SOIL SURVEY OF

Solano County, California

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

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

Major fieldwork for this soil survey was completed in the period 1956–68. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service, the University of California Agricultural Experiment Station, and Solano County. It is part of the technical assistance furnished to the Dixon, Ulatis, and Suisun Resource Conservation Districts.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

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

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

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

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 the Soils."

Newcomers in Solano County 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 County," at the back of the survey.

Cover: Fine Loamy range site on Dibble-Los Osos clay loams, 30 to 50 percent slopes, eroded.

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SOIL SURVEY OF SOLANO COUNTY, CALIFORNIA

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UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

SOLANO COUNTY is in the lower part of the west side of the Sacramento Valley (fig. 1). Putah Creek forms the northern boundary; Yolo County and the Sacramento River form the eastern boundary; Suisun and San Pablo Bays, the southern boundary; and Napa County, the western boundary.

Solano County has a land area of 526,720 acres and a water area of 49,710 acres. The eastern half of the county is nearly level and is under intensive irrigated farming. The western one-fourth is hilly to very steep and is used mostly for range. The southeastern one-eighth is rolling to hilly and is used for dryland small grain and pasture. The south-central one-eighth is marshland and is used mostly for waterfowl hunting.

The most developed urban and industrial areas are Travis Air Force Base, Mare Island Naval Base, and the cities of Vallejo, Benicia, Fairfield, Vacaville, Dixon, and Rio Vista.

Figure 1.—**Location of Solano County in California.**

How This Survey Was Made

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

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey (*15*).[1]

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. Egbert and Suisun, 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.

[1] Italic numbers in parentheses refer to Literature Cited, p. 110.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Conejo loam is one of several phases within the Conejo 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 roads, 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. One such kind of mapping unit shown on the soil map of Solano County is the soil complex.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Altamont-Diablo clays, 2 to 9 percent slopes, is an example.

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

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

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

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

General Soil Map

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

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, 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 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 general soil map at the back of this survey is at a scale of one-half inch equals 1 mile and can be used for broad-area general planning by using the interpretations presented in various sections of this soil survey.

The 17 soil associations in Solano County are placed in four major groups on the basis of the slope, drainage class, and the physiographic positions of the soils on the landscape. These four groups of associations and the 17 associations in them are discussed in the following paragraphs.

Nearly Level to Moderately Sloping, Well-Drained to Somewhat Poorly Drained Soils on Alluvial Fans

These soils are loams to silty clay loams. They formed in alluvium from mixed rocks that were mostly sedimentary. Slopes are 0 to 9 percent.

Elevation ranges from 25 to 250 feet. The average annual temperature is 58° to 62° F., the average annual rainfall is 18 to 25 inches, and the frost-free season is 240 to 280 days. Most areas of these soils are cultivated.

The three soil associations in this group make up about 15 percent of Solano County.

1. Yolo-Brentwood association

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

The soils in this association are very deep. These soils formed in alluvium derived from sedimentary

rocks. Slopes range from 0 to 9 percent, although most slopes are 0 to 2 percent. Elevation ranges from 25 to 250 feet. The average annual temperature is 60° to 62° F., the average annual rainfall is 18 to 25 inches, and the frost-free season is 240 to 280 days. This association makes up about 9 percent of Solano County.

About 60 percent of the association is Yolo soils, and about 25 percent is Brentwood soils. The remaining 15 percent is Capay, Reiff, and Rincon soils.

Yolo soils have a dark grayish-brown loam or silty clay loam surface layer. The substratum is brown loam.

Brentwood soils have a grayish-brown clay loam surface layer and a grayish-brown clay loam subsoil. The substratum is brown and pale-brown clay loam.

Many kinds of crops are intensively cultivated on these soils. The soils in this association are used for irrigated orchards and row and field crops. Apricots and almonds are the principal orchard crops. Sugar beets, tomatoes, and milo are the principal row crops. Alfalfa hay is the principal field crop. Many crops are grown for seed on these soils.

Wildlife is mainly upland game. Supplemental plantings are needed to provide food and cover.

2. *Yolo-Sycamore association*

Nearly level, well-drained and somewhat poorly drained silty clay loams; on alluvial fans

The soils in this association are very deep. These soils formed in alluvium derived from mixed rocks. Slopes are 0 to 2 percent. Elevation ranges from 25 to 150 feet. The average annual temperature is 58° to 62° F., the average annual rainfall is 18 to 25 inches, and the frost-free season is 240 to 270 days. This association makes up about 3 percent of the county.

About 45 percent of the association is Yolo soils, and about 45 percent is Sycamore soils. The remaining 10 percent consists of Brentwood, Clear Lake, Conejo, and Pescadero soils.

Yolo soils are well drained and have a dark grayish-brown silty clay loam surface layer and a brown loam substratum.

Sycamore soils are somewhat poorly drained and have a grayish-brown silty clay loam surface layer and a mottled grayish-brown silty clay loam subsoil. The substratum is distinctly mottled, light brownish-gray silty clay loam.

The soils in this association are intensively cultivated. They are used mainly for irrigated orchards. Cherries, peaches, apricots, and pears are the principal crops grown on the well-drained soils, and pears are the main orchard crop grown on the somewhat poorly drained soils.

Wildlife is mainly upland game. Food and cover must be provided.

3. *Rincon-Yolo association*

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

The soils in this association are very deep. These soils formed in alluvium derived from sedimentary rocks. Slopes are 0 to 9 percent. Elevation ranges from 25 to 200 feet. The average annual temperature is 59° to 62° F., the average annual rainfall is 18 to 25 inches, and the frost-free season is 240 to 260 days. Where the soils are not cultivated, the vegetation is annual grasses and forbs. This association makes up about 3 percent of Solano County.

About 65 percent of the association is Rincon soils, and about 20 percent is Yolo soils. The remaining 15 percent consists of Brentwood, Capay, Antioch, and San Ysidro soils.

Rincon soils have a grayish-brown and dark grayish-brown clay loam surface layer. The subsoil is dark grayish-brown and brown heavy clay loam. The substratum is yellowish-brown heavy clay loam.

Yolo soils have a dark grayish-brown silty clay loam surface layer and a grayish-brown loam substratum.

Soils in this association are used for irrigated orchards and row and field crops. Apricots, almonds, sugar beets, tomatoes, grain sorghum, and alfalfa are the principal crops.

Wildlife is mainly upland game. Food and cover must be provided.

Nearly Level to Gently Sloping, Moderately Well Drained to Very Poorly Drained Soils on Basin Rims, Alluvial Fans, and Deltas, and in Basins, Dredge Spoil Areas, and Salt Water Marshes

These soils are silty clay loams to clays or mucky clays, or they are mucks or peaty mucks. They formed in mixed alluvium, mostly derived from sedimentary rocks or from hydrophytic plant remains. Slopes are 0 to 5 percent.

Elevation ranges from 10 feet below sea level to 125 feet above sea level. The average annual temperature is 58° to 62° F., the average annual rainfall is 15 to 22 inches, and the frost-free season is 240 to 290 days. The vegetation is annual grasses, forbs, sedges, perennial herbs, and hydrophytes.

The six soil associations in this group make up 33 percent of Solano County.

4. *Capay-Clear Lake association*

Nearly level to gently sloping, moderately well drained and poorly drained silty clay loams to clays; on basin rims and in basins

The soils in this association are very deep. These soils formed in alluvium derived mainly from sedimentary rocks. Slopes are 0 to 5 percent. Elevation ranges from 10 to 125 feet. The average annual temperature is 59° to 62° F., the average annual rainfall is 16 to 22 inches, and the frost-free season is 260 to 290 days. Where the soils are not cultivated, the vegetation is annual grasses and forbs. This association makes up about 17 percent of Solano County.

About 70 percent of this association is Capay soils, and about 20 percent is Clear Lake soils. The remaining 10 percent is Brentwood, Omni, Rincon, and Sacramento soils.

Capay soils are moderately well drained and have a dark grayish-brown and brown silty clay loam or

clay surface layer. The substratum is pale-brown and grayish-brown clay loam.

Clear Lake soils are poorly drained and have a dark-gray clay surface layer and a grayish-brown clay substratum. The water table is at a depth of 48 inches to more than 60 inches.

The soils in this association are used for irrigated row crops and field crops. Sugar beets, tomatoes, milo, and barley are the principal crops.

Wildlife consists of upland game or waterfowl, depending on the type of food and cover available.

5. *Sacramento association*

Nearly level, poorly drained silty clay loams and clays; in basins

The soils in this association are very deep. These soils formed in alluvium derived from mixed rocks. Slopes are 0 to 2 percent. Elevation ranges from 0 to 10 feet. The average annual temperature is 59° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Where these soils are not cultivated, the vegetation is annual grasses and forbs. This association makes up about 2 percent of Solano County.

About 85 percent of the association is Sacramento soils, and about 15 percent is Egbert, Omni, and Valdez soils.

Sacramento soils have a mottled, gray and dark-gray silty clay loam or clay surface layer. The substratum is light-gray to black stratified clay to loam. The water table is at a depth of 36 to 48 inches, and some areas are subject to flooding.

The soils in this association are used for irrigated row crops and field crops. Sugar beets, tomatoes, corn, barley, and safflower are the principal crops.

Wildlife consists of upland game or waterfowl, depending on the types of supplemental food and cover that are provided.

6. *Egbert-Ryde association*

Nearly level, poorly drained silty clay loams and clay loams that are high in organic matter; in basins and on deltas

The soils in this association are very deep. These soils formed in alluvium derived from mixed rocks and in hydrophytic plant remains. Slopes are 0 to 2 percent. Elevation ranges from 10 feet below sea level to 10 feet above sea level. The average annual air temperature is 58° to 62° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 280 days. Where these soils are not cultivated, the vegetation is annual grasses and forbs or hydrophytes. This association makes up about 2 percent of Solano County.

About 45 percent of the association is Egbert soils, and about 45 percent is Ryde soils. The remaining 10 percent is Columbia, Sacramento, and Valdez soils.

Egbert soils have a gray silty clay loam surface layer and a mottled, gray silty clay loam subsoil and substratum. The water table is at a depth of 48 to 60 inches, and some areas are subject to occasional flooding.

Ryde soils have a mottled, gray and dark-gray clay loam surface layer underlain by mottled, very dark gray mucky loam. The substratum is gray to black, gleyed, stratified mucky loam to clay. The water table is at a depth of 36 to 48 inches.

The soils in this association are used for irrigated row crops and field crops, and for dryfarmed grain. Sugar beets, tomatoes, corn, grain sorghum, barley, and safflower are the principal crops.

Wildlife consists of upland game or waterfowl, depending on the types of supplemental food and cover that are provided.

7. *Valdez association*

Nearly level, somewhat poorly drained silt loams and silty clay loams; on alluvial fans and in dredge spoil areas

The soils in this association are very deep. These soils formed in alluvium from mixed sources or in materials dredged from rivers and channels. Slopes are 0 to 2 percent. Elevation ranges from near sea level to 15 feet above sea level. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 19 inches, and the frost-free season is 250 to 270 days. Where these soils are not cultivated, the vegetation is mostly annual grasses and forbs. This association makes up about 2 percent of Solano County.

About 90 percent of the association is Valdez soils, and 10 percent is Joice, Reyes, and Tamba soils.

The Valdez soils have a light brownish-gray and mottled light-gray and yellowish-brown silty clay loam surface layer. The subsoil is mottled light-gray to yellowish-brown, stratified silty clay loam and very fine sandy loam. It is underlain by light brownish-gray and pale-brown, stratified silty clay loam to very fine sandy loam. Some areas have a buried clay substratum. The water table is at a depth of 12 inches to more than 60 inches.

The soils in this association are used mainly for wildlife habitat and wildlife refuge. Dryfarmed barley is the principal cultivated crop.

Wildlife consists of upland game and waterfowl.

8. *Joice-Suisun association*

Nearly level, very poorly drained mucks and peaty mucks; in salt water marshes

The soils in this association are very deep. These soils formed from hydrophytic plant remains mixed with fine-textured mineral deposits. Slopes are 0 to 2 percent. Elevation ranges from 5 feet below sea level to near sea level. The average annual temperature is 58° to 60° F., the average annual rainfall is 15 to 20 inches, and the frost-free season is 240 to 270 days. Where the soils are not cultivated, the vegetation is perennial herbs and sedges. This association makes up about 4 percent of Solano County.

About 65 percent of the association is Joice soils, and 20 percent is Suisun soils. The remaining 15 percent is Alviso, Reyes, and Tamba soils.

Joice soils are black, saline clayey muck. Some areas are underlain by a buried clay subsoil. The water table is at a depth of 12 to 30 inches.

Suisun soils have a black muck surface layer underlain by black to very dark gray clayey muck. The water table is at a depth of 10 to 20 inches.

The soils in this association are used mainly for wildlife habitat, mostly for waterfowl.

9. Reyes-Tamba association

Nearly level, poorly drained and very poorly drained silty clay loams, silty clays, and mucky clays; in salt water marshes

The soils in this association are very deep. These soils formed in alluvium from mixed sources and in hydrophytic plant remains. Slopes are 0 to 2 percent. Elevation ranges from 3 feet below sea level to sea level. The average annual temperature is 58° to 60° F., the average annual rainfall is 15 to 20 inches, and the frost-free season is 240 to 260 days. Where the soils are not cultivated, the vegetation is salt-tolerant grasses, forbs, and sedges. This association makes up about 6 percent of the county.

About 45 percent of the association is Reyes soils, and about 40 percent is Tamba soils. The remaining 15 percent is Joice and Suisun soils and recently deposited sandy material.

Reyes soils are poorly drained and have a light-gray and grayish-brown silty clay surface layer mottled with dark reddish brown and yellowish red. The subsoil is gray silty clay. The substratum is also gray silty clay. The water table is at a depth of 24 inches to more than 60 inches.

Tamba soils are very poorly drained and have a light brownish-gray and grayish-brown surface layer mottled with yellowish brown. It is mucky clay. The subsoil is mottled, gray and black mucky clay underlain by gray mucky clay. The water table is at a depth of 12 to 36 inches.

The soils in this association are used for wildlife habitat, limited pasture, and very limited dryfarmed small grain.

Wildlife is mostly waterfowl, but there is some upland game.

Nearly Level to Moderately Steep, Well-Drained to Somewhat Poorly Drained Soils on Terraces and in Basins

These soils are gravelly loams to clays. They formed in alluvium derived mostly from mixed sedimentary rocks. Slopes are 0 to 30 percent.

Elevation ranges from 5 to 250 feet. The average annual temperature is 58° to 62° F., the average annual rainfall is 16 to 25 inches, and the frost-free season is 250 to 280 days. Where these soils are not cultivated, the vegetation is annual grasses, forbs, and some salt-tolerant plants.

The three soil associations in this group make up 17 percent of Solano County.

10. San Ysidro-Antioch association

Nearly level to moderately sloping, moderately well drained sandy loams and loams; on terraces

The soils in this association are shallow to moderately deep to a dense, very slowly permeable subsoil. These soils formed in alluvium derived from sedimentary rocks. Slopes are 0 to 9 percent. Elevation ranges from 10 to 100 feet. The average annual temperature is 58° to 61° F., the average annual rainfall is 16 to 22 inches, and the frost-free season is 250 to 270 days. Where the soils are not cultivated, the vegetation is annual grasses and forbs. This association makes up about 11 percent of Solano County.

About 60 percent of the association is San Ysidro soils, and 25 percent is Antioch soils. The remaining 15 percent is Capay, Pescadero, and Solano soils.

San Ysidro soils have a light brownish-gray fine sandy loam surface layer. The subsoil is dark yellowish-brown heavy clay loam and yellowish-brown sandy clay loam. The substratum is yellowish-brown light sandy clay loam and light yellowish-brown light clay loam. Roots commonly are restricted by the subsoil at a depth of 12 to 30 inches.

Antioch soils have a brown to light-gray loam surface layer. The subsoil is yellowish-brown and pale-brown clay and is underlain by pale-brown loam. Roots generally are restricted by the clay subsoil at a depth of 15 to 30 inches.

The soils in this association are used for shallow-rooted irrigated row crops, field crops, and pasture and for dryfarmed small grain.

Wildlife is mainly upland game. Supplemental plantings are needed to provide food and cover.

11. Corning association

Gently sloping to moderately steep, well-drained gravelly loams; on terraces

The soils in this association are shallow to a dense, very slowly permeable clay subsoil. These soils formed in softly consolidated, mixed, gravelly alluvium. Slopes are 2 to 30 percent. Elevation ranges from 25 to 250 feet. The average annual temperature is 60° to 62° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 260 to 280 days. Where the soils are not cultivated, the vegetation is chiefly annual grasses and forbs. This association makes up about 2 percent of Solano County.

About 85 percent of the association is Corning soils, and about 15 percent Altamont, Rincon, San Benito, and San Ysidro soils.

Corning soils have a yellowish-red gravelly loam surface layer. The subsoil is red clay at a depth of 14 to 20 inches. The substratum is a brownish-yellow, dense, very gravelly sandy loam. The dense subsoil and substratum can restrict plant roots.

The soils in this association are used for pasture, range, and dryfarmed small grain. Barley is the principal small grain crop.

Wildlife is mainly upland game. Water is the principal limiting factor for wildlife.

12. Solano-Pescadero association

Nearly level, somewhat poorly drained loams to clays; on terraces and in basins

The soils in this association are shallow to a dense, very slowly permeable subsoil, or they are very deep. These soils formed in alluvium derived from sedimen-

tary materials. Slopes are 0 to 2 percent. Elevation ranges from 5 to 100 feet. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 20 inches, and the frost-free season is 250 to 270 days. Where the soils are not cultivated, the vegetation is salt-tolerant plants, annual grasses, and forbs. This association makes up 4 percent of the county.

About 50 percent of the association is Solano soils, and 35 percent is Pescadero soils. The remaining 15 percent is Antioch, San Ysidro, and Willows soils.

Solano soils have a mottled, light brownish-gray and gray loam surface layer. The subsoil is brown and light yellowish-brown clay loam and silty clay loam at a depth of 6 to 12 inches. Roots commonly are restricted by the dense subsoil.

Pescadero soils have a light brownish-gray clay loam or clay surface layer. The subsoil is mottled gray to pale-brown clay and clay loam. The substratum is light-gray and light brownish-gray clay loam.

The soils in this association are used for irrigated pasture, for selected row crops, and for dryfarmed pasture and small grain. Irrigated pasture consists of salt-tolerant grasses and legumes. Barley and sugar beets are the principal crops.

Wildlife is upland game or waterfowl, depending upon the type of food and cover available.

Gently Sloping to Very Steep, Well-Drained and Somewhat Excessively Drained Soils on Dissected Terraces and Mountainous Uplands

These soils are loams or stony loams to clays. They formed in materials weathered from weakly consolidated sediments, sandstone, or basic igneous rocks. Slopes are 2 to 75 percent.

Elevation ranges from 25 to 3,000 feet. The average annual temperature is 54° to 62° F., the average annual rainfall is 15 to 40 inches, and the frost-free season is 220 to 280 days. The vegetation is mostly annual grasses and forbs, but some areas are covered by brush or scattered oaks.

The five soil associations in this group make up about 35 percent of Solano County.

13. Altamont-Diablo association

Gently sloping to steep, well-drained clays formed from weakly consolidated sediments; on dissected terraces

The soils in this association are moderately deep to deep. These soils formed in weakly consolidated sediments. Slopes are 2 to 50 percent. Elevation ranges from 25 to 500 feet. The average annual temperature is 58° to 61° F., the average annual rainfall is 15 to 23 inches, and the frost-free season is 250 to 280 days. Where these soils are not cultivated, the vegetation is annual grasses and forbs. This association makes up about 15 percent of Solano County.

About 40 percent of the association is Altamont soils, and 35 percent is Diablo soils. The remaining 25 percent is Ayar, Pescadero, San Benito, and San Ysidro soils.

Altamont soils have a dark grayish-brown clay and heavy clay loam surface layer underlain by light olive-brown silty clay loam. The parent material is light yellowish-brown siltstone at a depth of 25 to 40 inches.

Diablo soils have a dark-gray and dark grayish-brown clay surface layer underlain by grayish-brown silty clay loam. The parent material is light yellowish-brown, weakly consolidated sediments at a depth of 30 to 50 inches. These sediments have a texture of silty clay loam when crushed.

The soils in this association are used for dryfarmed small grain, pasture, range, and hay. The principal dryfarmed grains are barley and wheat.

Wildlife consists of upland game. Supplemental food and cover must be provided for optimum wildlife management.

14. Dibble-Los Osos association

Gently sloping to steep, well-drained loams and clay loams formed from sandstone; on mountainous uplands

The soils in this association are moderately deep. These soils formed in materials weathered from sandstone. Slopes are 2 to 50 percent. Elevation ranges from 100 to 2,000 feet. The average annual temperature is 58° to 60° F., the average annual rainfall is 20 to 30 inches, and the frost-free season is 225 to 260 days. The vegetation is mainly annual grasses, forbs, and scattered oaks. This association makes up about 10 percent of the county.

About 60 percent of this association is Dibble soils, and 30 percent is Los Osos soils. The remaining 10 percent is Altamont and Millsholm soils.

Dibble soils have a pale-brown loam or clay loam surface layer. The subsoil is dark yellowish-brown heavy clay loam and light olive-brown light clay. The parent material is light olive-brown sandstone at a depth of 20 to 40 inches.

Los Osos soils have a brown loam or clay loam surface layer. The subsoil is brown heavy clay loam and light clay. The parent material is light olive-brown sandstone at a depth of 20 to 40 inches.

The soils in this association are used for range, pasture, grass hay, and limited dryfarmed small grain.

Wildlife consists mainly of deer.

15. Millsholm association

Moderately steep to very steep, well-drained loams formed from sandstone; on mountainous uplands

The soils in this association are shallow. The parent material is sandstone. Slopes are 15 to 75 percent. Elevation ranges from 300 to 2,000 feet. The average annual temperature is 58° to 60° F., the average annual rainfall is 25 to 30 inches, and the frost-free season is 220 to 240 days. The vegetation is mostly annual grasses and forbs and a few scattered oaks. This association makes up about 3 percent of the county.

About 80 percent of the association is Millsholm soils, and 20 percent is Dibble, Los Gatos, Los Osos, and Maymen soils and Millsholm soils, moderately deep variant.

Millsholm soils are brown and dark yellowish-brown loam underlain by light yellowish-brown sandstone at a depth of 10 to 20 inches.

The soils in this association are used for range, wildlife habitat, and watershed.

Wildlife is mainly deer.

16. Maymen-Los Gatos association

Moderately steep to very steep, somewhat excessively drained and well-drained loams formed from sandstone; on mountainous uplands

The soils in this association are shallow or moderately deep. The parent material is sandstone (fig. 2). Slopes are 15 to 75 percent and are severely eroded. Elevation ranges from 1,500 to 3,000 feet. The average annual temperature is 54° to 56° F., the average annual rainfall is 30 to 40 inches, and the frost-free season is 220 to 240 days. The vegetation is a dense cover of brush, shrubs, and small trees. This association makes up about 3 percent of Solano County.

About 75 percent of the association is Maymen soils, and 15 percent is Los Gatos soils. The remaining 10 percent is Nibble, Los Osos, and Millsholm soils.

Maymen soils are somewhat excessively drained, brown to light yellowish-brown loam. Brownish-yellow sandstone is at a depth of 10 to 15 inches.

Los Gatos soils are well drained and have a brown loam surface layer and a yellowish-red clay loam subsoil. The parent material is yellowish-red sandstone at a depth of 20 to 25 inches.

The soils in this association are used for wildlife habitat and watershed.

Wildlife is mainly deer.

17. Hambright-Toomes association

Strongly sloping to very steep, well-drained and somewhat excessively drained loams and stony loams formed from basic igneous rocks; on mountainous uplands

The soils in this association are very shallow to shallow. The parent material is basic igneous rock (fig. 3).

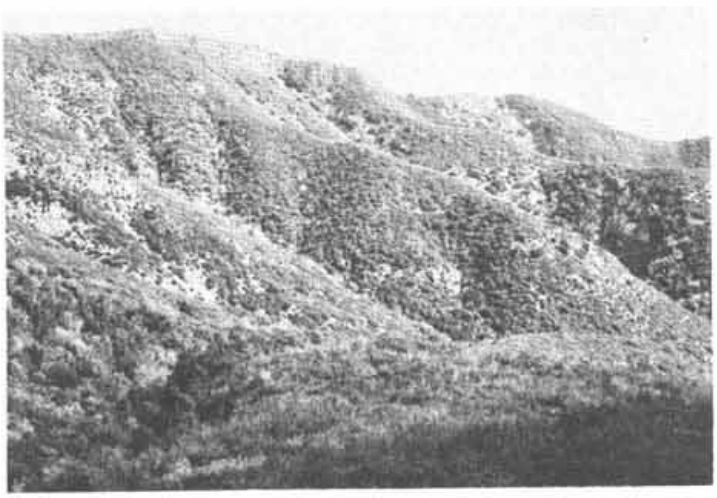

***Figure 2.*—Typical landscape of the Maymen-Los Gatos association.**

***Figure 3.*—Typical view of the soils in the Hambright-Toomes association.**

Slopes are 9 to 75 percent. Elevation ranges from 300 to 2,300 feet. The average annual temperature is 59° to 62° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 240 to 260 days. The vegetation is annual grasses and forbs and some brush and scattered oaks. This association makes up about 4 percent of Solano County.

About 65 percent of the association is Hambright soils, and 15 percent is Toomes soils. The remaining 20 percent is Dibble, Gilroy, Los Osos, and Trimmer soils.

Hambright soils are well-drained brown loam, stony loam, or cobbly loam. They are underlain by hard basic igneous rock at a depth of 6 to 20 inches.

Toomes soils are somewhat excessively drained, light brownish-gray and light gray loam or stony loam. They are underlain by white tuff over rock at a depth of 5 to 17 inches.

The soils in this association are used for range, wildlife habitat, and watershed.

Wildlife is mainly deer.

Descriptions of the Soils

In this section the soils of Solano County are described in detail. The procedure is to describe first the soil series and then the mapping units, or kinds of soil, in that series. Thus, to get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which the unit belongs.

Each soil series description contains a short narrative description of a profile considered representative of the series, and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations. The colors described are for dry soil, unless otherwise noted.

Some of the terms used in the soil descriptions are defined in the Glossary, and some are defined in the section "How This Survey Was Made." The approximate acreage and proportionate extent of each soil mapped are shown in table 1.

Altamont Series

The Altamont series consists of well-drained soils underlain by siltstone at a depth of 25 to 40 inches. These soils are on dissected terraces. Slopes are 2 to 50 percent. Where the soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 59° to 61° F., the average annual rainfall is 15 to 23 inches, and the frost-free season is 250 to 280 days. Elevation ranges from 50 to 500 feet.

