchard crops are poorly suited because of the slowly and very slowly permeable subsoil.

Irrigation should be carefully controlled to prevent saturation of the surface soil. Where runoff from higher areas crosses fields, diversions should be provided to convey the water to controlled outlets (fig. 5). All crop residue should be returned to the soil to help maintain soil structure and organic-matter content. In orchards, an annual cover crop should be planted and fertilized. Cover crops help to prevent erosion during the rainy season and add needed organic matter. A nitrogen and phosphorus

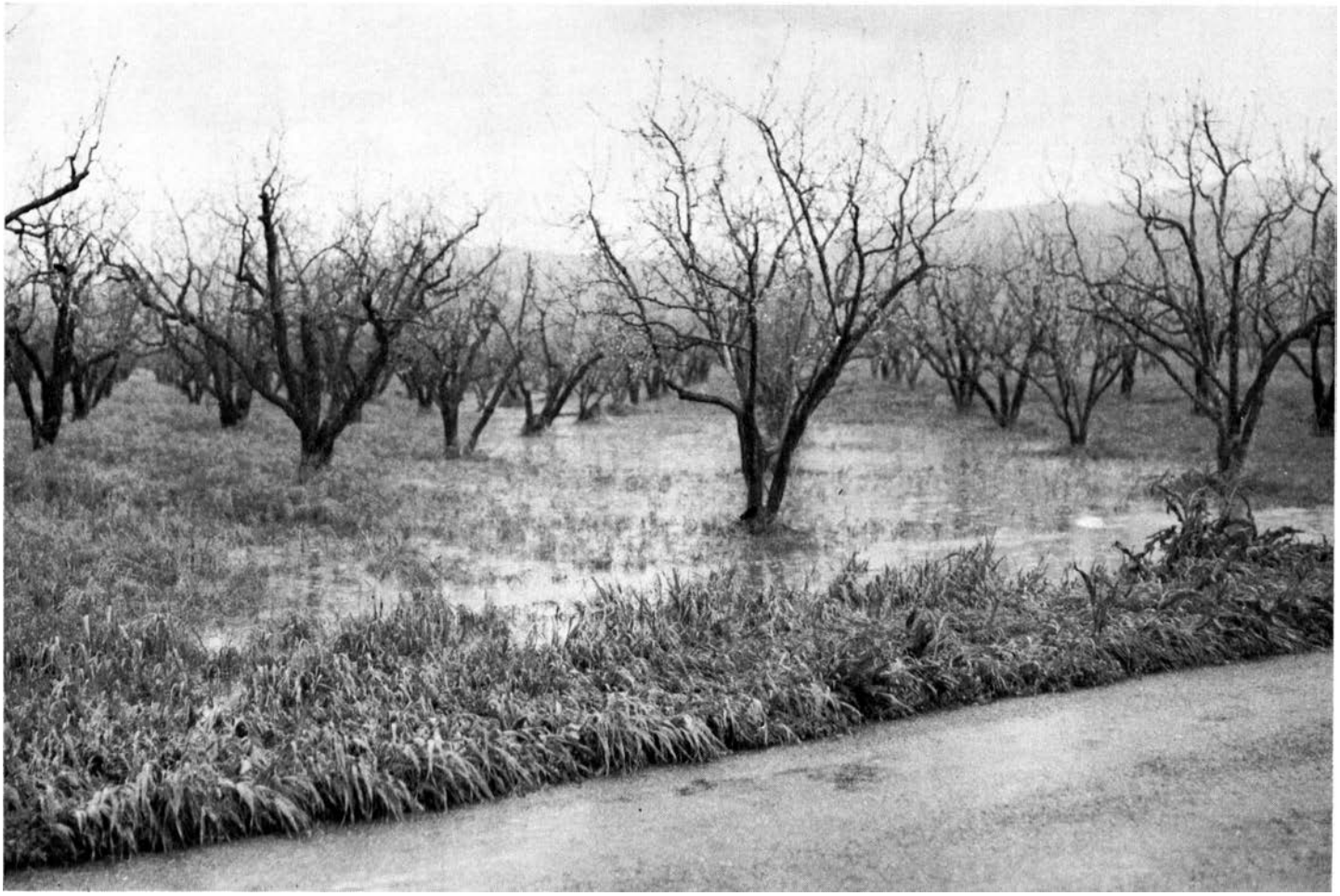

Figure 5.—**Runoff water from higher areas has accumulated in area of San Ysidro loam, 0 to 2 percent slopes.**

fertilizer generally benefits most crops, but fertilizer needs vary according to the crop grown.

CAPABILITY UNIT IIIc-1 (15)

This unit consists of very deep, well drained and moderately well drained, nearly level soils on alluvial fans. Slopes average less than 2 percent. These soils are in the Esparto, Garretson, and Yolo series. They have a loam surface layer and a silt loam, loam, and light clay loam substratum. Unconformable sand and gravel occur in some areas at a depth of 36 to 60 inches.

The soils in this unit have a medium acid to mildly alkaline surface layer. Favorable rooting depth is more than 60 inches. Permeability is moderate to moderately slow. Runoff is slow to very slow, and the hazard of erosion is none to slight. Fertility is moderate to high. The available water holding capacity is about 7.5 to 12 inches. Average annual rainfall is 15 to 25 inches, and the growing season is 250 to 275 days.

Because irrigation water is not available, the soils in this unit are better suited to climatically adapted dryland crops than to crops requiring irrigation. They are used for dryland grain hay and pasture. On grain-hay land, a green-manure crop should be planted every 3 to 4 years to help maintain organic-matter content and improve soil structure.

All crops grown on these soils respond well to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVe-1 (4)

Felton silt loam, 15 to 30 percent slopes, is the only soil in this unit. This is a moderately deep, well-drained, moderately steep soil on uplands. It has a silt loam surface layer and a clay loam subsoil. Underlying rock is interbedded shale and sandstone.

Reaction of the surface layer is medium acid. The subsoil is medium acid to strongly acid. Favorable rooting depth is 20 to 36 inches. Runoff is medium, and the hazard of erosion is moderate. Permeability in the subsoil is moderately slow. Fertility is moderate, and the available water holding capacity is about 4 to 7 inches. Average annual rainfall is 40 to 50 inches, and the growing season is 200 to 250 days.

Most areas of this soil have been cleared and used for dryland pasture; a small acreage has been planted to grain hay and Christmas trees. It is suited to Christmas trees or to timber production.

This soil is not well suited to tilled crops, because it has moderately steep slopes and a hazard of erosion. When this soil is cultivated, tillage should be across the slope to control sheet erosion. Crop residue should be returned to the soil to help maintain soil structure and organic-matter content. The soil should have a vegetative cover 3 years out of 5 if used for growing grain hay. Where slopes are long, or runoff water from higher areas crosses fields, diversions should be provided to convey all excess water to controlled outlets. Fire trails should be provided where necessary.

CAPABILITY UNIT IVe-1 (15)

This unit consists of moderately deep to very deep, well-drained, moderately sloping to moderately steep soils on uplands and terraces. Slopes range from 5 to 30 percent. These soils are in the Gilroy, Los Gatos, San Benito, and Pleasanton series. The Gilroy, Los Gatos, and San Benito soils have a gravelly loam and clay loam surface layer and a clay loam or gravelly clay loam subsoil. Their substratum consists of hard, metamorphosed basic igneous and shale bedrock or of gravelly sandy clay loam. Pleasanton gravelly loam, 9 to 15 percent slopes, eroded, differs from the Gilroy, Los Gatos, and San Benito soils. It is a very deep soil that was included in this capability unit because it needs management similar to that of the other soils in this unit.

The soils in this unit are medium acid to moderately alkaline. Favorable rooting depth is 18 to 43 inches to metamorphosed basic igneous rock or shale. Runoff is slow to rapid, and the hazard of erosion is slight to high. Fertility is moderate to high. The available water holding capacity is about 4 to 10 inches. Average annual rainfall is 16 to 40 inches, and the growing season is 200 to 255 days.

These soils are used for dryland grapes, grain hay, pasture, and range. They are best suited to grazing. Because of the slope and hazard of erosion, they should not be cultivated more than 2 years out of 5. Vineyards require either a fertilized and seeded fall cover crop or a continuous cover crop. All tillage should be as nearly on the contour as possible. All crop residue should be returned to the soil to help maintain organic-matter content and improve soil structure.

All crops grown on these soils respond well to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVe-3 (15)

This unit consists of very deep to moderately deep, well-drained, strongly sloping to moderately steep soils on uplands and terraces. Slopes range from 9 to 30 percent. These soils are in the Azule, Los Osos, and Parrish series. They have a clay loam or gravelly clay loam surface layer and a gravelly clay, gravelly sandy clay, or clay subsoil.

The soils in this unit are medium acid to strongly acid. Depth to bedrock is 24 inches to more than 60 inches. Permeability in the subsoil is slow. Runoff is slow to rapid, and the hazard of erosion is slight to high. Fertility is moderate to high. The available water holding capacity is about 4 to 9 inches. Average annual rainfall is 16 to 30 inches, and the growing season is 200 to 250 days.

These soils are best suited to grazing. They are used for vineyards, grain hay, pasture, and range. Because of the slope and hazard of erosion, they should not be cultivated more than 2 years out of 4.

Vineyards require use of intensive soil conservation practices such as growing a fertilized fall cover crop or a continuous cover crop. All tillage must be on the contour as nearly as possible. All crop residue should be returned to the soil to help maintain organic-matter content and improve soil structure. Where slopes are long, or runoff water crosses fields, diversions should be provided to convey all excess water to controlled outlets.

All crops grown on these soils respond well to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVe-5 (15)

This unit consists of moderately deep and deep, well-drained, moderately sloping to moderately steep soils on uplands. Slopes range from 9 to 30 percent. These soils are in the Altamont, Climara, Cropley, and Zamora series. They have a clay loam or clay surface layer and subsoil.

The soils in this unit are neutral to moderately alkaline. Favorable rooting depth is 20 to 56 inches and corresponds with depth to bedrock. Permeability is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is moderate to high. The available water holding capacity is about 3 to 7 inches. Average annual rainfall is 16 to 30 inches, and the growing season is 200 to 250 days. Because of similar use and management, Zamora and Cropley soils, 2 to 9 percent slopes, severely eroded, are included in this unit. Zamora soils are very deep, are moderately slowly permeable, and have a clay loam subsoil. They were included because they cannot be mapped separately from the Cropley soils. Unlike other soils in this unit, Zamora soils have up to 12 inches of available water holding capacity, surface runoff is slow, and the hazard of erosion is slight on the lesser slopes.

The soils in this unit are suited to grazing. They are used for dryland grain hay, pasture, and range. Because of the slope and hazard of erosion, they should not be cultivated more than 2 years out of 5.

The clay surface layer is difficult to till if the moisture content is not right. All tillage should be as nearly on the contour as possible. On areas used for grain hay, a green-manure crop should be planted every 4 years to help maintain organic-matter content and improve soil structure. All crop residue should be returned to the soil.

All crops grown on these soils respond well to nitrogen fertilizer. Some grasses respond to application of sulfur.

CAPABILITY UNIT IVe-8 (4)

Madonna loam, 15 to 30 percent slopes, is the only soil in this unit. This is a moderately deep, well-drained, moderately steep soil on uplands. It has a loam surface layer and subsoil. The underlying rock is hard sandstone.

The soil is medium acid. Favorable rooting depth is 20 to 28 inches. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is moderate. The available water holding capacity is 3 to 5 inches. Average annual rainfall is 35 to 50 inches, and the growing season is 200 to 250 days.

The soil in this unit is suited to pasture and range. It is used for grain hay, pasture, and range. A permanent cover, such as grasses, should be grown on these soils 3 years out of 5. All tillage should be on the contour as nearly as possible. All crop residue should be returned to the soil to help maintain organic-matter content and improve soil structure.

CAPABILITY UNIT IVw-4 (14)

Cortina very gravelly loam, 0 to 5 percent slopes, is the only soil in this unit. This is a very deep, somewhat excessively drained, gravelly soil on stream benches. It has a very gravelly loam and very gravelly fine sandy loam surface layer and a very gravelly sandy loam substratum.

This soil is slightly acid in both the surface layer and substratum. Favorable rooting depth is more than 60 inches. Permeability is rapid. Runoff is very slow, and this soil is subject to flooding 3 years out of 10. Fertility is low. The available water holding capacity is 2.5 to 4 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 250 to 275 days.

The soil in this unit is used mainly for pasture. A few areas have been planted to prunes. This soil is suited to some row crops and to orchards. Because of droughtiness and the very gravelly texture, dryland crops do not do well.

Dikes or other water control structures should be provided to protect crops and the soil from damaging overflow. Applications of irrigation water must be light and frequent to prevent loss of water by deep percolation. Water can best be controlled by using a sprinkler irrigation system. Cover crops and green-manure crops help to maintain soil structure and organic-matter content. All crop residue should be returned to the soil.

Crops grown on this soil respond to applications of nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVw-6 (14)

Willows clay is the only soil in this unit. This is a poorly drained, very deep soil that has slight to moderate soluble salt and alkali concentrations in basins and low positions on the alluvial plains. Slopes average less than 2 percent. This soil has a moderately alkaline clay surface layer and is underlain by a strongly alkaline clay substratum. Favorable rooting depth is restricted by a seasonal water table at a depth of 20 to 40 inches. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Fertility is low. The available water holding capacity is 6 to 7.5 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 250 to 275 days.

This soil is used for limited row crops and pasture. It is best suited to salt-tolerant pasture. Leached areas that have improved drainage can be used for limited salt-tolerant row crops and grain hay.

Because the basic water intake rate is very slow, irrigation water is difficult to manage. Excess amounts of water are needed to leach salts in order to prevent their accumulation in the upper part of the surface layer. Drains are needed to improve the natural drainage conditions as well as to remove excess water and leached salts during irrigation. Both open and closed drains can be used.

Soil amendments are generally needed on this soil. For example, annually adding approximately 3 tons of 90 percent gypsum per acre lowers the alkali content to a level the crops can tolerate. Generally, the upper 12 inches of the surface layer of this soil can be reclaimed and maintained. Substratum reclamation, however, has proven difficult. The surface layer should be leached so as to obtain a good emergence of seed for adapted crops. Crop residue or other organic matter should be returned to the soil to improve the structure and tilth.

CAPABILITY UNIT IVs-9 (14)

Maxwell clay, 0 to 5 percent slopes, is the only soil in this unit. This is a very deep, moderately well drained, nearly level to gently sloping soil on fans. It has a neutral to mildly alkaline clay surface layer that is underlain by a moderately alkaline clay and gravelly clay loam substratum.

This soil has a favorable rooting depth of more than 60 inches. Permeability is slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. Fertility is low because of an unfavorable calcium-magnesium ratio. The available water holding capacity is 8 to 10 inches. Average annual rainfall is 16 to 20 inches, and the growing season is 260 to 275 days.

This soil is used for limited orchards, dryland grain hay, and pasture. The only orchard crop grown is prunes.

Because of low fertility, this soil is better suited to pasture than to most other uses.

Crop residue should be returned to the soil to improve soil structure. The clay texture of the surface layer makes tillage difficult unless the moisture content is right. Excess water from higher lying areas may collect on the surface and should be diverted into suitable outlets. Irrigation must be controlled to prevent ponding and waterlogging. Sprinkler irrigation systems can best control the quantity of water applied.

Use of fertilizer has not proven economical.

CAPABILITY UNIT VIe-1 (4)

Felton silt loam, 30 to 50 percent slopes, is the only soil in this unit. This is a moderately deep to deep, well-drained, steep soil on uplands. It has a silt loam surface layer and a clay loam subsoil. Underlying rock is interbedded shale and sandstone.

This soil is medium acid in the surface layer and medium acid to strongly acid in the subsoil. Favorable rooting depth is 35 to 59 inches. Permeability in the subsoil is moderately slow. Runoff is rapid, and the hazard of erosion is high. The available water holding capacity ranges from 5 to 10 inches. Fertility is moderate. Average annual rainfall is 40 to 50 inches, and the growing season is 200 to 250 days.

This soil is used for timber production and range. It is best suited to timber production, Christmas tree production, and grazing. This soil should not be used for cultivated crops.

The soil in this unit should have a permanent cover because of the steep slopes and high hazard of erosion. To keep sheet and gully erosion to a minimum, the gradient of logging roads should not exceed 12 percent. Adequate ditches and culverts should be provided on main roads for control of runoff water. Placing slash on landings and skid trails after logging helps to prevent gullies. Slash should be kept out of streams to maintain accessibility to fish and other wildlife and to prevent flooding. Fire trails should be provided where needed.

CAPABILITY UNIT VIe-1 (15)

This unit consists of moderately deep to deep, well-drained, moderately steep to steep soils on uplands. Slopes range from 15 to 50 percent. These soils are in the Gilroy, San Andreas, San Benito, and Santa Lucia series. They have a fine sandy loam, clay loam, and gravelly or shaly loam surface layer. Texture of the subsoil is sandy loam, clay loam, gravelly clay loam, or very shaly clay loam. The substratum is hard, shattered sandstone, shale, or basic igneous rock.

The soils in this unit are medium acid to moderately alkaline. Permeability is moderately slow to moderately rapid. Depth to bedrock is 20 to 50 inches. Runoff is rapid, and the hazard of erosion is high. Fertility is moderate to high. The available water holding capacity is about 2 to 10 inches. Average annual rainfall is 16 to 40 inches, and the growing season is 200 to 250 days.

These soils are used for grapes and range. Because of the hazard of erosion, they are best suited to grazing.

The soils in this unit should not be cultivated, except to prepare a seedbed to plant better forage grasses and legumes. Proper grazing management is needed to obtain good yields of forage and to control sheet and gully erosion. Fire trails should be provided where needed. Nitrogen, phosphorus, and sulfur fertilizers, applied in adequate amounts before the first rain, increase early production of forage.

CAPABILITY UNIT VIe-3 (15)

This unit consists of moderately deep to deep, well-drained, strongly sloping to steep soils on uplands and terraces. These soils are in the Hillgate, Los Osos, and Parrish series. They have a silt loam, clay loam, or gravelly clay loam surface layer and a gravelly clay or clay subsoil. They overlie old terrace sediments or metamorphosed shale. The soils on terraces have slopes that range from 9 to 30 percent, and the soils on uplands have slopes that range from 30 to 50 percent.

The soils in this unit are slightly acid to strongly acid. Rooting depth generally is 24 inches to more than 60 inches, but in places it is as shallow as 10 inches for root-sensitive crops because of the slowly permeable clay subsoil. Permeability in the subsoil is slow to very slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility rate is high to low, and the available water holding capacity is about 4 to 8 inches. Average annual rainfall is 16 to 30 inches, and the growing season is 200 to 275 days.

These soils are used for range. Because they are subject to sheet and gully erosion, they are better suited to grazing than to most other uses.

The soils in this unit should not be cultivated, except to prepare a seedbed for planting better forage grasses and legumes. Proper grazing management is needed to control erosion and to obtain good yields of forage. Fire trails should be provided where needed. Nitrogen, phosphorus, and sulfur fertilizers, applied in adequate amounts before the first rain, increase early yields of forage.

CAPABILITY UNIT VIe-5 (15)

This unit consists of moderately deep and deep, well-drained, moderately steep to steep soils on uplands. Slopes range from 15 to 50 percent. These soils are in the Altamont, Climara, and Diablo series. They have a clay and stony clay surface layer and a clay substratum. The parent material is shale, sandstone, and basic igneous rock.

The soils in this unit are neutral to moderately alkaline. The moderately alkaline soils in places are calcareous in the surface layer and in the substratum. Favorable rooting depth is 20 to 56 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Fertility is moderate to high, and the available water holding capacity is about 3 to 7 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 200 to 275 days.

These soils are used for range. They are well suited to grazing, and forage production is high.

The soils in this unit should not be cultivated, except to prepare a seedbed for planting better forage grasses and legumes. Proper grazing management is needed to control erosion and to obtain good production of forage. Fire trails should be provided where needed. Nitrogen, phosphorus, and sulfur fertilizers, applied in adequate amounts before the first fall rain, increase early production of forage.

CAPABILITY UNIT VIe-7 (15)

This unit consists of shallow to moderately deep, well-drained, moderately sloping to moderately steep soils on uplands. Slopes range from 5 to 30 percent. These soils are

in the Gaviota and Vallecitos series. They have a loam surface layer and a gravelly loam and clay subsoil that is underlain by hard sandstone and shale rock. The surface is 2 to 10 percent rock outcrops.

The soils in this unit are slightly acid to medium acid. Favorable rooting depth is 10 to 30 inches to bedrock. Permeability in the subsoil is slow to moderate. Runoff is slow to rapid, and the hazard of erosion is slight to high. Fertility is low to moderate. The available water holding capacity is 2 to 6 inches. Average annual rainfall is from 15 to 30 inches, and the growing season is 200 to 250 days.

Because of rock outcrops on the surface, the soils in this unit are not suited to cultivation but are used for range. Limited cultivation, such as the reseeding needed to establish grasses or legumes, can be done to increase forage and to control erosion. Proper grazing management is needed to obtain good production of forage.

Nitrogen, phosphorus, and sulfur fertilizers, applied in adequate amounts before the first rains in fall, increase early yields of forage.

CAPABILITY UNIT VIe-8 (4)

Madonna loam, 30 to 50 percent slopes, is the only soil in this unit. This is a moderately deep, well-drained, steep soil on uplands. The surface layer and subsoil are loam and are underlain by coarse-grained hard sandstone.

This soil is medium acid. Favorable rooting depth is 20 to 28 inches. Runoff is rapid, and the hazard of erosion is high. Permeability is moderate. Fertility is moderate, and the available water holding capacity is 3 to 5 inches. Average annual rainfall is 35 to 50 inches, and the growing season is 200 to 250 days.

This soil is used for range and watershed. It is better suited to pasture and range than to most other uses.

Because of the steep slopes and high hazard of erosion, this soil should not be cultivated. All cultivation operations, where used, should be across the slope. Where this soil is planted to dryland orchards, intensive conservation practices are needed to prevent sheet and gully erosion. A fall cover crop should be seeded and fertilized, or a permanent cover crop should be grown. All crop residue should be returned to the soil to help maintain organic-matter content and soil structure. Fire trails should be constructed where needed.

CAPABILITY UNIT VIe-8 (15)

This unit consists of very shallow to shallow, well-drained and somewhat excessively drained, moderately sloping to moderately steep soils on uplands. The soils are in the Gaviota series. They are loam and gravelly loam that are about 6 to 20 inches deep to hard sandstone.

The soils in this unit are slightly acid. Slopes range from 5 to 30 percent. Permeability in the subsoil is moderate. Runoff is slow to rapid, and the hazard of erosion is slight to high. Fertility is low. The available water holding capacity is about 1 to 3 inches. Average annual rainfall is 15 to 30 inches, and the growing season is 200 to 250 days.