In a representative profile, the surface layer is dark grayish-brown clay and heavy clay loam 28 inches

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

Soil	Acres	Percent	Soil	Acres	Percent
Altamont clay, 2 to 9 percent slopes	4,121	0.8	Made land	2,435	.5
Altamont clay, 9 to 30 percent slopes	7,970	1.5	Maymen-Los Gatos loams, 15 to 75 percent slopes, severely eroded	13,485	2.6
Altamont clay, 30 to 50 percent slopes, eroded	2,945	.6	Millsap sandy loam, 0 to 2 percent slopes	1,131	.2
Altamont-San Ysidro-San Benito complex, 2 to 9 percent slopes	6,186	1.2	Millsap-Los Osos complex, 2 to 9 percent slopes	2,416	.5
Altamont-San Ysidro-San Benito complex, 9 to 30 percent slopes	4,305	.8	Millsholm loam, 15 to 30 percent slopes	2,405	.5
Altamont-Diablo clays, 2 to 9 percent slopes	8,929	1.7	Millsholm loam, 30 to 75 percent slopes, eroded	11,667	2.2
Altamont-Diablo clays, 9 to 30 percent slopes, eroded	2,880	.6	Millsholm loam, moderately deep variant, 2 to 9 percent slopes	251	(1)
Alviso silty clay loam	1,831	.4	Millsholm loam, moderately deep variant, 9 to 30 percent slopes	780	.1
Antioch-San Ysidro complex, 0 to 2 percent slopes	21,307	4.1	Omni clay loam	697	.1
Antioch-San Ysidro complex, 2 to 9 percent slopes	3,661	.7	Omni silty clay	3,070	.6
Antioch-San Ysidro complex, thick surface, 0 to 2 percent slopes	5,734	1.1	Pescadero clay loam	7,017	1.3
Antioch-San Ysidro complex, thick surface, 2 to 9 percent slopes	1,744	.3	Pescadero clay	1,055	.2
Brentwood clay loam, 0 to 2 percent slopes	15,079	2.9	Reiff fine sandy loam	940	.2
Brentwood clay loam, 2 to 9 percent slopes	1,010	.2	Reyes silty clay loam, drained	1,810	.3
Capay silty clay loam	28,500	5.4	Reyes silty clay	14,586	2.8
Capay clay	36,788	7.0	Rincon loam, 2 to 9 percent slopes	473	.1
Clear Lake clay, 0 to 2 percent slopes	15,036	2.8	Rincon clay loam, 0 to 2 percent slopes	8,265	1.6
Clear Lake clay, 2 to 5 percent slopes	940	.2	Rincon clay loam, 2 to 9 percent slopes	3,547	.7
Clear Lake clay, saline, 0 to 2 percent slopes	430	.1	Riverwash	985	.2
Columbia fine sandy loam	961	.2	Ryde clay loam	6,340	1.2
Conejo loam	424	.1	Sacramento silty clay loam	3,885	.7
Conejo gravelly loam	215	(1)	Sacramento silty clay loam, occasionally flooded	745	.1
Conejo clay loam	325	.1	Sacramento clay	7,295	1.4
Conejo soils, wet	435	.1	San Ysidro sandy loam, 0 to 2 percent slopes	18,572	3.5
Corning gravelly loam, 2 to 15 percent slopes, eroded	7,387	1.4	San Ysidro sandy loam, 2 to 5 percent slopes	2,231	.4
Corning gravelly loam, 15 to 30 percent slopes, eroded	660	.1	San Ysidro sandy loam, thick surface, 0 to 2 percent slopes	4,781	.9
Diablo-Ayar clays, 2 to 9 percent slopes	7,200	1.4	Solano loam	9,921	1.9
Diablo-Ayar clays, 9 to 30 percent slopes, eroded	20,810	3.9	Solano-Pescadero complex	1,748	.3
Dibble-Los Osos loams, 2 to 9 percent slopes	1,250	.2	Solano loam, dark surface variant	1,405	.3
Dibble-Los Osos loams, 9 to 30 percent slopes	4,725	.9	Suisun peaty muck	4,916	.9
Dibble-Los Osos loams, 30 to 50 percent slopes, eroded	8,978	1.7	Sycamore silty clay loam	4,885	.9
Dibble-Los Osos clay loams, 2 to 9 percent slopes	3,630	.7	Sycamore silty clay loam, drained	2,580	.5
Dibble-Los Osos clay loams, 9 to 30 percent slopes	13,973	2.6	Sycamore silty clay loam, saline	2,295	.4
Dibble-Los Osos clay loams, 30 to 50 percent slopes, eroded	18,433	3.5	Sycamore complex, occasionally flooded	2,300	.4
Egbert silty clay loam	4,565	.9	Tamba mucky clay	14,729	2.8
Egbert silty clay loam, occasionally flooded	1,245	.2	Tidal marsh	2,405	.5
Gaviota sandy loam, 30 to 75 percent slopes, eroded	1,365	.3	Toomes stony loam, 30 to 75 percent slopes, eroded	3,840	.7
Gilroy loam, 9 to 30 percent slopes	1,315	.2	Trimmer loam, 9 to 30 percent slopes	845	.2
Hambright loam, 15 to 40 percent slopes	9,680	1.8	Trimmer cobbly clay loam, shallow variant, 15 to 50 percent slopes, eroded	831	.2
Hambright-Toomes stony loams, 9 to 30 percent slopes	1,404	.3	Tujunga fine sand	1,520	.3
Joice muck	14,470	2.7	Valdez silt loam, drained	4,742	.9
Joice muck, clay subsoil variant	1,350	.3	Valdez silty clay loam	5,400	1.0
			Valdez silty clay loam, wet	1,680	.3
			Valdez silty clay loam, clay substratum	1,705	.3
			Willows clay	2,130	.4
			Yolo loam	11,153	2.1
			Yolo loam, clay substratum	4,405	.8
			Yolo silty clay loam	26,225	5.0
			Total land area	526,720	100.0

[1] Less than 0.05 percent.

thick. The next layer is light olive-brown silty clay loam 10 inches thick. Light yellowish-brown siltstone is at a depth of 38 inches. Where these soils are dry, many large cracks are in the surface and extend into the substratum.

Permeability is slow.

Altamont soils are used for dryfarmed small grain, range, pasture, wildlife habitat, and recreation.

Following is a representative profile of Altamont clay, 2 to 9 percent slopes:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) clay, dark brown (10YR 3/3) when moist; strong, medium, granular structure in upper part, strong, very coarse, angular blocky in lower part; very hard, firm, sticky, plastic; many fine roots; common fine pores; slightly acid; clear, wavy boundary.

A11—8 to 12 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; strong, coarse, angular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine roots; common very fine pores; mildly alkaline; diffuse, wavy boundary.

A12—12 to 24 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) and has very fine, indistinct, dark-brown (10YR 4/3) splotches when moist; strong, coarse, angular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine roots; common fine pores; moderately alkaline; calcareous; diffuse, wavy boundary.

A13ca—24 to 28 inches, dark grayish-brown (10YR 4/2) heavy clay loam, very dark grayish brown (10YR 3/2) and has brown (10YR 4/3) splotches when moist; massive; extremely hard, very firm, sticky, plastic; very few fine roots; common fine pores; moderately alkaline; highly calcareous; gradual, irregular boundary.

C1—28 to 38 inches, light olive-brown (2.5Y 5/4) silty clay loam, light olive brown (2.5Y 5/4) and has very dark grayish-brown (10YR 3/2) tongues when moist; hard, firm, slightly sticky, plastic; very few fine roots; common fine pores; moderately alkaline; lime in soft masses and along cleavage planes; gradual, irregular boundary.

C2—38 to 60 inches, light yellowish-brown (2.5Y 6/4) siltstone, olive brown (2.5Y 4/4) when moist; massive; extremely hard; lime coatings on cleavage planes.

The A horizon ranges from dark grayish brown to brown in color. It is clay or silty clay in the upper part and heavy clay loam or heavy silty clay loam in the lower part. It is slightly acid to moderately alkaline and is from 25 to 40 inches in thickness. The C1 horizon ranges from yellowish brown to olive brown or light yellowish brown to light olive brown. It is heavy clay loam or silty clay loam.

Altamont clay, 2 to 9 percent slopes (AcC).—This soil has the profile described as representative for the series. It is on dissected terraces. Included with this soil in mapping are small areas of Corning gravelly loam, Diablo clay, San Benito clay loam, and a soil that is similar to this Altamont soil but does not have a calcareous substratum.

Surface runoff is slow to medium. Erosion is a slight hazard. Available water capacity is 4 to 7 inches. Effective rooting depth is 28 to 40 inches.

This soil is used for dryfarmed grain and pasture. It is also used for wildlife habitat and recreation. Capability unit IIIe–5 (15); not placed in a range site.

Altamont clay, 9 to 30 percent slopes (AcE).—This soil has a profile similar to the one described as representative for the series, except that its surface layer is 2 to 4 inches thinner as a result of slight water erosion. Included with this soil in mapping are small areas of Diablo clay, San Benito clay loam, and a soil that is similar to this Altamont soil but does not have a calcareous substratum.

Runoff is medium. Erosion is a moderate hazard. Available water capacity is 4 to 7 inches. Effective rooting depth is 28 to 40 inches.

This soil is used mainly for dryfarmed small grain and pasture. It is also used for wildlife habitat and recreation. Capability unit IVe–5 (15); not placed in a range site.

Altamont clay, 30 to 50 percent slopes, eroded (AcF2).—This soil has a profile similar to the one described as representative for the series, except that the surface layer is 3 to 6 inches thinner as a result of water erosion. Included with the soil in mapping are small areas of Dibble clay loam, Diablo clay, and a soil that is similar to this Altamont soil but does not have a calcareous C horizon.

Runoff is medium to rapid. Erosion is a moderate hazard. Available water capacity is 4 to 6 inches. Effective rooting depth is 25 to 35 inches.

This soil is used mostly for range. It is also used for wildlife habitat and recreation. Capability unit VIe–1 (15); Clayey range site.

Altamont-San Ysidro-San Benito complex, 2 to 9 percent slopes (AlC).—This complex is about 60 percent Altamont clay, 20 percent San Ysidro sandy loam, and 15 percent San Benito clay loam. The remaining 5 percent consists of included small areas of Diablo clay and Ayar clay. The Altamont soil is generally on side slopes, the San Ysidro soil is in drainageways and swales, and the San Benito soil is on rounded hilltops.

The Altamont soil has a profile similar to the one described as representative for the series. It is 28 to 40 inches deep. Available water capacity is 4 to 7 inches. Runoff is slow to medium, and erosion is a slight hazard.

The San Ysidro soil has a profile similar to the one described as representative for the series. It is 12 to 20 inches deep to the heavy clay loam subsoil. Available water capacity is 3 to 5 inches. Some water from the subsoil is available to plants. Runoff is medium, and erosion is a moderate hazard.

The San Benito soil has the profile described as representative for the series. Runoff is medium, and erosion is a moderate hazard.

These soils are used for dryfarmed small grain and pasture. They are also used for wildlife habitat and recreation. Capability unit IIIe-5 (15); not placed in a range site.

Altamont-San Ysidro-San Benito complex, 9 to 30 percent slopes (AlE).—This complex is about 60 percent Altamont clay, 20 percent San Ysidro sandy loam, and 15 percent San Benito clay loam. The remaining 5 percent consists of included small areas of Diablo clay and Ayar clay. The Altamont soil is on side slopes, the San Ysidro soil is along drainageways and in swales, and the San Benito soil is on rounded hilltops. These soils have a profile similar to the one described as representative for their respective series.

The Altamont soil is 28 to 40 inches deep. Available water capacity is 4 to 7 inches. Runoff is medium, and erosion is a moderate hazard.

The San Ysidro soil is 12 to 20 inches deep to the heavy clay loam subsoil. Available water capacity is 3 to 5 inches. A small amount of moisture from the subsoil is available to plants. Runoff is medium to rapid, and erosion is a moderate to high hazard.

Runoff is medium to rapid and erosion is a moderate to high hazard on the San Benito soil.

These soils are used for dryfarmed small grain and pasture. They are also used for wildlife habitat and recreation. Capability unit IVe–5 (15); not placed in a range site.

Altamont-Diablo clays, 2 to 9 percent slopes (AmC).—This complex is about 50 percent Altamont clay and 40 percent Diablo clay. The remaining 10 percent consists of included small areas of Ayar clay and San Benito clay loam. The Altamont soil is generally on the south- and west-facing slopes and on the ridgetops. The Diablo soil is generally on the north- and east-facing slopes. These soils have a profile similar to the one described as representative for their respective series.

The Altamont soil has an effective rooting depth of 28 to 40 inches. Available water capacity is 4 to 7 inches.

The Diablo soil has an effective rooting depth of 35 to 50 inches. Available water capacity is 5 to 8 inches.

Runoff is slow and erosion is a slight hazard on both the Altamont and Diablo soils.

These soils are used for dryfarmed small grain and pasture. They are also used for wildlife habitat and recreation. Capability unit IIIe–5 (15); not placed in a range site.

Altamont-Diablo clays, 9 to 30 percent slopes, eroded (AmE2).—This complex is about 50 percent Altamont clay and 40 percent Diablo clay. The remaining 10 percent consists of included small areas of Ayar clay and San Benito clay loam. The Altamont soil is generally on the south- and west-facing slopes and on hilltops. The Diablo soil is generally on the north- and east-facing slopes. Erosion has made the surface layer of the Altamont and Diablo soils 3 to 5 inches thinner than that of the representative profile in their respective series.

The Altamont soil is 25 to 35 inches deep. Available water capacity is 4 to 6 inches.

The Diablo soil is 30 to 45 inches deep. Available water capacity is 4 to 7 inches.

Runoff is medium, and erosion is a moderate hazard on both the Altamont and Diablo soils.

The soils in this complex are used for dryfarmed grain and pasture. They are also used for wildlife habitat and for watershed. Capability unit IVe–5 (15); not placed in a range site.

Alviso Series

The Alviso series consists of nearly level, poorly drained soils on the rims of marshes. These soils formed in mixed alluvium. The vegetation is salt-tolerant grasses and pickleweed. The average annual temperature is 57° to 59° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 270 to 320 days. Elevation ranges from sea level to 10 feet.

In a representative profile, the surface layer is dark-gray and gray silty clay loam 13 inches thick. The next layer is gray silty clay loam 6 inches thick. Between depths of 19 and 60 inches is dark-gray, gray, and greenish-gray silty clay loam. The profile is saline throughout.

Permeability is slow. Rooting depth is more than 60 inches. Available water capacity is 8 to 9 inches, and the water table is at a depth of 24 to 36 inches.

Alviso soils are used for saltgrass pasture, irrigated pasture, and dryfarmed barley. Waterfowl are hunted in some areas.

Following is a representative profile of Alviso silty clay loam:

A11—0 to 2 inches, dark-gray (N 4/0) silty clay loam, black (N 2/0) when moist; weak, medium, subangular blocky structure; hard, firm, sticky, plastic; many very fine and medium roots; common very fine tubular pores; mildly alkaline; abrupt, smooth boundary.

A12—2 to 13 inches, gray (5Y 5/1) silty clay loam that has many, medium, distinct, light olive-brown (2.5Y 5/4) mottles; dark olive gray (5Y 3/2) and has olive-brown (2.5Y 4/4) mottles when moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky structure; hard, firm, sticky, plastic; many very fine and fine roots; many very fine tubular pores; mildly alkaline; clear, smooth boundary.

C1—13 to 19 inches, gray (5Y 6/1) silty clay loam that has many medium, prominent, light olive-brown (2.5Y 5/4) mottles; olive gray (5Y 4/2) and has olive-brown (2.5Y 4/4) mottles when moist; massive; hard, firm, sticky, plastic; few fine roots, many coarse roots; many very fine tubular pores; moderately alkaline; very slightly effervescent; disseminated lime; clear, wavy boundary.

IIAb—19 to 26 inches, dark-gray (5Y 4/1) silty clay loam that has common, medium, distinct, olive-gray (5Y 5/2) mottles; black (5Y 2/1) and has olive-gray (5Y 4/2) mottles when moist; massive; hard, firm, sticky, plastic; few very fine and fine roots; common very fine tubular pores; moderately alkaline; very slightly effervescent; disseminated lime; few small marine shells; clear, wavy boundary.

IIC1b—26 to 40 inches, gray (5Y 5/1) silty clay loam that has many, small, prominent, reddish-yellow (7.5YR 6/6) mottles; dark gray (5Y 4/1) and has strong-brown (7.5YR 5/6) mottles when moist; massive; hard, firm, sticky, plastic; few very fine roots; many very fine and fine tubular pores; moderately alkaline; very slightly effervescent; disseminated lime; few small marine shells; clear, wavy boundary.

IIC2b—40 to 60 inches, greenish-gray (5GY 6/1) silty clay loam that has many, fine prominent, light yellowish-brown (10YR 6/4) mottles; greenish gray (5GY 5/1) and has brown (7.5YR 4/4) mottles when moist; massive; hard, firm, sticky, plastic; very few roots; very few tubular pores; moderately alkaline.

The A horizon ranges from gray to dark gray in color, from silty clay loam to silty clay in texture, and from 12 to 24 inches in thickness. It is neutral to moderately alkaline and moderately saline to strongly saline. The C, IIAb, and IICb horizons range from gray to greenish gray in hues of 5Y and 5GY, from silty clay loam to silty clay, from neutral to moderately alkaline, and from moderately saline to strongly saline. Mottles occur throughout the profile, except in the A11 horizon. The water table is at a depth of 2 to 3 feet. The Ab and Cb horizons are absent in some places.

Alviso silty clay loam (An).—This soil is nearly level and is along the edges of marshes. Included with it in mapping are small areas of Reyes clay and Tamba mucky clay.

Surface runoff is very slow. Erosion is a slight hazard.

This soil is used mainly for dryland pasture. It is also used for irrigated pasture and dryfarmed barley. Waterfowl are hunted in most areas. Capability unit IVw–6 (17); not placed in a range site.

Antioch Series

The Antioch series consists of moderately well drained soils on terraces. These soils formed in alluvium from sedimentary sources. Slopes are 0 to 9 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 59° to 61° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 260 to 280 days. Elevation ranges from 10 to 50 feet.

In a representative profile (fig. 4), the surface layer is mottled, light brownish-gray, brown, and light-gray loam 19 inches thick. The subsoil is mottled, light yellowish-brown, yellowish-brown, and pale-brown clay 41 inches thick. The substratum is pale-brown loam that extends to a depth of more than 60 inches. The subsoil and substratum contain a small amount of sodium.

Permeability is very slow.

Antioch soils are used for sugar beets, pasture, grain sorghum, dryfarmed small grain, wildlife habitat, and recreation.

Following is a representative profile of an Antioch loam:

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) loam that has common, fine, distinct yellowish-brown (10YR 5/6) mottles; dark grayish brown (10YR 4/2) and has common, fine, distinct, strong-brown (7.5YR 5/6) mottles when moist; massive; hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine and medium tubular pores; medium acid; clear, smooth boundary.

A1—5 to 14 inches, brown (10YR 5/3) loam that has few, fine, distinct yellowish-brown (10YR 5/6) mottles; dark brown (10YR 3/3) and has few, fine, distinct, strong-brown (7.5YR 5/6) mottles when moist; massive; hard, friable, slightly sticky, slightly plastic; few, very fine roots; many fine and medium tubular pores; medium acid; clear, wavy boundary.

A2—14 to 19 inches, light-gray (10YR 7/2) loam that has common, fine, distinct yellowish-brown (10YR 5/6) mottles; dark grayish brown (10YR 4/2) and has common, fine, distinct, strong-brown (7.5YR 5/6) mottles when moist; massive; hard, friable, slightly sticky, slightly plastic; very few very fine roots; many fine pores; slightly acid; manganese stains; abrupt, smooth boundary.

B21t—19 to 34 inches, light yellowish-brown (10YR 6/4) clay that has common, medium, faint, pale-brown (10YR 6/3) mottles; dark yellowish brown (10YR 4/4) and has common, medium, faint, brown (10YR 3/3) mottles when moist; moderate, very coarse, prismatic structure; extremely hard, very firm, sticky, very plastic; few very fine roots; common microtubular pores; many moderately thick clay films on ped faces and in pores; medium acid; few iron and manganese stains; clear, wavy boundary.

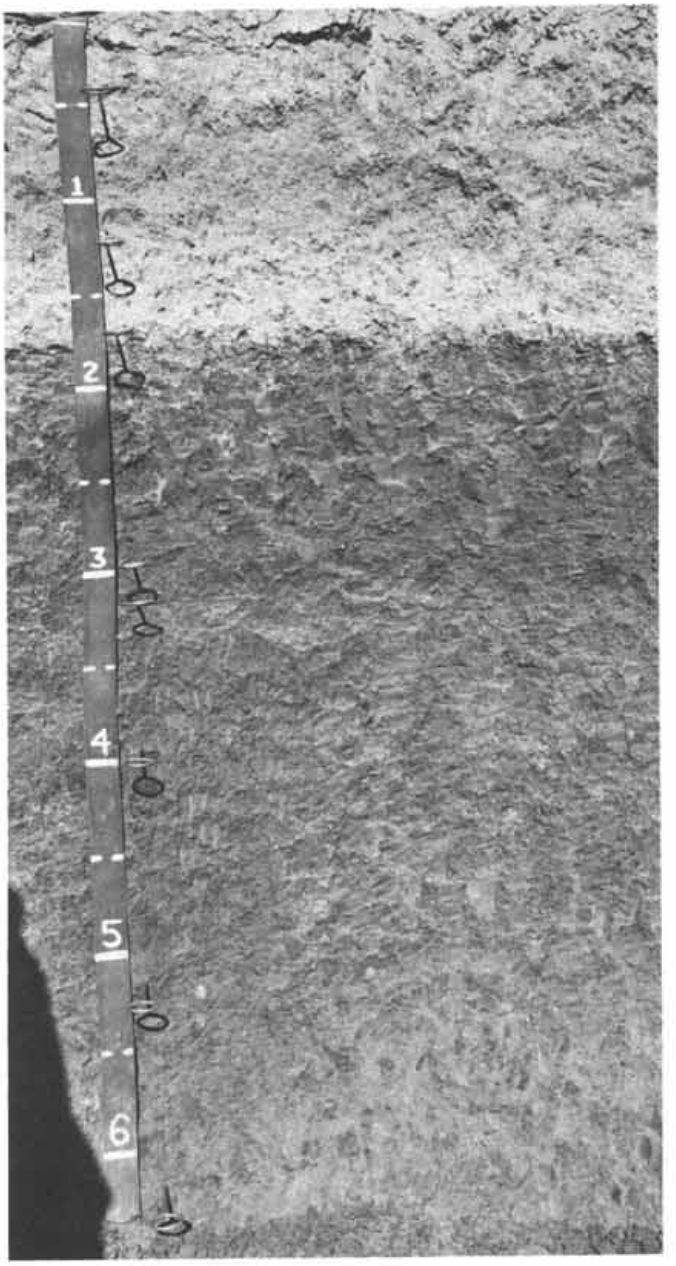

***Figure 4.*—Profile of an Antioch loam.**

B22t—34 to 37 inches, yellowish-brown (10YR 5/4) clay, dark brown (10YR 4/3) when moist; weak, medium, angular blocky structure; extremely hard, very firm, sticky, plastic; common very fine tubular pores; many moderately thick clay films on ped faces and in pores; moderately alkaline; many iron and manganese stains; clear, wavy boundary.

B23t—37 to 46 inches, pale-brown (10YR 6/3) clay, dark yellowish brown (10YR 4/4) and has dark-brown (7.5YR 3/2) and dark grayish-brown (2.5Y 4/2) ped faces when moist; weak, medium, angular blocky structure; hard, firm, sticky, plastic; common very fine tubular pores; continuous, moderately thick clay films on ped faces and in pores; moderately alkaline; common iron and manganese stains; diffuse boundary.

B24t—46 to 60 inches, pale-brown (10YR 6/3) light clay, olive brown (2.5Y 4/4) and has dark grayish-brown (2.5Y 4/2) and dusky-red (2.5YR 3/2) ped faces when moist; weak, medium, angular blocky structure; hard, firm, sticky, plastic; common very fine tubular pores; continuous, moderately thick clay films on ped faces and in pores; moderately alkaline; common iron and manganese stains; clear, wavy boundary.

C—60 to 72 inches, pale-brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, angular blocky structure; slightly hard, friable, slightly sticky, plastic; many very fine tubular pores; common thin clay films on ped faces and in pores; moderately alkaline; common iron and manganese stains.

The A horizon ranges from mottled brown to light brownish gray to mottled light gray in color and from loam to fine sandy loam in texture. The A horizon is from 15 to 30 inches in thickness, and is medium acid to strongly acid in reaction. The B horizon ranges from mottled yellowish brown to pale brown in color and from clay to heavy silty clay loam in texture. The B horizon is from 18 to 41 inches in thickness. Reaction is medium acid to strongly alkaline, and the content of exchangeable sodium is 15 to 25 percent. The C horizon ranges from yellowish brown to pale brown in color and from loam to silty clay loam in texture. Reaction is moderately alkaline to strongly alkaline.

Antioch-San Ysidro complex, 0 to 2 percent slopes (AoA).—This complex is about 50 percent Antioch loam and 35 percent San Ysidro sandy loam. The remaining 15 percent is included small areas of Solano loam and Pescadero clay loam. The Antioch soil has slightly concave slopes, and the San Ysidro soil has slightly convex slopes.

The Antioch soil has the profile described as representative for the series. It has an effective rooting depth of 15 to 20 inches. Available water capacity is 3.5 to 5.5 inches. A small amount of water is available to some plants from the clay subsoil.

The San Ysidro soil has a profile similar to the one described as representative for the series. It has an effective rooting depth of 12 to 20 inches. Available water capacity is 3 to 5 inches. Roots of some plants get a small amount of water from the subsoil.

Both the Antioch and San Ysidro soils have very slow runoff. Erosion is a slight hazard.

These soils are used for irrigated pasture, grain sorghum, sugar beets, dryfarmed small grain, and pasture. They are also used for wildlife habitat and recreation. Capability unit IVs–3 (17); not placed in a range site.

Antioch-San Ysidro complex, 2 to 9 percent slopes (AoC).—These soils are undulating to gently rolling on terraces. They are about 45 percent Antioch loam and 45 percent San Ysidro sandy loam. The remaining 10 percent is included small areas of Solano loam. The Antioch soil has slightly conclave slopes, and the San Ysidro soil has slightly convex slopes.

The Antioch soil has a profile similar to the one described as representative for the series. It has an effective rooting depth of 15 to 20 inches. Available water capacity is 3 to 5 inches. A small amount of water is available from the subsoil.

The San Ysidro soil has a profile similar to the one described as representative for the series. It has an effective rooting depth of 12 to 20 inches. Available water capacity is 3.5 to 5.5 inches. Some roots get a small amount of water from the subsoil.

Both the Antioch and San Ysidro soils have medium runoff. Erosion is a slight hazard.

The soils in this complex are used mostly for dryfarmed small grain and pasture. They are also used for irrigated pasture, wildlife habitat, and recreation. Capability unit IVe–3 (17); not placed in a range site.

Antioch-San Ysidro complex, thick surface, 0 to 2 percent slopes (AsA).—This complex is about 55 percent Antioch loam and about 35 percent San Ysidro sandy loam. The remaining 10 percent is included small areas where the clayey subsoil is at a depth of less than 20 inches. The Antioch soil is mostly in slightly concave areas, and the San Ysidro soil is in slightly convex areas.

These soils have a profile similar to the one described as representative for their respective series. The effective rooting depth is 20 to 30 inches. Available water capacity is 4 to 6 inches. Runoff is very slow, and erosion is a slight hazard.

These soils are used mostly for irrigated grain sorghum, pasture, sugar beets, beans, dryfarmed small grain, and dryland pasture. Capability unit IIIs–3 (17); not placed in a range site.

Antioch-San Ysidro complex, thick surface, 2 to 9 percent slopes (AsC).—This complex is about 45 percent Antioch loam and about 45 percent San Ysidro sandy loam. The remaining 10 percent is included small areas of these soils that have a rooting depth of less than 20 inches. The soils in this complex are undulating to gently rolling on terraces. Antioch loam has concave slopes, and San Ysidro sandy loam has convex slopes.

The Antioch and San Ysidro soils have a profile similar to the one described as representative for their respective series. They have an effective rooting depth of 20 to 30 inches. Available water capacity is 4 to 6 inches. A small amount of water is available to some plants from the subsoil. Runoff is medium, and erosion is a slight hazard.

The soils in this complex are used mostly for dryfarmed small grain and pasture. They are also used for irrigated pasture, wildlife habitat, and recreation. Capability unit IIIe–3 (15); not placed in a range site.

Ayar Series

The Ayar series consists of well-drained soils on dissected terraces. These soils are underlain by weakly consolidated sediments at a depth of 40 inches to more than 60 inches. Slopes are 2 to 30 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 59° to 61° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 260 to 280 days. Elevation ranges from 25 to 300 feet.

In a representative profile, the surface layer is dark grayish-brown, calcareous clay 41 inches thick. When dry, many large cracks form in the surface and extend downward. The substratum is light yellowish-brown,

calcareous clay loam that is underlain at a depth of 51 inches by weakly consolidated sediments that crush to calcareous clay loam.

Permeability is slow. Effective rooting depth is 40 to 60 inches. Available water capacity is 5 to 9 inches.

Ayar soils are used for dryfarmed small grain, pasture, and wildlife habitat.

Following is a representative profile of an Ayar clay:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; strong, coarse, prismatic structure; very hard, very firm, sticky, plastic; common very fine roots; many very fine tubular and interstitial pores; moderately alkaline; strongly effervescent, lime disseminated and in fine concretions; abrupt, smooth boundary.

A11—6 to 19 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; strong, coarse and very coarse, prismatic structure; very hard, very firm, sticky, plastic; common very fine roots; many very fine tubular pores; moderately alkaline; strongly effervescent, lime disseminated and in medium concretions; clear, smooth boundary.

A12—19 to 28 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, very coarse, prismatic structure; very hard, very firm, sticky, plastic; few very fine roots; many very fine tubular pores; moderately alkaline; strongly effervescent, lime disseminated and in medium concretions; common medium slickensides; gradual, smooth boundary.

A13—28 to 41 inches, dark grayish-brown (10YR 4/2) clay that has common, large, distinct, light yellowish-brown (10YR 6/4) mottles; very dark grayish brown (10YR 3/2) and has dark yellowish-brown mottles when moist; weak, very coarse, prismatic structure; very hard, very firm, sticky, plastic; few very fine roots; many very fine tubular pores; moderately alkaline; strongly effervescent, lime disseminated, in large soft masses, and in medium concretions; common, medium, intersecting slickensides; gradual, smooth boundary.

C1—41 to 51 inches, light yellowish-brown (10YR 6/4) clay loam that has common, medium, distinct, dark grayish-brown (10YR 4/2) mottles; yellowish brown (10YR 5/4) and has very dark grayish-brown mottles when moist; massive; very hard, very firm, sticky, plastic; very few very fine roots; common very fine tubular pores; moderately alkaline; strongly effervescent, lime disseminated, and violently effervescent, lime in large soft masses and medium concretions; common, large, intersecting slickensides; gradual, smooth boundary.

C2—51 to 66 inches, light yellowish-brown (10YR 6/4) semiconsolidated sediments that crush to clay loam, yellowish brown (10YR 5/4) when moist; massive; very hard, very firm, sticky, plastic; no roots; few very fine tubular pores; moderately alkaline; very slightly effervescent, lime disseminated, and strongly effervescent, lime in large soft masses; few small slickensides.

The A horizon is clay to heavy silty clay loam in texture and 30 to 42 inches in thickness. The C1 horizon ranges from yellowish brown to light yellowish brown in color and is clay loam or silty clay loam in texture. The C2 horizon is at a depth of 40 inches to more than 60 inches.

Ayar soils are mapped only in complexes with Diablo soils.

Brentwood Series

The Brentwood series consists of well-drained soils on alluvial fans. These soils formed in materials derived from sedimentary rocks. Slopes are 0 to 9 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 60° to 62° F., the average annual rainfall is 18 to 25 inches, and the frost-free season is 260 to 280 days. Elevation ranges from 75 to 250 feet.

In a representative profile, the surface layer is grayish-brown clay loam 6 inches thick. The subsoil is grayish-brown heavy clay loam 28 inches thick. The substratum is brown and pale-brown clay loam that extends to a depth of more than 60 inches.

Permeability is moderately slow. Effective rooting depth is more than 60 inches, and available water capacity is 10 to 12 inches.

Brentwood soils are used for irrigated orchard, row crops, forage crops, dryfarmed grain, wildlife habitat, and recreation.

Following is a representative profile of Brentwood clay loam, 0 to 2 percent slopes:

Ap—0 to 6 inches, grayish-brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) when moist; massive; hard, friable, slightly sticky, slightly plastic; few fine roots; many fine and very fine pores; neutral; clear, wavy boundary.

B21—6 to 21 inches, grayish-brown (2.5Y 5/2) heavy clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak, medium, angular blocky structure; hard, friable, sticky, plastic; few fine and few coarse roots; common fine pores and few medium pores; few, thin, continuous clay films on ped faces and in pores; neutral; clear, wavy boundary.

B22—21 to 34 inches, grayish-brown (2.5Y 5/2) heavy clay loam, dark grayish brown (2.5Y 4/2) when moist; medium, angular blocky structure; hard, friable, sticky, plastic; few fine roots and few coarse roots; common fine pores and few medium pores; common, medium, continuous clay films on ped faces; slightly acid; clear, wavy boundary.

C1—34 to 43 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; massive; hard, friable, sticky, plastic; few coarse roots; few fine pores; mildly alkaline; clear, wavy boundary.

C2—43 to 60 inches, pale-brown (10YR 6/3) clay loam, yellowish brown (10YR 5/4) when moist; massive; hard, friable, sticky, slightly plastic; few coarse roots; mildly alkaline.

The A horizon ranges from grayish brown to dark grayish brown in color and from clay loam to heavy silty clay loam in texture. It is 6 to 18 inches thick. Reaction is slightly acid to mildly alkaline. The B horizon ranges from brown to grayish brown in color and from heavy clay loam to light clay in texture. It is 20 to 34 inches thick. Reaction is slightly acid to moderately alkaline. The C horizon ranges from pale brown or brown to yellowish brown in color and from clay loam to loam in texture. Reaction is slightly acid to moderately alkaline.

Brentwood clay loam, 0 to 2 percent slopes (BrA).—This soil is on alluvial fans. It has the profile described as representative for the series. Included with it in mapping are small areas of Yolo silty clay loam and Rincon clay loam.

Runoff is very slow, and erosion is a slight hazard.

This soil is used mainly for irrigated apricots, walnuts, almonds, prunes, alfalfa, tomatoes, and sugar beets, and for dryfarmed barley (fig. 5). It is also used for wildlife habitat, recreation, and urban development. Capability unit I–1 (17); not placed in a range site.

Figure 5.—**Young prune orchard on Brentwood clay loam, 0 to 2 percent slopes.**

Brentwood clay loam, 2 to 9 percent slopes (BrC).—This soil is on alluvial fans. Included with this soil in mapping are small areas of Yolo silty clay loam and Rincon clay loam.

Surface runoff is medium. Erosion is a slight hazard.

This soil is used mostly for irrigated prunes, almonds, and alfalfa, and for dryfarmed barley. It is also used for wildlife habitat, recreation. Capability unit IIe–1 (17) ; not placed in a range site.

Capay Series

The Capay series consists of nearly level to level, moderately well drained soils on basin rims. These soils formed in alluvium derived from sedimentary rocks. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 60° to 62° F., the average annual rainfall is 16 to 22 inches, and the frost-free season is 260 to 290 days. Elevations range from 10 to 125 feet.

In a representative profile, the surface layer is dark grayish-brown and grayish-brown clay 40 inches thick. The next layers are pale-brown and yellowish-brown clay loam that extends to a depth of more than 60 inches.

Permeability is slow. Effective rooting depth is more than 60 inches.

Capay soils are used for some irrigated row crops, for dryfarmed grain, and for wildlife habitat.

Following is a representative profile of Capay clay:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; 1 to 2 inches of strong, medium, granular structure over strong, coarse, prismatic structure; very hard, very firm, sticky, very plastic; many very fine and fine roots; common very fine tubular pores; slightly acid; clear, smooth boundary.

A11—5 to 21 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) and has few, fine, prominent, strong-brown (7.5YR 5/6) mottles when moist; strong, very coarse, prismatic structure; very hard, very firm, sticky, very plastic; many very fine and few fine roots; common very fine tubular pores; neutral; strongly effervescent, fine soft masses of lime in lower 4 inches; clear, wavy boundary.

A12—21 to 32 inches, grayish-brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) when moist; strong, coarse, prismatic structure; very hard, very firm, sticky, very plastic; many very fine roots; common very fine tubular pores; moderately

alkaline; strongly effervescent, fine soft masses of lime; prominent slickensides; clear, wavy boundary.

AC—32 to 40 inches, grayish-brown (10YR 5/2) clay, dark yellowish brown (10YR 4/4) and has very dark grayish-brown (10YR 3/2) ped faces when moist; moderate, medium, prismatic structure; hard, firm, sticky, very plastic; few very fine roots; many very fine tubular pores; moderately alkaline; slightly effervescent, fine soft masses of lime; distinct slickensides; gradual, smooth boundary.

C1—40 to 50 inches, pale-brown (10YR 6/3) heavy clay loam, dark yellowish brown (10YR 4/4) and has dark-brown (10YR 3/3) ped faces when moist; weak, coarse, angular blocky structure; hard, firm, sticky, and very plastic; very few very fine roots; many very fine tubular pores; moderately alkaline; very slightly effervescent, fine soft masses of lime; diffuse boundary.

C2—50 to 62 inches, yellowish-brown (10YR 5/6) heavy clay loam that has few, fine, distinct, strong-brown (7.5YR 5/6) mottles; dark yellowish brown (10YR 4/4) and has dark-brown (10YR 3/3) ped faces and few, fine, faint, yellowish-brown (10YR 5/6) mottles when moist; weak, fine and medium, angular blocky structure; hard, firm, sticky, very plastic; no roots; many very fine tubular pores; moderately alkaline; very slightly effervescent, fine soft masses of lime; diffuse boundary.

C3—62 to 80 inches, pale-brown (10YR 6/3) heavy clay loam that has few, fine, distinct, strong-brown (7.5YR 5/6) mottles; dark yellowish brown (10YR 4/4) and has brown (10YR 4/3) ped faces and few, fine, faint yellowish-brown (10YR 5/6) mottles when moist; massive; hard, firm, sticky, very plastic; no roots; many very fine tubular pores; moderately alkaline; very slightly effervescent, fine soft masses of lime; common iron and manganese concretions.

The A horizon ranges from grayish brown to dark grayish brown in hues of 10YR or 2.5Y; value is 4 or 5, and chroma is 2. It ranges from clay to silty clay loam in texture, from slightly acid to moderately alkaline in reaction, and from 29 to 40 inches in thickness. Intersecting slickensides are prominent to distinct in the lower part of the A horizon. The C horizon ranges from yellowish brown to pale brown in color and from clay to silty clay loam in texture. It is mildly alkaline to moderately alkaline in reaction. Depth to lime generally is 16 to 40 inches.

Capay silty clay loam [Ca].—This nearly level to level soil has a profile similar to the one described as representative for the series, except that it has a texture of a silty clay loam throughout the profile. Included with it in mapping are small areas of Rincon clay loam, Yolo silty clay loam, and Brentwood clay loam.

Surface runoff is very slow, and erosion is a slight hazard. Available water capacity is 9 to 11 inches.

This soil is used mainly for tomatoes, sugar beets, alfalfa, corn, grain sorghum, and beans (fig. 6). It is

Figure 6.—Irrigated beans on Capay silty clay loam.

also used for wildlife habitat and recreation. Capability unit IIs–3 (17) ; not placed in a range site.

Capay clay (Cc).—This soil is nearly level on basin rims. It has the profile described as representative for the series. Included with it in mapping are small areas of Clear Lake clay, Omni silty clay, and Pescadero clay loam.

Surface runoff is very slow, and erosion is a slight hazard. Available water capacity is 8 to 10 inches.

This soil is used mostly for irrigated sugar beets, tomatoes, grain sorghum, and dryfarmed barley. It is also used for irrigated pasture, wildlife habitat, and recreation. Capability unit IIs–5 (17); not placed in a range site.

Clear Lake Series

The Clear Lake series consists of poorly drained soils in basins. These soils formed in mixed alluvium. Slopes are 0 to 5 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 59° to 61° F., the average annual rainfall is 16 to 22 inches, and the frost-free season is 260 to 290 days. Elevation ranges from 10 to 100 feet.

In a representative profile, the surface layer is dark-gray clay 45 inches thick. The substratum is grayish-brown clay that extends to a depth of more than 60 inches.

Permeability is slow. Effective rooting depth is more than 60 inches.

Clear Lake soils are used for irrigated row crops, field crops, pasture, dryfarmed grain, wildlife habitat, and recreation.

Following is a representative profile of Clear Lake clay, 0 to 2 percent slopes:

A11—0 to 13 inches, dark-gray (N 4/0) clay, very dark gray (N 3/0) when moist; few, fine, faint mottles; strong, medium, granular structure in the upper part and strong, very coarse, prismatic structure in the lower part when dry, massive when wet; very hard, firm, very sticky, very plastic; many very fine and fine roots; common very fine and fine pores; neutral; grass seed, grass, and burned plant remains in cracks and along cleavage planes; gradual, wavy boundary.

A12—13 to 19 inches, dark-gray (N 4/0) clay, very dark gray (N 3/0) when moist; strong, coarse, prismatic structure when dry, massive when wet; extremely hard, very firm, very sticky, very plastic; many very fine and fine roots; many very fine and fine pores; moderately alkaline; many slickensides; grass residue in cracks and along cleavage planes; clear, wavy boundary.

A13—19 to 45 inches, dark-gray (N 4/0) clay, very dark gray (N 3/0) when moist; strong, coarse, prismatic structure when dry, massive when wet; extremely hard, very firm, very sticky, very plastic; few very fine and fine roots; few very fine and fine pores; moderately alkaline; slightly calcareous; many slickensides; few fine manganese shot; smooth pressure faces on peds, resembling clay films; diffuse, irregular boundary.

C—45 to 60 inches, grayish-brown (2.5Y 5/2) clay that has light yellowish-brown (10YR 6/4) mottles; light olive brown (2.5Y 5/4) and has very dark grayish-brown (2.5Y 3/2) tongues in the upper part when moist; massive; very hard, very firm, very sticky, very plastic; very few, very fine roots; very few, very fine pores; moderately alkaline; few soft lime concretions, slightly calcareous; few slickensides; few fine manganese shot; water table at a depth of 48 inches.

The A horizon ranges from gray to black in color, from slightly acid to moderately alkaline in reaction, and from 40 to 45 inches in thickness. Intersecting slickensides are common to many. Lime ranges in depth from 20 to 30 inches. The C horizon ranges from grayish brown to pale olive in color and from mildly alkaline to moderately alkaline in reaction. The C horizon is generally calcareous.

Clear Lake clay, 0 to 2 percent slopes (CeA).—This soil is in basins. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Capay clay, Sacramento clay, and Omni silty clay, and areas underlain by softly consolidated terrace deposits at a depth of 30 to 60 inches.

This soil was poorly drained, but drainage has been improved by leveling, using open drains, and general lowering of the water table to a depth of 5 feet. Surface runoff is very slow. There is no hazard of erosion. Available water capacity is 8 to 10 inches.

This soil is used mostly for irrigated pasture, sugar beets, tomatoes, and grain sorghum. It is also used for dryfarmed barley, wildlife habitat, and recreation. Capability unit IIs–5 (17) ; not placed in a range site.

Clear Lake clay, 2 to 5 percent slopes (CeB).—This soil is in basins. Included with this soil in mapping are small areas of Rincon clay loam, Diablo clay, and Altamont clay.

Surface runoff is slow. Erosion is a slight hazard. Available water capacity is 8 to 10 inches. The water table has been lowered to a depth of more than 60 inches.

This soil is used mostly for dryland pasture and barley. It is also used for irrigated pasture, wildlife habitat, and recreation. Capability unit IIIe–5 (17); not placed in a range site.

Clear Lake clay, saline, 0 to 2 percent slopes (ClA).—This soil has a profile similar to that described as representative for the series, except it is moderately saline. Included with this soil in mapping are small areas of Sycamore silty clay loam, saline, Alviso silty clay loam, and Rincon clay loam.

Surface runoff is very slow, and erosion is a slight hazard. Available water capacity is 5 to 7 inches.

This soil is used mostly for dryland pasture. It is also used for irrigated pasture, dryfarmed barley, wildlife habitat, and recreation. Capability unit IVw–6 (17) ; not placed in a range site.

Columbia Series

The Columbia series consists of nearly level, somewhat poorly drained soils on flood plains. These soils formed from mixed alluvium. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 60° to 62° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 260 to 280 days. Elevation ranges from sea level to 10 feet.

In a representative profile, the surface layer is pale-brown fine sandy loam 16 inches thick. The un-

derlying material is pale-brown and very pale brown, prominently mottled, stratified fine sandy loam, sand, and silt loam 22 inches thick. Below this is pale-brown and gray, distinctly mottled, stratified sand, loam, and silty clay loam that extends to a depth of more than 60 inches.

Permeability is moderately rapid. Effective rooting depth is more than 60 inches, and available water capacity is 7.5 to 9 inches. The water table is at a depth of 48 to 60 inches or more.

Columbia soils are used for irrigated row and field crops, dryfarmed grain, wildlife habitat, and recreation.

Following is a representative profile of Columbia find sandy loam:

Ap—0 to 11 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) when moist; slightly hard, very friable, nonsticky, nonplastic; common very fine roots; few very fine tubular pores and many very fine interstitial pores; slightly acid; clear, smooth boundary.

A1—11 to 16 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; many very fine roots; common very fine tubular pores; slightly acid; clear, wavy boundary.

C1—16 to 23 inches, pale-brown (10YR 6/3) fine sandy loam that has common, fine, prominent, yellowish-brown (10YR 5/6) mottles; brown (10YR 4/3) and has common, fine, distinct, strong-brown (7.5YR 5/6) mottles when moist; massive; soft; very friable, nonsticky, nonplastic; common very fine roots; many very fine interstitial pores; slightly acid; clear, wavy boundary.

IIC2—23 to 26 inches, pale-brown (10YR 6/3) sand, dark brown (10YR 3/3) when moist; single grain; loose, nonsticky, nonplastic; many very fine roots; many very fine interstitial pores; slightly acid; clear, smooth boundary.

IIIC3—26 to 31 inches, mottled very pale brown (10YR 7/3) and reddish-yellow (7.5YR 6/6) fine sandy loam, mottled yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) when moist; massive; slightly hard, very friable, nonsticky, nonplastic; common very fine roots; many very fine tubular pores; neutral; clear, smooth boundary.

IIIC4—31 to 34 inches, very pale brown (10YR 7/3) silt loam that has many, medium, distinct, reddish-yellow (7.5YR 6/6) mottles; brown (10YR 5/3) and has many, medium, distinct, strong-brown (7.5YR 5/6) mottles when moist; moderate, medium, prismatic structure; hard, friable, slightly sticky, slightly plastic; very few very fine roots; many very fine and fine tubular pores; mildly alkaline; clear, smooth boundary.

IIIC5—34 to 38 inches, very pale brown (10YR 7/3) fine sandy loam that has many, medium, distinct, reddish-yellow (7.5YR 6/6) mottles; brown (10YR 5/3) and has many, medium, distinct, strong-brown (7.5YR 5/6) mottles when moist; massive; slightly hard, very friable, nonsticky, nonplastic; very few very fine roots; many very fine tubular pores and common very fine interstitial pores; mildly alkaline; clear, smooth boundary.

IVC6—38 to 41 inches, pale-brown (10YR 6/3) sand, dark brown (10YR 3/3) when moist; single grain; loose, nonsticky, nonplastic; common very fine roots; common very fine tubular pores and many very fine interstitial pores; neutral; very abrupt, smooth boundary.

VC7—41 to 55 inches, pale-brown (10YR 6/3) loam that has many, medium, distinct, reddish-yellow (7.5YR 6/6) mottles; brown (10YR 5/3) and has many, medium, distinct, strong-brown (7.5YR 5/6) mottles when moist; massive; slightly hard, very friable, slightly sticky, nonplastic; few very fine roots; many very fine, fine, medium, and coarse tubular pores; moderately alkaline; clear, smooth boundary.

VIA1b—55 to 60 inches, gray (10YR 6/1) silty clay loam that has common, fine, distinct, strong-brown (7.5YR 5/6) mottles; dark gray (10YR 4/1) and has common, fine, distinct, dark-brown (7.5YR 3/2) mottles when moist; massive; hard, friable, sticky, slightly plastic; very few very fine roots; many very fine, fine, and medium tubular pores; moderately alkaline.

The A horizon ranges from pale brown to brown in color, from fine sandy loam or loam to silt loam in texture, from slightly acid to mildly alkaline in reaction, and from 10 to 18 inches in thickness. The C horizon is highly stratified and ranges from grayish brown, brown, or pale brown to very pale brown in color and has distinct to prominent mottles in places. The C horizon ranges from silt loam to sand in texture and from neutral to moderately alkaline in reaction. Buried A horizons occur in places. Where they occur, they are below a depth of 40 inches.

Columbia fine sandy loam (Cm).—This nearly level soil formed on flood plains. Included with this soil in mapping are small areas of Valdez silt loam, Egbert silty clay loam, and Ryde clay loam.

Surface runoff is slow, and erosion is not a hazard.

This soil is used mostly for irrigated sugar beets, corn, pears, tomatoes, and alfalfa. It is also used for dryfarmed safflower, small grain, wildlife habitat, and recreation. Capability unit IIw–2 (17); not placed in a range site.

Conejo Series

The Conejo series consists of nearly level, well-drained soils. These soil formed in alluvium derived from basic igneous rocks. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 59° to 60° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 260 to 290 days. Elevation ranges from 100 to 200 feet.

In a representative profile, the surface layer is grayish-brown and dark grayish-brown loam 25 inches thick. The substratum is brown loam that extends to a depth of more than 60 inches.

Effective rooting depth is 60 inches or more.

Conejo soils are used for orchards, vineyards, row crops, pasture, field crops, urban development, wildlife habitat, and recreation.

Following is a representative profile of Conejo loam:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine roots; common very fine tubular pores and common fine and medium interstitial pores; slightly acid; clear, smooth boundary.

A11—6 to 19 inches, grayish-brown (10YR 5/2) loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots and few medium roots; common very fine tubular pores and many fine and medium interstitial pores; slightly acid; gradual, smooth boundary.

A12—19 to 25 inches, grayish-brown (10YR 5/2) loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots and few medium roots; common very fine tubular pores and many fine and medium interstitial pores; slightly acid; clear, smooth boundary.

C—25 to 60 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) when moist; massive; hard, friable, slightly sticky, slightly plastic; few very fine pores and common medium roots; common very fine tubular pores and common fine and medium interstitial pores; slightly acid.

The A horizon ranges from grayish-brown to dark gray in color, from loam to clay loam in texture, and from 20 to 30 inches in thickness. Reaction is slightly acid to neutral. The C horizon ranges from brown to dark gray in color and from loam to clay loam in texture. Reaction is slightly acid to mildly alkaline. Content of gravel throughout the profile ranges from 0 to about 30 percent by volume.

Conejo loam (Cn).—This is a nearly level soil on alluvial fans. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Trimmer loam and Conejo soils, wet.

Permeability is moderate. Runoff is slow, and erosion is not a hazard. Available water capacity is 9 to 11 inches.

This soil is used mostly for cherries, pears, and grapes. It is also used for urban development, wildlife habitat, and recreation. Capability unit I–1 (17); not placed in a range site.

Conejo gravelly loam (Co).—This soil has a profile similar to the one described as representative for the series, except that gravel makes up 20 to 30 percent, by volume, of the profile. Included with this soil in mapping are small areas of Conejo loam and Conejo soils, wet.

This soil is moderately permeable. Runoff is slow, and erosion is a slight hazard. Available water capacity is 7 to 9 inches.

This soil is used mostly for growing cherries, peaches, and grapes. It is also used for urban development, wildlife habitat, and recreation. Capability unit IIs–4 (17); not placed in a range site.

Conejo clay loam (Cr).—This soil has a profile similar to the one described as representative for the series, except that it has clay loam texture throughout. Included with this soil in mapping are small areas of Conejo loam and Conejo soils, wet.

Permeability is moderately slow. Runoff is slow, and erosion is a slight hazard. Available water capacity is 11 to 13 inches.

This soil is used mostly for growing cherries, pears, and grapes. It is also used for wildlife habitat and recreation. Capability unit I–1 (17); not placed in a range site.

Conejo soils, wet (Cs).—This mapping unit consists of intermingled areas of Conejo loam and Conejo clay loam. These soils have a profile similar to the one described as representative for the series, except that the Conejo clay loam has clay loam texture throughout the profile. Included with these soils in mapping are areas of Conejo gravelly loam.

These normally well-drained soils now have a fluctuating water table at a depth of 3 to 5 feet. Permeability is moderately slow to moderate. Runoff is slow, and erosion is a slight hazard. Available water capacity is 9 to 13 inches.

These soils are used mostly for growing pears and grapes. They are also used for wildlife habitat and recreation. Capability unit IIw–2 (17); not placed in a range site.

Corning Series

The Corning series consists of well-drained soils on dissected terraces of softly consolidated, mixed, gravelly alluvium. Slopes are 2 to 30 percent. The vegetation is chiefly annual grasses and forbs. The average annual rainfall is 20 to 25 inches, the average annual temperature is 60° to 62° F., and the frost-free season is 260 to 280 days. Elevation ranges from 25 to 250 feet.

In a representative profile, the surface layer is yellowish-red gravelly loam 17 inches thick. The subsoil is red clay that is 9 inches thick. The substratum is brownish-yellow, dense very gravelly sandy loam that extends to a depth of more than 60 inches.

Permeability is very slow in the subsoil. Effective rooting depth is 14 to 20 inches to the clay subsoil. Available water capacity is 2.5 to 3.5 inches. A small amount of water is available to some plants from the subsoil.