These soils are used for pasture and range. Because of the shallow depth to hard sandstone and the hazard of erosion, these soils are better suited to grazing than to most other uses. They should not be cultivated, except to prepare a seedbed for improved grasses and legumes. Proper grazing management is needed to obtain good production of forage and to control sheet and gully erosion. Applications of nitrogen, phosphorus, and sulfur fertilizers increase forage production.

CAPABILITY UNIT VIw-4 (15)

Cortina very gravelly loam, 0 to 5 percent slopes, is the only soil in this unit. This is a very deep, somewhat excessively drained, nearly level to gently sloping soil on benches along drainageways. It has a very gravelly loam surface layer and a very gravelly sandy loam substratum.

This soil is slightly acid throughout the profile. Roots can penetrate to a depth of more than 60 inches. Permeability is rapid. Runoff is very slow, and the hazard of erosion is none to slight. This soil is subject to flooding about 3 years out of 10. Fertility is low, and the available water holding capacity is 2.5 to 4 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 250 to 275 days.

This soil is used for dryland pasture, wildlife habitat, and recreation. Because irrigation water is not available, this soil is better suited to pasture, range, wildlife habitat, and recreation than to most other uses. The low available water holding capacity makes this soil unsuitable for economical production of dryland crops. Dikes or other water diversion structures should be provided to protect this soil from damaging overflow. Grazing must be carefully managed to maintain adequate forage production. Fertilizing and reseeding with adapted annuals improve forage quality and production.

CAPABILITY UNIT VIIe-1 (4)

This unit consists of moderately deep to deep, well-drained, very steep soils on uplands. Slopes range between 50 and 75 percent. These soils are in the Ben Lomond and Felton series. They have a silt loam or fine sandy loam surface layer and a very fine sandy loam or clay loam subsoil. The substratum is soft shales and sandstone.

The surface layer is medium acid, the subsoil is medium to strongly acid, and the substratum is strongly acid. Favorable rooting depth is from 33 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high. Fertility is moderate. The available water holding capacity is about 5 to 10 inches. Permeability in the subsoil is moderately rapid or moderately slow. Average annual rainfall is 35 to 50 inches, and the growing season is 200 to 250 days.

The soils in this unit are used for timber production, wildlife, recreation, and watershed. They are better suited to forestry, wildlife, recreation, and watershed than to most other uses.

Because of very steep slopes and a very high hazard of erosion, these soils have severe limitations for equipment use and require intensive erosion control practices. When these soils are logged, roads and trails should be located so that gradients are kept small and adequate surface drainage is provided. Outsloping of temporary roads is recommended. For regeneration, a source of seed for young timber stands is about 80 trees per 10 acres. Seed trees should be 18 inches or more in diameter at breast height. Slash disposal should be by lapping and scattering, except where the fire hazard necessitates burning small concentrations of slash. Erosion is reduced by using logging slash on skid trails; however, slash should be kept out of streams to maintain accessibility for fish and other wildlife and to

prevent flooding. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-1 (15)

This unit consists of moderately deep to deep, well-drained, steep to very steep soils on uplands and terraces. Slopes range from 30 to 75 percent. These soils are in the Azule, Gilroy, Hillgate, Los Gatos, Los Osos, Parrish, San Andreas, San Benito, and Santa Lucia series. Also included in this unit is Terrace escarpments. The soils in this unit have a fine sandy loam, silt loam, shaly loam, gravelly loam, gravelly clay loam, or clay loam surface layer. Texture of the subsoil is sandy loam to clay and in places is gravelly or very shaly. These soils overlie old, soft sediments, sandstone, shale, and basic igneous rocks.

The soils in the unit are strongly acid to moderately alkaline. Favorable rooting depth generally is 20 inches to more than 60 inches. Permeability in the subsoil is moderately rapid to very slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Fertility is low to high. The available water holding capacity is about 2 to 10 inches. Average annual rainfall is 16 to 40 inches, and the growing season is 200 to 275 days.

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

Because of steep to very steep slopes and a high or very high hazard of erosion, these soils should have a permanent cover. Good grazing management maintains forage production and protects these soils from sheet and gully erosion. Seeding and fertilizing are too difficult and response is too poor to justify the expense, except for erosion and sedimentation control. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-5 (15)

Altamont clay, 50 to 75 percent slopes, eroded, is the only soil in this unit. This is a moderately deep, well-drained, very steep soil on uplands. Also included in this unit is Landslides. This Altamont soil has a clay surface layer and substratum. The parent material is fractured shale.

The soil in this unit is neutral to moderately alkaline. The substratum is calcareous in places. Permeability is slow. Favorable rooting depth is 25 to 35 inches or more. Runoff is very rapid, and the hazard of erosion is very high. Fertility is high, and the available water holding capacity is about 3.5 to 4.5 inches. Average annual rainfall is 15 to 30 inches, and the growing season is from 200 to 250 days.

This soil is used for range, wildlife, watershed, and recreation. It produces a large amount of forage and is better suited to grazing than to most other uses.

The soil in this unit is not suited to cultivation, because of slope and the hazard of erosion. Good grazing management maintains forage production and protects the soil from sheet erosion. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-7 (15)

This unit consists of shallow, well-drained and somewhat excessively drained, very steep soils on uplands. These soils are in the Inks, Maymen, and Vallecitos series. They have a fine sandy loam, loam, or gravelly clay loam surface layer and a fine sandy loam, gravelly clay loam, or clay subsoil that is underlain by hard basic igneous rock, sandstone, or shale. About 2 to 10 percent of the surface is covered by rock outcroppings.

The soils in this unit are slightly acid to strongly acid. Favorable rooting depth is 11 to 24 inches. Runoff is very rapid, and the hazard of erosion is very high. Permeability is moderately rapid to slow. Fertility is low to moderate. The available water holding capacity is about 1 to 5 inches. Average annual rainfall is 16 to 50 inches, and the growing season is 200 to 250 days.

These soils are used for limited range, wildlife habitat, recreation, and watershed. They are better suited to these uses than to most other uses because of slope, shallow soil depth, and rockiness. They provide limited forage for livestock and wildlife and cover for erosion control. Reseeding generally is too difficult and expensive to be justified as a way of controlling erosion and sedimentation. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-8 (4)

Madonna loam, 50 to 75 percent slopes, is the only soil in this unit. This is a moderately deep, well-drained, very steep soil on uplands. It has a surface layer and subsoil of loam that is underlain by hard, coarse-grained sandstone.

This soil is medium acid. Favorable rooting depth is 20 to 28 inches. Runoff is very rapid, and the hazard of erosion is very high. Permeability is moderate. Fertility is moderate. The available water holding capacity is about 3 to 5 inches. Average annual rainfall is 35 to 50 inches, and the growing season is 200 to 250 days.

This soil is used for range, recreation, and watershed. It is better suited to these than to most other uses because of the very steep slopes and a very high hazard of erosion. Good grazing management maintains forage production and protects this soil from sheet and gully erosion. Areas that have a dense brush cover are best maintained as protected watershed and browse areas for wildlife. Fire trails should be provided where needed.

CAPABILITY UNIT VIIe-8 (15)

This unit consists of shallow and moderately deep, somewhat excessively drained and well-drained, steep to very steep soils on uplands. Slopes are 30 to 75 percent. These soils are in the Gaviota, Los Gatos, and Maymen series. They are fine sandy loam to gravelly loam about 6 to 20 inches deep to hard sandstone.

The soils in this unit are slightly acid to strongly acid. Permeability is moderately rapid to moderately slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Fertility is low to moderate. Available water holding capacity is about 1 to 8 inches. Average annual rainfall is 15 to 50 inches, and the growing season is 200 to 250 days.

These soils are used for range, watershed, wildlife habitat, and recreation. Because of the shallow depth to hard sandstone, the steep to very steep slopes, and a high to very high hazard of erosion, these soils should be kept in a permanent cover. Good grazing management maintains forage production and protects the soils from erosion. Seeding and fertilizing are not practicable on these soils.

CAPABILITY UNIT VIIe-9 (15)

This unit consists of shallow, somewhat excessively drained, moderately steep to steep soils on uplands. These soils are in the Montara and Henneke series. They have a clay loam and gravelly clay loam surface layer that is

underlain by serpentine rock. About 5 to 10 percent of the surface is covered by stones and rock outcroppings.

These soils are moderately alkaline. Favorable rooting depth is 10 to 18 inches. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. Permeability is moderately slow to slow. Fertility is low and very low. The available water holding capacity is about 1 to 3 inches. Average annual rainfall is 16 to 25 inches, and the growing season is 200 to 275 days.

The soils in this unit are used for limited range, wildlife, recreation, and watershed. They are better suited to these uses than to most other uses because of slope, shallow soil depth, low fertility, and rockiness. Forage production is low. Fertility is low because of an unfavorable calcium-magnesium ratio. Reseeding is too difficult and expensive to justify, except for erosion and sedimentation control. Fire trails should be provided where needed.

CAPABILITY UNIT VIIIw-4 (14, 15)

Only Riverwash is in this unit. It consists of coarse or very coarse material in stream channels. This land type is not suited to the commercial production of plants. It should be managed for wildlife habitat and for recreation.

CAPABILITY UNIT VIIIs-1 (15)

Only Rock land is in this unit. It consists of rock outcrops and very shallow soils having slopes of 50 to 75 percent. Runoff is very rapid, and the hazard of erosion is very high. Available water holding capacity is less than 2 inches. The present chamise brush cover provides valuable protection against sediments washing into streams.

This land type is better suited to wildlife habitat, recreation, and watershed than to most other uses.

Storie Index Rating [2]

In the "Guide to Mapping Units," the soils of the Eastern Santa Clara Area are listed in alphabetic order and are rated according to the Stories index (*9*). 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, which 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 as 100 percent. The coarser and finer textures, such as sand and clay, are rated less than 100 percent.

Factor C, Slopes.—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 as 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 high water table, erosion, salts or alkali, low fertility, acidity, or unfavorable microrelief. If more than one limitation exists, the values of each are multipled 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 a rating of 100 percent for factor C, but a high 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 high 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 farm crops as shown by their Storie index ratings. The six grades and their range in index ratings are—

	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 for farming.

Estimated Yields and Soil Management Practices

This section presents yields of the principal crops grown in the survey area and some of the management practices used to obtain these yields. Yields are listed in table 2 for apricots, grapes, pears, prunes, sugar beets, tomatoes, and walnuts. These estimates are based on observations made by the soil scientists who surveyed the area, on information furnished by farmers, on data from the Soil Conservation Service, and on crop data from Federal and county census records. Detailed information was not available for crops

[2] GORDON L. HUNTINGTON, specialist in soils, University of California, Davis, California, helped to prepare this subsection.

on some soils. If little or no information was available about the yield on a particular soil, estimates were made by comparing that soil with a similar soil. Information on yields on soils used for range is contained in the section "Range."

The estimated yields given in table 2 are for the principal irrigated crops grown in the survey area under optimum management. This is a level of management, based on experience, field trials, and research findings, from which highest returns can be expected at the present time.

The information on yields and management practices provided in this part of the soil survey will be most useful immediately upon release of this survey, because new developments in crops, plant breeding, control of insects and diseases, use of fertilizer, tillage, irrigation, and drainage may make obsolete much of the information on management. The latest information can be obtained from State and Federal publications or agricultural agencies.

Several important limitations should be kept in mind when using the yield estimates in table 2. First, the figures are estimates or predictions. Second, the figures are averages that may be expected over a period of years. Third, there are considerable variations in some soils, such as variations resulting from the content of salts and alkali, and these were considered in making the estimates.

Management commonly practiced for most crops grown in the Eastern Santa Clara Area includes proper seedbed preparation and control of insects and weeds. Under an optimum level of management, the best adapted and most desirable varieties of crops are grown and planting, har-

TABLE 2.—*Estimated acre yields for principal irrigated crops*

[No estimates are given for soils on which a particular crop is not grown. Dashes indicate that the soil is not suited to that particular crop]

Soil name	Apricots (fresh)	Grapes, wine (fresh)	Pears (fresh)	Prunes (fresh)	Sugar beets	Tomatoes (fresh)	Walnuts
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Pounds*
Arbuckle gravelly loam, 0 to 2 percent slopes	6	----	----	6	----	20	1, 000
Campbell silty clay loam	8	----	25	10	35	35	2, 000
Campbell silty clay loam, clay substratum	----	----	----	----	20	30	----
Campbell silty clay	8	----	25	8	30	30	1, 500
Campbell silty clay, muck substratum	----	----	----	----	20	30	----
Clear Lake clay	----	----	15	----	20	25	----
Clear Lake clay, drained	5	----	15	8	30	30	----
Clear Lake clay, saline	----	----	----	----	15	20	----
Cortina very gravelly loam, 0 to 5 percent slopes	----	----	----	6	----	----	----
Cropley clay, 0 to 2 percent slopes	5	----	15	8	30	25	1, 500
Cropley clay, 2 to 9 percent slopes	5	----	15	8	30	25	1, 500
Garretson loam, gravel substratum, 0 to 2 percent slopes	8	5	----	8	----	35	1, 500
Garretson gravelly loam, 0 to 5 percent slopes	6	5	----	6	----	30	1, 500
Hillgate silt loam, 2 to 9 percent slopes	4	3	----	3	----	----	----
Keefers clay loam, 0 to 2 percent slopes	5	4	----	6	----	20	1, 000
Keefers clay loam, 2 to 9 percent slopes, eroded	5	4	----	6	----	20	1, 000
Los Gatos gravelly loam, 15 to 30 percent slopes, eroded	----	3	----	----	----	----	----
Los Robles clay loam, 0 to 2 percent slopes	8	5	----	8	----	30	2, 000
Los Robles clay loam, 2 to 9 percent slopes	8	5	----	8	----	30	2, 000
Maxwell clay, 0 to 5 percent slopes	----	----	----	4	----	----	----
Pacheco fine sandy loam	----	----	10	----	20	25	----
Pacheco silt loam, drained	----	----	----	10	30	35	2, 000
Pacheco clay loam	----	----	10	----	20	25	----
Pacheco clay loam, gravelly substratum	----	----	----	8	----	35	----
Pleasanton loam, 0 to 2 percent slopes	7	5	----	8	----	25	1, 500
Pleasanton loam, 2 to 9 percent slopes	7	5	----	8	----	25	1, 500
Pleasanton gravelly loam, 0 to 2 percent slopes	6	5	----	6	----	20	1, 000
Pleasanton gravelly loam, 2 to 9 percent slopes	6	5	----	6	----	20	1, 000
Rincon clay loam, 0 to 2 percent slopes	7	5	----	6	----	25	1, 500
Rincon clay loam, 2 to 9 percent slopes, eroded	7	5	----	8	----	25	1, 500
San Andreas fine sandy loam, 15 to 30 percent slopes, eroded	----	4	----	----	----	----	----
San Ysidro loam, 0 to 2 percent slopes	4	3	----	3	----	15	----
San Ysidro loam, acid variant, 0 to 2 percent slopes	4	3	----	3	----	15	----
San Ysidro loam, acid variant, 2 to 9 percent slopes	4	3	----	3	----	15	----
Sunnyvale silty clay	----	----	----	----	----	15	----
Sunnyvale silty clay, drained	----	----	15	6	20	20	----
Willows clay	----	----	----	----	----	15	----
Yolo loam, 0 to 2 percent slopes	8	----	25	10	35	35	2, 000
Yolo loam, 2 to 5 percent slopes	8	----	25	10	35	35	2, 000
Yolo silty clay loam, 0 to 2 percent slopes	8	5	25	10	35	35	2, 000
Yolo silty clay loam, 2 to 9 percent slopes	8	5	25	10	35	35	2, 000
Zamora loam, 0 to 2 percent slopes	8	5	----	10	30	35	2, 000
Zamora loam, 2 to 9 percent slopes	8	5	----	10	30	35	2, 000
Zamora clay loam, 0 to 2 percent slopes	8	5	----	10	30	35	2, 000
Zamora clay loam, 2 to 9 percent slopes	8	5	----	10	30	35	2, 000

vesting, pruning, tillage, irrigation, and other management practices are performed at the proper time. Management by capability units is discussed in the section "Capability Groups of Soils."

The following paragraphs discuss the cropping sequence, rates of planting and fertilization, and amounts of irrigation water assumed when the yields for the crops specified in table 2 were estimated.

Apricots (fresh).—Apricots use 40 pounds of nitrogen and 40 pounds of phosphorus per acre annually. For a cover crop on sloping soils, 30 pounds of barley seed and 20 pounds of purple vetch or 80 pounds of horsebeans is planted. From 27 to 34 acre-inches of irrigation water is used, applied in two to four applications before harvest and one or two applications after harvest.

Grapes, wine (fresh).—From 40 to 60 pounds of nitrogen per acre is used annually. A cover crop of adapted bromegrass is drilled between the rows at a rate of 8 pounds per acre to reduce sheet and gully erosion. From 6 to 12 acre-inches of irrigation water is applied in two applications during the year. Prunings from grapevines are shredded and disked into the soil in alternate rows.

Pears (fresh).—From 100 to 175 pounds of nitrogen per acre is used, depending on vigor of the trees. Zinc points are driven into trees where necessary. For a cover crop on sloping soils, 30 pounds of barley seed and 20 pounds of horsebeans are planted. From 27 to 34 acre-inches of irrigation water is applied in about four or five annual applications.

Prunes (fresh).—From 60 to 100 pounds of nitrogen per acre is used annually for prunes; on some soils, as much as 60 pounds of potassium is used. For winter cover, 20 pounds of purple vetch and 30 to 60 pounds of barley or 80 pounds of horsebeans is planted on the sloping soils. From 24 to 36 acre-inches of irrigation water is applied annually. Irrigation water is applied three or four times before harvest and one or two times after harvest to help establish the cover crop.

Sugar beets.—A typical cropping sequence consists of sugar beets for 1 year, a truck crop for 1 to 3 years, and a winter green-manure crop. Three years of alfalfa can be substituted for the winter green-manure crop. Sometimes corn is grown for silage for 1 year. From 120 to 150 pounds of nitrogen per acre per year is used. From 24 to 36 acre-inches of irrigation water is applied.

Tomatoes (fresh).—A typical cropping sequence consists of tomatoes grown for 2 years and sugar beets or a truck crop for 1 year. A winter green-manure crop or alfalfa grown for 3 years can be substituted for the sugar beets. Tomatoes are fertilized according to the individual needs of the soil and plants, as indicated by chemical analyses. In the Eastern Santa Clara Area, tomatoes generally use 40 to 80 pounds of nitrogen and 40 pounds of phosphorus per acre per year. Potassium is also used on some soils. From 24 to 36 acre-inches of irrigation water is used annually.

Walnuts.—From 100 pounds to 150 pounds of nitrogen per acre annually is applied in two separate applications. For a cover crop on sloping soils, 30 pounds of barley seed and 20 pounds of purple vetch seed or 80 pounds of horsebeans is planted. From 30 to 40 acre-inches of irrigation water, in about three or four applications, is used annually. At least one application follows harvest.

Range [3]

Approximately 391,390 acres in the survey area is used for range. Soils in the Gaviota, Los Gatos, Vallecitos, and Gilroy series are the major soils used for range. They are on the mountains that parallel the valley on the east and west sides. The Diablo, Altamont, Azule, and Los Osos soils produce large amounts of forage. These soils are in a narrow belt just above the valley on the east.

A large acreage of Gaviota gravelly loam and Rock land that produces small amounts of forage is along the county line on the east, extending from Alameda County on the north nearly to the Merced County line on the south. This area is very steep and is generally covered with brush.

Range sites

Range sites are kinds of soil that produce significantly different kinds or amounts of vegetation. Each site has a different potential for production of forage, and each presents different management problems. Most of the important range forage plants in the Eastern Santa Clara Area are introduced. The original forage plants are mostly cool-weather annuals. The annuals take full advantage of the soil moisture while it is available, 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 of the 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. Less desirable plants then increase. If grazing is continued, even the second-choice plants are thinned out or eliminated and undesirable, unpalatable plants take their place or the soil is left bare.

The soils in the Eastern Santa Clara Area have been grouped into seven range sites. The following range site descriptions include (1) a brief description of the soils as a group that make up the site, (2) a listing of the important, desirable, less desirable, and undesirable forage plants, (3) the acreage and general location of the sites in the survey area, and (4) the estimated production potential.

CLAYEY SITE

This site lies in a narrow belt on the lower foothills along the east side of the valley. Elevation ranges from 400 to 2,000 feet. The average annual rainfall ranges from 16 to 25 inches. This site is the highest forage-producing site in the survey area, and it occupies about 8,500 acres. The major acreage consists of soils that have slopes of 30 to 50 percent. There are only small acreages of soils that have slopes of more than 50 percent and about 2,000 acres that have slopes of less than 30 percent.

The soils in this site are in the Altamont, Climara, Diablo, and San Benito series. The land type Landslides is also in this site. These soils are well-drained clays and clay loams that are more than 20 inches deep to calcareous sandstone, shale, or metamorphosed basic igneous rock. The surface layer is neutral to moderately alkaline. The moderately alkaline soils have a calcareous substratum.

[3] This section was prepared by ROCHE D. BUSH, range conservationist, Soil Conservation Service, Berkeley, California.

These soils have moderately slow to slow permeability, and available water holding capacity is 3 to 10 inches. Fertility is moderate or high. There are some rock outcroppings, particularly in the Climara soils. Landslips are frequent in these soils.

This site mainly has a cover of open grass. Individual oaks and clusters of oaks are on some north-facing slopes (fig. 6). When the site is producing at its potential, approximately 70 percent of the herbage is a mixture of wild oats, soft chess, and filaree, and large amounts of burclover. Other desirable plants, including remnant perennial grasses, are also present. Approximately 20 percent is ripgut brome, annual fescues, annual lupines, wild barley, and other less desirable plants. The rest consists of silver hairgrass, tarweed, vinegarweed, turkeymullein, thistle, and mustard or other undesirable plants.

The soils in this site, except AcG2, LaF, and SbF3, are well suited to seeding with Hardinggrass and adapted annual grasses and legumes. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur.

Brush and trees are not a problem on this site. The safe operation of equipment limits range improvement practices on this site to soils that have slopes of less than 50 percent.

Total annual production of air-dry forage on this site ranges from 4,000 pounds per acre in favorable years to 1,800 pounds per acre in unfavorable years.

FINE LOAMY SITE

This site is in the same general area as the Clayey range site, in the lower foothills adjacent to and east of the valley. Elevation ranges from 300 to 2,200 feet. Average annual rainfall ranges from 16 to 50 inches. This site occupies about 16,000 acres. About 6,000 acres consists of soils that have slopes in excess of 50 percent, about 5,000 acres have slopes of 30 to 50 percent, and about 5,000 acres have slopes that are less than 30 percent.