Corning soils are used for pasture, range, dry-farmed small grain, wildlife habitat, and recreation.

Following is a representative profile of Corning gravelly loam, 2 to 15 percent slopes, eroded:

Ap—0 to 6 inches, yellowish-red (5YR 5/6) gravelly loam, dark yellowish red (5YR 3/6) when moist; massive; hard, friable, slightly sticky, nonplastic; few fine roots; common fine, medium, and coarse pores; medium acid; clear, wavy boundary.

A11—6 to 14 inches, yellowish-red (5YR 4/6) gravelly loam, dark red (2.5YR 3/6) when moist; massive; hard, friable, slightly sticky, nonplastic; few fine roots; common fine, medium, and coarse pores; medium acid; gradual, wavy boundary.

A12—14 to 17 inches, yellowish-red (5YR 4/6) gravelly loam, dark yellowish red (5YR 3/6) when moist; massive; hard, friable, slightly sticky, nonplastic; few fine roots; common fine, medium, and coarse pores; medium acid; abrupt, wavy boundary.

B2t—17 to 26 inches, red (2.5YR 4/6) clay, red (2.5YR 4/6) when moist; columnar, top of columns coated with thin reddish-yellow (5YR 6/8) layer; extremely hard, very firm, very sticky, very plastic; many, thick, continuous clay films on ped faces and in pores; slightly acid; abrupt, wavy boundary.

C1—26 to 36 inches, brownish-yellow (10YR 6/6) very gravelly sandy loam, yellowish brown (10YR 5/6) when moist; massive; dense, partially cemented; very hard, very firm, nonsticky, nonplastic; clay films on sand grains; neutral; diffuse, wavy boundary.

C2—36 to 60 inches, brownish-yellow (10YR 6/6) very gravelly sandy loam, yellowish brown (10YR 5/6) when moist; massive, dense; very hard, very firm, nonsticky, nonplastic; clay films on surface of some gravel; moderately alkaline.

The A horizon ranges from brown or reddish brown to yellowish red in color. It is gravelly loam to gravelly sandy loam that is 20 to 30 percent gravel, and it is 14 to 20

inches thick. Reaction is medium acid to strongly acid. The B2t horizon ranges from red or reddish brown to yellowish red in color, from clay to gravelly clay that is 5 to 25 percent gravel, and from 8 to 16 inches in thickness. Reaction is slightly acid to medium acid. The C horizon ranges from strong brown to brownish yellow and from loam to very gravelly sandy loam that is 5 to 50 percent gravel. Reaction is neutral to moderately alkaline.

Corning gravelly loam, 2 to 15 percent slopes, eroded (CvD2).—This soil is undulating to rolling on terraces. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Altamont clay and San Ysidro sandy loam.

Runoff is medium, and erosion is a moderate hazard.

This soil is used mostly for pasture and dryfarmed barley. It is also used for hay, wildlife habitat, and recreation. Capability unit IVe–3 (17); not placed in a range site.

Corning gravelly loam, 15 to 30 percent slopes, eroded (CvE2).—This soil is on terraces. Included with it in mapping are small areas of Altamont clay and Dibble clay loam.

Runoff is rapid, and erosion is a moderate hazard.

This soil is used for dryland pasture and range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIe–1 (17); Claypan range site.

Diablo Series

The Diablo series consists of well-drained soils on dissected terraces. These soils are underlain by weakly consolidated sediments at a depth of 30 to 50 inches. Slopes are 2 to 30 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 260 to 280 days. Elevation ranges from 25 to 300 feet.

In a representative profile, the surface layer is dark gray and dark grayish-brown clay 30 inches thick. It is underlain by 6 inches of grayish-brown silty clay loam. The substratum is light yellowish-brown, weakly consolidated sediments that extend to a depth of more than 60 inches. These sediments crush to silty clay loam. Where this soil is dry, many large cracks are in the surface layer and extend downward.

Permeability is slow.

Diablo soils are used for dryfarmed small grain, pasture, and wildlife habitat.

Following is a representative profile of a Diablo clay in an area of Diablo clays, 2 to 9 percent slopes:

Ap—0 to 7 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; strong, medium, granular structure on immediate surface, and prismatic parting to strong, coarse, angular blocky structure in the lower part; hard, firm, sticky, plastic; many very fine roots; common very fine pores; slightly acid; clear, wavy boundary.

A11—7 to 17 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) and has common, medium, distinct, dark yellowish-brown (10YR 4/4) splotches when moist; prismatic parting to strong, coarse, angular blocky structure; extremely hard, very firm, very sticky, very plastic; many very fine roots; common very fine pores; neutral; many, small, hard lime concretions ⅛ inch in diameter; common slickensides; diffuse, wavy boundary.

A12—17 to 30 inches, dark grayish-brown (10YR 4/2) clay; very dark grayish brown (10YR 3/2) and has few, fine, faint, dark yellowish-brown (10YR 4/4) splotches when moist; prismatic parting to angular blocky structure; extremely hard, very firm, very sticky, very plastic; many very fine roots; many very fine pores; common slickensides; moderately alkaline; calcareous disseminated lime; gradual, irregular boundary.

ACca—30 to 36 inches, grayish-brown (2.5Y 5/2) silty clay loam, olive brown (2.5Y 4/4) and has very dark grayish-brown (10YR 3/2) tongues and splotches when moist; massive when moist; hard, firm, sticky, plastic; very few very fine roots; moderately alkaline; calcareous; lime in soft masses and along cleavage planes; common slickensides; gradual, irregular boundary.

C—36 to 60 inches, light yellowish-brown (2.5Y 6/4), weakly consolidated sediments that crush to silty clay loam, light olive brown (2.5Y 5/4) when moist; massive; very hard, firm, sticky, plastic; moderately alkaline; calcareous; lime along cleavage planes.

The A horizon ranges from gray to dark grayish brown or very dark gray in color, from clay to silty clay in texture, and from 30 to 45 inches in thickness. Reaction is slightly acid to moderately alkaline. The C horizon is calcareous and moderately alkaline. The C1 horizon, where present, ranges from yellowish brown to light yellowish brown and is silty clay loam or clay loam. The C2 horizon ranges from weakly consolidated sediments to siltstone. Depth to the C2 horizon is 30 to 50 inches.

Diablo-Ayar clays, 2 to 9 percent slopes (DaC).—This complex is about 65 percent Diablo clay and 25 percent Ayar clay. The remaining 10 percent is included small areas of Altamont clay and San Benito clay loam. The Diablo soil generally is on sides of hills, and the Ayar soil is on rounded hilltops. These soils have the profile described as representative for their respective series.

Diablo clay is 35 to 50 inches deep and has an available water capacity of 5 to 8 inches.

Runoff is slow on both soils. Erosion is a slight hazard.

These soils are used for dryfarmed small grain and pasture. They are also used for wildlife habitat and recreation. Capability unit IIIe–5 (15); not placed in a range site.

Diablo-Ayar clays, 9 to 30 percent slopes, eroded (DaE2).—This complex is about 60 percent Diablo clay and 30 percent Ayar clay. The Diablo soil is mostly on sides of hills, and the Ayar soil is on hilltops. On dissected terraces, these soils are strongly sloping to moderately steep. About 5 inches of the surface layer has been lost through erosion. These soils have a profile similar to the one described as representative for their respective series.

Diablo clay has an effective rooting depth of 30 to 45 inches. Available water capacity is 4 to 7 inches.

Runoff is medium and erosion is a moderate hazard on both soils.

These soils are used for dryfarmed small grain and for pasture. They are also used for wildlife habitat and recreation. Capability unit IVe–5 (15); not placed in a range site.

Dibble Series

The Dibble series consists of well-drained soils that are underlain by sandstone at a depth of 20 to 40 inches. These soils are on mountainous uplands. Slopes are 2 to 50 percent. The vegetation is mainly annual grasses, forbs, and scattered oaks. The average annual temperature is 58° to 60° F., the average annual rainfall is 20 to 30 inches, and the frost-free season is 225 to 250 days. Elevation ranges from 100 to 2,000 feet.

In a representative profile, the surface layer is pale-brown clay loam 13 inches thick. The subsoil is dark yellowish-brown and light olive-brown heavy clay loam and light clay 17 inches thick. The substratum is light olive-brown sandstone at a depth of 30 inches.

Permeability is slow.

Dibble soils are used for dryfarmed small grain, pasture, range, wildlife habitat, recreation, and watershed.

Following is a representative profile of a Dibble clay loam:

A11—0 to 4 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, sticky, plastic; many very fine roots; many very fine pores; slightly acid; diffuse, smooth boundary.

A12—4 to 13 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, sticky, plastic; common very fine roots; common very fine pores; slightly acid; clear, smooth boundary.

B21t—13 to 23 inches, dark yellowish-brown (10YR 4/4) heavy clay loam, dark yellowish brown (10YR 3/4) when moist; weak, fine and medium, angular blocky structure; very hard, firm, sticky, plastic; few very fine roots; common very fine pores; common thin clay films on ped faces and in pores; neutral; clear, smooth boundary.

B22t—23 to 30 inches, light olive-brown (2.5Y 5/4) light clay, olive brown (2.5Y 4/4) when moist; weak, fine and medium, angular blocky structure; very hard, firm, sticky, plastic; very few roots; common very fine pores; many thin clay films on ped faces and in pores; neutral; clear, irregular boundary.

C—30 to 40 inches, light olive-brown (2.5Y 5/4) weathered fine sandstone, light olive-brown (2.5Y 5/6) when moist; becomes harder as depth increases.

The A horizon ranges from pale brown to yellowish brown in color, from loam to silty clay loam in texture, and from 10 to 18 inches in thickness. Reaction is slightly acid to medium acid. Reaction in the B horizon is slightly acid to neutral, and thickness is 10 to 22 inches. The C horizon is yellowish brown or light olive brown.

Dibble-Los Osos loams, 2 to 9 percent slopes (DbC).—This complex is about 60 percent Dibble loam and 30 percent Los Osos loam. The remaining 10 percent is included small areas of Millsholm loam. The Dibble soil is on ridge crests and on south-facing slopes. The Los Osos soil is on north-facing slopes.

Both soils have a profile similar to that described as representative for their respective series, except that they both have a loam surface layer. They are 30 to 40 inches deep to weathered sandstone. Available water capacity is 5 to 7 inches. Runoff is medium, and erosion is a slight to moderate hazard.

These soils are used for dryfarmed small grain and pasture. Limited areas are used for orchards and irrigated pasture. These soils are also used for wildlife habitat and recreation. Capability unit IIIe–3 (15); Fine Loamy range site.

Dibble-Los Osos loams, 9 to 30 percent slopes (DbE).—This complex is about 60 percent Dibble loam and about 30 percent Los Osos loam. The remaining 10 percent is included small areas of Millsholm loam. The Dibble soil is on ridge crests and on south-facing slopes, and the Los Osos soil is on north-facing slopes.

Both soils have a profile similar to that described as representative for their respective series, except that they both have a loam surface layer. They are 30 to 40 inches deep and have an available water capacity of 5 to 7 inches. Runoff is medium, and erosion is a moderate hazard.

These soils are used mostly for range and dryland pasture. They are also used for dryfarmed small grain, wildlife habitat, and recreation. Capability unit IVe–3 (15); Fine Loamy range site.

Dibble-Los Osos loams, 30 to 50 percent slopes, eroded (DbF2).—This soil complex is about 60 percent Dibble loam and 30 percent Los Osos loam. The remaining 10 percent is included small areas of Millsholm loam and Los Gatos loam. The Dibble soil is on ridge crests and on south-facing slopes, and the Los Osos soil is on north-facing slopes. The upper 10 inches of the surface layer of these soils has been eroded away.

Both soils have a profile similar to the one described as representative for their respective series, except that they both have a loam surface layer. Effective rooting depth is 20 to 30 inches. Available water capacity is 3 to 5 inches. Runoff is rapid, and erosion is a high hazard.

These soils are used for range, wildlife habitat, recreation, and watershed. Capability unit VIe–1 (15); Fine Loamy range site.

Dibble-Los Osos clay loams, 2 to 9 percent slopes (DlC).—This complex is about 60 percent Dibble clay loam and 30 percent Los Osos clay loam. The remaining 10 percent is included small areas of Millsholm loam. The Dibble soil is on ridgetops and on south-facing slopes, and the Los Osos soil is on north-facing slopes.

Both soils have a profile that is similar to the one described as representative for their respective series. They are 30 to 40 inches deep to the weathered parent material. Available water capacity is 5 to 7 inches. Runoff is medium, and erosion is a slight hazard.

These soils are used mostly for dryfarmed grain and pasture. They are also used for orchards, irrigated pasture, wildlife habitat, and recreation. Capability unit IIIe–3 (15); Fine Loamy range site.

Dibble-Los Osos clay loams, 9 to 30 percent slopes (DlE).—This complex is about 60 percent Dibble clay loam and about 30 percent Los Osos clay loam. The remaining 10 percent is included small areas of Millsholm loam and Los Gatos loam. The Dibble soil is on ridge crests and on south-facing slopes and the Los Osos soil is on north-facing slopes.

Both soils have a profile that is similar to the one described as representative for their respective series.

They have an effective rooting depth of 30 to 40 inches and an available water capacity of 5 to 7 inches. Runoff is medium, and erosion is a moderate hazard.

These soils are used for dryfarmed pasture and range. They are also used for dryfarmed small grain, wildlife habitat, and recreation. Capability unit IVe–3 (15); Fine Loamy range site.

Dibble-Los Osos clay loams, 30 to 50 percent slopes, eroded (DlF2).—This complex is about 60 percent Dibble clay loam and about 30 percent Los Osos clay loam. The remaining 10 percent is included small areas of Millsholm loam and Los Gatos loam. The Dibble soil is on ridge crests and on south-facing slopes, and the Los Osos soil is on north-facing slopes.

Both soils have the profile that is described as representative for their respective series. They are 25 to 40 inches deep. Available water capacity is 4 to 7 inches. Runoff is rapid, and erosion is a high hazard.

These soils are used for range, wildlife habitat, recreation, and watershed. Capability unit VIe–1 (15); Fine Loamy range site.

Egbert Series

The Egbert series consists of level to nearly level, poorly drained soils in basins. These soils formed in alluvium derived from mixed sources. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 60° to 62° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 260 to 280 days. Elevation ranges from 5 feet below sea level to 10 feet above sea level.

In a representative profile, the surface layer is gray silty clay loam 31 inches thick. The subsoil is mottled, gray silty clay loam 14 inches thick. The substratum is mottled, gray silty clay loam that extends to a depth of more than 60 inches.

Permeability is moderately slow in the subsoil. Effective rooting depth is more than 60 inches. Available water capacity is 10 to 12 inches where these soils are drained. The water table is maintained at a depth of 48 to 60 inches.

Egbert soils are used for irrigated row crops, field crops, dryfarmed grain, wildlife habitat, and recreation.

Following is a representative profile of Egbert silty clay loam:

Ap—0 to 6 inches, gray (10YR 5/1) silty clay loam; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; very dark gray (10YR 3/1) when moist; moderate, medium and coarse, granular structure; very hard, firm, sticky, plastic; many very fine and fine roots; common very fine tubular pores and many very fine interstitial pores; slightly acid; clear, smooth boundary.

A1—6 to 31 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) when moist; strong, very coarse, prismatic structure; very hard, firm, sticky, plastic; many very fine roots; common very fine and fine tubular pores; medium acid; gradual, wavy boundary.

B2g—31 to 45 inches, gray (10YR 6/1) silty clay loam that has common, fine, prominent, brown (7.5YR 5/4) and grayish-brown (2.5Y 5/2) mottles; very dark gray (10YR 3/1) and has common, fine, prominent, dark-brown (7.5YR 4/4) and dark grayish-brown (2.5Y 4/2) mottles when moist; moderate, very coarse, prismatic structure; very hard, very firm, sticky, plastic; many very fine and fine pores and few medium pores; medium acid; diffuse, smooth boundary.

Cg—45 to 60 inches, gray (5Y 6/1) silty clay loam that has many, large, prominent, reddish-yellow (7.5YR 6/6) mottles; dark gray (5Y 4/1) and has many, large, prominent, dark-brown (7.5YR 4/4) mottles when moist; moderate, very coarse, prismatic structure; very hard, firm, sticky, plastic; many very fine roots; common very fine and fine tubular pores; medium acid.

The A horizon ranges from gray to dark gray in color and from silty clay loam to heavy clay loam in texture. The A horizon is 8 to 31 inches thick. The B2g horizon ranges from gray to light gray in color and from silty clay loam to heavy clay loam in texture. Reaction is slightly acid to medium acid. Thickness is 12 to 20 inches. The C horizon ranges from gray to light gray in color and from silty clay loam to heavy clay loam in texture. Reaction is slightly acid to medium acid.

Egbert silty clay loam (Eb).—This nearly level soil is in basins. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Sacramento clay, Ryde clay loam, and Omni silty clay.

The naturally poor drainage of this soil has been improved by leveling, using open drains, and pumping so that the water table remains at a depth of 4 to 5 feet. Runoff is very slow, and erosion is not a hazard.

This soil is used mostly for irrigated sugar beets, tomatoes, corn, alfalfa, and grain sorghum. It is also used for dryfarmed barley, safflower, wildlife habitat, and recreation. Capability unit IIw–2 (17); not placed in a range site.

Egbert silty clay loam, occasionally flooded (Ec).—This soil has a profile similar to the one described as representative for the series, except that it is subject to flooding. Flooding occurs on the average at least 1 year in 3 and lasts more than 48 hours. Included with this soil in mapping are small areas of Sacramento silty clay loam, occasionally flooded, and of Sycamore complex, occasionally flooded.

Runoff is very slow, and erosion is a slight hazard.

This soil is used principally for irrigated grain sorghum, tomatoes, sugar beets, and corn. It is also used for dryfarmed safflower, wildlife habitat, and recreation. Capability unit IVw–2 (17); not placed in a range site.

Gaviota Series

The Gaviota series consists of well-drained soils that are underlain by sandstone at a depth of 8 to 15 inches. These soils are on mountainous uplands. Slopes are 30 to 75 percent. The vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 20 to 30 inches, and the frost-free season is about 230 to 250 days. Elevation ranges from 300 to 600 feet.

In a representative profile, the surface layer is brown sandy loam 12 inches thick. The substratum is mottled pale-brown and yellow sandstone.

Permeability is moderately rapid. Available water capacity is 1 to 2 inches. Rooting depth is 8 to 15 inches.

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

Following is a representative profile of Gaviota sandy loam, 30 to 75 percent slopes, eroded:

A11—0 to 4 inches, brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; many fine and very fine roots; many fine and very fine pores; neutral; diffuse, smooth boundary.

A12—4 to 12 inches, brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; common fine and very fine roots; common fine and very fine pores; slightly acid; abrupt, wavy boundary.

R—12 to 15 inches, mottled pale-brown (10YR 8/3) and yellow (10YR 7/6) sandstone and interbedded shale, pale brown (10YR 6/3) and brownish yellow (10YR 6/6) when moist.

The A horizon ranges from brown to dark brown in color and is sandy loam or fine sandy loam in texture. It is 8 to 15 inches thick. The R horizon is very pale brown to light-gray or yellow sandstone.

Gaviota sandy loam, 30 to 75 percent slopes, eroded (GaG2).—This soil is on mountainous uplands. Included with this soil in mapping are small areas of Millsholm loam and Dibble loam, and some areas that are more than 15 inches deep to bedrock.

Runoff is rapid to very rapid. Hazard of erosion is high to very high.

This soil is used mostly for range. It is also used for wildlife habitat, recreation, and watershed. Capability unit VIIe–1 (15); Very Shallow Loamy range site.

Gilroy Series

The Gilroy series consists of well-drained soils on mountainous uplands. These soils are underlain by basic igneous rock at a depth of 20 to 40 inches. Slopes are 9 to 30 percent. The vegetation is annual grasses and scattered oaks. The average annual temperature is 58° to 60° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 230 to 250 days. Elevation ranges from 500 to 1,500 feet.

In a representative profile, the soil is brown loam to heavy loam about 38 inches thick. The substratum is hard, fractured basic igneous rock.

Permeability is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is 3.5 to 7.0 inches.

Gilroy soils are used for pasture, range, wildlife habitat, and recreation.

Following is a representative profile of Gilroy loam, 9 to 30 percent slopes:

A1—0 to 12 inches, brown (10YR 5/3) loam, dark brown (7.5YR 3/2) when moist; moderate, fine and medium granular structure; hard, friable, nonsticky, slightly plastic; many very fine roots; common very fine interstitial pores and few very fine tubular pores; medium acid; clear, smooth boundary.

B2t—12 to 38 inches, brown (7.5YR 5/2) heavy loam, dark reddish brown (5YR 3/3) when moist; weak, fine and medium, granular structure; hard, very friable, slightly sticky, slightly plastic; common very fine roots and few coarse roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; slightly acid; 10 percent, by volume, is cobblestones; clear, wavy boundary.

R—38 to 45 inches, hard, fractured basic igneous rock.

The A horizon is brown in hues of 10YR and 7.5 YR, and is 8 to 14 inches thick. The texture is loam that is as much as 10 percent cobblestones, by volume. Reaction is slightly acid to medium acid. The B2t horizon ranges from brown to reddish brown in color in hues of 7.5YR and 5YR. Texture is heavy loam to light clay loam that is as much as 15 percent cobblestones. Reaction is slightly acid to medium acid, and thickness is 12 to 26 inches. Depth to bedrock is 20 to 40 inches.

Gilroy loam, 9 to 30 percent slopes (GlE).—This soil is on mountainous uplands. Included with this soil in mapping are small areas of Hambright loam and Trimmer loam.

Runoff is medium, and erosion is a moderate hazard.

This soil is used mostly for range. It is also used for pasture, wildlife habitat, and recreation. Capability unit IVe–1 (15); Fine Loamy range site.

Hambright Series

The Hambright series consists of well-drained soils on mountainous uplands. These soils are underlain by basic igneous rock at a depth of 6 to 20 inches. Slopes are 9 to 40 percent. The vegetation is annual grasses, forbs, and scattered oaks. The average annual temperature is 59° to 61° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 300 to 2,300 feet.

In a representative profile, the soil is brown loam and cobbly loam about 14 inches thick. The substratum is hard, fractured basic igneous rock.

Permeability is moderate.

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

Following is a representative profile of Hambright loam, 15 to 40 percent slopes:

A11—0 to 5 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, nonsticky, slightly plastic; many very fine roots; common very fine interstitial pores and few very fine tubular pores; medium acid; clear, smooth boundary.

A12—5 to 19 inches, brown (7.5YR 5/4) cobbly loam, dark reddish brown (5YR 3/3) when moist; moderate, fine granular structure; slightly hard, friable nonsticky, slightly plastic; many very fine roots; many very fine and fine interstitial pores and common fine and medium tubular pores; slightly acid; abrupt, irregular boundary.

R—19 to 22 inches, hard, fractured basic igneous rock.

The A horizon ranges from brown to dark brown in color. It is loam to cobbly loam in texture and is 5 to 50 percent cobblestones. It is 6 to 20 inches thick.

Hambright loam, 15 to 40 percent slopes (HaF).—This soil is on mountainous uplands. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Gilroy loam and of a soil that does not have cobblestones in the profile.

Surface runoff is medium to rapid. Hazard of erosion is high. Available water capacity is 2.0 to 3.5 inches. Effective rooting depth is 12 to 20 inches.

This soil is used for range. It is also used for wildlife habitat and recreation. Capability unit VIe–1 (15) ; Shallow Loamy range site.

Hambright–Toomes stony loams, 9 to 30 percent slopes (HtE).—This complex is about 70 percent Hambright stony loam and 20 percent Toomes stony loam. The remaining 10 percent is included small areas of Hambright loam. Stones and cobblestones cover 20 to 40 percent of the surface and make up 25 to 50 percent of the entire profile of these soils.

The Hambright soil has a profile similar to the one described as representative for the series. It is 6 to 12 inches deep. Available water capacity is 1.0 to 1.5 inches.

The Toomes soil has the profile described as representative for the series. It is 6 to 17 inches deep. Available water capacity is 1 to 2 inches.

On both the Hambright and Toomes soils, runoff is medium and erosion is a high hazard.

These soils are used for range. They are also used for wildlife habitat, recreation, and watershed. Capability unit VIIs–1 (15); Very Shallow Loamy range site.

Joice Series

The Joice series consists of nearly level, very poorly drained organic soils that have a high mineral content. These soils are in salt water marshes and formed from hydrophytic plant remains mixed with fine mineral sediments. The vegetation is mostly perennial herbs and sedges. The average annual temperature is 58° to 60° F., the average annual rainfall is 15 to 20 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 5 feet below sea level to sea level.

In a representative profile, the soil is black, saline clayey muck to a depth of more than 60 inches.

Permeability is moderately rapid. Available water capacity is 14 to 15 inches in the upper 60 inches of these soils, but the water table, at a depth of 12 to 30 inches, restricts the rooting depth of most plants.

Joice soils are used for wildlife habitat, recreation, and pasture.

Following is a representative profile of Joice muck:

Oa1—0 to 7 inches, clayey muck; 45 percent organic matter; 5 percent fibers, 50 percent of which are greater than 1 millimeter; dark-brown (7.5YR 3/2) natural fibers; black (10YR 2/1) matrix, black (10YR 2/1) when pressed firmly, black (10YR 2/1) when rubbed gently, black (10YR 2/1) when dry; weak, medium, crumb structure; very hard, nonsticky, slightly plastic; dusty; very strongly acid.

Oa2—7 to 20 inches, clayey muck; 40 percent organic matter; 20 percent fibers, 50 percent of which are greater than 1 millimeter; dark-brown (7.5YR 3/2) natural fibers; black (5YR 2/1) matrix, black (5YR 2/1) when pressed firmly, black (10YR 2/1) when rubbed gently, gray (N 6/8) and has few, medium, prominent, black mottles (N 2/8) when dry; massive; extremely hard, sticky, slightly plastic; 50 percent ooze, turbid; dusty; very strongly acid.

Oa3—20 to 40 inches, clayey muck; 35 percent organic matter; 25 percent fibers, 50 percent of which are greater than 1 millimeter; dark-brown (7.5YR 3/2) natural fibers; very dark gray (10YR 3/1) matrix, very dark gray (10YR 3/1) when pressed firmly, very dark brown (10YR 2/2) when rubbed gently, mottled gray (N 6/0) and black (N 2/0) and has few, fine, prominent, yellowish-brown (10YR 5/8) mottles when dry; massive; extremely hard, slightly sticky, slightly plastic; 75 percent ooze, turbid; dusty; very strongly acid.

Oa4—40 to 60 inches, clayey muck; 35 percent organic matter 60 percent fibers, 60 percent of which are greater than 1 millimeter; dark-brown (7.5YR 3/2) natural fibers; very dark gray (10YR 3/1) matrix, mottled dark brown (7.5YR 3/2) and very dark brown (10YR 2/2) when pressed firmly, very dark brown (10YR 2/2) when rubbed gently, black (N 2/0) and has many, fine, prominent, yellowish-brown (10YR 5/8) mottles when dry; massive; extremely hard, nonsticky, slightly plastic; 60 percent ooze, turbid; dusty; moderately alkaline.

The Oa1 and Oa2 horizons range from very dark gray or very dark brown to black in color. They are clayey muck to mucky clay loam in texture and are 8 to 20 inches thick. Reaction is strongly acid to very strongly acid. The subsurface horizons range from very dark gray or black to very dark brown clayey muck that is 30 to 50 percent organic matter. Reaction is very strongly acid to moderately alkaline. These layers are 40 inches to more than 50 inches thick. Management of levees and tide gates alters the water table, but it is generally less than 30 inches below the surface in midsummer and is near the surface in winter. These soils are strongly saline, and the electrical conductance is 15 to 50 millimhos per centimeter at 25° C. Moderately alkaline layers become acidic if the soil is exposed to air and allowed to dry.

Joice muck (Ja).—This soil is nearly level. Included with this soil in mapping are small areas of Suisun peaty muck and Tamba mucky clay.

Runoff water is ponded, and erosion is a slight hazard.

This soil is used mostly for wildlife habitat and recreation. It is also used for pasture. Capability unit VIw–1 (16); not placed in a range site.

Joice Series, Clay Subsoil Variant

The Joice series, clay subsoil variant, consists of very poorly drained, nearly level organic soils that are underlain by mineral clay at a depth of 25 to 35 inches. These soils are in salt water marshes. They formed from hydrophytic plant remains mixed with fine mineral sediments. The vegetation is dominantly perennial herbs and sedges. The average annual temperature is 58° to 60° F., the average annual rainfall is 15 to 20 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 3 feet above sea level to 1 foot below sea level.

In a representative profile, the surface layer is dark-gray clayey muck 7 inches thick. The next layers are black clayey muck 22 inches thick. The substratum is gray clay to a depth of more than 60 inches.

Permeability is moderately rapid in the upper part of these soils and is very slow in the clay substratum. Available water capacity is 6 to 9 inches. The water table, at a depth of 12 to 30 inches, restricts the effective rooting depth of some plants.

These soils are used for wildlife habitat, recreation, and pasture.

Following is a representative profile of Joice muck, clay subsoil variant:

Oa1—0 to 7 inches, clayey muck; 30 percent organic matter; 50 percent fibers, 10 percent of which are larger than 1 millimeter; brown (7.5YR 5/4) natural fibers, dark olive-gray (5Y 3/2) matrix, dark grayish brown (10YR 4/2) when pressed firmly, very dark grayish brown (10YR 3/2) when rubbed gently, dark gray (N 4/0) when dry; massive; very hard, nonsticky, slightly plastic; 10 percent ooze, turbid; dusty; neutral; clear, wavy boundary.

Oa2—7 to 21 inches, clayey muck; 40 percent organic matter; 40 percent fibers, 10 percent of which are larger than 1 millimeter; brown (7.5YR 5/4) natural fibers, very dark brown (10YR 2/2) matrix, very dark gray (10YR 3/1) when pressed firmly, very dark brown (10YR 2/2) when rubbed gently, black (10YR 2/1) when dry; massive; very hard, nonsticky, nonplastic; 15 percent ooze, turbid; dusty; slightly acid; clear, wavy boundary.

Oa3—21 to 29 inches, clayey muck; 50 percent organic matter; 45 percent fibers, 10 percent of which are larger than 1 millimeter; brown (7.5YR 5/4) natural fibers, very dark brown (10YR 2/2) matrix, very dark brown (10YR 2/2) when rubbed gently, black (10YR 2/1) when dry; very hard, nonsticky, nonplastic; 15 percent ooze, turbid; dusty; slightly acid; abrupt, smooth boundary.

C—29 to 60 inches, gray (N 6/0) clay, very dark gray (N 3/0) when moist; massive; very hard, very firm, slightly sticky, plastic; moderately alkaline; disseminated lime, very slight effervescent.

The Oa1 layer ranges from dark gray to black in color and from clayey muck to mucky clay loam in texture. It is 5 to 8 inches thick. Reaction is strongly acid to neutral. The Oa2 and Oa3 layers range from black to very dark brown in color. They are 23 to 28 inches thick. Reaction is slightly acid to moderately alkaline. The C horizon ranges from gray to greenish gray in color and from clay to sandy clay in texture.

Joice muck, clay subsoil variant (Jb).—This soil is nearly level. Included with this soil in mapping are small areas of Suisun peaty muck and Joice muck.

Surface runoff is ponded, and erosion is a slight hazard.

This soil is used for wildlife habitat and pasture. It is also used for recreation. Capability unit VIw–1 (16) ; not placed in a range site.

Los Gatos Series

The Los Gatos series consists of well-drained soils on mountainous uplands. These soils are underlain by sandstone at a depth of 20 to 25 inches. Slopes are 15 to 75 percent. The vegetation is a dense cover of shrubs and small trees, mostly bay and several species of oak. The average annual temperature is 54° to 56° F., the average annual rainfall is 30 to 40 inches, and the frost-free season is 220 to 240 days. Elevation ranges from 1,500 to 3,000 feet.

In a representative profile, the surface layer is brown loam about 12 inches thick. The subsoil is yellowish-red clay loam about 10 inches thick. Yellowish-red sandstone bedrock is at a depth of 22 inches.

Permeability is moderately slow. Effective rooting depth is 20 to 25 inches. Available water capacity is 3.5 to 4.5 inches.

Los Gatos soils are used for wildlife habitat, recreation, and watershed.

Following is a representative profile of Los Gatos loam:

A11—0 to 4 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 3/2) when moist; moderate, medium, crumb structure; slightly hard, friable, slightly sticky, slightly plastic; common fine and medium roots; many fine and very fine pores; slightly acid; clear, wavy boundary.

A12—4 to 12 inches, brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common fine and medium roots; many fine and very fine pores; slightly acid; clear, wavy boundary.

B21t—12 to 16 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) when moist; moderate, fine, subangular blocky structure; hard, firm, sticky, plastic; few medium and very few fine roots; many very fine pores and few coarse pores; thin clay films bridging sand grains; medium acid; diffuse, wavy boundary.

B22t—16 to 22 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) when moist; moderate, fine, subangular blocky structure; hard, firm, sticky, plastic; very few medium and fine roots; many very fine pores and few coarse pores; moderately thick discontinuous clay films on ped faces; medium; clear, wavy boundary.

R—22 to 26 inches, yellowish-red (5YR 5/8), hard, fractured sandstone; thick, dark reddish-brown (2.5YR 3/4) clay films along fracture planes.

Texture of the A horizon ranges from loam to fine sandy loam, reaction is slightly acid to medium acid, and thickness is 10 to 15 inches. The B horizon ranges from yellowish red to dark brown in color and from clay loam to heavy loam in texture. It is 10 to 18 inches thick. Reaction is medium acid to slightly acid. The R horizon is sandstone and is at a depth of 20 to 25 inches.

Los Gatos soils are mapped only in a complex with Maymen soils.

Los Osos Series

The Los Osos series consists of well-drained soils on mountainous uplands. These soils are underlain by sandstone at a depth of 20 to 40 inches. Slopes are 2 to 50 percent. The vegetation is mostly annual grasses, forbs, and scattered oaks. The average annual temperature is 58° to 60° F., the average annual rainfall is 20 to 30 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 100 to 2,000 feet.

In a representative profile, the surface layer is brown clay loam about 7 inches thick. The subsoil is brown heavy clay loam and light clay about 18 inches thick. The substratum is light olive-brown sandstone at a depth of 25 inches.

Permeability in the subsoil is slow.

Los Osos soils are used for dryfarmed small grain, range pasture, wildlife habitat, recreation, and watershed.

Following is a representative profile of a Los Osos clay loam:

A1—0 to 7 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; weak, moderate, prismatic structure parting to weak, medium and coarse, subangular blocky structure; hard, friable, sticky, plastic; common very fine and fine roots; common fine and very fine pores; medium acid; clear, smooth boundary.

B21t—7 to 10 inches, brown (10YR 5/3) heavy clay loam, brown (10YR 4/3) when moist; weak, prismatic

structure parting to weak, medium, subangular blocky structure; very hard, friable, sticky, plastic; common fine roots, very few coarse roots; common fine and very fine pores and very few medium and coarse pores; common moderately thick clay films on ped faces and in pores; slightly acid; clear, smooth boundary.

B2t—10 to 25 inches, brown (10YR 4/3) light clay, dark yellowish brown (10YR 3/4) when moist; weak, prismatic structure parting to moderate, medium, angular blocky structure; very hard, firm, sticky, plastic; common fine and medium roots, very few coarse roots; common fine and very fine pores and very few medium and coarse pores; many moderately thick clay films on ped faces and in pores; slightly acid; clear, wavy boundary.

C—25 to 28 inches, light olive-brown (2.5YR 5/4) weathered sandstone, olive brown (2.5Y 4/4) when moist; very few coarse roots.

The A horizon ranges from brown to dark brown in color, from loam to silty clay loam in texture, and from 7 to 18 inches in thickness. Reaction is slightly acid to medium acid. The B horizon ranges from brown to yellowish brown in color, from heavy clay loam to light clay in texture, and from 13 to 22 inches in thickness. Reaction is slightly acid to neutral. The C horizon is yellowish-brown to light olive-brown sandstone and is at a depth of 20 to 40 inches.

Los Osos soils are mapped only in complexes with Dibble or Millsap soils.

Made Land

Made land (Ma) consists of areas that have been filled in with mixed materials (fig. 7). Sandstone, shale, concrete, and blacktop fragments make up as much as 80 percent of the mass. The soil material in the mixture ranges in texture from sandy loam to clay. The size and kinds of material present vary within short distances. The fill material is well drained, but it is commonly underlain by poorly drained tidal marsh or saline sediments that are at a depth of more than 3 feet to as much as 7 feet. Included in mapping are small areas of Valdez silty clay loam, wet.

Figure 7.—**Made land developed from material hauled in by truck.**

This land type is used mostly for urban development. Not placed in a capability unit or range site.

Maymen Series

The Maymen series consists of somewhat excessively drained soils on mountainous uplands. These soils are underlain by sandstone at a depth of 10 to 15 inches. Slopes are 15 to 75 percent. The vegetation is chaparral. The average annual temperature is 54° to 56° F., the average annual rainfall is 30 to 40 inches, and the frost-free season is 220 to 240 days. Elevation ranges from 1,500 to 3,000 feet.

In a representative profile, the soil is brown to light yellowish-brown loam about 10 inches thick. This is underlain by brownish-yellow sandstone bedrock.

Permeability is moderate. Effective rooting depth is 10 to 15 inches. Available water capacity is 1.5 to 2.5 inches.

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

Following is a representative profile of Maymen loam:

O1—½ inch to 0, undecomposed leaves and plant remains.

A11—0 to 3 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; moderate, fine, crumb structure; sticky; slightly hard, friable, slightly plastic, many fine roots; slightly acid; clear, wavy boundary.

A12—3 to 10 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, fine, subangular blocky structure; hard, firm, slightly sticky, plastic; many fine roots, decreasing with depth to few; very few, thin, patchy clay films; slightly acid; clear, wavy boundary.

R—10 to 14 inches, brownish-yellow (10YR 6/6) fractured sandstone; thick, dark-red, somewhat continuous clay films along fracture planes.

The A horizon ranges from brown or light brown to light yellowish brown in color, from loam to fine sandy loam in texture, from slightly acid to medium acid in reaction, and from 10 to 15 inches in thickness.

Maymen-Los Gatos loams, 15 to 75 percent slopes, severely eroded (MeG3).—This complex is about 70 percent Maymen loam and about 20 percent Los Gatos loam. The remaining 10 percent is included areas of Millsholm loam. The Maymen soil is on the tops of ridges and hills and on south-facing slopes, and the Los Gatos soil is on north-facing slopes. These soils have the profile described as representative for their respective series. They have many gullies, and much of their surface layer has been removed through erosion.

Surface runoff is rapid to very rapid, and erosion is a high to very high hazard.

The soils in this complex are used for wildlife habitat, recreation, and watershed. Capability unit VIIIs–1 (15) ; not placed in a range site.

Millsap Series

The Millsap series consists of moderately well drained soils on uplands. These soils are underlain by sandstone at a depth of 20 to 30 inches. Slopes are 0 to 9 percent. The vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 75 to 200 feet.

In a representative profile, the surface layer is light-gray sandy loam about 14 inches thick. The subsurface layer is light-gray loamy sand about 2 inches thick. The subsoil is grayish-brown clay about 12 inches thick. This is underlain by yellowish-brown, very hard sandstone bedrock at a depth of about 28 inches.

Permeability in the subsoil is very slow. Available water capacity is 2 to 3.5 inches. Rooting depth is 20 to 30 inches, but only a small amount of water from the subsoil is available to some plants.

Millsap soils are used for dryfarmed small grain, pasture, wildlife habitat, and recreation.

Following is a representative profile of Millsap sandy loam, 0 to 2 percent slopes:

Ap—0 to 14 inches, light-gray (10YR 6/1) sandy loam that has common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky, nonplastic; common very fine roots; many very fine tubular pores and few fine tubular pores; strongly acid; clear, smooth boundary.

A2—14 to 16 inches, light-gray (10YR 7/1) loamy sand; massive; soft, very friable, nonsticky, nonplastic; few very fine roots; many very fine pores; medium acid; abrupt, smooth boundary.

B2t—16 to 28 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; strong, very coarse, columnar structure; very hard, very firm, sticky, plastic; very few very fine roots; many very fine pores; continuous thick clay films on ped faces and in pores; slightly acid.

R—28 to 60 inches, yellowish-brown fine sandstone; very hard.

The Ap horizon ranges from light gray to light brownish gray in color, from very fine sandy loam to sandy loam in texture, from strongly acid to medium acid in reaction, and from 12 to 18 inches in thickness. The B horizon ranges from grayish brown to dark grayish brown in color, from clay to heavy silty clay loam in texture, from slightly acid to neutral in reaction, and from 10 to 14 inches in thickness.

In Solano County the Millsap soils differ from Millsap soils mapped elsewhere in California. The A horizon is more acid (strongly acid) and grayer (chroma of 1) than is typical for the Millsap series.

Millsap sandy loam, 0 to 2 percent slopes (MkA).—This soil is on uplands. It has the profile described as representative for the series. Included with this soil in mapping are small areas of San Ysidro sandy loam and Los Osos clay loam, and areas of soils that are slightly steeper than 2 percent.

Runoff is slow. Erosion is a slight hazard.

This soil is used mostly for dryfarmed pasture. It is also used for dryfarmed small grain, wildlife habitat, and recreation. Capability unit IVs–3 (15); not placed in a range site.

Millsap-Los Osos complex, 2 to 9 percent slopes (MlC).—This complex is about 55 per cent Millsap sandy loam and 35 percent Los Osos clay loam. The remaining 10 percent is included small areas of San Ysidro sandy loam. The Millsap and Los Osos soils have profiles similar to those described as representative for their respective series.

The Los Osos soil has an effective rooting depth of 20 to 30 inches and an available water capacity of 4 to 6 inches.

Runoff is medium and erosion is a slight hazard on both soils.

These soils are used mostly for dryfarmed pasture. They are also used for range, wildlife habitat, and recreation. Capability unit IVe–3(15); Millsap soil is in Claypan range site; Los Osos soil is in Fine Loamy range site.

Millsholm Series

The Millsholm series consists of well-drained soils on mountainous uplands. These soils are underlain by sandstone at a depth of 10 to 20 inches. Slopes are 15 to 75 percent. The vegetation is annual grasses, forbs, and scattered oaks. The average annual temperature is 58° to 60° F., the average annual rainfall is 25 to 30 inches, and the frost-free season is 220 to 240 days. Elevation ranges from 300 to 2,000 feet.

In a representative profile, the soil is brown to dark yellowish-brown loam about 17 inches thick. The substratum is light yellowish-brown sandstone.

Permeability is moderate. Available water capacity is 1.5 to 3.5 inches. Roots penetrate to a depth of 10 to 20 inches.

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

Following is a representative profile of Millsholm loam, 15 to 30 percent slopes:

A1—0 to 8 inches, brown (10YR 5/3) loam, dark yellowish brown (10YR 3/4) when moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; many very fine and fine pores; slightly acid; diffuse, smooth boundary.

B2—8 to 17 inches, dark yellowish-brown (10YR 4/4) loam (slightly more clay than in A1 horizon), dark yellowish brown (10YR 3/4)when moist; massive when moist; slightly hard, very friable, slightly sticky, slightly plastic; common very fine roots; many fine and very fine pores; few thin clay films in pores and on sand grains; slightly acid; abrupt, wavy boundary.

R—17 to 22 inches, light yellowish-brown (10YR 6/4) soft sandstone, yellowish brown (10YR 5/6) when moist; becomes harder with depth.

The A horizon ranges from brown to pale brown in color, from loam to light clay loam in texture, from slightly acid to neutral in reaction, and from 4 to 9 inches in thickness. The B horizon ranges from yellowish brown to dark yellowish brown to brown in color. It is loam to clay loam in texture and contains slightly more clay than the A horizon. It is slightly acid to neutral in reaction and 8 to 11 inches in thickness. The R horizon is generally sandstone but is shale in places. It is at a depth of 10 to 20 inches.

Millsholm loam, 15 to 30 percent slopes (MmE).—This soil is on mountainous uplands. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Dibble

loam and Dibble clay loam, and some areas where bedrock is at a depth of more than 20 inches.

Runoff is medium, and erosion is a moderate hazard.

This soil is used mostly for range. It is also used for wildlife habitat and recreation. Capability unit VIe–1 (15) ; Shallow Loamy range site.

Millsholm loam, 30 to 75 percent slopes, eroded (MmG2).—This soil has a profile similar to the profile described as representative for the series, except that erosion has made the surface layer a few inches thinner. Included with this soil in mapping are areas of Dibble loam, Dibble clay loam, Maymen loam, and Los Gatos loam.

Runoff is rapid to very rapid, and erosion is a high to very high hazard.

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

Millsholm Series, Moderately Deep Variant

The Millsholm series, moderately deep variant, consists of well-drained soils on mountainous uplands. These soils are underlain by sandstone at a depth of 20 to 36 inches. Slopes are 2 to 30 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 230 to 250 days. Elevations range from 200 to 500 feet.

In a representative profile, the soil is pale-brown and yellowish-brown loam about 28 inches thick. The substratum is very pale brown sandstone.

Permeability is moderate. Available water capacity is 3.5 to 5.5 inches. Effective rooting depth is 20 to 36 inches.

These soils are used for orchards, pasture, dryfarmed small grain, wildlife habitat, and recreation.

Following is a representative profile of Millsholm loam, moderately deep variant, 9 to 30 percent slopes:

Ap—0 to 8 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 3/3) when moist; weak, subangular blocky structure; hard, friable, slightly sticky, slightly plastic; slightly acid; clear, smooth boundary.

B1—8 to 20 inches, yellowish-brown (10YR 5/4) loam, dark yellowish-brown (10YR 4/4) when moist; weak subangular blocky structure; hard, friable, slightly sticky, slightly plastic; neutral; gradual, smooth boundary.

B2—20 to 28 inches, yellowish-brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) when moist; weak, blocky structure; hard, friable, sticky, slightly plastic; slightly acid; abrupt, smooth boundary.

C—28 to 34 inches, very pale brown (10YR 8/3) weathered sandstone.

The A horizon ranges from pale brown to brown in color, from loam to sandy loam in texture, from slightly acid to neutral in reaction, and from 6 to 10 inches in thickness. The B horizon ranges from yellowish brown to light yellowish brown in color, from loam to sandy loam in texture, from slightly acid to neutral in reaction, and from 16 to 26 inches in thickness. The C horizon is very pale brown sandstone at a depth of 20 to 36 inches.

Millsholm loam, moderately deep variant, 2 to 9 percent slopes (MnC).—This soil is on mountainous uplands. Included with this soil in mapping are small areas of Dibble loam and Millsholm loam.

Runoff is medium, and erosion is a slight hazard.

This soil is used mostly for pasture and hay. It is also used for orchards, dryfarmed small grain, wildlife habitat, and recreation. Capability unit IIIe–1 (15); not placed in a range site.

Millsholm loam, moderately deep variant, 9 to 30 percent slopes (MnE).—This soil is rolling to hilly on uplands. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Dibble loam and Millsholm loam.

Runoff is medium, and erosion is a moderate hazard.

This soil is used mostly for pasture. It is also used for dryfarmed small grain, wildlife habitat, and recreation. Capability unit IVe–1 (15); not placed in a range site.

Omni Series

The Omni series consists of poorly drained, calcareous soils. These soils are nearly level in basins. They formed in mixed alluvium. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 260 to 280 days. Elevation ranges from sea level to 10 feet.

In a representative profile, the surface layer is calcareous, grayish-brown silty clay about 8 inches thick. The subsoil is mottled, calcareous, gray silty clay 25 inches thick. The substratum is stratified, mottled, dark-gray to yellowish-brown or olive-gray silty clay that extends to a depth of more than 60 inches.

Permeability is slow. The water table is at a depth of 20 to 48 inches.

Omni soils are used for irrigated row crops, forage crops, dryfarmed field crops, wildlife habitat, and recreation.

Following is a representative profile of Omni silty clay:

Ap—0 to 8 inches, grayish-brown (2.5Y 5/2) silty clay, very dark grayish-brown (2.5Y 3/2) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky, plastic; few very fine and fine roots; common very fine and fine tubular pores and many very fine interstitial pores; moderately alkaline; very slightly effervescent; common light reddish-brown (5YR 6/4) concretions 1 to 5 millimeters in size; clear, smooth boundary.

B21g—8 to 18 inches, gray (5Y 5/1) silty clay, very dark gray (5Y 4/1) and has common, fine, prominent, dark-brown (7.5YR 4/4) mottles when moist; weak, coarse and very coarse, prismatic structure parting to medium and coarse, subangular blocky structure; very hard, firm, sticky, plastic; few very fine roots; common very fine and fine tubular pores; moderately alkaline; very slightly effervescent; abrupt, wavy boundary.

B22cag—18 to 33 inches, gray (5Y 6/1) silty clay, gray (5Y 5/1) and has many, fine, prominent, dark yellowish-brown (10YR 4/4) mottles when moist;

massive; very hard, very firm, sticky, plastic; few very fine roots; many very fine tubular pores; moderately alkaline; slightly effervescent; abrupt, smooth boundary.

A1bg—33 to 42 inches, mottled dark-gray (10YR 4/1), gray (10YR 6/1) and yellowish-brown (10YR 5/4) silty clay; mottled black (10YR 2/1), dark gray 10YR 4/1), and dark yellowish brown (10YR 4/4) when moist; massive; very hard, firm, sticky, plastic; no roots; common very fine tubular pores; moderately alkaline; very slightly effervescent; clear, wavy boundary.

Cbg—42 to 60 inches, olive-gray (5Y 5/2) silty clay; dark grayish brown (2.5Y 4/2) and has many, fine, prominent, dark yellowish-brown (10YR 4/4) mottles when moist; massive; very hard; very firm, sticky, plastic; no roots; few, very fine tubular pores; moderately alkaline; very slightly effervescent.

The A horizon ranges from grayish brown to gray or olive gray in color. It is silty clay or clay in texture, neutral to strongly alkaline in reaction, and 8 to 24 inches in thickness: In places the A horizon is clay loam 10 to 20 inches thick. Lime is common to a depth of 10 inches. The B2 horizon ranges from dark gray to light gray in color and has common to many, distinct to prominent mottles. Texture is silty clay or clay, reaction is moderately alkaline to strongly alkaline, and thickness is 6 to 25 inches.

Omni clay loam (Om).—This soil has a profile similar to the one described as representative for the series, except that it is strongly alkaline and has a dark clay loam surface layer 10 to 20 inches thick. This soil is slightly saline in places. Included with this soil in mapping are small areas of Solano loam, Clear Lake clay, and Rincon clay loam.

Runoff is slow, and erosion is a slight hazard. Available water capacity is 8 to 10 inches where this soil is drained.

This soil is used mostly for pasture and dryfarmed small grain. It is also used for wildlife habitat and recreation. Capability unit IVw–6 (17); not placed in a range site.

Omni silty clay (On).—This soil has the profile described as representative for the series. Included with this soil in mapping are small areas of Sacramento clay, Egbert silty clay loam, and Willows clay.

Runoff is very slow, and erosion is a slight hazard. Available water capacity is 7 to 9 inches.

This soil is used mostly for sugar beets, corn, and tomatoes. It is also used for dryfarmed barley, safflower, wildlife habitat, and recreation. Capability unit IIIw–5 (17); not placed in a range site.

Figure 8.—**Profile of Pescadero Series**

Pescadero Series

The Pescadero series consists of nearly level, somewhat poorly drained soils that have a saline-alkali subsoil. These soils are in basins. They formed in alluvium derived from sedimentary rocks. The vegetation is salt-tolerant plants. The average annual air temperature is 58° to 60° F., the average annual rainfall is 16 to 20 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 25 to 100 feet.

In a representative profile (fig. 8), the surface layer is light brownish-gray clay loam 4 inches thick. The subsoil is gray, grayish-brown, and pale-brown clay and clay loam 43 inches thick. The substratum is light-gray and light brownish-gray clay loam to a depth of more than 60 inches.

Permeability is slow in the subsoil. Available water capacity is 7 to 8 inches. Effective rooting depth is more than 60 inches.

Pescadero soils are used for dryfarmed small grain, pasture, irrigated pasture, alkali-tolerant row crops, wildlife habitat, and recreation.

Following is a representative profile of Pescadero clay loam:

A2—0 to 4 inches, light brownish-gray (10YR 6/2) clay loam that has common, fine, distinct, yellowish-brown (10YR 5/4) mottles; grayish brown (10YR 5/2) and has common, fine, faint, dark yellowish-brown (10YR 4/4) mottles when moist; weak, medium, platy structure over strong, coarse, prismatic structure; very hard, friable, slightly sticky plastic; many very fine roots and common medium roots; many very fine tubular pores; medium acid; abrupt, smooth boundary.

B21t—4 to 14 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; strong, coarse, prismatic structure parting to moderate, fine and medium, angular blocky structure; very hard, firm, sticky, very plastic; common very fine and medium roots; common very fine tubular pores; many moderately thick clay films on ped faces and in pores; moderately alkaline; very slightly effervescent; clear, smooth boundary.

B22t—14 to 22 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, coarse, prismatic structure parting to moderate, fine and medium, angular blocky structure; very hard, firm, sticky, very plastic; common, very fine, fine and medium roots; common very fine tubular pores; many moderately thick clay films on ped faces and in pores; very strongly alkaline; strongly effervescent, lime in soft masses; few slickensides; gradual, smooth boundary.

B23t—22 to 34 inches, mottled pale-brown 10YR 6/3) and light-gray (10YR 6/1) clay, mottled light olive-brown (2.5Y 5/4) and dark grayish brown (2.5Y 4/2) when moist; weak, coarse, prismatic structure parting to weak, fine, angular blocky structure; very hard, firm, sticky, very plastic; few very fine and medium roots; few, very fine tubular pores; many moderately thick clay films on ped faces and in pores; very strongly alkaline; strongly effervescent, lime in soft masses; few slickensides; gradual, wavy boundary.