The soils in this site are in the Azule, Felton, and Los Osos series. They are well-drained clay loams and silt loams that are 20 inches to more than 60 inches deep over alluvium or fine-grained sandstones and shales. The subsoil is clay loam, gravelly sandy clay, or clay. These soils are slightly acid to medium acid in the surface layer and subsoil. Available water holding capacity is 4 to 10 inches. Permeability is moderately slow to slow. Fertility is moderate to high.

This site is mostly covered by open grass. Clusters of oaks are in pockets on north-facing slopes. When this site is producing at its potential, approximately 70 percent of the herbage is a mixture of wild oats, soft chess, burclover, and filaree, and remnant perennial grasses and other desirable plants. Approximately 20 percent is ripgut brome, annual fescues, wild barley, annual lupines, and other less desirable plants. The rest consists of tarweed, turkeymullein, thistles, mustard, and other undesirable plants.

The soils in this site, except AuG, AuG2, and LoG, are well suited to seeding with Hardinggrass and adapted annual grasses and legumes. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur.

Brush is generally not a problem on this site. Thinning the clumps of trees increases forage production in some areas. The safe operation of equipment limits range improvement practices on this site to soils that have slopes of more than 50 percent.

Total annual production of air-dry forage on this site ranges from 3,600 pounds per acre in favorable years to 1,600 pounds per acre in unfavorable years.

LOAMY SITE

This site is on the mountain slopes on the east and west sides of the valley. Elevation ranges from 200 to 4,000 feet. The average annual rainfall ranges from 16 to 50 inches. This site occupies approximately 91,000 acres.

Figure 6.—An Altamont clay in the Clayey range site. The plant cover is open grass and individual oaks.

About 5,000 acres consists of soils that have slopes of less than 30 percent, about 14,500 acres have slopes of 30 to 50 percent, and 71,500 acres have slopes that are more than 50 percent.

The soils in this site are in the Gilroy, Los Gatos, Madonna, Parrish, Pleasanton, San Andreas, and Santa Lucia series. The land type Terrace escarpments is also in this site. These soils are well drained and have a fine sandy loam, loam, gravelly loam, shaly loam, clay loam, or gravelly clay loam surface layer and a sandy loam, loam, clay loam, gravelly clay loam, very shaly clay loam, or gravelly clay subsoil. The parent material is alluvium, sandstone, shale, or igneous rock. The surface layer is slightly acid to medium acid, and the subsoil is neutral to strongly acid. These soils are more than 18 inches deep to sandstone, shale, or igneous rock and in places are very deep. Permeability is moderately rapid to slow. Available water holding capacity is 2 to 9 inches. Fertility is moderate. In some places there are rock outcrops and the soil is eroded.

This site has a cover of open grass and of grass and oak trees. Presently there are many areas that are covered by brush. When this site is producing at its potential, approximately 70 percent of the herbage is a mixture of soft chess and filaree, some wild oats and burclover, a few remnant perennial grasses, and other desirable plants. Approximately 20 percent is ripgut brome, annual fescues, annual lupines, and other less desirable plants. The rest consists of turkeymullein, tarweed, California poppy, mustard, and other undesirable plants.

The soils in this site, except GoG, LfG, LhG, MbG, PfG, ScG, and TeF, are well suited to seeding with adapted annual grasses and legumes. Forage plants respond well to nitrogen, phosphorus, and sulfur fertilizers.

Brush control and tree thinning are desirable practices where equipment can be operated safely; that is, on slopes of less than 50 percent. Seeding and fertilizing are also desirable but must be restricted on steep slopes except for emergency erosion control.

Total annual production of air-dry forage on this site varies from 3,000 pounds per acre in favorable years to 1,200 pounds per acre in unfavorable years.

CLAYPAN SITE

This site is mainly on the low fans and terraces on the east side of the valley just south of San Martin. There are a few small areas in the higher foothills. Elevation ranges from 200 to 2,000 feet. The average annual rainfall ranges from 16 to 25 inches. This site occupies only about 4,400 acres. About two-thirds of the site has slopes that are less than 30 percent.

The soils in this site are in the Hillgate series. They are well drained and have a silt loam surface layer and a clay subsoil. The substratum is stratified gravelly clay loam. These soils are medium acid throughout the profile. The effective rooting depth is generally very deep. Permeability is very slow, and available water holding capacity is 6 to 7 inches. Fertility is low.

This site predominantly has an open cover of grass. When it is producing at its potential, approximately 70 percent of the herbage is a mixture of soft chess, filaree, and annual clovers, and there are small amounts of wild oats, burclover, and other desirable plants. Approximately 20 perecnt is ripgut brome, red brome, annual fescues, annual lupines, and other less desirable plants. The rest consists of nitgrass, tarweed, turkeymullein, vinegarweed, mustard, and other undesirable plants.

Some of the soils in this site (HfD2 and HfE2) are well suited to seeding with Hardinggrass and adapted annual grasses and legumes. Forage plants respond well to applications of nitrogen, phosphorus, and sulfur.

Total annual production of air-dry forage on this site ranges from 3,000 pounds per acre in favorable years to 1,200 pounds per acre in unfavorable years.

SHALLOW LOAMY SITE

This site is in the hills on both sides of the valley. Elevation ranges from 200 to 4,000 feet. The average annual rainfall ranges from 15 to 30 inches. This is the most extensive site in the survey area, and it occupies approximately 192,000 acres. About 64,000 acres consists of soils that have slopes of less than 30 percent, about 16,000 acres have slopes of 30 to 50 percent, and about 112,000 acres have slopes of more than 50 percent.

The soils in this site are in the Gaviota, Inks, and Vallecitos series. They are well drained and somewhat excessively drained and have a dominantly loam or gravelly clay loam surface layer and subsoil. They are 10 to 19 inches deep to sandstone, shale, and basic igneous rock. Available water holding capacity is 1 to 6 inches. Permeability is moderate to slow. Reaction is slightly acid to medium acid. Fertility is very low to moderate. In some places there are rock outcrops and the soils are eroded.

This site has a cover of open grass, of grass and oak trees, and, in many places, of brush. When this site is producing at its potential, approximately 70 percent of the herbage is a mixture of soft chess and filaree, moderate amounts of burclover and wild oats, and a few remnant perennial grasses and other desirable plants. About 20 percent is ripgut brome, annual fescue, annual lupines, and other less desirable plants. The rest consists of silver hairgrass, nitgrass, vinegarweed, tarweed, and other undesirable plants.

Some of the soils in this site (GcD2, GcE, GkE2, SaE2, and VaE2) are suited to seeding with adapted annual grasses and legumes, and these plants respond to nitrogen, phosphorus, and sulfur fertilizers. The other soils are not suited to such seeding. Areas selected for application of fertilizer should be free of brush and trees.

Brush control and tree thinning, which help to increase forage production, are practicable only on soils that have slopes of less than 50 percent.

Total annual production of air-dry forage on this site ranges from 2,400 pounds per acre in favorable years to 1,000 pounds per acre in unfavorable years.

SHALLOW GRAVELLY LOAM SITE

This low forage-producing site is almost entirely in a block on the tops and side slopes of the mountains along the Stanislaus County line, from Alameda County on the north nearly to Merced County on the south. Elevation ranges from 500 to 4,000 feet. Average annual rainfall is from 15 to 50 inches. Slopes are 15 to 75 percent. This site occupies about 70,000 acres. Large acreages of Rock land are closely associated with this site.

The soils in this site are in the Gaviota, Inks, and Maymen series. They are somewhat excessively drained and

are gravelly loam, stony clay loam, or fine sandy loam that are 7 to 19 inches deep to hard, coarse-grained sandstone, basalt, and shale. Available water capacity is 1 to 3 inches. Permeability is moderately rapid to moderately slow. Reaction is slightly acid to strongly acid. Fertility is low to very low.

This site is predominantly covered by brush. Chamise is the principal species, but there is California sagebrush in badly eroded areas. When brush-free areas are producing at their potential, approximately 70 percent of the herbage is a mixture of soft chess, filaree, and a little burclover and wild oats. Pine bluegrass is about the only native perennial. Approximately 20 percent is ripgut brome, red brome, annual fescue, annual lupine, and other less desirable plants. The rest consists of silver hairgrass, vinegarweed, turkeymullein, and other undesirable plants.

The soils in this site and the slopes prevent range improvement through seeding, fertilizing, or brush clearing. Watersheds may be protected by seeding as an emergency treatment after wildfires.

Total annual production of air-dry forage on this site ranges from 1,200 pounds per acre in favorable years to 500 pounds in unfavorable years.

SERPENTINE SITE

This site is in a narrow strip in the low foothills just east of U.S. Highway 101. It starts at the northern boundary of the survey area and extends south to a point directly east of Morgan Hill. Elevation ranges from 800 to 3,000 feet. Average annual rainfall ranges from 16 to 25 inches. Slopes are from 15 to 75 percent. This site occupies about 8,500 acres.

The soils in this site are in the Henneke and Montara series. They are somewhat excessively drained and are clay loam and gravelly clay loam that is 10 to 18 inches deep to serpentine rock. Rock outcrops cover 5 to 10 percent of the surface. Permeability is moderately slow to slow. Available water holding capacity is 1 to 3 inches. Reaction is moderately alkaline. Fertility is low or very low.

This site is predominantly covered by open grass. When it is producing at its potential, approximately 60 percent of the herbage is a mixture of soft chess, filaree, and some annual clover. There are very small amounts of wild oats or burclover. In some areas, other desirable plants include purple needlegrass and squirreltail. Approximately 30 percent is ripgut brome, red brome, annual lupine, wild carrot, and large amounts of annual fescues and other less desirable plants. The rest consists of annual weeds, broadiaea, turkeymullein, and other undesirable plants. The soils in this site are not suited to seeding or fertilizing, except to produce a ground cover in critical areas.

Brush is normally not a problem on this site.

Total annual production of air-dry forage on this site ranges from 1,500 pounds per acre in favorable years to 700 pounds per acre in unfavorable years.

Wildlife and Fish [4]

Wildlife and fish are important in the Eastern Santa Clara Area, and the leasing of land for hunting can bring economic returns. There are large reservoirs that can be used for the production of fish. Important game species in the area are Columbian black-tailed deer, mourning doves, California quail, band-tailed pigeons, brush rabbits, and squirrels. Many nongame birds, such as finches, warblers, brushtits, and flycatchers, are also in the area.

Wildlife occupies a variety of habitats, and the nature of a particular habitat depends upon the characteristics of the soils and the vegetation growing on them. Table 3 gives the wildlife suitability groups in the survey area and rates them according to their suitability for specified plants important to wildlife. The list of plants is not complete for the area, but it contains the most important plants that can be used for habitat improvement. The plants included in table 3 are those that have widespread occurrence, are of value for different wildlife species, are appropriate for more than one suitability group, and are available for planting. No implication of value is intended in a wildlife rating, because the specific food and cover requirements of each wildlife species differ.

Wildlife suitability groups

The soils in the Eastern Santa Clara Area have been grouped into eight wildlife suitability groups. Following is a description of each group, including a brief description of the soils, vegetation, wildlife species, and suggested management. After the wildlife suitability groups, the use of ponds and reservoirs by waterfowl and for the production of fish is also discussed.

WILDLIFE SUITABILITY GROUP 1

This group consists of moderately deep to very deep soils that are moderately well drained to somewhat excessively drained. These soils are in the Arbuckle, Azule, Campbell, Cortina, Esparto, Garretson, Gilroy, Los Gatos, Los Osos, Los Robles, Madonna, Pacheco, Parrish, Pleasanton, Rincon, San Andreas, San Benito, Yolo, and Zamora series. These soils have slopes of 0 to 30 percent and are on alluvial plains, fans, low terraces, and uplands of the Santa Clara Valley and other small valleys. This group covers about 57,500 acres.

The surface layer ranges from fine sandy loam to silty clay loam and is gravelly or very gravelly in places. Permeability is moderately rapid to slow. Fertility is moderate to high. The available water holding capacity ranges from 2.5 to 12 inches. The Pacheco and Campbell soils are in this group because drainage has lowered the water table to a depth of more than 5 feet.

Natural vegetation consists of grasses, forbs, and scattered oak trees. Most of the soils in this group, however, have been cultivated. Under irrigation, they are used for row crops, including sugar beets, and for orchards and vineyards. On the uplands and in the small valleys, these soils are used for dryland grain, hay, pasture, and range.

A limited number of valley quail inhabit areas of these soils, and the number might increase if adequate watering facilities were available late in summer and early in fall. Food patches of wheat, barley, corn, or milo generally improve the habitat for these birds. The vineyards and orchards in this area also provide fairly good habitat for mourning doves, which prefer to feed in open areas where the ground cover is not too rank. Finches, warblers, titmice, flycatchers, and many other nongame birds are commonly found on this group of soils. Deer are mainly on the

[4] WENDELL A. MILLER, biologist, Soil Conservation Service, Berkeley, California, helped to prepare this section.

TABLE 3.—*Suitability of specified plants to the soils in the wildlife suitability groups*

[An arabic number 1 means the plant named is suited to the wildlife group; 2 means suitability of the plant is fair to marginal for the wildlife group; dashes in the columns means the plant is not suited to soils of the wildlife group or its suitability is not known]

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Alfalfa	[1] 1	1						
Barley	1	1	2	1			1	
Blackberry	[1] 1	1	2	1	2		1	
Buckwheat	1	2	2		2		1	2
Burclover	1	1	1	2	1		1	2
Ceanothus	1		2		1	2	1	2
Chamise	1		2		1	1	1	2
Chaparral pea	[2] 1		2		1		1	2
Cherry, hollyleaf	1	2			2		1	
Coffeeberry	1	1	2		1			2
Goar fescue	[1] 1	1	[1] 1	1			1	
Douglas-fir	[2] 1				[2] 1		1	[2] 2
Fiddleneck	1	1	1		1	2	1	2
Filaree	1	1	1		1	2	2	2
Hardinggrass	[1] 1	1	1	1	2		2	
Lupine (annual)	1	1	1		1	1	1	1
Mountain mahogany	1	2			1		1	2
Manzanita	1	2	2		1	2	1	2
Madrone	1				[2] 1		1	[2] 2
Oak, black	[2] 1				[2] 1		1	[2] 2
Oak, blue	1	1	2		1		2	2
Oak, California scrub	1			1	1		1	2
Oak, live	1	2	2	1	1		1	
Oak, valley	1	1	2	2	2		1	
Pine, digger	1	2	2	2	1		2	2
Poison oak	1	2	1	1	1		1	2
Pyracantha	1	1	1	1	1		1	
Rose, multiflora	1	1	1	1	1	2	1	2
Ryegrass	1	1	1	1	1	2	1	2
Sage, California	1	2	1	1	1	2	2	2
Softchess	1	1	1	2	1	2	1	2
Tarweed	1	1	1	1	1	2	2	2
Toyon	1	1	1	1	1	1	1	2
Turkey mullein	1	1	1	1	1	2	1	2
Vetch, Lana	1	1	1	1	1		1	2
Vetch, Deer	1	1	1	1	1	2	1	2
Wheat	1	1	1	1	1		1	2
Wildoats	1	1	1	1	1	2	1	2

[1] Irrigation water required on droughty soils.
[2] Requires 25 inches of rainfall or more.

uplands. Sometimes they move down to this area to feed in orchards, vineyards, and pastures.

WILDLIFE SUITABILITY GROUP 2

This group consists of moderately deep to very deep clays and silty clays that are well drained. Some areas of these soils are stony. These soils are in the Altamont, Campbell, Climara, Cropley, Diablo, Sunnyvale, and Zamora series. Some of the Campbell, Clear Lake, and Sunnyvale soils that have been drained are in this group. The land type Landslides is also in this group. Slopes are 0 to 75 percent. These soils are along the edge of the Santa Clara Valley and the foothill areas. This group covers approximately 15,000 acres.

Available water holding capacity of these soils is 3 to 12 inches. Fertility is moderate to high.

Natural vegetation consists of annual grasses and forbs, and of fairly dense stands of oak trees and brush on the north-facing slopes, in swales, and in gullies. Both annual and perennial grasses are mixed with a variety of weedy herbs, which are important sources of food for wildlife.

This group provides good habitat for both deer and California quail whenever water is available and where the brush and grassland intermingle. Mourning doves, band-tailed pigeons, cottontail rabbits, and nongame birds also use this habitat.

Soils that have slopes of less than 50 percent are suitable for habitat improvement. Ponds can be constructed where suitable damsites can be located. The leasing of hunting rights on these soils has good potential for economic returns for the landowner.

WILDLIFE SUITABILITY GROUP 3

This group consists of claypanlike soils that have a very slowly or slowly permeable subsoil or substratum and are well drained to moderately well drained. These soils are in the Hillgate, Keefers, and San Ysidro series, and in the San Ysidro series, acid variant. The topography is generally strongly sloping but ranges from nearly level to steep. Slopes are 0 to 50 percent. This group is on the older fans and terraces on both sides of the Santa Clara Valley. It covers about 17,000 acres.

The surface layer of these soils is loam, silt loam, or clay loam. Fertility is moderate to low. The available water holding capacity ranges from 5 to 9 inches.

Most areas of these soils are used for dryland grain, hay, and pasture, but irrigated orchards and vineyards are also grown. Undisturbed areas have a vegetative cover of annual grasses and forbs, a few scattered oak trees, and a little brush. Irrigation water is usually available for the soils on the older fans.

North-facing slopes can support cover suitable for deer. The soil depth in swales and hollows is generally sufficient to maintain some tree and shrub growth that is suitable for quail cover. Dove, finches, sparrows, and other nongame birds that eat seeds frequent the open grassland. Towhees, brushtits, and warblers use the bushy cover. Deer use these soils mainly in the winter and spring. The soils on low slopes have a fairly good potential for habitat improvement. A sufficient supply of water is generally available or can be developed for quail and other wildlife. Fishponds can be constructed on these soils where suitable damsites can be located.

WILDLIFE SUITABILITY GROUP 4

This group consists of wet soils that generally have a seasonal water table at a depth of 20 to 60 inches. Drainage is somewhat poor or poor. These soils are in the Campbell, Clear Lake, Pacheco, Sunnyvale, and Willows series. They have slopes of 0 to 2 percent and are on the valley floor. Some soils in this group are subject to flooding. This group covers about 5,500 acres.

The surface layer is fine sandy loam, clay loam, silty clay loam, or clay. Available water holding capacity is 6 to 13 inches. The Willows soil has moderate concentrations of salts.

The natural vegetation consists of annual grasses, forbs, and plants that require plenty of water. These soils are used for sugar beets, garlic, and pasture. A wide variety of shallow-rooted plants are suited to these soils. Irrigation water is usually available.

Uncultivated areas are used by deer, principally during winter. Mourning doves frequent the open areas. Limited numbers of California quail and cottontail rabbits are in favorable locations. A few ducks and geese also feed on pasture in this group. Ponds can be readily constructed on these soils. Except for the hazard of flooding, the soils in this group present few limitations to the development of wildlife habitat.

WILDLIFE SUITABILITY GROUP 5

This group consists of shallow to deep, well-drained soils on hard sedimentary and basic igneous rock. These soils are in the Gaviota, Gilroy, Los Gatos, Los Osos, Madonna, Parrish, San Benito, Santa Lucia, and Vallecitos series. They have slopes of 5 to 50 percent and are on the uplands on both sides of the Santa Clara Valley. This group covers about 85,500 acres.

The surface layer ranges from loam to clay loam and in some places is gravelly or shaly. Rock outcrops cover up to 10 percent of the surface in places. Some areas of these soils are eroded.

The natural vegetation is generally annual grasses, forbs, and scattered oak trees, but there is a fairly dense shrub and tree cover on the north-facing slopes and in swales and gullies. Grasses and a variety of weedy herbs are important sources of food for wildlife. Wildlife habitat is not so readily established on the soils that have extensive stands of heavy tree and brush cover as it is on the soils that have a cover of open grass and brush. These soils are used for pasture and range.

Deer and California quail occur where brushy draws on north-facing slopes are intermingled with open grassland. Mourning doves, band-tailed pigeons, many small birds, and brush rabbits also use this habitat.

Water is usually available for wildlife except late in summer. In winter, however, rainfall is adequate to make water developments feasible. Many livestock reservoirs have been constructed. Ponds can be constructed on the soils in this group where suitable sites exist. The leasing of hunting rights on these soils has good potential for economic returns for the landowner.

WILDLIFE SUITABILITY GROUP 6

This group consists of shallow, rocky soils formed on serpentine rock. These soils are in the Henneke, Maxwell, and Montara series. They have slopes of 15 to 75 percent and are mainly on both sides of the Santa Clara Valley in the uplands. Maxwell soils are on small alluvial fans. This group covers about 9,000 acres.

The surface layer is clay loam, and rock outcrops cover 2 to 10 percent of the surface. Fertility is low or very low. Available water holding capacity is 1 to 3 inches.

The natural vegetation is mainly annual grasses and forbs, but brush is dominant on the Henneke soils. The soils of this group are used for range, wildlife, recreation, and watershed.

Deer, rabbits, a few doves, quail, and nongame birds are on these soils. The soils in this group, however, have very low potential for the development of wildlife habitat.

WILDLIFE SUITABILITY GROUP 7

This group consists of moderately deep to deep, well-drained fine sandy loams and silt loams. These soils are in the Ben Lomond and Felton series. They are in the cooler, foggy, high-rainfall part of the Santa Cruz Mountains and have slopes of 15 to 75 percent. This group covers about 4,000 acres.

Available water holding capacity is 4 to 10 inches. Fertility is moderate.

The natural vegetation consists of redwood and Douglas-fir forests that contain such associated hardwood species as tan oak, live oak, and madrone, and various other trees and shrubs.

Game species are deer, band-tailed pigeons, California quail, brush rabbits, and gray squirrels. This group of soils also forms an ideal habitat for many species of nongame birds. Pure stands of mature timber on these soils provide protection and food for a limited number of deer, quail, and rabbits, and openings or regrowth areas provide an excellent habitat for these game species. These soils are suitable for many wildlife food and cover plants.

WILDLIFE SUITABILITY GROUP 8

This group consists of shallow to deep soils and land types that are well drained to somewhat excessively drained. These soils are in the Azule, Gaviota, Gilroy, Inks, Los Gatos, Los Osos, Madonna, Mayman, Parrish, San Andreas, San Benito, and Vallecitos series. Riverwash, Rock land, and Terrace escarpments are also included. These soils are on the uplands on both sides of the Santa Clara Valley and have slopes of 15 to 75 percent. This group covers about 327,000 acres.

The surface layer is loam, clay loam, or fine sandy loam and is gravelly, stony, or shaly in places. In some places rock outcrops cover up to 10 percent of the surface and the soils are eroded. Fertility is very low to high. The available water holding capacity is 1 to 10 inches.

The natural vegetation is generally annual grasses, forbs, and some scattered oak trees. There is a fairly dense cover of shrubs and trees on the north-facing slopes and in swales and gullies. The grasses and weedy herbs are important sources of food for wildlife. These soils are used mainly for range, wildlife, recreation, and watershed.

This group provides a good habitat for both deer and California quail, especially where brushy draws or north-facing slopes are intermingled with open grassland. Rabbits and gray squirrels and band-tailed pigeons, mourning doves, and other birds also use this habitat.

The physical characteristics of the soils in this group severely limit the potential for the development of wildlife habitat. The availability of water for wildlife is variable. The leasing of hunting rights has good potential for economic returns for the landowner.

PONDS AND RESERVOIRS

Most impoundments in this survey area are too small to attract large numbers of ducks. During the winter, Canada geese use Anderson and Coyote Reservoirs to some extent and graze on the adjacent grassland.

Livestock reservoirs and farm ponds are suitable for fish production. Those with cooler water are suitable for trout production, and the others are excellent for the production of black bass, sunfish, and channel catfish. Production of fish in a pond is dependent upon the fertility of the water, which in turn is influenced significantly by the fertility of the soils in the watershed, and to some extent by the soil on the bottom of the pond. Ponds on infertile soils produce less fish per acre.

Ponds and reservoirs have good potential for economic returns from fish production and recreation in hunting areas.

Engineering Uses of the Soils [5]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, and pipelines, the foundations of buildings, facilities for storing water, structures for controlling erosion, drainage systems, and systems for disposing of sewage. Among the properties most important to the engineer are permeability to water, water holding capacity, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and soil reaction. Also important are depth to the water table, flooding hazard, depth to bedrock or to sand and gravel, and relief. Laboratory analysis is needed to accurately determine these qualities. Such information is made available in this section. Engineers can use it to—

1. Make soil and land use studies that will aid in selecting and developing industries, businesses, residences, and recreational areas.
2. Expedite planning and designing of erosion and flood control structures, drainage improvements, farm ponds, irrigation systems, diversion terraces, and other structures for conservation of soil and water.
3. Make preliminary evaluations of soil conditions that will aid in selecting locations for highways, airports, pipelines, and cables, and in planning more detailed surveys for the selected locations.
4. Locate probable sources of topsoil, sand, gravel, and other materials suitable for construction needs.
5. Correlate performance of engineering structures with mapping units to develop information for general planning that will be useful in designing and maintaining certain engineering practices and structures.
6. Supplement information obtained from other published maps and reports and aerial photographs.
7. Develop other preliminary estimates for construction purposes pertinent to the particular area.

It should be emphasized that the interpretations made in this soil survey do not eliminate the need for sampling and testing at a site chosen for a specific engineering work that involves heavy loads or at a site where excavations are to be deeper than the depths of the layers here reported. Nevertheless, by using this survey an engineer can select and concentrate on those soil units most important for his proposed kind of construction, and in this manner he can reduce the number of samples taken for laboratory testing and thus complete an adequate soil investigation at minimum cost.

The soil mapping units shown on the maps in this survey may include small areas of a different soil material. They are too small to be mapped separately and generally are not significant to farming in the area but may be important in engineering planning.

Information of value in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used by the scientist may be unfamiliar to the engineer, and some words—for example, soil, clay, silt, and sand—may have a special meaning in soil science. These and other special terms used in the soil survey are defined in the Glossary at the back of this survey. Most of the information about engineering is given in tables 4, 5, and 6.

Engineering classification systems

Agricultural scientists of the U.S. Department of Agriculture classify soils according to texture (*10*). In some ways this system of naming textural classes is comparable to the systems most commonly used by engineers for classifying soils; that is, the system of the American Association of State Highway Officials (AASHO) and the Unified system.

AASHO system.—Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (*1*). In this system soil materials are classified in seven principal groups.

[5] E. C. JAHR, Soil Conservation Service, assisted in the preparation of this section.

TABLE 4.—*Engineering*

[Tests performed by the California

Soil series and location	Calif. report No.	Depth	Classification			Moisture density [4]		Atterberg values	
			USDA texture [1]	Unified [2]	AASHO [3]	Maximum dry density	Optimum moisture	Liquid limit	Plastic index
		Inches				*Lb. per cu. ft*			
Arbuckle:									
NW¼SE¼ sec. 22, R. 3 E., T. 9 S.	2732	0–6	Gravelly loam	SM–SC	A–4(1)	132	8	19	5
	2728	20–32	Gravelly loam	SM–SC	A–2–4(0)	138	8	18	5
	2714	40–60	Very gravelly sandy loam.	SM–SC	A–2–4(0)	142	8	24	7
Azule:									
NE¼SE¼ sec. 6, T. 10 S., R. 4 E.	2718	0–12	Clay loam	SC	A–6(4)	123	12	31	13
	2717	12–28	Gravelly sandy clay	SC	A–6(5)	117	13	39	19
	2712	48–60	Gravelly sandy clay loam.	SC	A–2–6(1)	128	11	34	15
Ben Lomond:									
NE¼NE¼ sec. 35, T. 10 S., R. 2 E.	2720	0–6	Fine sandy loam	SM	A–2–4(0)	113	15	[7] NP	[7] NP
	2716	15–27	Very fine sandy loam	SM	A–2–4(0)	124	10	NP	NP
Campbell:									
NW¼SW¼ sec. 35, T. 8 S., R. 2 E.	2729	8–27	Silty clay loam	CL	A–6(10)	112	16	34	15
	2715	40–68	Silty clay loam	CL	A–6(9)	122	10	29	13
Gilroy:									
NE¼SW¼ sec. 18, T. 11 S., R. 4 E.	2721	0–8	Clay loam	SM–SC [8]	A–2–6(0)	123	12	39	12
	2735	8–21	Clay loam	SM–SC	A–6–1	120	16	38	12
Hillgate:									
SW¼NW¼ sec. 8, T. 10 S., R. 4 E.	2730	5–10	Silt loam	ML–CL	A–4(6)	122	12	20	5
	2726	10–26	Clay	CL	A–7–6(12)	111	16	41	19
	2731	40–60	Gravelly clay loam	SC	A–6(2)	129	12	28	12
Los Gatos:									
NW¼SE¼ sec. 20, T. 10 S., R. 3 E.	2723	0–7	Gravelly loam	SC	A–4(0)	120	12	30	10
	2719	16–29	Gravelly clay loam	SM–SC	A–4(1)	128	11	22	7
Maymen:									
SW¼SW¼ sec. 15, T. 10 S., R. 2 E.	2724	3–14	Fine sandy loam	SM	A–4(1)	120	12	NP	NP
San Ysidro, acid variant:									
NE¼NW¼ sec. 18, T. 10 S., R. 4 E.	2733	4–10	Loam	ML–CL	A–4(6)	126	9	19	5
	2727	29–42	Clay	SC	A–6(3)	126	12	25	11
	2725	42–58	Gravelly clay loam	SC	A–2–4(0)	127	9	25	10
Sunnyvale:									
NE¼SE¼ sec. 34, T. 8 S., R. 2 E.	2722	14–34	Silty clay	CL	A–7–6(14)	115	13	45	23
	2734	42–60	Silty clay	CL	A–6(11)	121	13	35	17
Yolo:									
SE¼NW¼ sec. 35, T. 8 S., R. 2 E.	2713	7–18	Silty clay loam	CL	A–6(9)	116	15	30	12
	2711	36–67	Silty clay loam	CL	A–6(9)	125	11	28	12
Zamora:									
SE¼SW¼ sec. 4, T. 10 S., R. 3 E.	6421A	7–15	Clay loam	----	----	----	----	----	----
	6422A	15–26	Clay loam	----	----	----	----	----	----
	6423A	35–58	Fine sandy clay loam	----	----	----	----	----	----

[1] By field determination. Mechanical analysis by the California Division of Highways procedure frequently may differ from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS).

[2] Based on the Unified Soil Classification System (*12*).

[3] Based on AASHO Designation M145–49 (*1*).

[4] Based on the method of testing for relative compaction of untreated and treated soils and aggregates, California test method No. 216E.

[5] Coefficient of linear extensibility of the whole soil (all size fractions). Fractional change of one dimension (thickness) of the soil upon wetting from ovendry to ⅓ bar water content. This special test was made by USDA Soil Survey Laboratory, Riverside, Calif.

test data
State Division of Highways]

COLE [5]	Mechanical analysis [6]														
	Percentage passing sieve—											Percentage smaller than—			
	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.
In. per in.															
----------	------	100	99	98	97	89	82	73	59	53	41	36	25	13	8
----------	------	100	96	90	88	81	76	68	53	47	35	33	21	13	8
----------	100	96	91	84	80	73	64	47	28	23	16	15	8	6	8
----------	------	------	------	------	100	98	85	87	70	63	49	47	32	25	20
----------	------	------	------	100	99	95	87	79	66	59	46	44	34	29	24
----------	------	------	------	100	98	92	83	72	52	44	30	27	19	15	12
----------	------	------	------	------	------	------	100	96	76	62	34	31	14	6	3
----------	------	------	------	------	------	------	100	95	78	63	35	32	19	11	6
----------	------	------	------	------	------	------	--------	--------	100	99	94	90	67	43	31
----------	------	------	------	------	------	------	--------	100	98	94	78	73	52	35	26
----------	------	------	------	100	99	90	87	74	61	44	32	30	17	10	7
----------	------	------	100	99	99	95	90	82	58	48	36	33	22	13	9
0. 008	------	------	------	------	------	------	100	97	87	71	63	59	40	23	14
. 068	------	------	------	------	------	------	100	98	92	89	77	74	59	50	43
. 024	100	97	95	95	94	89	84	74	61	57	41	38	24	19	15
----------	------	------	100	99	98	95	89	74	52	47	36	35	24	14	7
----------	------	------	------	100	99	96	93	82	58	52	41	38	29	18	11
----------	------	------	------	------	------	------	100	95	82	74	39	35	21	14	8
----------	------	------	------	------	------	------	100	95	87	82	65	61	37	22	13
----------	------	------	------	------	------	------	100	92	75	68	48	44	28	21	19
----------	------	------	------	100	99	96	94	78	54	48	33	30	20	16	13
. 070	------	------	------	------	------	------	--------	100	99	98	94	92	67	47	36
. 045	------	------	------	------	------	------	--------	100	99	98	89	85	59	38	29
----------	------	------	------	------	------	------	--------	--------	100	99	91	86	58	49	29
----------	------	------	------	------	------	------	--------	--------	100	98	89	83	57	34	26
. 028	------	------	------	------	------	------	--------	--------	--------	--------	--------	-------	-------	-------	-------
. 057	------	------	------	------	------	------	--------	--------	--------	--------	--------	-------	-------	-------	-------
. 033	------	------	------	------	------	------	--------	--------	--------	--------	--------	-------	-------	-------	-------

[6] Mechanical analyses by California Division of Highways. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the SCS. In the California procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for uses in naming textural classes for soil.

[7] NP=Nonplastic.

[8] Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification.

TABLE 5.—*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 that appear in the first column of this table. Landslides (LaF), Riverwash (Rg), Rock land (RnG), and Terrace than]

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				
Altamont: AcE, AcF, AcG2	2½–5	(1)	0–44	Clay	CH	A–7	0
			44	Shale.			
Arbuckle: AkC, ArA	3–5	(1)	0–40	Gravelly loam	SM or SC	A–4	0
			40–60	Very gravelly sandy loam (bedrock in places).	SM or SC	A–2	0
Azule: AuD2, AuE, AuE2, AuG, AuG2.	>5	(1)	0–12	Clay loam	SC	A–6	0
			12–48	Gravelly sandy clay	SC	A–6	0
			48–60	Gravelly sandy clay loam	SC	A–2	0
Ben Lomond: BeG	3–5	(1)	0–43	Fine sandy loam or very fine sandy loam.	SM	A–2	0
			43	Soft sandstone.			
Campbell:							
Ca, Cd	>5	(1)	0–68	Silty clay loam	CL	A–6	0
Cc	>5	3–5	0–36	Silty clay loam	CL	A–6	0
			36–60	Clay	CH	A–7	0
Ce	>5	2½–3½	0–36	Silty clay loam	CL	A–6	0
			36–60	Mucky clay	OH	A–7	0
Clear Lake: Cg, Ch, Ck	5+	2½–6	0–60	Clay	CH	A–7	0
Climara: ClD, CmE	1½–3½	(1)	0–27	Clay	CH	A–7	0
			27	Metamorphosed basic igneous rock.			
Cortina: CoB	5+	(1)	0–60	Very gravelly loam, fine sandy loam or sandy loam.	GM	A–1	0–5
Cropley: CrA, CrC	5+	(1)	0–60	Clay	CH	A–7	0
Diablo: DaD, DaF	2–5	(1)	0–40	Clay	CH	A–7	0
			40	Sandstone.			
Esparto: EsA, EsC	5+	(1)	0–14	Loam	ML	A–4	0
			14–48	Clay loam and silt loam	ML or CL	A–6	0
			48–60	Gravelly clay loam	SC	A–6	0
Felton: FaE, FaF, FaG	1½–5	(1)	0–48	Clay loam	CL	A–7	0
			48	Shale or sandstone.			
Garretson:							
GaA	5+	(1)	0–40	Loam	ML to CL	A–4	0–5
			40	Sand and gravel	GP	A–1	0–5
GbB	5+	(1)	0–60	Gravelly loam	ML to CL	A–4	0
*Gaviota: GcD2, GcE, GcG, GhG2, GhG3, GkE2, GmF. (For Los Gatos part of GmF, see the Los Gatos series.)	½–1½	(1)	0–19	Loam or gravelly loam	SM or SC	A–4	0
			19	Sandstone and shale.			
Gilroy: GoD, GoE2, GoF, GoG.	1½–3	(1)	0–21	Clay loam	SM or SC	A–2 or A–6	0
			21	Basic igneous rock.			

See footnotes at end of table.

engineering properties

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for escarpments (TeF) are so variable that their properties were not estimated. The symbol < means less than; the symbol > means more

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index						
						Inches per hour	*Inches per inch of soil*	*pH value*	*Mmhos./cm. at 25° C.*		
100	100	95–100	75–95	50–60	25–35	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	<1	High	High.
75–85	65–85	50–60	35–45	15–20	5–10	0. 63–2. 00	0. 12–0. 14	5. 6–6. 5	<1	Moderate	Low.
60–70	40–50	25–35	10–35	15–25	5–10	2. 00–6. 30	0. 05–0. 07	6. 1–6. 5	<1	Low	Low.
95–100	80–90	65–75	40–50	30–40	10–20	0. 20–0. 63	0. 19–0. 21	5. 6–6. 0	<1	Moderate	Moderate.
80–95	70–80	60–70	40–50	30–40	10–20	0. 06–0. 20	0. 12–0. 14	5. 6–6. 0	<1	High	High.
80–90	65–75	50–60	25–35	30–40	10–20	0. 06–0. 20	0. 11–0. 13	5. 6–6. 0	<1	Moderate	High.
100	95–100	75–80	30–35	[2] NP	[2] NP	2. 00–6. 30	0. 14–0. 16	5. 1–6. 5	<1	Low	Low.
100	100	95–100	75–95	25–35	10–20	0. 20–0. 63	0. 19–0. 21	7. 4–8. 4	<1	Moderate	High.
100	100	95–100	75–95	25–35	10–20	0. 20–0. 63	0. 19–0. 21	7. 4–8. 4	<1	Moderate	High.
100	100	95–100	85–95	50–60	30–35	0. 06–0. 20	0. 14–0. 16	8. 0–8. 4	<1	High	High.
100	100	95–100	75–95	25–35	10–20	0. 06–0. 20	0. 19–0. 21	7. 4–8. 4	<1	Moderate	High.
100	100	95–100	85–95	70–90	15–30	0. 20–0. 63	0. 23–0. 25	8. 0–8. 4	<1	High	High.
100	100	100	90–100	50–60	30–35	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	0–15	High	High.
100	80–90	85–95	75–85	50–60	30–35	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	<1	High	High.
70–85	20–50	15–40	5–20	NP	NP	6. 30–20. 0	0. 04–0. 07	6. 1–6. 5	<1	Low	Low.
100	100	100	95–100	50–60	30–40	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	<1	High	High.
100	100	100	95–100	50–60	30–40	0. 06–0. 20	0. 14–0. 16	7. 4–8. 4	<1	High	High.
100	100	75–80	60–75	30–35	0–10	0. 63–2. 00	0. 16–0. 18	5. 6–6. 0	<1	Moderate	Low.
100	100	90–95	70–80	35–40	10–15	0. 20–0. 63	0. 19–0. 21	6. 1–7. 3	<1	Moderate	Moderate.
70–80	65–70	50–60	40–50	30–35	10–15	0. 20–0. 63	0. 14–0. 16	6. 6–7. 3	<1	Moderate	Moderate.
100	100	95–100	75–85	40–50	25–30	0. 20–0. 63	0. 19–0. 21	5. 1–6. 0	<1	Moderate	Moderate.
90–100	85–95	75–85	60–70	20–30	0–10	0. 63–2. 00	0. 16–0. 18	6. 6–7. 3	<1	Moderate	Low.
40–50	30–40	20–30	0–5	NP	NP	>20. 0	0. 03–0. 05	6. 6–8. 4	<1	Low	Low.
90–100	80–85	70–80	55–65	20–30	0–10	0. 63–2. 00	0. 12–0. 14	6. 6–8. 4	<1	Moderate	Low.
75–80	75–90	60–70	40–50	30–40	5–10	0. 63–2. 00	0. 14–0. 16	6. 1–6. 5	<1	Low	Low.
85–95	85–95	55–65	30–40	30–40	10–20	0. 20–0. 63	0. 19–0. 21	5. 6–6. 0	<1	Moderate	Moderate.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface (typical profile)	Classification: USDA texture	Classification: Unified	Classification: AASHO	Coarse fraction greater than 3 inches
	Feet	*Feet*	*Inches*				
Henneke: HeG3	1–1½	(1)	0–15	Very gravelly clay	GC	A–2	30–40
			15	Serpentine rock.			
Hillgate: HfC, HfD2, HfE2, HfF2.	5+	(1)	0–10	Silt loam	ML or CL	A–4	0
			10–40	Clay and clay loam	CL or ML	A–6 or A–7	0
			40–60	Gravelly clay loam	SC	A–6	0
Inks: InG2, IsG3	1–1½	(1)	0–15	Gravelly clay loam	SC or SM	A–2	0–5
			15	Metamorphosed basalt.			
Keefers: KeA, KeC2	>5	(1)	0–23	Clay loam	CL	A–6	0
			23–38	Very gravelly clay loam	GC or GM	A–2	0
			38–60	Gravelly clay	CL or ML	A–6	0
*Los Gatos: LfE2, LfF, LfG, LhG. (For the Gaviota part of LhG, see the Gaviota series.)	2–4	(1)	0–10	Gravelly loam	SC or SM	A–4 or A–6	0
			10–35	Gravelly clay loam	SC or SM	A–4 or A–6	0
			35	Shale.			
Los Osos: LoE, LoF, LoG	2–3½	(1)	0–10	Clay loam	CL or ML	A–6	0
			10–36	Clay	CH	A–7	0
			36	Sandstone.			
Los Robles: LrA, LrC	>5	(1)	0–14	Clay loam	CL or ML	A–6	0
			14–60	Gravelly clay loam	CL	A–6	0
Madonna: MbE, MbF, MbG	2–2½	(1)	0–25	Loam	SM	A–4	0
			25	Sandstone.			
Maxwell: McB	>5	(1)	0–46	Clay	CH	A–7	0
			46–60	Gravelly clay loam	CL	A–6	0
Maymen: MeF2, MfG2	1–1½	(1)	0–14	Fine sandy loam	SM	A–4	0
			14	Sandstone.			
Montara: MwF2	1–1½	(1)	0–13	Clay loam	CL	A–6	0
			13	Serpentine rock.			
Pacheco: Pa, Pb, Pd	>5	3–6+	0–60	Clay loam, loam, and very fine sandy loam. (Surface layer is fine sandy loam or silt loam in places.)	ML or CL	A–6	0
Pe	>5	(1)	0–36	Clay loam and loam	ML or CL	A–6	0
			36–60	Gravel and sand	GP	A–1	0–5
Parrish: PfE, PfF, PfG	2–3½	(1)	0–19	Gravelly clay loam	ML or CL	A–4	0
			19–38	Gravelly clay	CH	A–7	0–10
			38	Shale.			
Pleasanton: PoA, PoC, PpA, PpC, PpD2.	>5	(1)	0–60	Loam, gravelly clay loam and gravelly sandy clay loam.	ML or CL	A–6	0–10
Rincon: RaA, RaC2	>5	(1)	0–19	Clay loam	CL	A–7	0
			19–50	Gravelly clay or clay	CH	A–7	0
			50–72	Clay loam	ML	A–4	0
San Andreas: SaE2, SaG2	2–2½	(1)	0–23	Fine sandy loam	SM	A–2	0
			23	Soft sandstone.			
San Benito: SbE2, SbF, SbF3, SbG.	2–4	(1)	0–39	Clay loam	CL	A–7	0
			39	Shale.			