B3t—34 to 47 inches, pale-brown (10YR 6/3) clay loam that has few, fine, faint, brownish-yellow (10YR 6/6) mottles; light olive brown (2.5Y 5/4) and has common, fine, faint, light olive-brown (2.5Y 5/6) mottles when moist; weak, medium, angular blocky structure; very hard, firm, sticky, very plastic; very few very fine roots; many very fine tubular pores; common thin clay films on ped faces and in pores; very strongly alkaline; slightly effervescent, lime disseminated and in soft masses; clear, wavy boundary.

C1—47 to 58 inches, light-gray (2.5Y 7/2) clay loam that has common, medium, distinct, brownish-yellow (10YR 6/6) mottles, light olive brown (2.5Y 5/4) and has common, fine, distinct, yellowish-brown (10YR 5/6) mottles when moist; moderate, coarse, angular blocky structure; very hard, firm, sticky, plastic; very few very fine roots; few very fine tubular pores; pressure faces on peds; very strongly alkaline; slightly effervescent, lime disseminated and in soft masses; manganese shot; gradual, wavy boundary.

C2—58 to 69 inches, light brownish-gray (2.5Y 6/2) clay loam that has common, medium, distinct, brownish-yellow (10YR 6/6) mottles, light olive brown (2.5Y 5/4) and has common, fine, distinct, yellowish-brown (10YR 5/6) mottles when moist; moderate, medium and coarse, angular blocky structure; very hard, firm, sticky, very plastic; very few very fine roots; few very fine tubular pores; pressure faces on peds; strongly alkaline; slightly effervescent, lime in seams; manganese shot.

The A horizon ranges from light brownish gray to light gray in color. It is clay loam to silty clay loam in texture, medium acid to strongly acid in reaction, and near 0 to 4 inches in thickness. The B horizon ranges from gray to pale brown in color, from clay to clay loam in texture, and from 20 to 45 inches in thickness. The C horizon ranges from light gray or light brownish gray to yellowish brown in color. It is clay loam or silty clay loam in texture and moderately alkaline to very strongly alkaline in reaction. The exchangeable sodium percentage is 20 to 50 percent.

Pescadero clay loam (Pc).—This soil is nearly level in basins. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Solano loam and Willows clay.

Runoff is very slow, and erosion is a slight hazard.

This soil is used mostly for native pasture. It is also used for irrigated pasture, wildlife habitat, and recreation. Capability unit IVw–6 (17); not placed in a range site.

Pescadero clay (Pe).—This soil is in basins and depressions. Slopes are less than 1 percent. This soil has a profile similar to the one described as representative for the series, except that the surface layer has a clay texture because plowing has mixed the very thin original clay loam surface layer with the clay subsoil. This soil also lacks prismatic structure in the subsoil and is grayish brown rather than gray. Included with this soil in mapping are small areas of Pescadero clay loam and Solano loam.

Runoff is very slow to ponded, and erosion is not a hazard.

This soil is used mostly for dryfarmed pasture. It is also used for dryfarmed barley, wildlife habitat, and recreation. Capability unit IVw–6 (17); not placed in a range site.

Reiff Series

The Reiff series consists of nearly level, well-drained soils on alluvial fans. These soils formed in mixed alluvium. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 60° to 62° F., the average annual rainfall is 18 to 20 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 30 to 150 feet.

In a representative profile, the soil is grayish-brown to light yellowish-brown fine sandy loam to a depth of more than 60 inches.

Permeability is moderately rapid. Effective rooting depth is more than 60 inches, and the available water capacity is 7.5 to 9.0 inches.

Reiff soils are used for orchards, irrigated row crops, forage crops, dryfarmed small grain, wildlife habitat, and recreation.

Following is a representative profile of Reiff fine sandy loam:

Ap—0 to 13 inches, grayish-brown (2.5Y 5/2) fine sandy loam, dark brown (10YR 3/3) when moist; massive; hard, very friable, nonsticky, slightly plastic; many very fine roots; common very fine tubular pores; moderately alkaline; clear, wavy boundary.

A1—13 to 18 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable, nonsticky, slightly plastic; common very fine roots; common very fine tubular pores; moderately alkaline; clear, wavy boundary.

C1—18 to 25 inches, light yellowish-brown (10YR 6/4) fine sandy loam that has common, fine and medium, prominent, reddish-brown (5Y 4/4) mottles, dark yellowish brown (10YR 4/4) and has thin bands of dark yellowish-brown (10YR 4/4) loam when moist; massive; slightly hard, very friable, nonsticky, slightly plastic; common very fine roots; many very fine tubular pores; moderately alkaline; clear, wavy boundary.

C2—25 to 42 inches, pale-brown (10YR 6/3) fine sandy loam that has thin strata of loamy fine sand and loam, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky, nonplastic; few very fine roots; many very fine tubular pores; moderately alkaline; gradual, wavy boundary.

C3—42 to 60 inches, light yellowish-brown (2.5Y 6/4) fine sandy loam that has thin strata of loamy fine sand, loam, and silt; olive brown (2.5Y 4/4) and has common, fine, prominent, reddish-brown (5YR 4/4) mottles when moist; massive; slightly hard, very friable, nonsticky, nonplastic; very few very fine roots; many very fine and medium pores; moderately alkaline.

The A horizon ranges from grayish brown and light brownish gray to dark grayish brown in color. Texture is sandy loam to fine sandy loam, reaction is slightly acid to moderately alkaline, and thickness is 11 to 20 inches. The C horizon is mostly fine sandy loam in texture, but thin strata of loamy sand, silt loam, loam, or silty clay loam are present in places. The C horizon ranges from neutral to moderately alkaline in reaction.

Reiff fine sandy loam (Ra).—This is a nearly level soil on alluvial fans. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Yolo loam. About one-fourth of the acreage mapped as this Reiff soil has a buried silty clay loam and clay substratum.

Runoff is very slow to slow, and erosion is a slight hazard.

This soil is used mostly for almonds, walnuts, sugar beets, tomatoes, and alfalfa. Other uses include dryfarmed barley, wildlife habitat, and recreation. Capability unit I–1 (17); not placed in a range site.

Reyes Series

The Reyes series consists of poorly drained soils that are very strongly acid and saline. These soils are nearly level in salt water marshes. They formed in alluvium derived from mixed sources. The vegetation is salt-tolerant grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 15 to 20 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 3 feet below sea level to sea level.

In a representative profile, the surface layer is light-gray, yellowish-red, and grayish-brown mottled silty clay 7 inches thick. The subsoil is mottled, gray silty clay 35 inches thick. The substratum is gray silty clay. It is moderately alkaline but becomes strongly acid if exposed to air and allowed to dry.

Permeability of the subsoil is slow. Where these soils are drained and reclaimed, rooting depth is 60 inches or more.

Reyes soils are used for wildlife habitat, recreation, and dryfarmed oats.

Following is a representative profile of Reyes silty clay:

Ap1—0 to 3 inches, mottled light-gray (10YR 6/1, N 6/0) and yellowish-red (5YR 5/6) silty clay; mottled dark reddish-brown (5YR 3/4), yellowish-red (5YR 4/6), and grayish-brown (10YR 5/2) when moist; strong, medium, angular blocky structure; hard, firm, sticky, plastic; many fine and very fine roots; many fine and very fine tubular pores; strongly acid; clear, smooth boundary.

Ap2—3 to 7 inches, grayish-brown (2.5Y 5/2) silty clay grayish brown (10YR 5/2) when moist; few, fine, distinct, reddish-brown (5YR 5/4) mottles; strong, medium, angular blocky structure; hard, firm, sticky, plastic; many fine and very fine roots; many fine and very fine tubular pores; very strongly acid; diffuse, wavy boundary.

B21—7 to 16 inches, gray (10YR 5/1) silty clay that has common, medium, prominent, reddish-brown (5YR 5/4) mottles; dark gray (10YR 4/1) and has many, large, prominent, dark reddish-brown (5YR 3/4) and yellowish-red (5YR 4/6) mottles when moist; strong, medium and coarse, angular blocky structure; hard, firm, sticky, plastic; many fine and very fine roots; common fine and very fine tubular pores; very strongly acid; diffuse, wavy boundary.

B22—16 to 42 inches, gray (10YR 5/1) silty clay, dark gray (10YR 4/1) when moist; strong, coarse, prismatic structure; hard, firm, sticky, plastic; many fine and very fine roots; common fine and very fine tubular pores; very strongly acid; diffuse, wavy boundary.

C1—42 to 62 inches, gray (N 5/0) silty clay, dark gray (N 4/0) when moist; weak, coarse, prismatic structure; hard, firm, sticky, plastic; common fine roots; common fine tubular pores; very strongly acid; diffuse, wavy boundary.

C2—62 to 70 inches, gray (N 5/0) silty clay, dark gray (N 4/0) when moist; massive; very hard, very firm, sticky, plastic; few fine roots; very few tubular pores; moderately alkaline.

The A horizon is mottled in a wide range of colors, including light gray, gray, light brownish gray, very pale brown, brownish yellow, and yellowish red. Texture ranges from heavy clay loam to silty clay, reaction ranges from medium acid to extremely acid, and thickness ranges from 5 to 11 inches. The B2 horizon is gray to light gray, mottled heavy clay loam to silty clay that is strongly acid to extemely acid. It is 28 to 40 inches thick and has strata of organic matter in places. The C horizon ranges from gray to bluish-gray in color, from clay to silty clay in texture, and from extremely acid to moderately alkaline in reaction.

Reyes silty clay loam, drained (Rd).—This soil has a profile similar to the one described as representative for the series, except that it has a heavy silty clay loam texture throughout and drainage has been improved by open ditches and levees. The water table is at a depth of about 4 feet to more than 5 feet, and the salts have been leached from the surface layer and subsoil. Included with this soil in mapping are small areas of Reyes silty clay and some areas of soils that are highly stratified with organic matter.

Runoff is very slow, and erosion is a slight hazard. Available water capacity is 7 to 8.5 inches.

This soil is used mostly for dryfarmed oats. It is also used for pasture, wildlife habitat, and recreation. Capability unit IVw–9 (16); not placed in a range site.

Reyes silty clay (Re).—This soil has the profile described as representative for the series. Included with

it in mapping are small areas of Tamba mucky clay and Valdez silty clay loam.

Runoff is ponded, and erosion is a slight hazard. Available water capacity is 6.0 to 7.5 inches. The water table is at a depth of 24 to 48 inches.

This soil is used mostly for wildlife habitat and recreation. It is also used for pasture. Capability unit VIw–1 (16); not placed in a range site.

Rincon Series

The Rincon series consists of well-drained soils on alluvial fans. These soils formed in alluvium derived from sedimentary rocks. Slopes are 0 to 9 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 59° to 61° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 25 to 200 feet.

In a representative profile, the surface layer is grayish-brown and dark grayish-brown clay loam 22 inches thick. The subsoil is dark grayish-brown and brown heavy clay loam 22 inches thick. The substratum is yellowish-brown heavy clay loam that extends to a depth of more than 60 inches.

Permeability in the subsoil is slow. Effective rooting depth is 60 inches or more.

Rincon soils are used for irrigated row crops, forage crops, dryfarmed small grain, wildlife habitat, and recreation.

Following is a representative profile of Rincon clay loam, 0 to 2 percent slopes:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; hard, friable, slightly sticky, slightly plastic; common fine roots; common very fine and fine pores; slightly acid; abrupt, wavy boundary.

A1—8 to 22 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish-brown (10YR 3/2) when moist; massive but porous; hard, friable, slightly sticky, slightly plastic; common fine roots; common very fine and fine pores; slightly acid; clear, wavy boundary.

B21t—22 to 32 inches, dark grayish-brown (10YR 4/2) heavy clay loam, very dark grayish brown (10YR 3/2) when moist; massive; very hard, firm, sticky, plastic; few fine roots; common very fine and fine pores; slightly acid; thin patchy clay films in root holes and in worm holes; gradual, wavy boundary.

B22t—32 to 44 inches, brown (10YR 5/3) heavy clay loam, very dark grayish brown (10YR 3/3) when moist; massive; very hard, firm, sticky, plastic; very few fine roots; common very fine pores; slightly acid; thin patchy clay films in pores; gradual, wavy boundary.

C—44 to 60 inches, yellowish-brown (10YR 5/4) heavy clay loam, dark brown (10YR 4/3) when moist; massive; very hard, firm, sticky, plastic; no roots; common very fine and fine pores; slightly acid.

The A horizon ranges from loam to clay loam in texture and from slightly acid to neutral in reaction. It is 12 to 30 inches thick. The B horizon ranges from heavy clay loam to light clay in texture, from slightly acid to neutral in reaction, and from 17 to 36 inches in thickness. The C horizon ranges from brown to yellowish brown in color, from clay loam to heavy clay loam in texture, and from slightly acid to mildly alkaline in reaction. The C horizon is calcareous in places.

Rincon loam, 2 to 9 percent slopes (RnC).—This soil has a profile similar to the one described as representative for the series, except that it has a loam surface layer about 15 to 25 inches thick. Slopes are dominantly 3 to 6 percent. Included with this soil in mapping are small areas of Brentwood clay loam.

Runoff is slow to medium, and erosion is a slight hazard. Available water capacity is 8 to 10 inches.

This soil is used mostly for dryfarmed pasture, barley, prunes, and almonds. It is also used for alfalfa, irrigated pasture, wildlife habitat, and recreation. Capability unit IIe–3 (17); not placed in a range site.

Rincon clay loam, 0 to 2 percent slopes (RoA).—This soil has the profile described as representative for the series. Included with this soil in mapping are small areas of Brentwood clay loam and Capay silty clay loam.

Runoff is slow, and erosion is a slight hazard. Available water capacity is 9 to 11 inches.

This soil is used mostly for irrigated sugar beets, tomatoes, and alfalfa. It is also used for almonds, grain sorghum, beans, dryfarmed barley, wildlife habitat, and recreation. Capability unit IIs–3 (17); not placed in a range site.

Rincon clay loam, 2 to 9 percent slopes (RoC).—This soil has a profile similar to the one described as representative for the series, except that slopes are dominantly 3 to 5 percent. Included with this soil in mapping are small areas of Brentwood clay loam.

Runoff is slow to medium, and erosion is a slight hazard. Available water capacity is 9 to 11 inches.

This soil is used mostly for dryfarmed pasture, barley, prunes, and almonds. It is also used for alfalfa, irrigated pasture, wildlife habitat, and recreation. Capability unit IIe–3 (17); not placed in a range site.

Riverwash

Riverwash (Rw) consists of excessively drained, coarse-textured, sandy, gravelly, cobbly, or stony stream deposits that are stratified throughout. It occupies stream channels and is subject to flooding. The vegetation is scattered cottonwoods, willows, and saltcedars. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 20 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 5 to 150 feet.

Included in mapping are small areas that have a thin surface layer of finer textured material.

Permeability is very rapid. Runoff is very slow in areas that are not flooded. Deposition of material by floodwater is a hazard. Available water capacity is less than 1 inch. Effective rooting depth is very shallow to moderately deep.

This miscellaneous land type is used mainly for rainwater drainageways, but it is also used for wildlife habitat and recreation. Capability unit VIIIw–1 (17); not placed in a range site.

Ryde Series

The Ryde series consists of poorly drained, nearly level soils in delta areas. These soils are high in con-

tent of organic matter. They formed in mixed alluvial and organic materials. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 10 feet below sea level to sea level.

In a representative profile (fig. 9), the surface layer is gray and dark-gray, mottled clay loam about 15 inches thick. Below this is very dark gray, mottled mucky loam 16 inches thick. The substratum is stratified gray or black, gleyed, mucky loam to clay that extends to a depth of more than 60 inches.

Permeability is moderate. The available water capacity is 15 to 18 inches, and in places roots extend to a depth of 60 inches where these soils are drained. The water table, which has been lowered to a depth of 36 to 48 inches, limits root penetration for most plants.

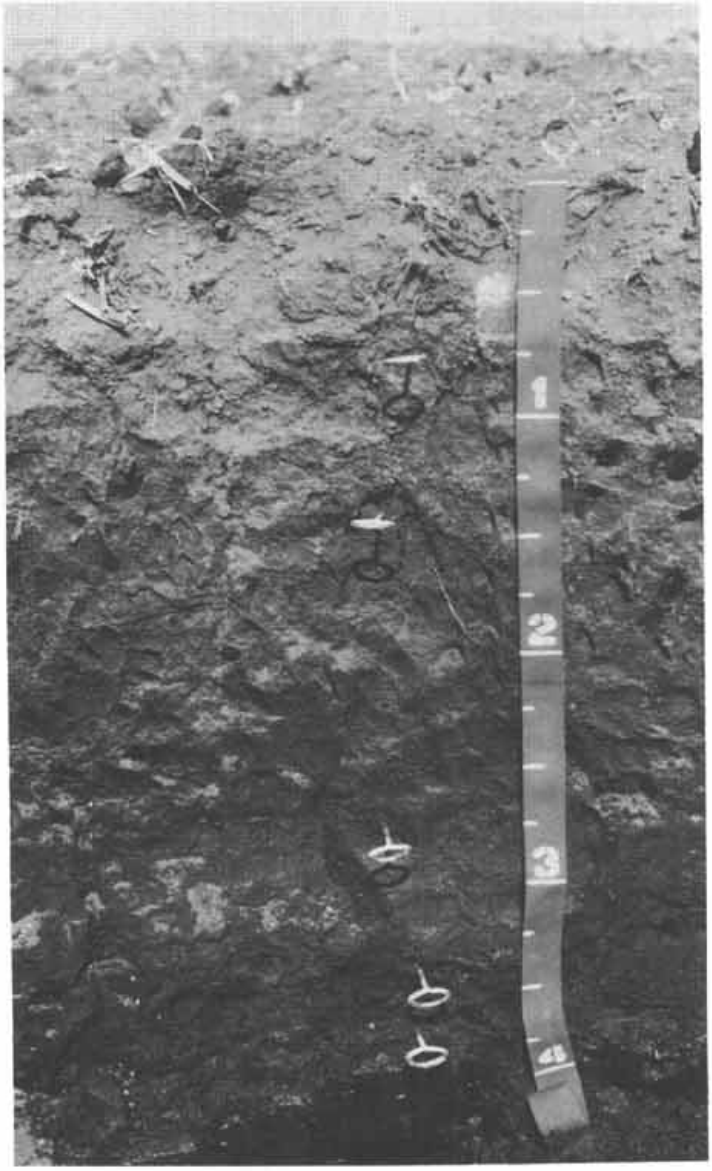

Figure 9.—**Profile of Ryde clay loam.**

Ryde soils are used for irrigated row crops, forage crops, dryfarmed small grain, wildlife, and recreation.

Following is a representative profile of Ryde clay loam:

Ap1—0 to 8 inches, gray (10YR 5/1) clay loam that has few, fine, prominent, pink (7.5YR 7/4) mottles, very dark gray (10YR 3/1) when moist; moderate, fine and medium, granular structure; hard, friable, sticky, plastic; common very fine and fine roots; many very fine interstitial pores; strongly acid; 5 to 10 percent organic matter; clear, smooth boundary.

Ap2—8 to 15 inches, dark-gray (10YR 4/1) clay loam that has few, fine, prominent, reddish-yellow (7.5YR 7/6) mottles, very dark gray (10YR 3/1) and has few, fine, prominent, reddish-yellow (7.5YR 6/6) mottles when moist; weak, coarse, prismatic structure; extremely hard, firm, sticky, plastic; common very fine roots; many very fine tubular and interstitial pores; strongly acid; 5 to 10 percent organic matter; abrupt, wavy boundary.

A1—15 to 31 inches, very dark gray (10YR 3/1) mucky loam that has few, fine, prominent, red (2.5YR 5/6) mottles, black (10YR 2/1) and has common, fine, prominent, dark-red (2.5YR 3/6) mottles when moist; moderate, coarse, prismatic structure parting to moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky, nonplastic; few very fine roots; common very fine tubular pores and many very fine vesicular pores; slightly acid; 15 to 20 percent organic matter; abrupt, wavy boundary.

C1—31 to 38 inches, mottled dark-gray (10YR 4/1), yellow (10YR 7/6), and grayish-brown (2.5Y 5/2) clay, mottled very dark grayish brown (10YR 3/2 and 2.5Y 3/2) and light olive brown (2.5Y 5/4) when moist; moderate, coarse, prismatic structure (irreversible vertical cracking); extremely hard, firm sticky, plastic; very few very fine roots; common very fine tubular pores; slightly acid; 5 percent organic matter; abrupt, wavy boundary.

C2—38 to 41 inches, mottled very dark gray (10 YR 3/1) and very dark brown (10YR 2/2) mucky loam that has strong-brown (7.5YR 5/6) organic fibers, very dark brown (10YR 2/2) and has brown (7.5YR 4/4) organic fibers when moist; moderate, coarse, prismatic structure (irreversible vertical cracking); hard, firm, nonsticky, nonplastic; no roots; common very fine tubular pores; slightly acid; 15 to 30 percent organic matter; abrupt, wavy boundary.

C3—41 to 44 inches, gray (5Y 5/1) mucky loam, black (5Y 2/1) when moist; moderate, coarse, prismatic structure (irreversible vertical cracking); hard, firm, nonsticky, nonplastic; no roots; common very fine tubular pores; slightly acid; 10 to 15 percent (estimated) organic matter.

C4—44 to 72 inches, stratified gleyed material that is less than 5 to 40 percent organic matter; irreversible vertical cracking extends into this horizon.

The A horizon ranges from very dark gray or gray to grayish brown in color, from clay loam or silty clay loam to mucky loam in texture, from strongly acid to neutral in reaction, and from 15 to 31 inches in thickness. The C horizon ranges from black, very dark gray, dark gray, or gray to very dark brown in color; from mucky loam or mucky silty clay loam to clay in texture; and from slightly acid to mildly alkaline in reaction. Organic-matter content ranges from 10 to 30 percent by weight, and it can be as much as 40 percent in the lower part of the C horizon. This soil is slightly saline in places.

Ryde clay loam (Ry).—This soil has the profile described as representative for the series. Included with

this soil in mapping are small areas of Egbert silty clay loam and Sacramento clay.

The water table in this poorly drained soil has been lowered to about 3 to 4 feet by using drainage ditches and by pumping. Runoff is very slow, and erosion is a slight hazard.

This soil is used mostly for irrigated corn, sugar beets, tomatoes, and grain sorghum. It is also used for barley, wheat, safflower, wildlife habitat, and recreation. Capability unit IIIw–2 (16); not placed in a range site.

Sacramento Series

The Sacramento series consists of nearly level, poorly drained soils in basins. These soils formed in mixed alluvium. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Elevation ranges from sea level to 10 feet.

In a representative profile, the surface layer is mottled, gray and dark-gray clay 27 inches thick. The substratum is mottled, light-gray to black, stratified loam to clay that extends to a depth of more than 60 inches.

Permeability is slow. Effective rooting depth is more than 60 inches where these soils are drained. The water table is at a depth of 36 to 48 inches and restricts the roots of most plants.

Sacramento soils are used for irrigated row crops, field crops, dryfarmed field crops, wildlife habitat, and recreation.

Following is a representative profile of Sacramento clay:

Ap—0 to 15 inches, gray (10YR 5/1) clay that has few, fine, faint, pale-brown (10YR 6/3) mottles, very dark gray (10YR 3/1) and has few, fine, faint, brown (7.5YR 5/4) mottles when moist; moderate, fine, medium and coarse, granular structure; extremely hard, firm, sticky, plastic; many medium roots; many very fine interstitial pores; moderately alkaline; clear, smooth boundary.

A11—15 to 24 inches, gray (10YR 5/1) clay that has common, fine, prominent, light yellowish-brown (10YR 6/4) mottles, black (10YR 2/1) and has common, fine, prominent, dark yellowish-brown (10YR 4/4) mottles and common, medium, prominent, yellowish-red (5YR 5/6) concretions when moist; moderate, coarse, prismatic structure; extremely hard, firm, sticky, plastic; common fine roots; many very fine tubular pores and many very fine interstitial pores; moderately alkaline; abrupt, smooth boundary.

A12—24 to 27 inches, dark-gray (10YR 4/1) clay that has many, fine, prominent, light-gray (10YR 6/1) and reddish-brown (2.5YR 5/4) mottles, black (10YR 2/1) and has many, fine, prominent, gray (10YR 5/1) and dark reddish-brown (2.5YR 3/4) mottles when moist; moderate, coarse, prismatic structure; extremely hard, firm, sticky, plastic; few very fine roots; common very fine tubular pores; moderately alkaline; abrupt, smooth boundary.

C—27 to 60 inches, light-gray (5Y 6/1, 10YR 7/2) to black (10YR 2/1), highly stratified loam to clay that has many, fine to medium, prominent, reddish-yellow (7.5YR 6/6), reddish-brown (5YR 5/4), and light olive-gray (5Y 6/2) mottles, gray (5Y 5/1) and grayish brown (10YR 5/2) to black (10YR 2/1) and has many, fine to medium, prominent, strong-brown (7.5YR 5/6), reddish-brown (5YR 4/3), and olive-gray (5Y 5/2) mottles when moist; mostly massive; roots and pores decrease gradually as depth increases; moderately alkaline.

The A horizon ranges from gray to dark gray or grayish brown in color. Mottles are few, fine, faint to many, medium, prominent. Texture is clay or silty clay, reaction is slightly acid to moderately alkaline, and thickness is 10 to 30 inches. Some areas are made up of as much as 20 inches of clay loam overwash material. The C horizon ranges from black, dark gray, or light gray to greenish gray in color and has common to many, medium to large, prominent mottles. The texture is dominantly clay stratified with lenses of loam that is high in content of organic matter. The C horizon is calcareous in places.

Sacramento silty clay loam (Sa).—This soil has a profile similar to the one described as representative for the series, except that it has grayish-brown silty clay loam overwash material on the surface. This material is as much as 20 inches thick. Included with this soil in mapping are small areas of Sacramento clay and Egbert silty clay loam.

The drainage of this poorly drained soil has been improved by use of open drainage ditches and levees so that the water table remains below a depth of 36 inches. Runoff is slow, and erosion is a slight hazard. The available water capacity is 9 to 11 inches.

This soil is used mostly for irrigated sugar beets, tomatoes, beans, and grain sorghum. It is also used for dryfarmed small grain and safflower, wildlife habitat, and recreation. Capability unit IIIw–3 (17); not placed in a range site.

Sacramento silty clay loam, occasionally flooded (Sc).—This soil has a profile similar to the one described as representative for the series, except that it has grayish-brown silty clay loam overwash material on the surface. This material is as much as 20 inches thick. This soil is subject to flooding at least 1 year in 3, and the flooding lasts more than 48 hours. Included with this soil in mapping are small areas of Egbert silty clay loam, flooded.

The drainage of this poorly drained soil has been improved by use of open drainage ditches and levees so that the water table remains below a depth of 36 inches. Runoff is very slow, and erosion is a slight hazard. The available water capacity is 9 to 11 inches.

This soil is used mostly for irrigated beans, tomatoes, grain sorghum, and sugar beets. It is also used for dryfarmed safflower and small grain, wildlife habitat, and recreation. Capability unit IVw–3 (17); not placed in a range site.

Sacramento clay (Sd).—This soil has the profile described as representative for the series. Included with this soil in mapping are small areas of Clear Lake clay, Egbert silty clay loam, and Ryde clay loam.

The drainage of this poorly drained soil has been improved by use of open drainage ditches and levees so that the water table remains below a depth of 36 inches. Runoff is very slow, and erosion is a slight hazard. The available water capacity is 8 to 10 inches.

This soil is used mostly for irrigated tomatoes, sugar beets, and grain sorghum. It is also used for dryfarmed small grain and safflower, wildlife habitat, and recreation. Capability unit IIIw–5 (17); not placed in a range site.

San Benito Series

The San Benito series consists of well-drained soils on dissected terraces. These soils are underlain by weakly consolidated sediments at a depth of 25 to 40 inches. Slopes are 2 to 30 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 25 to 250 feet.

In a representative profile (fig. 10) the surface layer is brown clay loam about 25 inches thick. The substratum is light yellowish-brown and white, calcareous, weakly consolidated sediments that crush to loam.

Permeability is moderately slow. The available water capacity is 4.5 to 8.5 inches. Roots penetrate to a depth of 25 to 40 inches.

San Benito soils are used for dryfarmed small grain, pasture, wildlife habitat, and recreation.

Following is a representative profile of a San Benito clay loam:

Ap—0 to 5 inches, brown (10YR 4/3) clay loam, dark brown (10YR 3/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, sticky, plastic; many very fine roots; many very fine and fine tubular pores; medium acid; abrupt, smooth boundary.

A11—5 to 17 inches, brown (10YR 4/3) clay loam, dark brown (10YR 3/3) when moist; moderate, medium and coarse, prismatic structure; hard, friable, sticky, plastic; common very fine roots; many very fine and fine tubular pores; slightly acid; few lime concretions; gradual, wavy boundary.

A12—17 to 25 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure; hard, friable, sticky, plastic; common very fine roots; many very fine and medium tubular pores; neutral; few lime concretions; clear, wavy boundary.

Cca—25 to 34 inches, mottled light yellowish-brown (10YR 6/4) and white (10YR 8/2), weakly consolidated sediments that crush to loam, mottled dark yellowish brown (10YR 4/4) and light gray (10YR 7/2) when moist; massive; hard, friable, slightly sticky, slightly plastic; moderately alkaline; violently effervescent, lime disseminated and in soft masses; many large krotovinas.

The A horizon ranges from brown to dark grayish brown in color. It is clay loam or silty clay loam in texture and 25 to 40 inches in thickness. The C horizon ranges from light yellowish-brown to white in color. It is made up of consolidated calcareous sediments that crush to loam, clay loam, or silty clay loam. Depth to the C horizon is 25 to 40 inches.

San Benito soils are mapped only in complexes with Altamont and San Ysidro soils.

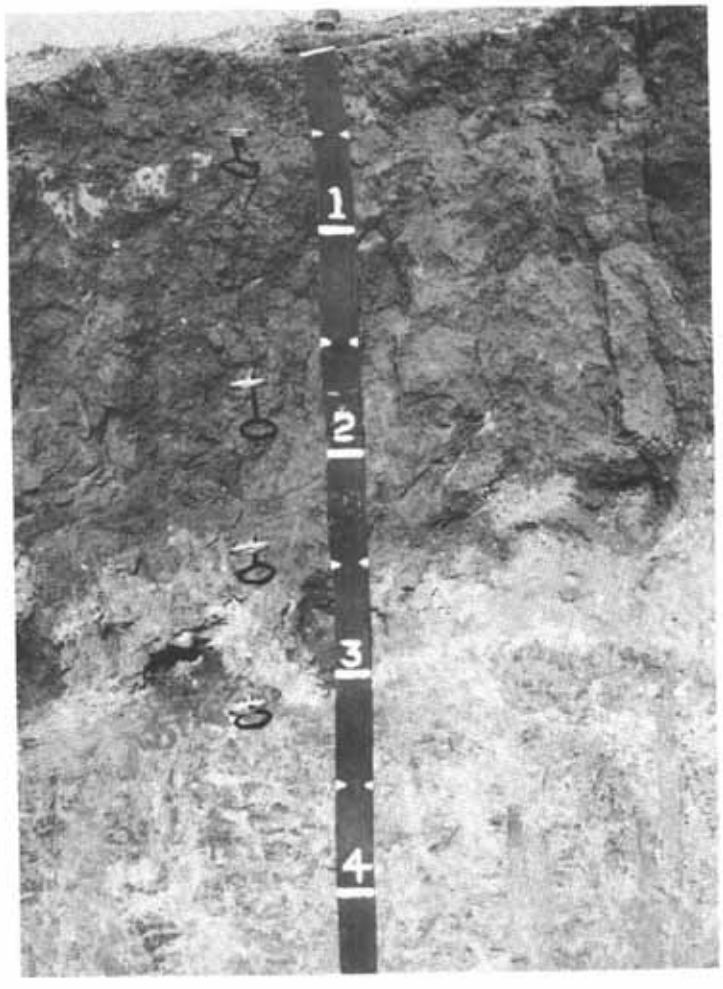

Figure 10.—**Profile of San Benito clay loam.**

San Ysidro Series

The San Ysidro series consists of moderately well drained soils on terraces. These soils formed in alluvium derived from sedimentary rocks. Slopes are 0 to 30 percent. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., average annual rainfall is 16 to 22 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 25 to 100 feet.

In a representative profile (fig. 11), the surface layer is light brownish-gray sandy loam and fine sandy loam 14 inches thick. The subsoil is dark yellowish-brown heavy clay loam and yellowish-brown sandy clay loam 26 inches thick. The substratum is yellowish-brown light sandy clay loam and light yellowish-brown light clay loam that extend to a depth of more than 60 inches.

Permeability is very slow.

San Ysidro soils are used for irrigated row crops and pasture, dryfarmed small grain, dryland pasture, wildlife habitat, and recreation.

Following is a representative profile of San Ysidro sandy loam, 0 to 2 percent slopes:

Ap—0 to 7 inches, light brownish-gray (10YR 6/2) sandy loam that has few, fine, distinct mottles of brownish yellow (10YR 6/6), brown (10YR 3/3) when moist; massive; hard, friable, nonsticky, slightly plastic; many very fine roots and common fine and medium roots; common very fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

A1—7 to 14 inches, light brownish-gray (10YR 6/2) fine sandy loam that has few, fine, distinct mottles of brownish yellow (10YR 6/6), brown (10YR 3/3) when moist; massive; hard, friable, nonsticky, slightly plastic; many very fine roots, common fine

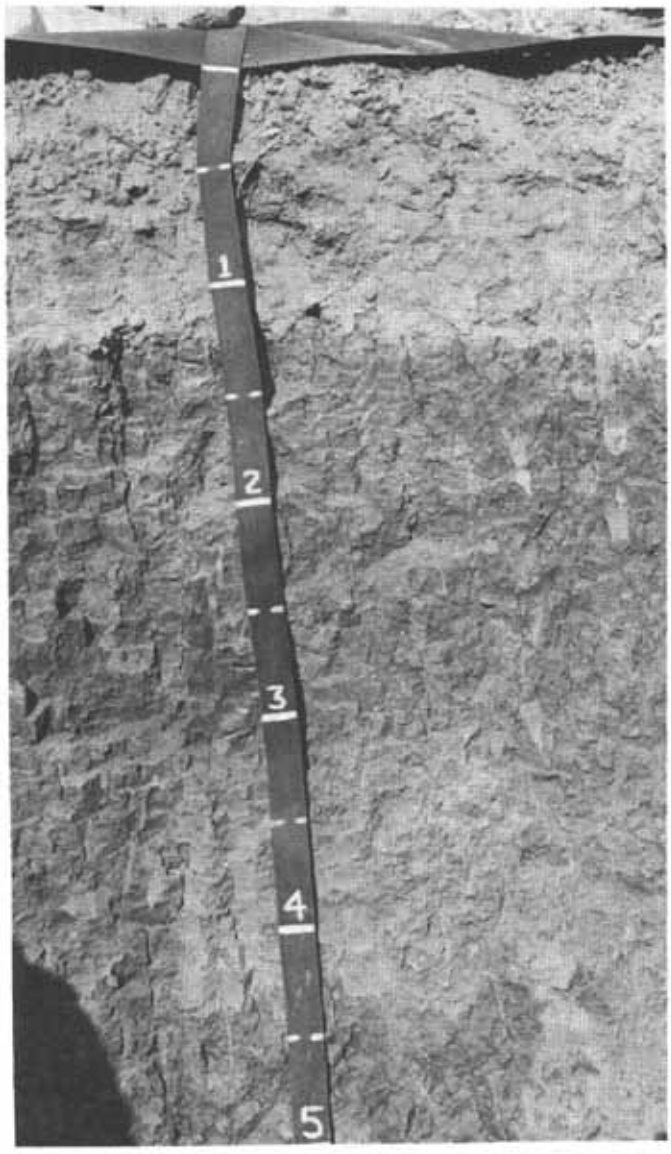

Figure 11.—**Profile of San Ysidro sandy loam, 0 to 2 percent slopes.**

and medium roots; common very fine tubular pores; medium acid; abrupt, smooth boundary.

B21t—14 to 28 inches, dark yellowish-brown (10YR 4/4) heavy clay loam, dark brown (7.5YR 4/4) when moist; strong, coarse, prismatic structure; a thin bleached layer immediately above the prisms is light gray (10YR 7/2), light brownish gray (10YR 6/2) when moist; extremely hard, very firm, sticky, plastic; few very fine and fine exped roots; common very fine tubular pores; many moderately thick clay films on ped surfaces and in pores; slightly acid; iron and manganese concretions; gradual, smooth boundary.

B22t—28 to 40 inches, yellowish-brown (10YR 5/6) sandy clay loam, dark yellowish brown (10YR 4/4) and has dark-brown (7.5YR 4/4) coatings when moist; strong, medium, prismatic structure; extremely hard, very firm, sticky, plastic; few very fine and fine exped roots; common very fine tubular pores; many moderately thick clay films on ped faces and in pores; neutral; iron and manganese concretions; gradual, smooth boundary.

C1—40 to 54 inches, yellowish-brown (10YR 5/4) light sandy clay loam, dark yellowish brown (10YR 4/4) when moist; moderate, medium, prismatic structure; extremely hard, very firm, sticky, plastic; few, very fine exped roots; common very fine tubular pores; many moderately thick clay films on ped faces and in pores; neutral; iron and manganese concretions; gradual, wavy boundary.

C2—54 to 68 inches, light yellowish-brown (10YR 6/4) light clay loam, dark yellowish brown (10YR 4/4) and has brown (7.5YR 4/4) coatings when moist; strong, medium, prismatic structure; hard, firm, sticky, plastic; few, very fine exped roots; common very fine tubular pores; continuous moderately thick clay films on ped faces and in pores; moderately alkaline.

The A1 horizon ranges from light brownish gray to pale brown in color, from very fine sandy loam to sandy loam in texture, and from 12 to 30 inches in thickness. Where present, the A2 horizon ranges from light gray to very pale brown in color, from very fine sandy loam to sandy loam in color, and from nearly 0 to 3 inches in thickness. It is slightly acid to medium acid. The B horizon is dark yellowish brown to light yellowish brown or brownish yellow. Texture ranges from heavy clay loam or sandy clay loam to clay. It is 12 to 30 inches thick and is slightly acid to mildly alkaline. The C horizon ranges from pale brown to yellowish brown. It is calcareous in some places.

San Ysidro sandy loam, 0 to 2 percent slopes (SeA).—This soil has the profile described as representative for the series. Included with this soil in mapping are small areas of Antioch loam and San Ysidro sandy loam, thick surface.

Runoff is slow. Erosion is a slight hazard. Available water capacity is 2 to 4 inches. Effective rooting depth is only 12 to 20 inches, but some water is slowly available to some plants from the subsoil.

This soil is used mainly for irrigated grain sorghum, sugar beets, and pasture; dryfarmed small grain; dryland pasture; wildlife habitat; and recreation. Capability unit IVs–3 (17); not placed in a range site.

San Ysidro sandy loam, 2 to 5 percent slopes (SeB).—This is an undulating soil on terraces. Included with this soil in mapping are small areas of Antioch loam and San Ysidro sandy loam, thick surface.

Runoff is medium. Erosion is a slight to moderate hazard. Available water capacity is 2 to 4 inches. Effective rooting depth is only 12 to 20 inches, but a small amount of water is available to some plants from the subsoil.

This soil is used for irrigated pasture, dryfarmed small grain, dryland pasture, wildlife habitat, and recreation. Capability unit IVe–3 (17); not placed in a range site.

San Ysidro sandy loam, thick surface, 0 to 2 percent slopes (SfA).—This soil has a profile similar to the one described as representative for the series, except that the subsoil is at a depth of 20 to 30 inches. Included with this soil in mapping are small areas of Antioch loam and San Ysidro sandy loam.

Runoff is slow. Erosion is a slight hazard. Available water capacity is 4 to 6 inches. Effective rooting depth is only 20 to 30 inches, but a small amount of water also is available to some plants from the subsoil.

This soil is used for irrigated grain sorghum, sugar beets, and pasture; dryfarmed small grain; dryland

pasture; wildlife habitat; and recreation. Capability unit IIIs–3 (17) not placed in a range site.

Solano Series

The Solano series consists of nearly level, somewhat poorly drained soils on terraces (fig. 12). These soils formed in alluvium derived from sedimentary rocks. The vegetation is alkali-tolerant annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 5 to 40 feet.

In a representative profile (fig. 13) the surface layer is mottled, light brownish-gray and light-gray loam about 9 inches thick. The subsoil is brown and light yellowish-brown clay loam and silty clay loam that extends to a depth of more than 60 inches.

Permeability is very slow. Effective rooting depth is 6 to 12 inches. Available water capacity is only 1.5 to 2.5 inches, but some moisture also is slowly available to some plants from the subsoil.

Solano soils are used for dryland pasture, irrigated pasture, alkali-tolerant row crops, wildlife habitat, and recreation.

Following is a representative profile of Solano loam:

A21—0 to 4 inches, light brownish-gray (10YR 6/2) loam that has few, fine, distinct yellowish-brown (10YR 5/8) mottles, dark grayish brown (10YR 4/2) and has few, fine, distinct, yellowish-red (5YR 4/8) mottles when moist; massive; hard, friable, non-sticky, slightly plastic; many very fine and fine roots; many very fine tubular pores and common fine tubular pores; very strongly acid; clear, wavy boundary.

Figure 12.—Typical area of Solano loam.

Figure 13.—Profile of Solano loam.

A22—4 to 9 inches, light-gray (10YR 7/2) loam that has few, fine, distinct, yellowish-brown (10YR 5/6) mottles, dark grayish brown (10YR 4/2) and has few, fine, distinct, dark reddish-brown (5YR 3/4) mottles when moist; massive; hard, friable, sticky, slightly plastic; many very fine roots; many very fine tubular pores; strongly acid; abrupt, wavy boundary.

B21t—9 to 21 inches, brown (10YR 5/3) clay loam, brown (10YR 4/3) matrix and dark grayish-brown (10YR 4/2) ped faces when moist; strong, coarse, columnar structure; extremely hard, firm, sticky, plastic; common very fine exped roots; many very fine tubular pores; many thin clay films on ped faces and in pores; neutral; gradual, wavy boundary.

B22t—21 to 32 inches, light yellowish-brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) and has dark reddish-brown (5YR 2/2) stains when moist; weak, medium and coarse, prismatic structure and weak, medium, angular blocky structure; extremely hard, firm, sticky, plastic; few very fine exped roots; common very fine tubular pores; many moderately thick clay films on ped faces;

moderately alkaline; common iron and manganese concretions; few slickensides; clear, wavy boundary.

B23t—32 to 48 inches, light yellowish-brown (10YR 6/4) clay loam; yellowish-brown (10YR 5/6) matrix, light olive-brown (2.5Y 5/4) ped faces and dark reddish-brown (5YR 2/2) stains when moist; weak, medium and coarse, prismatic structure and weak, medium, angular blocky structure; very hard, friable, slightly sticky, plastic; very few very fine exped roots; common very fine tubular pores; many moderately thick clay films on ped faces; strongly alkaline; strongly effervescent, medium soft masses and concretions of lime; many iron and manganese concretions; few slickensides; gradual, wavy boundary.

B24t—48 to 62 inches, light yellowish-brown (10YR 6/4) silty clay loam; light olive-brown (2.5Y 5/6) matrix, light olive-brown (2.5Y 5/4) ped faces and dark reddish-brown (5YR 2/2) stains when moist; weak, fine, angular blocky structure; very hard, friable, sticky, plastic; no roots; common very fine tubular pores; continuous moderately thick clay films on ped faces; strongly alkaline; strongly effervescent, large soft masses and concretions of lime; many iron and manganese concretions.

The A horizon is silt loam or loam in texture and ranges from slightly acid to very strongly acid in reaction. Thickness ranges from 6 to 12 inches but is generally about 7 inches. The B horizon ranges from 20 inches to more than 53 inches in thickness. Exchangeable sodium percentage ranges from 15 to 45 percent. The electrical conductance ranges from 2 to 10 millimhos. The C horizon, where present, ranges from yellowish brown to light yellowish brown in color, from clay loam to sandy clay loam in texture, and from moderately alkaline to strongly alkaline in reaction. Exchangeable sodium percentage ranges from 8 to 25 percent.

Solano loam (Sh).—This soil has the profile described as representative for the series. Included with this soil in mapping are small areas of Antioch loam, San Ysidro sandy loam, and Pescadero clay loam.

Runoff is very slow, and erosion is not a hazard. This soil has been drained and the water table lowered so that the water table is a limitation only after heavy rains or when this soil is overirrigated.

This soil is used for dryland pasture, irrigated pasture and sugar beets, wildlife habitat, and recreation. Capability unit IVs–6 (17) ; not placed in a range site.

Solano-Pescadero complex (Sk).—This complex is made up of about 45 percent Solano loam and 45 percent Pescadero clay loam. The remaining 10 percent is included small areas of Antioch loam and San Ysidro sandy loam. The Solano soil is on rounded mounds, and the Pescadero soil is in swales. The Solano and Pescadero soils have a profile similar to the one described as representative for their respective series.

Runoff is very slow, and erosion is not a hazard.

These soils are used for dryland pasture; irrigated pasture, sugar beets, and small grain; wildlife habitat, and recreation. Capability unit IVw–6 (17) ; not placed in a range site.

Solano Series, Dark Surface Variant

The Solano series, dark surface variant, consists of nearly level, somewhat poorly drained soils on terraces. These soils formed in alluvium derived from sedimentary rocks. The vegetation is saline- and alkali-tolerant annual grasses and forbs. The average annual temperature is 58° to 60° F., the annual rainfall is 18 to 20 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 5 to 60 feet.

In a representative profile, the surface layer is gray loam about 7 inches thick. The subsoil is light brownish-gray light clay loam about 6 inches thick. The substratum is pale-brown and light yellowish-brown loam and very pale brown loamy sand that extend to a depth of more than 60 inches.

Permeability is very slow. The effective rooting depth is commonly 6 to 12 inches. The available water capacity is only 1.5 to 2.5 inches, but some water also is available to some plants from the subsoil.

These soils are used for dryland pasture, wildlife habitat, and recreation.

Following is a representative profile of Solano loam, dark surface variant:

A1—0 to 7 inches, gray (10YR 5/1) loam, dark gray (10YR 4/1) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots and many medium roots; common very fine and fine tubular pores; moderately alkaline; very slightly effervescent; clear, smooth boundary.

B2t—7 to 13 inches, light brownish-gray (10YR 6/2) light clay loam, grayish brown (10YR 5/2) when moist; weak, medium and coarse, prismatic structure; hard, friable, sticky, plastic; common very fine and fine exped roots; common very fine and fine tubular pores; few, thin clay films in pores; strongly alkaline; strongly effervescent; clear, smooth boundary.

C1—13 to 21 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; massive; hard, friable, slightly sticky, slightly plastic; few very fine exped roots; common very fine tubular pores; strongly alkaline; strongly effervescent; clear, smooth boundary.

C2—21 to 30 inches, light yellowish-brown (10YR 6/4) loam, yellowish brown (10YR 5/4) when moist; massive; very hard, firm, slightly sticky, slightly plastic; no roots; common very fine pores; moderately alkaline; very slightly effervescent; gradual, smooth boundary.

C3—30 to 55 inches, light yellowish-brown (10YR 6/1) loam, yellowish brown (10YR 5/4) when moist; massive; very hard, very firm, slightly sticky, slightly plastic; moderately alkaline; abrupt, smooth boundary.

IIC4—55 to 63 inches, very pale brown (10YR 7/3) loamy sand, pale brown (10YR 6/3) when moist; single grain; loose, nonsticky, nonplastic; moderately alkaline.

The A horizon ranges from gray to grayish brown in color, from loam to sandy loam in texture, from medium acid to strongly alkaline in reaction, and from 3 to 12 inches in thickness. The B horizon ranges from light brownish gray or gray to pale brown in color, from clay loam to loam in texture, from moderately alkaline to very strongly alkaline in reaction, and from 6 to 30 inches in thickness. Exchangeable sodium percentage ranges from 15 to 45 percent. Electrical conductance ranges from 4 to 15 millimhos. The C horizon ranges from clay loam to loamy sand in texture. Exchangeable sodium percentage ranges from 15 to 45 percent. Electrical conductance ranges from 4 to 10 millimhos.

Solano loam, dark surface variant (Sm).—This soil has the profile described as representative for the series. Included with this soil in mapping are small areas of Solano loam and Antioch loam.

Runoff is very slow, and erosion is not a hazard. This soil has been drained and the water table lowered

so that the water table is a limitation only after heavy rains or when this soil is overirrigated.

This soil is used mostly for dryland pasture. It is also used for wildlife habitat and recreation. Capability unit IVs–6 (17) ; not placed in a range site.

Suisun Series

The Suisun series consists of nearly level, very poorly drained organic soils in salt water marshes. These soils formed from hydrophytic plant remains mixed with fine mineral sediments derived from mixed sources. The vegetation is mostly perennial herbs and sedges. The average annual temperature is 58° to 60° F., the average annual rainfall is 15 to 20 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 5 feet below sea level to sea level.

In a representative profile, the surface layer is black muck that contains dark reddish-brown fibers and is about 18 inches thick. The next layers are black to very dark gray peaty muck that contains dark reddish-brown fibers and is 20 inches thick. The substratum is very dark gray peaty muck that contains reddish-brown fibers and extends to a depth of more than 60 inches.

Permeability is rapid. The water table is at a depth of 10 to 20 inches and limits root penetration. The available water capacity is 15 to 19 inches and effective rooting depth is more than 60 inches where these soils are drained.

Suisun soils are used for pasture, wildlife habitat, and recreation.

Following is a representative profile of Suisun peaty muck:

Oa1—0 to 9 inches, muck, 50 percent organic matter; 5 percent fibers, 60 percent of which are larger than 1 millimeter; dark reddish-brown (5YR 3/2) natural fibers; black (10YR 2/1) matrix; black (10YR 2/1) when pressed firmly, black (10YR 2/1) when rubbed gently, very dark gray (10YR 3/1) when dry; many prominent light-gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; massive; hard, slightly sticky, slightly plastic; turbid; dusty; very strongly acid.

Oe1—9 to 18 inches, peaty muck, 70 percent organic matter; 40 percent fibers, 40 percent of which are larger than 1 millimeter; dark reddish-brown (5YR 3/2) natural fibers; black (10YR 2/1) matrix, black (10YR 2/1) when pressed firmly, black 10YR 2/1) when rubbed gently, black (10YR 2/1) when dry; massive; hard, nonsticky, slightly plastic; turbid; dusty; very strongly acid.

Oe2—18 to 28 inches, peaty muck, 60 percent organic matter; 70 percent fibers, 70 percent of which are larger than 1 millimeter; dark reddish-brown (5YR 3/3) natural fibers; black (10YR 2/1) matrix; mixed black (10YR 2/1), very dark gray (10YR 3/1), and dark brown (10YR 3/3) when pressed firmly, black (10YR 2/1) when rubbed gently, black (10YR 2/1) and dark grayish brown (10YR 4/2) when dry; massive, hard, nonsticky, nonplastic; turbid; dusty; moderately alkaline, becoming strongly acid when exposed to air for a few weeks.

Oe3—28 to 38 inches, peaty muck, 50 percent organic matter; 50 percent fibers, 50 percent of which are larger than 1 millimeter; dark reddish-brown (5YR 3/3) natural fibers; very dark gray (10YR 3/1) matrix; black (10YR 2/1) when pressed firmly, mixed black (10YR 2/1) and very dark gray (10YR 3/1) when rubbed gently, black (10YR 2/1) and light gray (10YR 6/1) when dry; massive; hard, slightly sticky, slightly plastic; turbid; dusty; strongly alkaline, becoming medium acid when exposed to air for a few weeks.

Oe4—38 to 60 inches, peaty muck, 50 percent organic matter; 40 percent fibers, 85 percent of which are larger than 1 millimeter; dark reddish-brown (5YR 3/3) natural fibers; very dark gray (10YR 3/1) matrix; black (10YR 2/1), very dark gray (10YR 2/1), and dark reddish brown (5YR 3/3) when pressed firmly, black (10YR 2/1) and very dark gray (10YR 3/1) when rubbed gently, black and light gray (10YR 2/1, 6/1) when dry; massive; hard, nonplastic, slightly sticky; turbid; dusty; strongly alkaline, becoming less alkaline when exposed to air.

The Oa1 horizon ranges from black or very dark gray to very dark brown in color, from muck to peaty muck in texture, from medium acid to very strongly acid in reaction, and from 15 to 18 inches in thickness. The next layer ranges from black or very dark gray to very dark brown in color. Texture is peaty muck that is 50 to 70 percent organic matter. Reaction ranges from mildly alkaline to strongly alkaline. Thickness is 42 inches to more than 45 inches. The water table varies with management of levees and tide gates, but it is generally at a depth of less than 30 inches in midsummer and near the surface in winter. The profile is strongly saline, and the electrical conductance ranges from 15 to 50 millimhos per centimeter at 25° C. The moderately alkaline layers become acidic if exposed to air and allowed to dry.

Suisun peaty muck (Sp).—This soil has the profile described as representative for the series. Included with it in mapping are small areas of Joice muck and Tamba mucky clay.

Runoff is ponded, and erosion is not a hazard.

This soil is used mostly for wildlife habitat and recreation. It is also used for limited pasture. Capability unit VIw–1 (16) ; not placed in a range site.

Sycamore Series

The Sycamore series consists of nearly level, somewhat poorly drained soils on alluvial fans. These soils formed in alluvium washed from mixed sources. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 18 to 25 inches, and the frost-free season is 250 to 270 days. Elevation ranges ranges from 25 to 150 feet.