See footnotes at end of table.

properties—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index						
						Inches per hour	*Inches per inch of soil*	*pH value*	*Mmhos./cm. at 25° C.*		
40–50	40–45	30–40	20–30	50–60	25–35	0. 06–0. 20	0. 10–0. 12	6. 6–7. 3	<1	Moderate	High.
100	90–100	80–90	60–70	20–25	0–10	0. 63–2. 00	0. 19–0. 21	5. 6–6. 0	<1	Moderate	Moderate.
100	95–100	90–95	70–80	35–45	15–25	<0. 06	0. 04–0. 06	5. 6–6. 0	<1	High	High.
80–90	70–80	60–70	40–50	25–30	10–15	0. 20–0. 63	0. 15–0. 17	5. 6–6. 0	<1	Moderate	Moderate.
90–95	70–80	60–70	30–35	35–40	10–15	0. 20–0. 63	0. 15–0. 17	6. 1–6. 5	<1	Moderate	Moderate.
90–95	85–90	75–85	70–80	30–35	10–15	0. 20–0. 63	0. 18–0. 20	6. 1–6. 5	<1	Moderate	Moderate.
40–50	35–45	30–35	25–30	30–40	10–15	0. 06–0. 20	0. 12–0. 14	6. 6–7. 3	<1	Moderate	Moderate.
85–90	75–85	75–80	70–80	30–35	10–15	0. 06–0. 20	0. 04–0. 06	7. 4–7. 8	<1	Moderate	Moderate.
80–90	70–80	50–60	35–45	20–30	5–15	0. 63–2. 00	0. 12–0. 14	6. 1–6. 5	<1	Moderate	Low.
90–100	80–90	50–60	40–50	20–30	5–15	0. 20–0. 63	0. 15–0. 17	5. 6–6. 0	<1	Moderate	Moderate.
100	95–100	90–95	75–85	30–40	10–20	0. 20–0. 63	0. 19–0. 21	6. 1–6. 5	1	Moderate	Moderate.
100	95–100	90–95	80–90	50–60	30–40	0. 06–0. 20	0. 14–0. 16	6. 1–6. 5	1	High	High.
90–95	85–95	80–85	70–80	30–40	10–20	0. 20–0. 63	0. 19–0. 21	6. 6–7. 3	1	Moderate	Moderate.
80–85	65–75	60–70	50–60	30–40	15–20	0. 20–0. 63	0. 14–0. 16	6. 6–7. 3	1	Moderate	Moderate.
95–100	90–95	80–90	35–45	NP	NP	0. 63–2. 0	0. 16–0. 18	5. 6–6. 0	1	Moderate	Low.
100	100	95–100	90–95	50–70	40–55	0. 06–0. 20	0. 14–0. 16	6. 6–8. 4	1	High	High.
80–85	75–80	70–75	60 70	30–40	15–25	0. 06–0. 20	0. 14–0. 16	7. 9–8. 4	1	Moderate	High.
100	95–100	80–90	35–40	NP	NP	2. 00–6. 3	0. 13–0. 15	5. 1–6. 0	1	Low	Low.
90–100	90–100	90–95	85–95	30–40	20–35	0. 20–0. 63	0. 19–0. 21	7. 9–8. 4	1	Moderate	Moderate.
100	95–100	90–100	65–85	30–40	10–15	0. 63–2. 00	0. 16–0. 19	7. 9–8. 4	0–8	Moderate	High.
100	95–100	90–100	65–85	30–40	10–15	0. 63–2. 00	0. 19–0. 21	7. 9–8. 4	0–8	Moderate	High.
40–50	30–40	20–30	0–5	NP	NP	6. 30–20. 0	0. 03–0. 05	7. 9–8. 4	0–8	Low	Low.
75–85	70–80	65–70	60–65	20–40	5–10	0. 63–2. 00	0. 14–0. 15	5. 1–6. 0	<1	Moderate	High.
60–70	55–65	55–65	50–60	50–60	20–30	0. 06–0. 20	0. 11–0. 13	5. 1–5. 5	<1	High	High.
80–90	75–90	65–75	60–65	20–40	10–20	0. 20–0. 63	0. 13–0. 18	6. 1–7. 3	<1	Moderate	Moderate.
100	100	90–100	80–90	40–50	20–30	0. 20–0. 63	0. 19–0. 21	6. 6–7. 8	<1	Moderate	Moderate.
90–100	75–100	70–95	70–90	50–60	30–40	0. 06–0. 20	0. 12–0. 16	7. 4–8. 4	<1	High	High.
100	100	90–100	80–90	30–40	5–10	0. 20–0. 63	0. 19–0. 21	7. 9–8. 4	<1	Moderate	Moderate.
90–100	90–100	80–90	30–35	15–20	0–5	2. 00–6. 30	0. 13–0. 15	5. 6–6. 0	<1	Low	Low.
100	90–100	85–90	70–85	40–50	20–30	0. 20–0. 63	0. 19–0. 21	6. 6–8. 4	<1	Moderate	Moderate.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				
Santa Lucia: ScF2, ScG	2–3	(1)	0–23	Shaly and very shaly clay loam.	MH	A–5	0
			23	Shale.			
San Ysidro: SdA, SdB2	>5	(1)	0–20	Loam	CL–ML or CL	A–4	0
			20–36	Clay	SC or CL	A–6	0
			36–60	Clay loam or sandy clay loam.	SC	A–2 or A–4	0
San Ysidro, acid variant: SfA, SfC.	>5	(1)	0–29	Loam	ML to CL	A–4	0
			29–42	Clay	SC or CL	A–6	0
			42–58	Gravelly clay loam	SC	A–2 or A–4	0
Sunnyvale: Su, Sv	>5	2½–5+	0–60	Silty clay	CL	A–6 or A–7	0
Vallecitos: VaE2, VaG2	1–2½+	(1)	0–10	Loam	SM	A–4	0
			10–19	Clay loam and clay	CL or CH	A–7	0
			19	Shale.			
Willows: Wa	>5	1½–3½	0–60	Clay	CH	A–7	0
Yolo:							
YaA, YaB	>5	(1)	0–60	Loam and silt loam	ML	A–4 or A–5	0
YeA, YeC	>5	(1)	0–67	Silty clay loam	CL	A–6	0
*Zamora: ZaA, ZaC, ZbA, ZbC, ZeC3. (For Cropley part of ZeC3, see Cropley series.)	>5	(1)	0–58	Clay loam and sandy clay loam. (Surface layer is loam in places.)	CL	A–6	0–5

[1] No observed water table to depth of study, which generally was 5 feet for soils not underlain by bedrock.
[2] NP=Nonplastic.

TABLE 6.—*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 referring to other series that appear in the first column of this table. Landslides (LaF), Riverwash (Rg)

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Altamont: AcE, AcF, AcG2.	Poor: clay	Unsuitable for sand: 75 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–7	D	2½ to 5 feet to rock; 15 to 75 percent slopes; high shrink-swell potential.
Arbuckle: AkC, ArA	Fair to poor: gravelly loam or loam over very gravelly sandy loam.	Fair to poor for sand: 10 to 45 percent passes No. 200 sieve. Fair to unsuitable for gravel: 15 to 60 percent gravel.	Fair to good: A–4, A–2.	B	3 to 5 feet or more to rock; 0 to 9 percent slopes; moderate shrink-swell potential.

properties—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index						
						Inches per hour	*Inches per inch of soil*	*pH value*	*Mmhos./cm. at 25° C.*		
70–80	65–70	50–65	40–50	70–85	0–10	0. 63–2. 00	0. 10–0. 12	5. 6–6. 0	<1	Moderate	Moderate.
95–100	90–95	80–90	50–65	15–25	5–10	0. 63–2. 00	0. 16–0. 18	5. 6–6. 5	<1	Moderate	Moderate.
95–100	90–95	75–85	45–55	25–35	10–20	<0. 06	0. 04–0. 06	6. 1–7. 3	<1	High	High.
85–95	70–80	50–60	30–40	20–30	5–10	0. 20–0. 63	0. 14–0. 16	7. 9–8. 4	<1	Moderate	Moderate.
95–100	90–95	80–90	50–65	15–25	5–10	0. 63–2. 00	0. 16–0. 18	5. 6–6. 0	<1	Moderate	Moderate.
95–100	90–95	75–85	45–55	25–35	10–20	<0. 06	0. 04–0. 06	5. 1–5. 5	<1	High	High.
90–95	75–80	50–60	30–40	20–30	5–10	0. 63–2. 00	0. 14–0. 16	5. 1–5. 5	<1	Moderate	High.
100	100	95–100	85–95	35–45	15–25	0. 06–0. 20	0. 15–0. 17	7. 9–8. 4	0–8	High	High.
85–95	80–90	55–80	40–50	30–40	5–10	0. 63–2. 00	0. 16–0. 18	5. 6–6. 5	<1	Moderate	Moderate.
85–95	80–90	65–80	55–65	40–60	25–35	0. 06–0. 20	0. 17–0. 19	5. 6–6. 0	<1	High	High.
100	100	95–100	90–95	50–60	30–40	0. 06–0. 20	0. 14–0. 16	7. 9–9. 0	4–15	High	High.
100	100	85–95	80–90	35–45	5–10	0. 63–2. 00	0. 17–0. 19	6. 6–7. 8	<1	Moderate	Low.
100	100	90–100	85–95	25–35	10–20	0. 20–0. 63	0. 19–0. 21	6. 1–8. 4	<1	Moderate	Moderate.
95–100	95–100	95–100	85–95	30–40	15–20	0. 20–0. 63	0. 19–0. 21	6. 6–7. 3	<1	Moderate	Moderate.

interpretations

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for Rock land (RnG), and Terrace escarpments (TeF) are so variable that their properties were not estimated]

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 15 to 75 percent slopes; 2½ to 5 feet to rock.	Well drained; slow permeability; 2½ to 5 feet to rock.	15 to 75 percent slopes; 2½ to 5 feet to rock.	Severe: slow permeability; 15 to 75 percent slopes.
Fair stability; good strength; slight compressibility; good to poor resistence to piping and cracking.	Moderate permeability; 0 to 9 percent slopes; 3 to 5 feet or more to rock.	Well drained; moderate permeability; 3 to 5 feet or more to rock.	Moderate water holding capacity; moderately rapid intake rate; 0 to 9 percent slopes: 3 to 5 feet or more to rock.	ArA, slight. AkC, moderate: 3 to 5 feet or more to rock; 5 to 9 percent slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Azule: AuD2, AuE, AuE2, AuG, AuG2.	Poor: clay loam over gravelly sandy clay and gravelly sandy clay loam.	Poor for sand: 25 to 50 percent passes No. 200 sieve. Poor to unsuitable for gravel: 10 to 35 percent gravel.	Poor to good: A–6, A–2.	C	9 to 75 percent slopes; high shrink-swell potential.
Ben Lomond: BeG	Fair: fine sandy loam; 3 to 5 feet to rock.	Poor for sand: 30 to 35 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 5 percent gravel.	Good: A–2	B	3 to 5 feet to soft rock; 50 to 75 percent slopes; low shrink-swell potential.
Campbell:					
Ca, Cd	Fair: silty clay loam; water table below depth of 5 feet.	Unsuitable for sand: 75 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–6	C	Moderate shrink-swell potential.
Cc	Fair: silty clay loam; clay at depth of 3 feet; water table at depth of 3 to 5 feet.	Unsuitable for sand: 75 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–6, A–7 material at depth of 3 feet.	D	3 to 5 feet to water table, moderate shrink-swell potential to depth of 3 feet, high shrink-swell potential below.
Ce	Fair: silty clay loam; mucky clay at depth of 3 feet; water table at depth of 2½ to 3½ feet.	Unsuitable for sand: 75 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor to unsuitable: A–6, with organic A–7 material at depth of 3 feet.	D	2½ to 3½ feet to water table; moderate shrink-swell potential to depth of 3 feet, high shrink-swell organic materials below.
Clear Lake: Cg, Ch, Ck	Poor: clay	Unsuitable for sand: 90 to 100 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–7	D	2½ to 6 feet to water table; high shrink-swell potential.
Climara: ClD, CmE	Poor: clay and stony clay; 1½ to 3½ feet to rock.	Unsuitable for sand: 75 to 85 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 10 percent gravel.	Poor: A–7	D	1½ to 3½ feet to rock; 9 to 50 percent slopes; high shrink-swell potential.
Cortina: CoB	Poor: very gravelly sandy loam to very gravelly loam.	Fair for sand: 5 to 20 percent passes No. 200 sieve. Fair for gravel: 50 to 80 percent gravel.	Good: A–1	A	0 to 5 percent slopes; low shrink-swell potential.
Cropley: CrA, CrC	Poor: clay	Unsuitable for sand: 95 to 100 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–7	D	0 to 9 percent slopes; high shrink-swell potential.
Diablo: DaD, DaF	Poor: clay; 2 to 5 feet to rock.	Unsuitable for sand: 95 to 100 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–7	D	2 to 5 feet to rock; 9 to 50 percent slopes; high shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair stability; good strength; slight compressibility; good resistance to piping; fair resistance to cracking.	Slow permeability; 9 to 75 percent slopes.	Well drained; slow permeability.	9 to 75 percent slopes	Severe: slow permeability; 9 to 75 percent slopes.
Fair stability; good strength; slight compressibility; poor resistance to piping and cracking.	Moderately rapid permeability; 50 to 75 percent slopes; 3 to 5 feet to soft rock.	Well drained; moderately rapid permeability; 3 to 5 feet to soft rock.	50 to 75 percent slopes; 3 to 5 feet to soft rock.	Severe: 50 to 75 percent slopes.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 5 feet or more to water table.	Somewhat poorly drained; moderately slow permeability; 5 feet or more to water table.	High water holding capacity; slow intake rate; 5 feet or more to water table.	Severe: moderately slow permeability; 5 feet or more to water table.
Fair to poor stability; fair to poor strength; medium to high compressibility; good resistance to piping and cracking.	Slow permeability; 3 to 5 feet to water table.	Somewhat poorly drained; slow permeability; 3 to 5 feet to water table.	High water holding capacity; slow intake rate; 3 to 5 feet to water table.	Severe: slow permeability; 3 to 5 feet to water table.
Not suitable for embankment materials below depth of 3 feet.	Slow permeability; 2½ to 3½ feet to water table; OH material at depth of 3 feet.	Somewhat poorly drained; slow permeability; 2½ to 3½ feet to water table.	High water holding capacity; slow intake rate; 2½ to 3½ feet to water table.	Severe: slow permeability; 2½ to 3½ feet to water table.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 2½ to 6 feet to water table.	Slow permeability; 2½ to 6 feet to water table.	High water holding capacity; slow intake rate; 2½ to 6 feet to water table; some areas are saline.	Severe: slow permeability; 2½ to 6 feet to water table.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 9 to 50 percent slopes; 1½ to 3½ feet to rock.	Slow permeability; 1½ to 3½ feet to rock.	Moderate water holding capacity; slow intake rate; 9 to 50 percent slopes; 1½ to 3½ feet to bedrock.	Severe: slow permeability; 1½ to 3½ feet to rock; 9 to 50 percent slopes.
Fair stability; good strength; slight compressibility; poor resistance to piping; fair resistance to cracking.	Rapid permeability; 0 to 5 percent slopes.	Somewhat excessively drained; rapid permeability.	Low water holding capacity; very rapid intake rate; 0 to 5 percent slopes.	Slight.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 0 to 9 percent slopes.	Well drained; slow permeability.	High water holding capacity; slow intake rate; 0 to 9 percent slopes.	Severe: slow permeability.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 9 to 50 percent slopes; 2 to 5 feet to rock.	Well drained; slow permeability; 2 to 5 feet to rock.	9 to 50 percent slopes; 2 to 5 feet to rock.	Severe: slow permeability; 9 to 50 percent slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Esparto: EsA, EsC	Fair: loam over clay loam and gravelly clay loam.	Poor to unsuitable for sand: 40 to 80 percent passes No. 200 sieve. Poor to unsuitable for gravel; 0 to 35 percent gravel.	Fair to poor: A-4, A-6.	B	0 to 9 percent slopes; moderate shrink-swell potential.
Felton: FaE, FaF, FaG	Fair: clay loam 1½ to 5 feet to rock.	Unsuitable for sand: 75 to 85 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A-7	B	1½ to 5 feet to rock; 15 to 75 percent slopes moderate shrink-swell potential.
Garretson: GaA, GbB	Good to fair: loam and gravelly loam.	Good to unsuitable for sand; 0 to 70 percent passes No. 200 sieve. Fair to unsuitable for gravel: 5 to 70 percent gravel.	Fair to good: A-4, A-1.	B	0 to 5 percent slopes; moderate shrink-swell potential.
*Gaviota: GcD2, GcE, GcG, GhG2, GhG3, GkE2, GmF. (For Los Gatos part of GmF, see Los Gatos series.)	Poor: ½ to 1½ feet to rock.	Unsuitable for sand: ½ to 1½ feet to rock. Unsuitable for gravel: ½ to 1½ feet to rock.	Poor: A-4; ½ to 1½ feet to rock.	D	½ to 1½ feet to rock; 5 to 75 percent slopes; low shrink-swell potential.
Gilroy: GoD, GoE2, GoF, GoG.	Fair: clay loam; 1½ to 3 feet to rock.	Poor for sand: 30 to 40 percent passes No. 200 sieve. Poor to unsuitable for gravel; 5 to 15 percent gravel.	Good to poor: A-2, A-6.	C	1½ to 3 feet to rock; 5 to 75 percent slopes; moderate shrink-swell potential.
Henneke: HeG3	Poor: very gravelly clay; 1 to 1½ feet to rock.	Unsuitable for sand: 1 to 1½ feet to rock. Unsuitable for gravel: 1 to 1½ feet to rock.	Poor: A-2; 1 to 1½ feet to rock.	D	1 to 1½ feet to rock; 30 to 75 percent slopes; moderate shrink-swell potential.
Hillgate: HfC, HfD2, HfE2, HfF2.	Poor: silt loam over clay and gravelly clay loam.	Poor to unsuitable for sand: 40 to 80 percent passes No. 200 sieve. Poor to unsuitable for gravel: 0 to 30 percent.	Fair to poor: A-4, A-6, A-7.	D	2 to 50 percent slopes; high shrink-swell potential.
Inks: InG2, IsG3	Poor: gravelly clay loam; 1 to 1½ feet to rock.	Unsuitable for sand: 1 to 1½ feet to rock. Unsuitable for gravel: 1 to 1½ feet to rock.	Poor: A-2; 1 to 1½ feet to rock.	D	1 to 1½ feet to rock; 30 to 75 percent slopes; moderate shrink-swell potential.
Keefers: KeA, KeC2	Fair to poor: clay loam over very gravelly clay loam.	Poor to unsuitable for sand: 25 to 80 percent passes No. 200 sieve. Fair to unsuitable for gravel: 10 to 65 percent gravel.	Good to poor: A-6, A-2.	C	0 to 9 percent slopes; moderate shrink-swell potential.
*Los Gatos: LfE2, LfF, LfG, LhG. (For Gaviota part of LhG, see Gaviota series.)	Fair: gravelly loam over gravelly clay loam; 2 to 4 feet to rock.	Poor for sand: 35 to 50 percent passes No. 200 sieve. Poor to unsuitable for gravel: 10 to 30 percent gravel.	Fair to good: A-4, A-6.	B/C	2 to 4 feet to rock; 15 to 75 percent slopes; moderate shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair to poor stability; fair to poor strength; medium to high compressibility; good to poor resistance to piping and cracking.	Moderately slow permeability; 0 to 9 percent slopes.	Moderately well drained; moderately slow permeability.	High water holding capacity; moderate intake rate; 0 to 9 percent slopes.	Severe: moderately slow permeability; 9 to 50 percent slopes.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 1½ to 5 feet to rock; 15 to 75 percent slopes.	Well drained; moderately slow permeability; 1½ to 5 feet to rock.	15 to 75 percent slopes; 1½ to 5 feet to rock.	Severe: moderately slow permeability; 15 to 75 percent slopes.
Poor stability; fair strength; medium compressibility; poor resistance to piping and cracking.	Moderate permeability (very rapid in GaA below depth of 40 inches); 0 to 5 percent slopes.	Well drained; moderate permeability (very rapid below 40 inches in unit GaA).	High water holding capacity; moderate intake rate; 0 to 5 percent slopes.	Slight.
Fair stability; good strength; slight compressibility; good to poor resistance to piping and cracking; ½ to 1½ feet to rock.	Moderate permeability; ½ to 1½ feet to rock; 5 to 75 percent slopes.	Somewhat excessively drained and well drained; moderate permeability; ½ 1½ feet to rock.	5 to 75 percent slopes; ½ to 1½ feet to rock.	Severe: ½ to 1½ feet to rock; 5 to 75 percent slopes.
Fair stability; good strength; slight compressibility; good to poor resistance to piping and cracking.	Moderately slow permeability; 5 to 75 percent slopes; 1½ to 3 feet to rock.	Well drained; moderately slow permeability; 1½ to 3 feet to rock.	5 to 75 percent slopes; 1½ to 3 feet to rock.	Severe: moderately slow permeability; 5 to 75 percent slopes.
Fair stability; good strength; slight compressibility; good resistance to piping; fair resistance to cracking. 1 to 1½ feet to rock.	Slow permeability; 30 to 75 percent slopes; 1 to 1½ feet to rock.	Somewhat excessively drained; slow permeability; 1 to 1½ feet to rock.	30 to 75 percent slopes; 1 to 1½ feet to rock.	Severe: slow permeability; 1 to 1½ feet to rock; 30 to 75 percent slopes.
Fair to poor stability; fair strength; medium to high compressibility; good to poor resistance to piping and cracking.	Very slow permeability; 2 to 50 percent slopes.	Well drained; very slow permeability.	Moderate to high water holding capacity; moderate intake rate; 2 to 50 percent slopes; very slow permeability.	Severe: very slow permeability; 2 to 50 percent slopes.
Fair stability; good strength; slight compressibility; good resistance to piping; fair resistance to cracking; 1 to 1½ feet to rock.	Moderately slow permeability; 30 to 75 percent slopes; 1 to 1½ feet to rock.	Somewhat excessively drained; moderately slow permeability; 1 to 1½ feet to rock.	30 to 75 percent slopes; 1 to 1½ feet to rock.	Severe: moderately slow permeability; 1 to 1½ feet to rock; 30 to 75 percent slopes.
Fair to good stability; fair to good strength; slight to high compressibility; good resistance to piping; good to fair resistance to cracking.	Slow permeability; 0 to 9 percent slopes.	Well drained; slow permeability.	Moderate water holding capacity; moderately slow intake rate: 0 to 9 percent slopes.	Severe: slow permeability.
Fair stability; good strength; slight compressibility; good resistance to piping; fair resistance to cracking.	Moderately slow permeability; 15 to 75 percent slopes; 2 to 4 feet to rock.	Well drained; moderately slow permeability; 2 to 4 feet to rock.	15 to 75 percent slopes; 2 to 4 feet to rock.	Severe: moderately slow permeability; 15 to 75 percent slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Los Osos: LoE, LoF, LoG.	Poor: clay loam over clay; 2 to 3½ feet to rock.	Unsuitable for sand: 75 to 90 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 5 percent gravel.	Poor: A-6, A-7.	C	2 to 3½ feet to rock; 15 to 75 percent slopes; high shrink-swell potential.
Los Robles: LrA, LrC	Fair: clay loam over gravelly clay loam.	Unsuitable for sand: 50 to 85 percent passes No. 200 sieve. Poor to unsuitable for gravel: 5 to 35 percent gravel.	Poor: A-6	B	0 to 9 percent slopes; moderate shrink-swell potential.
Madonna: MbE, MbF, MbG.	Fair; loam, 2 to 2½ feet to rock.	Poor for sand: 35 to 45 percent passes No. 200 sieve. Unsuitable for gravel: 5 to 10 percent gravel.	Fair: A-4	C	2 to 2½ feet to rock; 15 to 75 percent slopes; moderate shrink-swell potential.
Maxwell: McB	Poor: clay over gravelly clay loam.	Unsuitable for sand: 60 to 95 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 25 percent gravel.	Poor: A-7, A-6.	D	0 to 5 percent slopes; high shrink-swell potential.
Maymen: MeF2, MfG2.	Poor: 1 to 1½ feet to rock.	Unsuitable for sand: 1 to 1½ feet to rock. Unsuitable for gravel: 1 to 1½ feet to rock.	Poor: A-4; 1 to 1½ feet to rock.	D	1 to 1½ feet to rock; 15 to 75 percent slopes; low shrink-swell potential.
Montara: MwF2	Poor: 1 to 1½ feet to rock.	Unsuitable for sand: 1 to 1½ feet to rock. Unsuitable for gravel: 1 to 1½ feet to rock.	Poor: A-6; 1 to 1½ feet to to rock.	D	1 to 1½ feet to rock; 15 to 50 percent slopes; moderate shrink-swell potential.
Pacheco:					
Pa, Pb, Pd	Fair to good: 3 to 6 feet or more to water table; stratified clay loam to sandy loam.	Unsuitable for sand: 65 to 85 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 5 percent gravel.	Poor: A-6	B/C, drained	3 to 6 feet or more to water table; moderate shrink-swell potential.
Pe	Fair to good: stratified clay loam to sandy loam; 36 to 40 inches to stratified sand and gravel.	Unsuitable to good for sand: 0 to 85 percent passes No. 200 sieve. Fair to unsuitable for gravel: 0 to 70 percent gravel.	Poor to good: A-6, A-1.	B/C, drained	Moderate shrink-swell potential.
Parrish: PfE, PfF, PfG	Poor: gravelly clay loam over gravelly clay; 2 to 3½ feet to rock.	Unsuitable for sand: 50 to 65 percent passes No. 200 sieve. Poor to unsuitable for gravel: 20 to 45 percent gravel.	Fair to poor: A-4, A-7.	C	2 to 3½ feet to rock; 9 to 75 percent slopes; high shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair stability; fair to poor strength; medium to high compressibility; good resistance to piping and cracking.	Slow permeability; 15 to 75 percent slopes; 2 to 3½ feet to rock.	Well drained; slow permeability; 2 to 3½ feet to rock.	15 to 75 percent slopes; 2 to 3½ feet to rock.	Severe: slow permeability; 15 to 75 percent slopes.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 0 to 9 percent slopes.	Well drained; moderately slow permeability.	High water holding capacity; moderately slow intake rate; 0 to 9 percent slopes.	Severe: moderately slow permeability.
Fair stability; good strength; slight compressibility; poor resistance to piping; fair to poor resistance to cracking.	Moderate permeability; 15 to 75 percent slopes; 2 to 2½ feet to rock.	Well drained; moderate permeability; 2 to 2½ feet to rock.	15 to 75 percent slopes; 2 to 2½ feet to rock.	Severe: 15 to 75 percent slopes; 2 to 2½ feet to rock.
Fair stability; fair to poor strength; medium to high compressibility; good resistance to piping and cracking.	Slow permeability; 0 to 5 percent slopes.	Moderately well drained; slow permeability.	High water holding capacity; slow intake rate; 0 to 5 percent slopes.	Severe: slow permeability.
Fair stability; good strength; slight compressibility; poor resistance to piping; fair to poor resistance to cracking; 1 to 1½ feet to rock.	Moderately rapid permeability 15 to 75 percent slopes; 1 to 1½ feet to rock.	Somewhat excessively drained; moderately rapid permeability; 1 to 1½ feet to rock.	15 to 75 percent slopes; 1 to 1½ feet to rock.	Severe: 15 to 75 percent slopes; 1 to 1½ feet to rock.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking; 1 to 1½ feet to rock.	Moderately slow permeability; 15 to 50 percent slopes; 1 to 1½ feet to rock.	Somewhat excessively drained; moderately slow permeability; 1 to 1½ feet to rock.	15 to 50 percent slopes; 1 to 1½ feet to rock.	Severe: moderately slow permeability; 15 to 50 percent slopes; 1 to 1½ feet to rock.
Poor to good stability; fair strength; medium to high compressibility; good to poor resistance to piping and cracking.	Moderate permeability; 3 to 6 feet or more to water table.	Poorly drained (Pb has been drained) moderate permeability; 3 to 6 feet or more to water table.	High water holding capacity; moderate to moderately slow intake rate; 3 to 6 feet or more to water table.	Severe: 3 to 6 feet or more to water table.
Poor to good stability; fair to good strength; very slight to high compressibility; good to poor resistance to piping and cracking.	Moderate permeability (rapid below depth of 36 inches).	Moderately well drained; moderate permeability (rapid below depth of 36 inches).	High water holding capacity; moderately slow intake rate.	Moderate to slight; moderate permeability (rapid below depth of 36 inches).
Fair stability; fair strength; medium to high compressibility; good to poor resistance to piping and cracking.	Slow permeability; 9 to 75 percent slopes; 2 to 3½ feet to rock.	Well drained; slow permeability; 2 to 3½ feet to rock.	9 to 75 percent slopes; 2 to 3½ feet to rock.	Severe: slow permeability; 9 to 75 percent slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Pleasanton: PoA, PoC, PpA, PpC, PpD2.	Fair: loam or gravelly loam over gravelly clay loam.	Unsuitable for sand: 60 to 65 percent passes No. 200 sieve. Unsuitable for gravel: 10 to 25 percent gravel.	Poor: A-6	B	0 to 15 percent slopes; moderate shrink-swell potential.
Rincon: RaA, RaC2	Poor: clay loam over gravelly clay and clay.	Unsuitable for sand: 70 to 90 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 25 percent gravel.	Poor to fair: A-7, A-4.	D	0 to 9 percent slopes; high shrink-swell potential.
San Andreas: SaE2, SaG2.	Fair: fine sandy loam; 2 to 2½ feet to soft rock.	Poor for sand: 30 to 35 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 10 percent gravel.	Good: A-2	C	2 to 2½ feet to soft rock; 15 to 75 percent slopes; low shrink-swell potential.
San Benito: SbE2, SbF, SbF3, SbG.	Fair: clay loam; 2 to 4 feet to rock.	Unsuitable for sand: 70 to 85 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 10 percent gravel.	Poor: A-7	B	2 to 4 feet to rock; 15 to 75 percent slopes; moderate shrink-swell potential.
Santa Lucia: ScF2, ScG	Poor: shaly and very shaly clay loam; 2 to 3 feet to rock.	Unsuitable for sand: 40 to 50 percent passes No. 200 sieve. Poor for gravel: 30 to 35 percent gravel.	Fair: A-5	C	2 to 3 feet to rock; 30 to 75 percent slopes; moderate shrink-swell potential.
San Ysidro: SdA, SdB2	Poor: loam over clay and clay loam.	Poor to unsuitable for sand: 30 to 65 percent passes No. 200 sieve. Unsuitable for gravel: 5 to 30 percent gravel.	Good to poor: A-4, A-6, A-2.	D	0 to 5 percent slopes; high shrink-swell potential.
San Ysidro, acid variant: SfA, SfC.	Poor: loam over clay and gravelly clay loam.	Poor to unsuitable for sand: 30 to 65 percent passes No. 200 sieve. Unsuitable for gravel: 5 to 30 percent gravel.	Good to poor: A-4, A-6, A-2.	D	0 to 9 percent slopes; high shrink-swell potential.
Sunnyvale: Su, Sv	Poor: silty clay; 2½ to 5 feet or more to water table.	Unsuitable for sand: 85 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A-6, A-7.	C	2½ to 5 feet or more to water table; high shrink-swell potential.
Vallecitos: VaE2, VaG2	Poor: loam over clay loam and clay; 1 to 2½ feet to rock.	Poor to unsuitable for sand: 40 to 65 percent passes No. 200 sieve. Unsuitable for gravel: 10 to 20 percent gravel.	Fair to poor: A-4, A-7; 1 to 2½ feet to rock.	C	1 to 2½ feet to rock; 15 to 75 percent slopes; high shrink-swell potential.
Willows: Wa	Poor: clay; 2 to 4 feet to water table.	Unsuitable for sand: 90 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A-7	D	1½ to 3½ feet to water table; high shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Fair to poor stability; fair strength; medium to high compressibility; good to poor resistance to piping and cracking.	Moderately slow permeability; 0 to 15 percent slopes.	Well drained; moderately slow permeability.	High water holding capacity; moderate intake rate; 0 to 15 percent slopes.	Severe: moderately slow permeability.
Fair to poor stability; fair to poor strength; medium to high compressibility; good to poor resistance to piping and cracking.	Slow permeability; 0 to 9 percent slopes.	Well drained; slow permeability.	High water holding capacity; slow intake rate; 0 to 9 percent slopes.	Severe: slow permeability.
Fair stability; good strength; slight compressibility; poor resistance to piping; fair to poor resistance to cracking.	Moderately rapid permeability; 15 to 75 percent slopes; 2 to 2½ feet to soft rock.	Well drained; moderately rapid permeability; 2 to 2½ feet to soft rock.	15 to 75 percent slopes; 2 to 2½ feet to soft rock.	Severe: 15 to 75 percent slopes; 2 to 2½ feet to soft rock.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 15 to 75 percent slopes; 2 to 4 feet to rock.	Well drained; moderately slow permeability; 2 to 4 feet to rock.	15 to 75 percent slopes; 2 to 4 feet to rock.	Severe: moderately slow permeability; 15 to 75 percent slopes.
Poor stability; poor strength; very high compressibility; fair to poor resistance to piping and cracking.	Moderate permeability; 30 to 75 percent slopes; 2 to 3 feet to rock.	Well drained; moderate permeability; 2 to 3 feet to rock.	30 to 75 percent slopes; 2 to 3 feet to rock.	Severe: 30 to 75 percent slopes; 2 to 3 feet to rock.
Fair to poor stability; fair to good strength; slight to high compressibility; good to poor resistance to piping and cracking.	Very slow permeability; 0 to 5 percent slopes.	Moderately well drained; very slow permeability.	Moderate to high water holding capacity; moderate intake rate; 0 to 5 percent slopes.	Severe: very slow permeability.
Fair to poor stability; fair to good strength; slight to high compressibility; good to poor resistance to piping and cracking.	Very slow permeability; 0 to 9 percent slopes.	Moderately well drained; very slow permeability.	Moderate to high water holding capacity; moderate intake rate; 0 to 9 percent slopes.	Severe: very slow permeability.
Fair to good stability; fair strength; medium to high compressibility; good reisistance to piping and cracking.	Slow permeability; 2½ to 5 feet or more to water table.	Poorly drained; slow permeability; 2½ to 5 feet or more to water table.	High water holding capacity; slow intake rate; 2½ to 5 feet or more to water table; some areas are saline.	Severe: slow permeability; 2½ to more than 5 feet to water table.
Fair to poor stability; good to fair strength; slight to high compressibility; good to poor resistance to piping and cracking; 1 to 2½ feet to rock.	Slow permeability; 15 to 75 percent slopes; 1 to 2½ feet to rock.	Well drained; slow permeability; 1 to 2½ feet to rock.	Low to moderate water holding capacity; moderate intake rate; 15 to 75 percent slopes; 1 to 2½ feet to rock.	Severe: slow permeability; 15 to 75 percent slopes.
Fair to poor stability; fair to poor strength; high compressibility; good resistance to piping and cracking.	Slow permeability; 1½ to 3½ feet to water table.	Poorly drained; slow premeability; 1½ to 3½ feet to water. table	High water holding capacity; slow intake rate; 1½ to 3½ feet to water table; saline.	Severe: slow permeability; 1½ to 3½ feet to water table.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel	Road fill		Road location
Yolo: YaA, YaB	Good: loam and silt loam.	Unsuitable for sand: 80 to 90 percent passes No. 200 sieve. Unsuitable for gravel.	Fair: A–4, A–5	B	0 to 5 percent slopes; moderate shrink-swell potential.
YeA, YeC	Fair: silty clay loam.	Unsuitable for sand: 85 to 95 percent passes No. 200 sieve. Unsuitable for gravel.	Poor: A–6	B	0 to 9 percent slopes; moderate shrink-swell potential.
*Zamora: ZaA, ZaC, ZbA, ZbC, ZeC3. (For Cropley part of ZeC3, see the Cropley series.)	Fair: loam or clay loam over clay loam.	Unsuitable for sand: 85 to 95 percent passes No. 200 sieve. Unsuitable for gravel: 0 to 5 percent gravel.	Poor: A–6	B	0 to 9 percent slopes; moderate shrink-swell potential.

The groups range from A–1 (gravelly soils having high bearing capacity, the best soils for subgrade) to A–7 (clayey soils having low strength when wet, the poorest soils for subgrade). 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 4.

Unified system.—Some engineers prefer to use the Unified Soil Classification System (*12*). In this system soil materials are identified as coarse grained, 8 classes (GW, GP, GM, GC, SW, SP, SM, SC); fine grained, 4 classes (ML, CL, MH, CH); and highly organic, 3 classes (OL, OH, Pt). Table 4 shows the classification of the tested soils according to the Unified system.

Engineering test data

Table 4 gives test data for samples of selected layers taken from the profiles of some extensive soils of the survey area. The samples were taken in representative sites and were tested by the California State Division of Highways.

The data in table 4 shows the soil classifications under the USDA, the Unified, and the AASHO systems; moisture density; Atterberg values; coefficient of linear extensibility; and the mechanical analysis of the soil samples tested.

The relation of moisture content and the density to which a soil material 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 increase in moisture content. The moisture content at which the maximum dry density is obtained is the optimum moisture content.

The tests for liquid limit and plastic limit measure the effect of water on consistence 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 passes 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.

Also shown in table 4 is the capacity of the soils to expand. The procedure to determine the coefficient of linear extensibility was carried out on undisturbed, unconfined (except by moisture tension) samples. It determines the vertical component of volume change upon drying from a moisture tension of ⅓ atmosphere to oven dryness. The data on the coefficient of linear extensibility is useful in working with soil in a natural condition. Road construction, foundations of structures, and reservoir sites are all affected by high shrink-swell characteristics.

Mechanical analysis was determined by the sieve and hydrometer method. The data shows the relative proportions of the particles of different sizes in the soil material. The size and proportions of the particles affect the behavior of soil material when it is used for engineering purposes.

Estimated engineering properties

Table 5 lists the soil series and map symbols in the survey area. It also gives estimates of soil properties significant to some engineering work. Landslides, riverwash, Rock land, and Terrace escarpments, however, are not listed in the table. These land types are too variable in characteristics to be rated or otherwise are not suitable for engineering use.

interpretations—Continued

Soil features affecting—Continued				Soil limitations for septic tank filter fields
Water-retention structures		Agricultural drainage	Irrigation	
Embankments	Reservoir areas			
Poor stability; fair strength; medium compressibility; poor resistance to piping and cracking.	Moderate permeability; 0 to 5 percent slopes.	Well drained; moderate permeability.	High water holding capacity; moderate intake rate; 0 to 5 percent slopes.	Moderate: moderate permeability.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 0 to 9 percent slopes.	Well drained; moderately slow permeability.	High water holding capacity; moderately slow intake rate; 0 to 9 percent slopes.	Severe: moderately slow permeability.
Fair to good stability; fair strength; medium to high compressibility; good resistance to piping and cracking.	Moderately slow permeability; 0 to 9 percent slopes.	Well drained; moderately slow permeability.	High water holding capacity; moderate to moderately slow intake rate; 0 to 9 percent slopes.	Severe: moderately slow permeability.

Given in table 5 are the depth to rock, depth to seasonal high water table, and the estimated USDA, Unified, and AASHO soil classifications. In addition, estimates of the percentages of material passing through the various sieves are given. Also shown are estimates of the Atterberg values, permeability, available water capacity, reaction, salinity, shrink-swell potential, and corrosivity of uncoated steel.

The estimates are based partly on examinations made in the field and partly on results of test data shown in table 4. Since the estimates are only for typical soils, considerable variation from these values should be anticipated. More information on the range of properties of the soils can be obtained in other parts of this survey, particularly in the section "Descriptions of the Soils."

According to the system used by soil scientists of the U.S. Department of Agriculture, the basic textural class name is based on the size distribution of the material smaller than 2.0 millimeters in diameter. The material smaller than 2.0 millimeters in diameter is classified into three size fractions—sand, silt, or clay. The percentage of the three size fractions determines the textural classification. The prefix "gravelly" or "cobbly" is used if the soil is 15 to 35 percent gravel or cobblestones, by volume.

Soil permeability is the ability of a soil to transmit air or water. The rates shown in table 5 are for the soils as they occur in place. The estimates were made by comparison with soils of known permeability and are shown as the range in which the soil normally will fall. The rates are helpful in determining potential use. Rapid permeability, for example, indicates that seepage losses at reservoir sites in the soil will be large. Very slow permeability, on the other hand, suggests the soil is likely to have a perched water table during a long rainy season or after excessive irrigation.

The available water 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.

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.

Salinity of a soil is based on the electrical conductivity of saturated soil extract as expressed in millimhos per centimeter at 25° C. Salinity not only affects the suitability of a soil for production of crops, but it also affects the stability of a soil when used as construction material and its corrosiveness to other material.

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 (fig. 7). The soil that contains the most clay generally shrinks and swells the most, but in some areas the kind of clay in the soil may be more important than the amount.

Three limitation ratings are used to interpret the soils: low, moderate, and high. Soil properties and qualities used to determine the classes are: percentage of clay, predominant clay mineral, coefficient of linear extensibility (COLE) in inches per inch, and shrinkage index.

Soils that have a rating of *low* do not have more than 18 percent montmorillonitic clay or more than 30 percent kaolinitic clay mineral; a COLE value of less than 0.03 inch per inch; and a shrinkage index of less than 5.0.

Soils that have a rating of *moderate* have 18 to 30 percent mixed or montmorillonitic clay minerals or more than 30 percent kaolinitic clay mineral; a COLE value of 0.03 to 0.06 inch per inch; and a shrinkage index of 5.0 to 7.0.

Soils that have a rating of *high* have more than 30 percent mixed or montmorillonitic clay minerals; a COLE

Figure 7.—**Cropley clay, 0 to 2 percent slopes, has high shrink-swell potential and the surface cracks when dry.**

value greater than 0.06 inch per inch; and a shrinkage index greater than 7.0.

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 becomes 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 land slippage. Land slippage is particularly a hazard on the steeper slopes.

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 or 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.

Construction of buildings and pavements, fill and compaction operations, adding material to the surface soil, and other measures that alter soil permeability increase the probability of corrosion. Mechanical agitation or excavation that results in nonuniform mixing of soil horizons is likely also to increase the probability of corrosion. In addition, corrosivity, particularly for steel pipes or other structures, is likely to be increased by electrical leaks from underground cables and by electrical charges resulting from the composition of dissimilar metals. 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 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.

The ratings for corrosivity in table 5 are based strictly on soil characteristics. Three ratings, low, moderate, and high, are used to interpret the soils. Soil properties and qualities used to determine the classes are drainage class and texture, total acidity, and conductivity of saturation extract (mmhos/cm. at 25° C).

Soils that have a rating of *low* are somewhat excessively or excessively drained and coarse textured, or well drained and medium textured. They have a total acidity of less that 8 milliequivalents of hydrogen ion per 100 grams of soil and a conductivity of the saturation extract of less than 1 millimho per centimeter.

Soils that have a rating of *moderate* are well drained and moderately fine textured, or moderately well drained and medium textured. They have a total acidity of 8 to 12 milliequivalents of hydrogen ion per 100 grams of soil and a conductivity of the saturation extract of 1 to 4.

Soils that have a rating of *high* are well drained, somewhat poorly drained, or poorly drained and fine textured. They have a total acidity of more than 12 milliequivalents of hydrogen ion per 100 grams of soil and a conductivity of the saturation extract greater than 4.

Engineering interpretations

Table 6 rates the suitability of soils for certain uses, such as topsoil, sand and gravel, and road fill. It also gives features affecting various engineering practices such as road location, reservoir sites, drainage and irrigation, and septic tank filter fields. Then it lists hydrologic soil groups. The features given for moderate and severe ratings are generally those that are unfavorable. They detract from the qualities needed for structure foundations or for soil material to be used in earthen structures. These features are caution signs when considering a soil for a specific use.

The ratings used for the soils as a source of topsoil, sand and gravel, and road fill are *good*, *fair*, *poor*, or *unsuitable*. Soil sampling is done to a depth of 5 feet.

Hydrologic soil groups are groupings of soils that yield similar amounts of runoff from a given storm. Soil characteristics such as infiltration rate, claypans, and depth are given consideration. The groups are based on runoff that occurs following a long-duration storm where there is no protection from vegetation.

Group A consists of soils having a high infiltration rate when thoroughly wetted. These soils are chiefly deep, well-drained to excessively drained sand or gravel. They have a high rate of water transmission and a low runoff potential.

Group B consists of soils having a moderate infiltration rate when thoroughly wetted. These soils are moderately deep to deep, moderately well drained to well drained and are moderately fine to moderately coarse textured. They have a moderate rate of water transmission.

Group C consists of soils having a slow infiltration rate when thoroughly wetted. These are soils that generally have a layer that impedes downward movement of water, or they are moderately fine textured to fine textured. They have a slow rate of water transmission.

Group D consists of soils having a very slow infiltration rate when thoroughly wetted. In this group are (1) clay soils that have high swelling 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. These soils have a very slow rate of water transmission and a high runoff potential.

The rating for road location relates to problems of road construction and maintenance. The entire soil profile when mixed is considered, except where the surface layer has a high organic-matter content. Among the soil features considered are depth to rock or to the water table, slope, and shrink-swell potential.

Water-retention structures refers to such structures as irrigation reservoirs, fish ponds, and stockwater ponds. Table 6 gives ratings for both earthfill embankments and the floor of the water-ponding area. Depth to the water table or to rock, and soil features such as stability, compressibility, and problems of piping and cracking are considered for embankments; permeability, slope, and depth to rock or to the water table are considered for the floor.

For agricultural drainage the factors considered are those features of the soil that affect the installation and performance of surface and subsurface drainage systems. Among these are drainage class, depth to rock or to the water table, and permeability.

Irrigation factors considered are features that affect suitability of soils for irrigation, such as available water holding capacity, intake rate, slope, and depth to rock. For soils not suited to irrigation, only the feature, or features, limiting their use is given.

Septic tank filter fields or absorption systems for onsite sewage disposal generally consist of a subsurface tile drain or a perforated pipe system installed to carry effluent or waste sewage water from the septic tank to the filter field, where it can percolate into the ground.

For rating the soil as a septic tank filter field, the terms *slight*, *moderate*, or *severe* are used. These ratings are based on such soil properties as permeability, depth to the water table, depth to rock or to the hardpan, drainage class, slope, and overflow hazard. The limiting properties are listed with the rating.

Formation and Classification of Soils

In this section, the factors that influence soil formation are discussed and the soils of the survey area are classified into higher categories.

Formation of Soils

Soil is a natural body on the surface of the earth in which plants grow. It is a mixture of rocks and minerals, organic matter, water, and air, all of which occur in varying proportions. The rocks and minerals are fragmented and partly or wholly weathered. Soils have more or less distinctive layers, or horizons, that are the product of environmental forces acting upon materials deposited or accumulated by geological agencies.

The characteristics of the soil at any given point are determined by the interaction of (1) the parent material; (2) the climate in which the soil material has accumulated and has existed since accumulation; (3) the relief, or topography, which influences the local, or internal, environment of the soil, its drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and wind; (4) biological forces that act upon the soil material, such as the plants and animals living on and in it, and (5) the length of time the climatic and biological forces have acted on the soil material.

Parent material

Parent material from which the soils in the Eastern Santa Clara Area have developed is both residual and alluvial.

The largest single geologic unit in the area of residual soils is included in the Franciscan-Knoxville Group of about Upper Jurassic age. Rocks include interbedded sandstone, shale, and chert that have undergone various degrees of metamorphism. Serpentine intrusions are also common. The sandstone, shale, and chert materials contain a high percentage of gravel and sand-sized particles that are mostly composed of quartz minerals. The sandy or gravelly soils, such as those of the Maymen and Parrish series, formed in this material.

Where serpentine rock has intruded, the soils are shallow to unweathered rock and the fertility is low. These soils have an unfavorable calcium-magnesium ratio.

Long, narrow strips of fine sediments occur on both sides of Santa Clara Valley. They consist of stratified or mixed sand, gravel, and clay that have calcium carbonate as the principal cementing agent. The soils that formed in this material are fine textured and generally have a calcareous subsoil. The Altamont, Diablo, and Azule soils are typical of this group of soils.

Alluvial parent material is generally of local origin. It is washed from geologic formations of the uplands that surround the valley. Because of the wide variety of sedimentary, metamorphic, and igneous rock formations in the uplands, the alluvium is mixed.

Alluvial materials differ in texture mainly because they were deposited in different ways. Alluvium on fans and toe slopes generally has a texture and other characteristics similar to those of the material in the hills immediately above it. For example, Cropley clays developed on fans in material that had been washed down from upland areas of the Diablo and Altamont soils. Recent alluvium in the Santa Clara Valley has been laid down by flooding streams. As the streams overflowed their channels and the water spread over the flood plain, sediments were deposited. When the floodwaters spread, they moved more slowly, and silt mixed with some sand and clay was deposited. Most of the clay particles were deposited when the flood passed, and the water was left standing in the lowest part of the valley south of Gilroy.

An earlier cycle of deposition, when streams had different courses, is suggested by the many alluvial soils that have buried horizons at a depth of 40 to 80 inches, by some clayey soils that are underlain by sand at a depth of 40 to 80 inches, and by some loamy soils that have clay layers at a depth of 60 to 100 inches. Geologic changes, not stream meandering, are believed to have caused the streams to change their course and begin a new cycle of erosion and deposition.

Differences in texture of the alluvium are generally accompanied by differences in chemical and mineralogical

composition. The sandier sediments generally contain more quartz and less feldspar and ferromagnesian minerals than do the finer textured sediments. The finer textured alluvium generally contains a high percentage of montmorillonitic clay minerals and more exchangeable sodium.

Climate

Climate functions directly in the accumulation of soil parent material and in the differentiation of horizons of the soils in the Eastern Santa Clara Area. Temperature and rainfall govern rates of weathering of rocks and the decomposition of minerals. They also influence leaching, eluviation, and illuviation. Presumably, the climate in the survey area is similar to the climate under which the soils formed. It is generally a subhumid, mesothermal climate that is characterized by cool, moist winters and hot, dry summers.

Differences in annual rainfall and temperature are associated with changes in elevation on both sides of the Santa Clara Valley. The greatest amount of precipitation is in the Santa Cruz Mountains, where the seasonal average is 50 inches or more at some points. Average annual rainfall in the Gilroy area and most of the Diablo Range generally is 16 to 25 inches, but at higher elevations it is 25 to 30 inches. The southern part of Santa Clara Valley is warmest, with an average annual temperature of 60° F. at Gilroy. Average annual temperature in the Santa Cruz Mountains is 56° to 57°, and the coolest area is Mt. Hamilton, where the average annual temperature is 54°.

Organic-matter content is highest in the soils at the higher elevations, where the rainfall is highest, the temperature is cool, vegetation is abundant, the plants have fairly coarse roots, and much plant residue is returned to the soil. The cooler temperatures, however, do not favor rapid decomposition. Rainfall is sufficient to leach the soils of carbonates and other water-soluble materials. As a result, soils such as those of the Los Gatos series have a dark A horizon and a weak textural Bt horizon that is medium acid.

The effects of climatic changes on soils formed from similar parent material are evident in the soils of the Gaviota series. These soils formed in the areas of lower rainfall on the warmer south slopes. There the warmer climate has affected the rate at which water is lost through evaporation. Scarcity of water slows the weathering of rock, and less moisture means fewer kinds of plants can grow. Also, all carbonates have not leached out of the solum. Therefore, the Gaviota soils are shallow, have less organic matter, and are slightly acid in reaction.

Relief

The relief of the Eastern Santa Clara Area was mostly determined by the past geologic history. The area is in three prominent physiographic units: the Santa Cruz Mountains, the Diablo Range, and the Santa Clara Valley. Relief influences the formation of soils in the Eastern Santa Clara Area through its effects on drainage, erosion, air drainage, and variation in exposure to the sun and wind.

The Santa Cruz Mountains and Diablo Range are deeply dissected by drainageways. This dissection has formed long, winding ridges that have relatively steep side slopes. Some of the ridgetops are broad and have slopes ranging from 10 to 25 percent. Other ridgetops are narrow, are somewhat angular, and have slopes greater than 25 percent. Because of the steep and very steep slopes, most of the soils are well drained to somewhat excessively drained. Geologic erosion is active, and accelerated erosion has followed overgrazing, fires, and cultivation. Consequently, a thick soil profile seldom develops. Examples of shallow, steep and very steep soils are those of the Gaviota, Vallecitos, and Parrish series.

Variations in rainfall, caused largely by relief, are pronounced over short distances. For example, annual rainfall varies from 16 to 50 inches within a distance of 10 miles. Soils such as those of the Gaviota series lie in areas of low rainfall. These soils have been very slightly weathered and partially leached of carbonates. The shortage of moisture, which restricts weathering and leaching, also limits plant growth and leaves the soils with less than 1 percent organic matter. Soils such as those of the Los Gatos series in the areas of higher rainfall and on north-facing slopes receive less direct sunlight, have cooler soil temperatures, and retain moisture longer. These soils have more organic matter accumulated in the uppermost layer because vegetation is abundant, plants have fairly coarse roots, and much plant residue has been returned to the soil. Carbonates generally have been leached out of the solum, and reaction is medium acid.

The flood plains of the Santa Clara Valley are relatively flat and have slopes that are less than 2 percent. Along drainageways and on alluvial fans, slopes range up to 9 percent. Because of the level topography southeast of Gilroy, drainage is poor and drainage outlets are lacking. This causes a high or fluctuating water table and a concentration of exchangeable sodium. The Pacheco and Clear Lake soils formed in this low-lying, poorly drained area under salt-tolerant and water-tolerant plants. Because these soils have poor drainage, they have underlying horizons that indicate intense reduction of iron. This is evidenced by the presence of olive-brown, brown, and yellowish-brown mottles. The Yolo and Garretson soils formed on the well-drained alluvial fans and alluvial plains. These soils lack mottles, segregated lime, and gypsum.

Biological activity

After the accumulation of soil parent material, plants, worms, bacteria, and fungi begin to grow and die. At this stage organic matter tends to accumulate on and in the surface layer. Accumulation of organic matter has been an important process in horizon differentiation of the soils in the Eastern Santa Clara Area.

Upland soils on north slopes are protected from direct sunlight. They support a fairly dense canopy of various broadleaf plants and hardwood trees. These plants provide shade and cover that reduce runoff and erosion. Also, because the vegetation adds humus, organic-matter content may be as much as 5 percent. This has influenced the dark color, structure, and physical condition of the Los Gatos, Felton, and Ben Lomond soils. In contrast, the vegetation on the south slopes is grass and oak trees or brush. This cover provides little shade, and the soils are dry for longer periods of time, which creates an undersirable habitat for micro-organisms. As a result, geologic erosion is active and organic-matter content is less than 1 percent. The Gaviota and Maymen soils occur on these exposed slopes.

In the Santa Clara Valley, the well-drained alluvial

soils such as those of the Garretson and Yolo series developed under annual grasses, scattered brush, and scattered large oaks. In these soils the accumulation of organic matter has been the most important process in horizon differentiation. The formation of distinct horizons, however, has been slowed down by burrowing animals and earthworms that have been actively loosening and mixing the soil material.

The poorly drained soils of the flood plains have developed under grasses that require plenty of water and under other aquatic plants. While these soils were forming drainage was poor, water was readily available, and the native plants grew abundantly. Consequently, these soils are the darkest in the Santa Clara Valley. Most of them have an organic-matter content of more than 2 percent, and they provide a good habitat for micro-organisms. The Pacheco, Clear Lake, and Sunnyvale soils are examples of these soils.

Time

Time is required for soil formation, which proceeds in stages, none of which is distinct. It is not possible to be sure where one stage in soil formation ends and another begins. Thinking of soil formation as being in stages, however, is simply a way of looking at the continuous process one part at a time. In the Eastern Santa Clara Area, stages of these processes are expressed by the horizon differentiation within each soil.

In general, soils on the alluvial fans and alluvial plains are young. Soils such as those of the Yolo and Garretson series have developed in the unconsolidated sediments only in the time that has elapsed since the last sediments were laid down. These soils have been influenced enough by soil-forming processes to have a thin A horizon and some leaching of carbonates.

Rincon and Hillgate soils are on the old fans and terraces. These are the oldest and most strongly developed soils in the survey area. They have had time for translocation of silicate clay minerals, which is indicated by the abrupt change in texture from the A horizon to the B2t horizon.

Soils in the mountains and foothills differ somewhat in degree of development. Young soils such as those of the Gaviota series have steep and very steep slopes. They are shallow to bedrock and have a thin A horizon, because for soils in this position soil material is removed by geologic erosion nearly as fast as it forms. San Benito soils, on the other hand, are young, are less susceptible to erosion, and have had enough time for the accumulation of organic matter in the surface layer and for some leaching of carbonates. Los Gatos and Vallecitos soils are intermediate in age and have had time for some translocation of silicate clay minerals. This is indicated by changes in color, structure, and consistence of the B2t horizon.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and response to manipulation.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering works; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The current system was adapted for general use by the National Cooperative Soil Survey in 1965 (*11*). The system is under continual study, and readers interested in the latest developments in this system should consult the latest literature available (*8*).

In table 7 the soil series of the Eastern Santa Clara Area are placed in some categories of the current system of classification. The classes in the current system are briefly discussed in the following paragraphs. After this the soil orders represented in the Eastern Santa Clara 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. Two exceptions, Entisols and Histosols, occur in many different climates.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes having 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 resulting 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 the subgroups represents the central (typic) segment of the great group, and the others, called intergrades, contain those soils having 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 have genetic horizons that, except for texture of the surface soils, 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.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at the State, regional, and national levels of responsibility for soil classification results in a judgment that the new series should be established. Most of the soil series described in this publication have been established earlier.

TABLE 7.—*Classification of soils*

Series	Family	Subgroup
Altamont	Fine, montmorillonitic, thermic	Typic Chromoxererts.
Arbuckle	Fine-loamy, mixed, thermic	Typic Haploxeralfs.
Azule	Fine, montmorillonitic, thermic	Mollic Haploxeralfs.
Ben Lomond	Coarse-loamy, mixed, mesic	Cumulic Ultic Haploxerolls.
Campbell	Fine-silty, mixed, nonacid, thermic	Aquic Xerorthents.
Clear Lake	Fine, montmorillonitic, thermic	Typic Pelloxererts.
Climara	Fine, montmorillonitic, thermic	Chromic Pelloxererts.
Cortina	Loamy-skeletal, mixed, nonacid, thermic	Typic Xerofluvents.
Cropley	Fine, montmorillonitic, thermic	Chromic Pelloxererts.
Diablo	Fine, montmorillonitic, thermic	Chromic Pelloxererts.
Esparto	Fine-loamy, mixed, thermic	Typic Haploxeralfs.
Felton	Fine-loamy, mixed, mesic	Ultic Argixerolls.
Garretson	Fine-loamy, mixed, nonacid, thermic	Typic Xerorthents.
Gaviota	Loamy, mixed, nonacid, thermic	Lithic Xerorthents.
Gilroy	Fine-loamy, mixed, thermic	Typic Argixerolls.
Henneke	Clayey-skeletal, serpentinitic, thermic	Lithic Argixerolls.
Hillgate	Fine, montmorillonitic, thermic	Typic Palexeralfs.
Inks	Loamy-skeletal, mixed, thermic	Lthic Argixerolls.
Keefers	Clayey-skeletal, montmorillonitic, thermic	Mollic Haploxeralfs.
Los Gatos	Fine-loamy, mixed, mesic	Typic Argixerolls.
Los Osos	Fine, montmorillonitic, thermic	Typic Argixerolls.
Los Robles	Fine-loamy, mixed, thermic	Mollic Haploxeralfs.
Madonna	Fine-loamy, mixed, mesic	Dystric Xerochrepts.
Maxwell	Fine, montmorillonitic, thermic	Typic Pelloxererts.
Maymen	Loamy, mixed, mesic	Dystric Lithic Xerochrepts.
Montara	Loamy, serpentinitic, thermic	Lithic Haploxerolls.
Pacheco	Fine-loamy, mixed, thermic	Aquic Haploxerolls.
Parrish	Fine, vermiculitic, mesic	Ultic Haploxeralfs.
Pleasanton	Fine-loamy, mixed, thermic	Mollic Haploxeralfs.
Rincon	Fine, montmorillonitic, thermic	Mollic Haploxeralfs.
San Andreas	Coarse-loamy, mixed, thermic	Typic Haploxerolls.
San Benito	Fine-loamy, mixed, thermic	Pachic Haploxerolls.
Santa Lucia [1]	Clayey-skeletal, mixed, thermic	Ultic Haploxerolls.
San Ysidro	Fine, montmorillonitic, thermic	Typic Palexeralfs.
San Ysidro, acid variant	Fine, montmorillonitic, thermic	Aquultic Haploxeralfs.
Sunnyvale	Fine, montmorillonitic, thermic	Typic Calciaquolls.
Vallecitos	Clayey, montmorillonitic, thermic	Ruptic-Entic Lithic Mollic Haploxeralfs.
Willows	Fine, montmorillonitic, thermic	Typic Pelloxererts.
Yolo	Fine-silty, mixed, nonacid, thermic	Typic Xerorthents.
Zamora	Fine-silty, mixed, thermic	Mollic Haploxeralfs.

[1] This series is a taxadjunct because the dark colors are not so deep in the profile as in the Santa Lucia series elsewhere.

SOIL ORDERS IN THE AREA

The soil orders in the Eastern Santa Clara Area are Alfisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols.—Soils in this order have been in place a sufficient amount of time to have developed horizons of clay accumulation. These soils are on old alluvial fans, terraces, and uplands. Their A horizon is mainly hard or very hard and massive when the soils are dry. Thickness of the profile ranges from less than 1½ feet where the soils are underlain by hard rock to more than 5 feet where the parent material is unconsolidated. Clay mineralogy of the finer textured soils is dominantly montmorillonitic clay, but the others have mixed mineralogy. Average annual rainfall on these soils is between 16 and 30 inches, and the average annual air temperature is about 58° F. Relief is nearly level to very steep.

Natural vegetation on these soils consists of perennial and annual grasses, forbs, and scattered oak trees. These plants add ample organic matter to the soils, but because of the warm, moist weather in spring and the hot, dry weather in summer, oxidation is rapid. As a result, the organic-matter content of the surface layer is generally low. The weakness or lack of structure and light colors of these soils are mainly related to low organic-matter content.

Twelve series are in this order: Arbuckle, Esparto, San Ysidro, Azule, Keefers, Los Robles, Pleasanton, Rincon, Parrish, Hillgate, Vallecitos, and Zamora. These soils have been placed into the Xeralf suborder. They are classified in several subgroups.

The Esparto and Arbuckle soils are typical of the Xeralf suborder. They have a pale surface horizon and a reddish argillic horizon. The content of organic carbon is low. There is only a slight clay increase in their Bt horizon because of their relatively young age. These are very deep alluvial soils that have slopes of 0 to 9 percent. Esparto soils developed under moderately well drained conditions. Arbuckle soils are well drained.

Azule, Keefers, Los Robles, Pleasanton, Rincon, and Zamora are classified as Mollic intergrades. The soils are similar to those of typical Xeralf suborder soils, but they have a darker A1 horizon that contains slightly more organic matter; however, they are massive and hard when dry.

Azule and Rincon soils have a dark grayish-brown and dark-gray A horizon. Azule soils have brown, medium acid gravelly sandy clay argillic horizons, are strongly sloping to very steep, and developed on uplands. Rincon soils have grayish-brown, mildly alkaline gravelly clay argillic horizons, are nearly level to moderately sloping, and developed on alluvial fans.

Los Robles and Pleasanton soils are nearly level to strongly sloping and developed on alluvial fans. Los Robles soils have a dark-brown, neutral clay loam A horizon and similarly colored, neutral gravelly clay loam argillic horizons that developed in basic igneous alluvium. Pleasanton soils have a grayish-brown, slightly acid loam A horizon and brown, neutral gravelly clay loam argillic horizons that developed in sedimentary alluvium.

Zamora soils have a dark grayish-brown, neutral clay loam A horizon and dark-brown, neutral, weakly developed clay loam argillic horizons that developed in sedimentary alluvium.

Hillgate, San Ysidro, and San Ysidro, acid variant, soils are more strongly developed than other soils of this suborder. The surface horizon is pale brown to light brownish gray. It is low in content of organic carbon. Moist color values are 4 or more, and dry values are more than one unit higher. Organic-matter content is less than 1.2 percent. The boundary of the A and B horizons is abrupt (has a clay increase of 20 percent or more within 1 inch). The argillic horizons are massive or have prismatic structure and are clay in texture. The dominant clay mineral is montmorillonite.

San Ysidro soils differ from Hillgate soils by having mottles with a chroma of 3 or more within 18 inches of the surface; also, a thin, bleached A2 horizon is present just above the argillic horizon. Except for being strongly acid in the B and C horizons (less than 75 percent base saturation), San Ysidro soils, acid variant, are similar to San Yisdro soils.

Parrish soils have a reddish-brown, medium acid gravelly clay loam A horizon and a reddish-brown, strongly acid gravelly clay Bt horizon. These soils differ from other soils in this group by having less than 75 percent base saturation in some part of the Bt horizon.

Vallecitos soils have a brown, medium acid loam A horizon and a reddish-brown, medium acid clay Bt horizon. These soils differ from other soils in this group by having metamorphosed shale bedrock at a depth of 19 to 30 inches.

Entisols.—Soils placed in this order either lack distinctive horizons, either surface or subsurface, or have only the beginning of horizons. Included in this order are very deep alluvial soils that are mostly well drained and nearly level to gently sloping. There are some with substratum materials that are mottled from somewhat poor drainage and are nearly level. Also included with this group are shallow upland soils on hard sandstone. Slopes range from 5 to 75 percent, and drainage is good to somewhat excessive.

Accumulations of calcium carbonate occur in some of these soils, but not enough to be distinctive. Differences in chemical and mineralogical composition generally accompany differences in texture. The finer textured sediments are high in content of montmorillonitic clay minerals, and others have mixed mineralogy. Elevation ranges from 100 to 4,000 feet. Average annual rainfall is 15 to 50 inches, and the average annual air temperature is 55° to 60° F. Natural vegetation is abundant, and the soils developed under a cover of grasses, woodland, and brush. The plants have fairly coarse roots, and much plant residue is returned to the soil. Decomposition of plant residue is rapid, but the soils retain only low to moderate amounts of organic matter as a result of the oxidation that results from high temperatures.

Five soil series are in this order: Campbell, Cortina, Garretson, Gaviota, and Yolo. These soils are in the Orthent or Fluvent suborders.

Yolo soils are typical of this group. They have a grayish-brown, massive loam or silty clay loam A horizon and a brown, massive silt loam or silty clay loam C horizon. Calcium is the dominant exchangeable cation, and the base saturation is high. Campbell soils differ from Yolo soils by having developed under conditions of poorer drainage and by having a mottled C horizon. Garretson soils have a loamy C horizon. Cortina soils are low in organic-matter content and have a very gravelly C horizon. Gaviota soils are less than 20 inches deep to bedrock, are moderately steep to very steep, have low organic-matter content, and are on uplands.

Inceptisols.—Soils placed in this order have horizons that show alteration but lack extreme weathering. Soils in this group formed on weathered acid sandstone and shale in the Santa Cruz Mountains where the average annual rainfall is 30 to 50 inches. Carbonates have been removed by leaching. Natural vegetation is mainly annual grasses, forests, and shrubs. Average annual air temperature is 55° to 56° F. Elevation ranges from 1,500 to 4,000 feet.

Madonna and Maymen are the two soil series in this order. These soils are placed in the Ochrept suborder. All parts of these soils are dry for 60 or more consecutive days in 7 out of 10 years. Base saturation is less than 60 percent in some parts of the soils. The A1 horizon is light colored. These soils have slopes of 15 to 75 percent and are well drained and somewhat excessively drained. Erosion is active.

Mollisols.—Soils placed in this order have developed in areas where the moisture and temperature favored the accumulation of organic matter. As a result, the surface layer of these soils is dark colored and has an organic-matter content as high as 5 percent. These soils have a soft or slightly hard (when dry) A horizon and a moderate or strong structure.

Fourteen series included in this order are: Ben Lomond, Felton, Gilroy, Henneke, Inks, Los Gatos, Los Osos, Montara, Pacheco, San Andreas, San Benito, Santa Lucia, and Sunnyvale. These soils are placed in either the Aquoll or the Xeroll suborder.

Soils on the valley floor that have developed under poor drainage are classified as Aquolls. The Xeroll suborder is divided into soils with horizons of clay accumulation (Bt horizon), called Argixerolls, and soils without a Bt horizon but with horizons having evidence of alteration (B horizon), called Haploxerolls. These soils are further grouped at the family level by differences in textural class, soil temperature, and mineralogy.

Sunnyvale soils are in the Calciaquoll group. They are calcareous, granular silty clay in the A horizon and gleyed, calcareous silty clay in the lower part of the C horizon.

These soils developed under conditions of poor drainage and ground water that contained calcium bicarbonates. The capillary rise and evaporation, plus transpiration, caused the precipitation of lime.

Los Gatos, Los Osos, Gilroy, Inks, Henneke, and Felton soils are in the Argixeroll group. Soils in this group are dry throughout the profile for 60 consecutive days or more for 7 years out of 10. These soils differ mainly in the amount of clay in the Bt horizon, depth, mineralogy, and average annual soil temperature.

Los Gatos soils are typical of this group and have a brown, slightly acid gravelly loam A horizon and a reddish-brown, medium acid gravelly clay loam Bt horizon. They are moderately steep to very steep and developed on uplands over metamorphosed shale rock. Average annual soil temperature is 56° F.

Gilroy soils differ by having developed on basic igneous rock. Average annual soil temperature is more than 58°.

Los Osos soils differ by having a clay Bt horizon and an average annual soil temperature of more than 58°.

Inks soils have a lithic contact with basic igneous bedrock at a depth of 12 to 19 inches and an average annual soil temperature of more than 58°.

Henneke soils have a very gravelly clay Bt horizon and developed on serpentine rock; average annual soil temperature is more than 58°.

Felton soils are similar to Los Gatos soils in many respects, except they have a base saturation of more than 35 percent but less than 75 percent.

San Andreas, Santa Lucia, Montara, San Benito, Ben Lomond, and Pacheco soils are in the Haploxeroll group. Soils in this group are similar to the Argixerolls, except that they have altered horizons but lack a B horizon. They differ from one another in textural class, depth, mineralogy, drainage, and average annual soil temperature.

San Andreas soils are typical of this group and have a grayish-brown, granular, soft, medium acid fine sandy loam A horizon over soft sandstone at an average depth of 22 to 30 inches. These soils are moderately steep to very steep and developed on uplands. Average annual soil temperature is more than 58°.

Santa Lucia soils differ by having a gray shaly and very shaly clay loam profile developed on shale rock.

Montara soils differ by having a dark-gray clay loam A horizon and serpentine bedrock at a depth of less than 16 inches.

San Benito soils have a limy horizon developed on soft sandstone and shale.

Ben Lomond soils are similar in many respects, except they have a base saturation of more than 50 percent but less than 75 percent.

Pacheco soils have slopes of less than 2 percent and developed in sedimentary alluvium under more poorly drained conditions than exist today. They have mottles within 16 inches of the surface, and their organic-matter content decreases with depth.

Vertisols.—Soils placed in this order shrink during the dry season as they lose moisture, and they develop wide cracks. These soils swell during the winter wet season, and cracks in them close. Because of this shrink-swell characteristic, material from the upper horizons falls into cracks in the lower horizons, which mixes and churns the soil and offsets horizon differentiation. Texture is typically clay, and the dominant clay mineral is montmorillonite. The dark, thick A horizon and the strong structure of these soils are a result of their high organic-matter content. In the exchange complex of these soils, calcium and magnesium are dominant. The soils developed under grasses, shrubs, or mixed shrubs, grasses, and scattered oak trees. Average annual rainfall is 16 to 25 inches. Average annual air temperature is 58° to 60° F.

Soils in this order are in the Xerert suborder. These soils are in the Altamont, Clear Lake, Cropley, Climara, Diablo, Maxwell, and Willows series. The main differences among soils in this suborder are relief, drainage, color, and parent material.

The Diablo soils are typical of this suborder. These soils consist of dark-gray clay, have a thick A horizon, and are calcareous in the C horizon. In more than 7 years out of 10, cracks open and close once each year and remain open for 60 consecutive days or more. The Diablo soils are strongly sloping to steep and developed from soft, calcareous sandstone and shale on uplands.

Altamont soils are similar to the Diablo soils but have a color value of less than 3.5 when moist and 5.5 when dry throughout the upper 12 inches.

The Climara soils differ by having developed in metamorphosed basic igneous rock, but the Cropley soils are nearly level to moderately sloping and developed in mixed alluvium on fans.

Maxwell soils are moderately well drained, are nearly level to moderately sloping, and developed in serpentine alluvium on fans.

Clear Lake soils are level and developed under poor drainage on low flood plains. Willows soils have a chroma when moist of more than 1.5, are level and poorly drained, and developed on low flood plains; free gypsum crystals are present in their C horizon.

General Nature of the Area

This section briefly describes the history, physiography, geology, and climate of the Eastern Santa Clara Area. Then it discusses the water supply, industry and farming, population, community facilities, transportation, and vegetation.

History

The Spanish first explored the Santa Clara Valley in 1769, and in 1777 they established the first settlement at what is now San Jose (*7*). For the first 100 years, growth was very slow. The economy was based on herds of sheep and cattle. Hides and tallow were the only products of significance, and these had to be shipped to San Francisco through a port at Alviso. Trade was therefore limited by the difficulties of access.

In 1870 the coast route of the Southern Pacific Railroad was constructed through the valley. This gave considerable impetus to more intensive farming, which forced cattle raising into the foothills. Wheat farming gradually replaced cattle raising in the valley until, in 1880, the area from San Jose to Gilroy formed an almost unbroken wheat field.

Since 1880 grain farming has decreased and fruit raising has increased. Orchards, predominantly of French prunes, and vineyards were established on most of the tillable land.

At the present time, the valley floor from the vicinity of Gilroy northward is almost entirely planted to deciduous fruits and grapes. Canning became the first major industry.

The dominance of farming and associated industries continued through the first half of the present century. As recently as 1940, 23 percent of the workers in the county earned their living directly from the products of the soil, either in the fields or in the food processing plants, while many others provided services for these workers.

Since 1950 the dependence on farming has lessened. There has been an increasing number of factories that produce a variety of goods in no way related to farming. By 1962, 25 percent of all workers in the county were engaged in the manufacture of durable goods. Farming and food processing, which were once the principal economic enterprises of the county, now support fewer than 9 percent of the county work force.

Physiography

The Eastern Santa Clara Area consists of the southern part of the Santa Clara Valley, which extends through the central part of the area, and of the rolling hills and mountainous uplands on either side of the valley.

The uplands in the western part of the area are the Santa Cruz Mountains, which consist of a number of complex ridges or small ranges with rugged slopes that range in gradient from 40 to 60 percent or more. The crest of these mountains is generally at an elevation of about 2,000 to 3,400 feet. The highest point, Loma Prieta Peak, about a mile east of the ridge line, has an elevation of 3,806 feet.

The uplands in the eastern part of the area are in the Diablo Range, which separates the Santa Clara Valley from the San Joaquin Valley. This range consists of several parallel ridges having slopes of 20 to 60 percent and of small, intervening valleys. Copernicus Peak, near the Lick Observatory at Mt. Hamilton, and the highest point in the survey area, is 4,372 feet in elevation. The foothills of this range have smoother, less steep slopes that generally range from 20 to 40 percent. The crests of these foothills range from 1,000 feet to slightly more than 2,000 feet in elevation.

Upland areas of undulating to rolling relief on eroded terraces are, in many places, at the base of the mountains and hills on both sides of the valley. The slopes of these areas are from 5 to 35 percent, and elevation ranges from 250 to 1,000 feet.

The lowland, or valley floor, consists chiefly of a number of confluent alluvial fans and flood plains formed by deposits from the numerous streams that enter the valley from both mountain systems. The valley extends northwest and southeast through the central part of the area. The comparatively smooth floor of the valley ranges in elevation from 100 to 400 feet. An imperceptible alluvial divide at Morgan Hill separates the drainage of the valley into a north-flowing system and a south-flowing system. The former drains into San Francisco Bay at the north end of Santa Clara County, and the latter leads to the Pajaro River south of Gilroy and eventually flows into Monterey Bay. The regional drainage of the valley is generally well developed. Areas of poorly drained soils occur, and the most important of these are south and west of Old Gilroy.

Geology

The oldest rocks found within the limits of the Eastern Santa Clara Area are included in the Franciscan-Knoxville Group of Upper Jurassic age. These rocks form the largest single geologic unit in the area. Overlying the Jurassic rocks locally are marine sedimentary rocks of Cretaceous age. Bordering the San Andreas fault, and in isolated patches in the Diablo Range, Miocene beds occur. Along the margins of the Santa Clara Valley, Pliocene strata are exposed and the valley floor itself is composed of an accumulation of Quaternary clay, sand, and gravel. Tertiary volcanic rocks are scarce, and in the few isolated areas they occur only in small, local bodies.

The structure of the area is complex. It is controlled by faulting, the trend of which is predominantly in a northwesterly direction, which is characteristic of the general structural trend of California. In many places, folding and crumbling of the sediments are associated with faulting. The most notable faults in the area, which are also the major features of the Central Coast Ranges, are the San Andreas, Hayward, and Calaveras faults. Other prominent related faults of lesser extent are the Sargent, Silver Creek, and Madrone Springs faults.

The San Andreas fault, together with one of its prominent branches, the Sargent fault, subparallels the western boundary of Santa Clara County and separates Miocene strata from Upper Jurassic rocks. The Calaveras and Hayward faults are nearly parallel to each other on the western side of the Diablo Range. The three major fault systems are predominantly of the strike-slip type, with probable large right lateral displacements (east blocks moved relatively south). Two important faults branching off the Calaveras fault are the Madrone Springs and the Silver Creek faults.

Numerous northwest-trending folds in the Tertiary beds have been mapped. Folding within areas of Upper Jurassic rocks, however, is not so well known, because persistent axes cannot be traced with certainty.

Climate [6]

Santa Clara County has moderate temperatures and light to heavy precipitation (*2*). Temperature ranges from around 10° F. in winter to well above 100° in summer. Average low temperatures in winter are in the middle thirties (table 8). Temperatures of 32° or lower occur in most years over much of the area (table 9); however, the growing season still ranges from 200 to 275 days. As a result of the mild temperatures, the value for heating degree-days ranges from 2,500 to 4,500 units.

The moderating influence of the Pacific Ocean, to the west, is felt in the relatively uniform temperatures that are characteristic of the northern part of the Santa Clara Valley. Offshore circulation patterns only infrequently permit continental temperatures to establish themselves, and these occasions are usually only 2 or 3 days in dura-

[6] By C. Robert Elford, climatologist for California, and John Estills, assistant climatologist for California, National Weather Service, U.S. Department of Commerce.

TABLE 8.—*Temperature and precipitation data, San Jose, Calif.*

Month	Temperature				Precipitation		
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 4 days with—		Average monthly total	1 year in 10 will have—	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—
	° F. (1)	° F. (1)	° F. (2)	° F. (2)	Inches (1)	Inches (1)	Inches (1)
January	58	41	65	33	2.7	0.4	4.7
February	61	43	70	35	2.6	.8	5.7
March	65	45	78	37	1.9	.1	4.6
April	69	47	84	39	1.1	.2	3.2
May	73	50	89	44	.4	0	1.2
June	78	53	95	48	.1	0	.2
July	81	55	91	51	(3)	0	(3)
August	80	55	90	51	(3)	0	.1
September	80	55	93	49	.1	0	.3
October	74	51	88	45	.6	0	1.3
November	66	45	78	38	1.1	0	2.8
December	59	42	68	34	2.6	.6	5.0
Year	70	48	[4] 100	[5] 31	13.2	9.3	18.4

[1] Period of record: 1931–60.
[2] Period of record: 1951–60.
[3] Trace.
[4] Average highest annual maximum.
[5] Average lowest annual minimum.

tion. In the mountainous areas, the temperatures sometimes vary considerably within short distances.

During the summer, the cool temperature and the prevailing, moderate to strong, west and northwest offshore winds move into the San Francisco Bay area at low elevations; thus, the effect of the marine air is felt in the Santa Clara Valley mainly late in the afternoon and in the evening. Higher elevations are often above this layer of marine air, and its influence is diminished there.

Along the eastern edge of the survey area, on the east slope of the Diablo Range, the weather resembles that of the San Joaquin Valley. As a result, temperatures are warmer in summer and cooler in winter. Precipitation averages only 16 inches in parts of the Santa Clara Valley, but over the mountains to the east it is as much as 30 inches.

TABLE 9.—*Probabilities of last freezing temperatures in spring and first in fall, San Jose, Calif.*

Probability	Dates for given probability and temperature [1]		
	24° F. or lower	28° F. or lower	32° F. or lower
Spring:			
1 year in 10 later than	(2)	February 4	February 20
2 years in 10 later than	(2)	January 13	February 12
5 years in 10 later than	(2)	(2)	(2)
Fall:			
1 year in 10 earlier than	(3)	(3)	November 19
2 years in 10 earlier than	(3)	(3)	December 2
5 years in 10 earlier than	(3)	(3)	December 28

[1] Period of record: 1931–60.
[2] Earlier than January 1.
[3] Later than December 31.

Annual evapotranspiration ranges from 25 to 30 inches, but in dryfarmed areas it is only 6 to 10 inches during the growing season. Range grasses dry out during June in a typical year. Pan evaporation amounts to 55 to 60 inches per year; about two-thirds of it occurs during the May–October period.

In summer, cloudiness tends to blanket the valley at night, while the east slope of the Diablo Range remains clear. The orientation of the mountain chain results in a predominantly northwesterly flow of air in the Santa Clara Valley in summer and a southeasterly flow in winter. Mountain tops are subject to greater variability in wind direction in response to changing weather, particularly in winter. In the mountain valleys, wind patterns are influenced by local terrain.

In summer there is a moderate flow of marine air through the lower passes of the mountains. These winds frequently reach speeds of 20 miles per hour or more. The same pattern is also responsible for the light to moderate winds from the northwest that blow up the Santa Clara Valley on summer afternoons, except in its southern extremity, where this flow is countered by the northward spread of the marine air that enters through the Pajaro River Valley.

In winter, winds are predominantly southerly and are strongest at higher elevations. It is estimated that winds reach speeds of 30 miles per hour every other year, on the average, and as much as 80 miles per hour once in 50 years. These figures are based on an assumed average exposure, and some promontories and peaks probably receive considerably more wind than this.

Total annual sunshine is about 3,100 hours in the Santa Clara Valley and 3,300 hours in the eastern part of Santa Clara County. This represents 65 percent and 70 percent, respectively, of the total possible annual sunshine. The percentage of sunshine received (50 to 55 percent) is generally uniform over the survey area in winter, but in summer the percentage of sunshine received ranges from around 70 percent in the Santa Clara Valley to 90 percent or more along the eastern boundary of Santa Clara County.

Humidity is relatively high during the entire year along the coast and during the winter over inland areas. Humidity over inland areas late in summer and in fall, however, is moderate to low.

Water Supply

Ground water basins are the chief source of water in Santa Clara County (*5, 6*). Since farms, municipal areas, and industry are dependent upon an adequate water supply, the importance of ground water basin reserves cannot be overestimated. Reports by the Santa Clara County Flood Control and Water District indicate that there has been a long-term lowering of ground water tables below safe and economic operating levels.

Santa Clara County has three major interconnected ground water basins. They are the Santa Clara Valley, the Coyote, and the Llagas Ground Water Basins. There are other small ground water basins within the county, but their use at present is small. The Santa Clara Valley Ground Water Basin is not in the Eastern Santa Clara Area.

The Coyote Ground Water Basin is the smallest of the three major basins. It occupies about 9,000 acres between the northerly Santa Clara Valley Ground Water Basin and a southerly divide in the vicinity of Cochran Road, just north of Morgan Hill. It is estimated that 14,000 acre-feet of ground water was extracted for use in 1965–66; no overdraft is estimated for this period.

The Llagas Ground Water Basin, which occupies about 57,000 acres, is the most southerly one and extends from Cochran Road on the north to the Pajaro River on the south. In 1966 about 70,000 acre-feet of ground water was extracted from this basin for municipal and farming purposes; no overdraft is estimated for this period.

Rainfall on the valley floor and runoff from the tributary watersheds are the major sources of water available to replenish these ground water basins. Surface reservoirs on the major tributary streams store flood runoff that would otherwise be lost for later release to percolation areas, thereby increasing the amount of local water placed in underground storage. The Santa Clara County Flood Control and Water District delivers water on the surface. It has also contracted for supplemental water from the State Water Project and is constructing facilities for the distribution of this water to meet present and future demands. Projections of future farm, munipical, and industrial water needs show that additional water will be needed. Therefore, import water from the San Felipe Division of Central Valley Project will be contracted to the county for distribution by the Santa Clara County Flood Control and Water District.

Industry and Farming

The location of Santa Clara County in the region surrounding San Francisco Bay, its proximity to large western markets, and its educational institutions have attracted a large number of nationally and internationally known firms. Most industrial growth has been in the northern part of Santa Clara Valley.

Since 1940 farm output has increased, even though there has been a shift in its relative importance. The largest income was derived from fruits, nuts, and berries (*4*). Nursery products increased in importance to become the second most valuable income crop. Livestock, poultry, and vegetable crops are other high-income enterprises.

Population

The population of Santa Clara County increased from 642,300 in 1960 to 919,700 in 1966. By 1970 the population was estimated to be approximately 1,125,000. In the southern part of the county, however, there has been only a slight increase in population. The County Planning Department has estimated that the population, which was 22,000 in 1960, could increase to 117,000 by 1980.

Community Facilities

Two universities and a State college are near the survey area: Stanford University, near Palo Alto; Santa Clara University, in Santa Clara; and San Jose State College, in San Jose. In addition, three theological schools are in the area. The Lick Observatory of the University of California is located 26 miles from San Jose in the northeastern part of the survey area, on the summit of Mount Hamilton.

Public schools in the county include kindergartens, elementary schools, junior high schools, senior high schools, and four junior colleges. In rural areas, an extensive school bus system provides easy access to schools for children living in nearly every part of the area. Churches of many denominations are in the area.

The county maintains several parks in the area for outdoor recreation, and golf courses are located throughout the area. Several of the water-storage reservoirs are used for fishing, swimming, and boating. The Santa Cruz Mountains, particularly the timbered parts, have long been summer recreational areas. Many summer homes are located in the Llagas and Uvas Creek drainage area and elsewhere in the mountains.

Transportation

The survey area is served by two trancontinental railroads, the Southern Pacific and the Western Pacific.

U.S. Highway 101, which connects San Diego, Los Angeles, San Francisco, Portland, and Seattle, passes through the area. State Highway 17 connects San Jose with Oakland and Santa Cruz. Numerous paved county roads crisscross the area and allow easy and direct transportation by truck or automobile between points within and outside the area.

A commercial airport is located at San Jose. Also, an international airport is located at San Francisco. Both trans-

oceanic flights and flights east are scheduled daily from San Francisco.

Most of the processed foods and commercial cut flowers are trucked to the nearby San Francisco Bay area for shipment around the world. Much of the fresh farm produce of the area is marketed within a radius 50 miles from San Jose.

Vegetation

Approximately 15 percent of the area is grassland, which is in the foothills on both sides of the Santa Clara Valley and on the south slopes of the Diablo Range. Grassland consists predominantly of annual grasses, such as slender oats or wild oats, soft chess, ripgut brome, and foxtail fescue. In a few places, perennial purple needlegrass grows in considerable abundance. Commonly associated with the grasses are herbs such as filaree and burclover. Thistle and morningglory are the chief weeds of economic importance in the area. There are some areas of Klamath weed and puncturevine, and the county is sponsoring work to prevent their spread. Grasses predominate in winter and spring, but herbs generally are more conspicuous late in summer and in autumn. These areas are mostly used for grazing.

Grass and oak trees make up about 15 percent of the area and cover easterly slopes of the foothills and the Diablo Range. In the Diablo Range, open stands of trees are principally coast live oak, California black oak, California blue oak, and valley white oak. The herbaceous vegetation is similar to that in areas of grassland. These areas are used principally for grazing.

About 20 percent of the survey area is brushland. The largest area of brushland is east of Mt. Hamilton. Other large areas also occur in the Santa Cruz Mountain area. Brushland is closely related to lack of soil moisture and has replaced areas of forest or grassland. It consists of shrubs that are mainly hard and woody. Among the associated plants are manzanita, scrub oak, canyon live oak, Jimbrush, birchleaf mountain-mahogany, Christmasberry, poison-oak, chamise, and chaparral-pea. Areas of brushland provide an effective watershed cover, but they also create a fire hazard.

About 20 percent of the survey area is woodland. Woodland covers the northern and protected slopes of the Santa Cruz Mountains and the Diablo Range. It consists of various broad-leaved or hardwood trees that form fairly dense, closed-canopy stands. Predominant species are coast live oak, canyon live oak, California black oak, madrone, tanoak, and California laurel.

Forest land makes up less than 5 percent of the survey area. It occurs in small areas of the Santa Cruz Mountains. Stands of trees contain both redwood and Douglas-fir, and each of these species makes up about 20 percent or more of the total stand. Tanoak, madrone, and coast live oak are also in these stands. There is an undergrowth of shrubs such as poison-oak, California blackberry, and California huckleberry, and several species of fern are commonly present. The trees on forest land are young, mainly from 40 to 80 years old. They normally range in height from 60 to 130 feet, and in diameter from 8 to 36 inches. In the past, a few small areas have been used for the production of timber but now are not considered important.

The remaining 25 percent of the survey area is cultivated farmland, which is on the valley floor and adjacent foothills and terraces. Vegetation before cultivation began consisted of large, scattered valley white oaks and coast live oaks that had an understory of grasses and weeds. A few stands of eucalyptus, once planted for windbreaks and fast-growing timber, are at scattered locations on the valley floor and foothills.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water 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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low 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 commonly have mottlings 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 which a soil is readily penetrated by roots and utilized for extraction of water and plant nutrients. Limits of depth classes are:

Depth class	*Inches*
Very deep	More than 60
Deep	40 to 60
Moderately deep	20 to 40
Shallow	10 to 20
Very shallow	Less than 10

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Montmorillonite. A fine, platy, alumino-silicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Organic matter. A general term for plant and animal matter, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Pan. A layer in a soil that is firmly compacted or very rich in clay. Frequently the word "pan" is combined with other words that more explicity indicate the nature of the layers; for example, *hardpan, fragipan, claypan,* and *traffic pan.*

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

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. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	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		

Relief. The elevations or inequalities of a land surface, considered collectively.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very course sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

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.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

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 oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

U. S. DEPARTMENT OF AGRICULTURE

Washington, D. C. 20013

Soil Survey of Eastern Santa Clara Area, California

E R R A T U M

The following symbols are incorrect on some map sheets in the Eastern Santa Clara Area Soil Survey:

Incorrect Symbols	Correct to
Ce	Cd
Ch	Cg
Cg	Ch
Su	Sv
Sv	Su

The above symbols are incorrect on map sheets 9, 10, 15, 17, 21, 27, 28, 33, 39, 40, 44, 45, 46, and 49, except in the following locations:

Map sheet 9 - Two small areas of (Cg) surrounding small lake that is NW of large reservoir in central part of map.

Map sheet 45 - Small area of (Ce) located near base of map, dominantly between highway 101 and the Southern Pacific Railroad, and dissected by Tick Creek.

Large area of (Ce) located directly east of the town of Camadero and dissected by Llagas Creek.

Map sheet 49 - Small area of (Ce) located at top of map sheet directly east of the Southern Pacific Railroad and west of Tick Creek.

MAY 2 1978

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