In a representative profile, the surface layer is grayish-brown silty clay loam about 9 inches thick. The subsoil is mottled, grayish-brown silty clay loam 22 inches thick. The substratum is distinctly mottled, light brownish-gray silty clay loam that extends to a depth of more than 60 inches.

Sycamore soils are used for irrigated orchards and row crops; dryfarmed small grain; dryland pasture; wildlife habitat; and recreation.

Following is a representative profile of Sycamore silty clay loam:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; massive; hard, friable, slightly sticky, plastic; few very fine roots; common very fine and fine pores; slightly acid; clear, smooth boundary.

B21—9 to 25 inches, grayish-brown (2.5Y 5/2) silty clay loam that has many, medium, distinct, light olive-brown (2.5Y 5/4) mottles, very dark grayish

brown (2.5Y 3/2) and has many, medium, distinct, olive-brown (2.5Y 4/4) mottles when moist; massive; hard, friable, slightly sticky, plastic; few very fine roots; many very fine, fine, and medium pores; neutral; clear, smooth boundary.

B22—25 to 31 inches, grayish-brown (2.5Y 5/2) silty clay loam that has common, fine, distinct, light olive-brown (2.5Y 5/4) mottles, very dark grayish brown (2.5Y 3/2) and has common, fine, distinct, olive-brown (2.5 4/4) mottles when moist; massive; hard, friable, slightly sticky, plastic; very few very fine roots; very fine, fine, and medium pores; mildly alkaline; clear, smooth boundary.

C—31 to 60 inches, light brownish-gray (2.5Y 6/2) silty clay loam that has many, fine, distinct, light olive-brown (2.5Y 5/4) mottles, dark grayish brown (2.5Y 4/2), and has many, fine, distinct, olive-brown (2.5Y 4/4) mottles when moist; massive; hard, friable, slightly sticky, plastic; very few very fine roots; many very fine pores; very slightly effervescent; moderately alkaline.

The A horizon ranges from grayish brown to gray in color, from loam to silty clay loam in texture, from slightly acid to mildly alkaline in reaction, and from 7 to 16 inches in thickness. The B horizon ranges from grayish brown to light brownish gray in color and has distinct to prominent mottles. Texture is silty clay loam to silt loam, reaction is neutral to moderately alkaline, and thickness is 15 to 30 inches. The C horizon ranges from light brownish gray to pale olive in color and has distinct to prominent mottles. It is silty clay loam to loam in texture and neutral to moderately alkaline in reaction. A fluctuating water table is at a depth of less than 5 feet in some years.

Sycamore silty clay loam (Sr).—This soil has the profile described as representative for the series. Included with this soil in mapping are small areas of Yolo silty clay loam and Sycamore silty clay loam, drained.

Permeability is moderately slow. Runoff is slow, and erosion is a slight hazard. The available water capacity is 10 to 12 inches. The effective rooting depth is 60 inches or more. The water table is at a depth of 36 to 60 inches.

This soil is used mostly for pears (fig. 14). It is also used for tomatoes, alfalfa, prunes, dryfarmed barley,

Figure 14.—Pear orchard on Sycamore silty clay loam.

wildlife habitat, and recreation. Capability unit IIw–2 (17) not placed in a range site.

Sycamore silty clay loam, drained (Ss).—This soil is on alluvial fans. Included with it in mapping are small areas of Yolo silty clay loam, Reiff fine sandy loam, and Brentwood clay loam.

Permeability is moderately slow. This soil is drained to maintain the water table at a depth of more than 60 inches. Runoff is slow, and erosion is a slight hazard. The available water capacity is 10 to 12 inches. The effective rooting depth is more than 60 inches.

This soil is used mostly for pears, peaches, prunes, and apricots. It is also used for tomatoes, dryfarmed barley, wildlife habitat, and recreation. Capability unit I–1 (17) ; not placed in a range site.

Sycamore silty clay loam, saline (St).—This soil has a profile similar to the one described as representative for the series, except that it is underlain by buried silty clay loam at a depth of 20 to 36 inches. This buried soil is moderately to strongly saline. Included with this soil in mapping are areas of Sycamore silty clay loam and Alviso silty clay loam.

Permeability is slow. Runoff is slow, and erosion is a slight hazard. The rooting depth of most plants is restricted by the buried soil. The available water capacity is 4 to 7.5 inches. The water table is at a depth of 36 to 60 inches.

This soil is used mostly for irrigated and dryfarmed pasture, dryfarmed small grain, and hay. It is also used for wildlife habitat and recreation. Capability unit IIIw–6 (17) ; not placed in a range site.

Sycamore complex, occasionally flooded (Su).—This complex consists of 45 percent Sycamore soils that have a silty clay loam surface layer and 45 percent that have a loam surface layer. Except for texture of the surface layer, these soils have a profile similar to the one described as representative for the series. They are underlain by buried, strongly saline silty clay loam at a depth of 36 to 60 inches. These soils are in the "Bypass," and because of flowage easements, they are subject to flooding that lasts more than 48 hours at least 1 year in 3. Included with these soils in mapping, and making up 10 percent of the acreage, are small areas of Sacramento silty clay loam, flooded, and Egbert silty clay loam, flooded.

Permeability is slow. Runoff is slow, and erosion is a slight hazard. The available water capacity is 6 to 10 inches. The effective rooting depth for most plants is 36 to 60 inches. The water table is at a depth of 36 to 60 inches.

These soils are used mostly for irrigated sugar beets, grain sorghum, and beans. They are also used for tomatoes, safflower, wildlife habitat, and recreation. Capability unit IVw–3 (17); not placed in a range site.

Tamba Series

The Tamba series consists of nearly level, very poorly drained soils that are high in content of organic matter. The soils are in salt water marshes. They formed in alluvium derived from mixed sources and in hydrophytic plant remains. The vegetation is mostly perennial sedges and herbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 15 to 20 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 3 feet below sea level to sea level.

In a representative profile, the surface layer is light brownish-gray, grayish-brown, and yellowish-brown, mottled mucky clay about 10 inches thick. The subsoil is mottled, gray and black mucky clay about 42 inches thick. The substratum is gray mucky clay that extends to a depth of more than 60 inches.

Permeability of the subsoil is moderate. The effective rooting depth is 60 inches or more and the available water capacity is 9 to 11 inches where these soils are drained. The water table is at a depth of 12 to 36 inches and restricts most plant roots.

Tamba soils are used for pasture, wildlife habitat, and recreation.

Following is a representative profile of Tamba mucky clay:

A11—0 to 5 inches, light brownish-gray (10YR 6/2) mucky clay that has common, medium, distinct, light yellowish-brown (10YR 6/4) mottles, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, crumb structure; slightly hard, friable, sticky, plastic; many very fine roots; many very fine pores; strongly acid; clear, smooth boundary.

A12—5 to 10 inches, mottled grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) mucky clay, mottled very dark brown and dark yellowish brown (10YR 2/2, 3/4) when moist; weak, fine, granular structure and weak, crumb structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; common very fine pores; very strongly acid; abrupt, smooth boundary.

B21g—10 to 31 inches, gray (N 6/0) and black (10YR 2/1) mucky clay that has few, fine prominent, yellowish-red (10YR 5/8) mottles, black (10YR 2/1) and has few, fine, prominent, dark-red (2.5YR 3/6) mottles when moist; massive; slightly hard, friable, sticky, plastic; common very fine roots; common very fine pores; very strongly acid; diffuse, wavy boundary.

B22g—31 to 52 inches, gray (N 6/0) and black (10YR 2/1) mucky clay that has few, fine, prominent, brown (7.5YR 3/2) mottles, very dark brown (10YR 2/2) and has few, fine, distinct, dark-brown (7.5YR 3/2) mottles when moist; massive; slightly hard, friable, sticky, plastic; few very fine roots; common very fine pores; very strongly acid; gradual, wavy boundary.

Cg—52 to 72 inches, gray (N 6/0) mucky clay, dark greenish gray (5BG 4/1) when moist; massive; slightly hard, firm, very sticky, plastic; many fine tubular pores; moderately alkaline, strong odor of hydrogen sulfide, becomes acid when exposed to air for a few weeks.

The A horizon ranges from gray, light gray, or light brownish gray to grayish brown in color, from clay to mucky clay in texture, from medium acid to very strongly acid in reaction, and from 8 to 15 inches in thickness. The B horizon is clay to mucky clay in texture and is 15 to 30 percent organic matter. Reaction ranges from very strongly acid to moderately alkaline, and thickness ranges from 25 to 42 inches. The C horizon ranges from gray to greenish gray in color and from clay to mucky clay in texture. Reaction is moderately alkaline but becomes acid if this layer is exposed to air and allowed to dry. Thickness ranges from 10 inches to more than 27 inches. The water table varies with management of levees and tide gates, but it is at a depth of about 3 feet in midsummer and near the

surface in winter. The profile is strongly saline, and electrical conductance ranges from 15 to 40 millimhos per centimeter at 25° C.

Tamba mucky clay (Ta).—This soil has the profile described as representative for the series. Included with it in mapping are small areas of Reyes silty clay, Joice muck, and Suisun peaty muck.

Runoff is ponded, and erosion is a slight hazard.

This soil is used mostly for wildlife habitat and recreation, but it is also used for pasture. Capability unit VIw–1 (16); not placed in a range site.

Tidal Marsh

Tidal marsh (Td) is a very poorly drained, strongly saline land type that is located between constructed levees and bodies of water. It is flooded periodically by tidal water. This land type ranges from mud flats that are covered daily by tidal flow to a mixture of hydrophytic plant remains and alluvium that is covered by water only at high tide. There is no vegetation on the mud flats, but rushes and sedges are in the areas that are less often covered at high tide.

This land type is used for wildlife habitat and recreation. Capability unit VIIIw–1 (16); not placed in a range site.

Toomes Series

The Toomes series consists of somewhat excessively drained soils on mountainous uplands. These soils are underlain by tuffaceous igneous rocks at a depth of 5 to 17 inches. Slopes are 9 to 75 percent. The vegetation is annual grasses and scattered oaks and brush. The average annual temperature is 60° to 62° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 300 to 2,300 feet.

In a representative profile, the soil is light brownish-gray and light-gray loam about 17 inches thick. The substratum is white tuffaceous rock.

Permeability is moderate.

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

Following is a representative profile of a Toomes loam:

A11—0 to 13 inches, light brownish-gray (10YR 6/2) loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; hard, friable, nonsticky, nonplastic; common very fine roots and few medium roots; many very fine tubular pores; medium acid; gradual, smooth boundary.

A12—13 to 17 inches, light-gray (10YR 7/2) loam, brown (10YR 4/3) when moist; massive; hard, friable, nonsticky, nonplastic; common very fine roots; many very fine, fine, and medium pores; medium acid; abrupt, smooth boundary.

R—17 to 23 inches, white (2.5Y 8/2) tuff, pale olive (5Y 6/3) when moist; very hard.

The A horizon ranges from light brownish gray or light gray to light yellowish brown in color, from loam to sandy loam in texture, from slightly acid to medium acid in reaction, and from 5 to 17 inches in thickness. Stones commonly cover 20 to 50 percent of the surface. As much as 30 percent of the profile is cobblestones. The R horizon is white, tuffaceous igneous rock.

The dry color of Toomes soils in Solano County differs from that of Toomes soils mapped elsewhere in California because they have values of 6 and 7 instead of 4 and 5. Toomes stony loam, 30 to 75 percent slopes, eroded, is also shallower than is typical for the series.

Toomes stony loam, 30 to 75 percent slopes, eroded (ToG2).—This soil has a profile similar to the profile described as representative for the series, except it is only 5 to 10 inches deep to rock. Stones and cobblestones cover 20 to 50 percent of the surface area, and cobblestones make up 15 to 30 percent of the soil by volume. Rock outcrops are common on the steeper slopes. Included with this soil in mapping are areas of Hambright loam and Hambright stony loam.

Runoff is rapid to very rapid, and erosion is a very high hazard. The available water capacity is less than 1 inch. The rooting depth is 5 to 10 inches.

This soil is used mostly for watershed, but it is also used for wildlife habitat and recreation. Capability unit VIIIs–1 (15); not placed in a range site.

Trimmer Series

The Trimmer series consists of well-drained soils on mountainous uplands. These soils are underlain by basic igneous rock at a depth of 22 to 40 inches. Slopes are 9 to 30 percent. The vegetation is mostly annual grasses and scattered oaks. The average annual temperature is 58° to 60° F., the average annual rainfall is 20 to 25 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 500 to 1,700 feet.

In a representative profile, the surface layer is grayish-brown and brown loam about 20 inches thick. The subsoil is brown clay loam about 20 inches thick. The substratum is hard, fractured basic igneous rock.

Permeability is moderately slow in the subsoil. The available water capacity is 3.5 to 7.0 inches. The effective rooting depth is 22 to 40 inches.

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

Following is a representative profile of Trimmer loam:

A11—0 to 4 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; hard, friable, nonsticky, nonplastic; many very fine roots; common very fine tubular pores; medium acid; clear, smooth boundary.

A12—4 to 14 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; hard, friable, nonsticky, nonplastic; many very fine roots; many very fine and fine tubular pores and many very fine interstitial pores; medium acid; clear, smooth boundary.

A13—14 to 20 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) when moist; moderate, fine, granular structure; hard, friable, slightly sticky, slightly plastic; few very fine roots; many very fine and fine tubular pores and many very fine and fine interstitial pores; slightly acid; clear, smooth boundary.

B2t—20 to 40 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate, fine, granular structure; hard, friable, sticky, plastic; few very fine roots; common very fine and fine tubular pores and many very fine interstitial pores; common thin clay films in pores and on ped faces; neutral; abrupt, irregular boundary.

R—40 to 46 inches, hard basic igneous rock.

The A horizon ranges from loam to cobbly loam in texture and from 12 to 20 inches in thickness. The B horizon ranges from brown to reddish brown in color, from clay loam to cobbly clay loam in texture, from slightly acid to neutral in reaction, and from 10 to 22 inches in thickness. The R horizon is hard basic igneous rock that ranges from 22 to 40 inches in depth. Cobblestones make up less than 20 percent of the profile by volume.

Trimmer loam, 9 to 30 percent slopes (TrE).—This soil is on mountainous uplands. Included with it in mapping are small areas of Hambright loam and areas of soils that are loam throughout the profile.

Runoff is medium, and erosion is a moderate hazard.

This soil is used mostly for pasture. It is also used for range, wildlife habitat, recreation, and watershed. Capability unit IVe–1 (15); Fine Loamy range site.

Trimmer Series, Shallow Variant

The Trimmer series, shallow variant, consists of well-drained soils on mountainous uplands. These soils are underlain by weathered basic igneous rock at a depth of 11 to 20 inches. Slopes are 15 to 50 percent. The vegetation is annual grasses and scattered oaks. The average annual temperature is 58° to 60° F., the average annual rainfall is 22 to 27 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 500 to 1,000 feet.

In a representative profile, the surface layer is very dark gray cobbly clay loam about 5 inches thick. The subsoil is dark-gray cobbly clay about 8 inches thick. The substratum is light-gray basaltic rock.

Permeability in the subsoil is slow. The available water capacity is 1.5 to 3.0 inches. Effective rooting depth is 11 to 22 inches.

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

Following is a representative profile of Trimmer cobbly clay loam, shallow variant, 15 to 50 percent slopes:

A1—0 to 5 inches, very dark gray (10YR 3/1) cobbly clay loam, very dark gray (10YR 3/1) when moist; moderate, medium, subangular blocky structure; hard, friable, sticky, plastic; many very fine roots; many very fine pores; medium acid; 3-inch to 6-inch, angular basalt cobblestones make up 40 to 50 percent of the horizon by volume; gradual, smooth boundary.

B2t—5 to 13 inches, dark-gray (10YR 4/1) cobbly clay, very dark gray (10YR 3/1) when moist; moderate, medium, angular blocky structure; very hard, firm, sticky, plastic; common very fine roots; common very fine pores; common thin clay films on ped faces and in pores; slightly acid; 3-inch to 6-inch angular basalt cobblestones make up 40 to 50 percent of the horizon by volume; abrupt, smooth boundary.

R—13 to 17 inches, light-gray basaltic rock.

The A horizon ranges from very dark gray to very dark grayish brown in color, from clay loam to loam in texture, from medium acid to strongly acid in reaction, and from 5 to 10 inches in thickness. The B horizon ranges from dark gray to dark grayish brown in color, from clay to heavy clay loam in texture, from medium acid to slightly acid in reaction, and from 6 to 10 inches in thickness. Cobblestones make up 20 to 50 percent of the profile by volume. Depth to rock is 11 to 20 inches.

Trimmer cobbly clay loam, shallow variant, 15 to 50 percent slopes, eroded (TsF2).—This soil is on mountainous uplands. Included with it in mapping are small areas of Millsholm loam.

Runoff is medium to rapid, and erosion is a moderate hazard.

This soil is used mostly for range, but it is also used for recreation and wildlife habitat. Capability unit VIIe–1 (15); Shallow Loamy range site.

Tujunga Series

The Tujunga series consists of nearly level, excessively drained soils in dredge spoil areas. These soils consist of mixed dredged alluvium. The vegetation is very sparse annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 5 to 40 feet.

In a representative profile, the soil is light brownish-gray to yellowish-brown fine sand and sand that extends to a depth of more than 60 inches.

Permeability is rapid. The available water capacity is 3.5 to 4.5 inches. The effective rooting depth is more than 60 inches.

Tujunga soils are used for irrigated orchards, pasture, wildlife habitat, and recreation.

Following is a representative profile of Tujunga fine sand:

C1—0 to 12 inches, light brownish-gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) when moist; single grain; loose, nonsticky, nonplastic; many very fine roots and few fine roots; many very fine interstitial pores; neutral; abrupt, smooth boundary.

C2—12 to 45 inches, yellowish-brown (10YR 5/4) sand, dark brown (10YR 3/3) when moist; single grain; loose, nonsticky, nonplastic; common very fine roots; many very fine interstitial pores; slightly acid; abrupt, smooth boundary.

C3—45 to 60 inches, light brownish-gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) when moist; single grain; loose, nonsticky, nonplastic; common, very fine roots; many very fine interstitial pores; slightly acid.

Tujunga fine sand (Tu).—This soil consists of mixed dredged alluvium. Included with it in mapping are small areas of Columbia sandy loam and areas of soils that have silt lenses throughout the profile.

Runoff is very slow. Erosion is a slight to moderate hazard.

This soil is used mostly for irrigated walnuts, grapes, and pasture. It is also used for melons, wildlife habitat, recreation, and construction fill material. Capability unit IIIs–4 (17); not placed in a range site.

Valdez Series

The Valdez series consists of nearly level, poorly drained soils on alluvial fans and in dredge spoil areas. These soils formed in mixed alluvium. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 58° to 60° F., the average annual rainfall is 16 to 19

inches, and the frost-free season is 250 to 270 days. Elevation ranges from near sea level to 15 feet above sea level.

In a representative profile, the surface layer is light brownish-gray and mottled light-gray and yellowish-brown silty clay loam about 12 inches thick. The subsoil is mottled light-gray, light yellowish-brown, and yellowish-brown, stratified silty clay loam and very fine sandy loam about 20 inches thick. The substratum is mottled, light brownish-gray and pale-brown, stratified silty clay loam, silt loam, and very fine sandy loam and extends to a depth of more than 60 inches.

The water table fluctuates to within 12 inches of the surface.

Valdez soils are used for irrigated row crops, forage crops, dryfarmed small grain, wildlife habitat, and recreation.

Following is a representative profile of Valdez silty clay loam:

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) silty clay loam that has common, medium, prominent, strong-brown (7.5YR 5/6) mottles, brown (10YR 4/3) and has common, medium, prominent, strong-brown (7.5YR 4/6) mottles when moist; weak, fine, subangular blocky structure; hard, friable, sticky, plastic; common fine and medium roots, many very fine roots; common tubular pores; common medium and few very fine tubular pores; slightly acid; clear, smooth boundary.

A1—5 to 12 inches, mottled light-gray (10YR 6/1 and 2.5Y 7/2) and yellowish-brown (10YR 5/6) silty clay loam, brown (10YR 5/3) when moist and has common, medium, prominent, strong-brown (7.5YR 5/6) mottles and common, large, prominent, dark reddish-brown (5YR 3/4) mottles; weak, thin, platy structure and weak, medium, prismatic structure; hard, friable, sticky, plastic; common fine and medium roots and many very fine roots; common very fine tubular pores; medium acid; clear, smooth boundary.

B2—12 to 32 inches, mottled light-gray (10YR 7/1), light yellowish-brown (10YR 6/4), and yellowish-brown (10YR 5/8), stratified silty clay loam and very fine sandy loam, grayish brown (10YR 5/2) and has many, large, prominent, strong-brown and dark reddish-brown mottles (7.5YR 5/6, 5YR 3/4) when moist; thin, platy structure in very fine sandy loam and medium, angular blocky structure in silty clay loam; hard, firm; very fine sandy loam is nonsticky and slightly plastic, silty clay loam is sticky and plastic; common very fine roots; common very fine tubular pores; medium acid; clear, smooth boundary.

C1—32 to 45 inches, light brownish-gray (10YR 6/2) silty clay loam that has many, large, prominent, strong-brown (7.5YR 5/6) mottles, dark grayish-brown (10YR 4/2) and has strong-brown and reddish-brown (7.5YR 5/6, 5YR 4/4) mottles when moist; compound structure is strong, thin, platy and moderate, medium, prismatic; hard, firm, sticky, plastic; common very fine exped roots; few very fine tubular pores; medium acid; clear, smooth boundary.

C2—45 to 50 inches, pale-brown (10YR 6/3) silt loam that has many, large, prominent, reddish-brown (5YR 4/4) mottles, brown (10YR 4/3) and has many, large, prominent, reddish-brown and dark reddish-brown (5YR 4/4, 3/4) mottles when moist; moderate, thin, platy structure parting to moderate, fine, angular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine roots; few very fine tubular pores; slightly acid; abrupt, smooth boundary.

C3—50 to 60 inches, light brownish-gray (10YR 6/2) very fine sandy loam that has common, medium, distinct, yellowish-brown (10YR 5/4) mottles and few, large, prominent, reddish-brown (5YR 4/4) mottles, dark grayish-brown (10YR 4/2) and has common, medium, distinct, dark yellowish-brown mottles (10YR 4/4) and few, large, prominent, dark reddish-brown (5YR 3/4) mottles when moist; weak, thin, platy structure; slightly hard, very friable, nonsticky, slightly plastic; few very fine roots; few very fine tubular pores; medium acid.

The A horizon ranges from yellowish brown, light brownish gray, or pale brown to light gray in color and has distinct to prominent mottles in places. The A horizon ranges from silty clay loam to silt loam in texture and from 10 to 15 inches in thickness. The B2 horizon ranges from light gray or pale brown to yellowish brown in color and has distinct to prominent mottles. It is silty clay loam in texture and has thin strata of very fine sandy loam, sandy loam, and silt loam. Reaction is medium acid to neutral, thickness is 16 to 25 inches, and salinity is slight to moderate. The C horizon ranges from light gray to pale olive or light brownish gray in color and has distinct to prominent mottles. Texture ranges from silty clay loam to sandy loam, reaction from medium acid to moderately alkaline, and salinity from moderate to strong. The profile commonly is stratified. Some profiles have a buried clay substratum at a depth of 35 to 50 inches.

Valdez silt loam, drained (Va).—This soil has a profile similar to the one described as representative for the series, except that the texture is silt loam throughout the profile and the soil does not contain an excessive amount of harmful salts. Artificial drainage ditches maintain the fluctuating water table below a depth of 4 feet. Included with this soil in mapping are small areas of Columbia sandy loam.

Permeability is moderately slow. Runoff is slow, and erosion is a slight hazard. The available water capacity is 9 to 11 inches. The effective rooting depth is 48 inches to more than 60 inches.

This soil is used mostly for irrigated sugar beets, tomatoes, alfalfa, and grain sorghum. It is also used for dryfarmed small grain, pasture, wildlife habitat, and recreation. Capability unit IIw–2 (17) ; not placed in a range site.

Valdez silty clay loam (Vc).—This soil has the profile described as representative for the series. Included with it in mapping are small areas of Reyes silty clay and some areas of soils that have a silty clay surface layer.

Permeability is moderately slow. Runoff is slow, and erosion is a slight hazard. The available water capacity is 6 to 8 inches. The water table is at a depth of 36 to 60 inches and limits the rooting depth of most plants. The effective rooting depth is 60 inches or more where this soil is drained.

This soil is used mostly for wildlife habitat. It is also used for dryfarmed barley, pasture, and recreation. Capability unit IIIw–6 (16); not placed in a range site.

Valdez silty clay loam, wet (Vd).—This soil has a profile similar to the one described as representative for the series, except that it is strongly saline throughout. This soil formed in dredged material pumped from saline bodies of water. The thickness of the dredged deposit ranges from a few inches to more

than 5 feet. Included with this soil in mapping are small areas of Reyes silty clay.

Permeability is slow. Runoff is very slow, and erosion is a slight hazard. The water table is at a depth of 12 to 20 inches and limits the rooting depth of most plants. The available water capacity is 6 to 8 inches and the effective rooting depth is 60 inches or more where this soil is drained.

This soil is used mostly for wildlife habitat. It is also used for pasture and recreation. Capability unit VIw–1 (16) ; not placed in a range site.

Valdez silty clay loam, clay substratum (Ve).—This soil has a profile similar to the one described as representative for the series, except that it is underlain by a buried clay soil at a depth of 35 to 50 inches. It is moderately to strongly saline. Included with this soil in mapping are small areas of Reyes silty clay and Tamba mucky clay.

Permeability is slow. Runoff is slow, and erosion is a slight hazard. The available water capacity is 6 to 7.5 inches and the effective rooting depth is more than 60 inches where this soil is drained. The water table fluctuates between depths of 3 feet and about 5 feet. Some plants roots are restricted by the buried clay substratum and by the water table.

This soil is used mostly for wildlife habitat. It is also used for pasture, dryfarmed barley, and recreation. Capability unit IVw–6 (16) ; not placed in a range site.

Willows Series

The Willows series consists of nearly level, poorly drained alkali soils in basins. These soils formed in mixed alluvium. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 60° to 62° F., the average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Elevation ranges from 5 to 50 feet.

In a representative profile, the surface layer is gray clay about 14 inches thick. The next layers are grayish-brown and light-gray clay about 23 inches thick. The substratum is mottled light olive-gray and light yellowish-brown clay and mottled greenish-gray and brownish-yellow heavy sandy clay loam. It extends to a depth of more than 60 inches.

Permeability is slow. The available water capacity is 6 to 8 inches. The effective rooting depth is 60 inches.

Willows soils are used for irrigated row crops, pasture, dryfarmed small grain, wildlife habitat, and recreation.

Following is a representative profile of Willows clay:

A11—0 to 14 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) when moist; strong, very coarse, prismatic structure parting to strong, very coarse, angular blocky structure; extremely hard, very firm, sticky, plastic; common very fine roots; common very fine tubular and interstitial pores; moderately alkaline; very slightly effervescent, disseminated lime and fine-sized rounded lime concretions; gradual, smooth boundary.

A12—14 to 22 inches, grayish-brown (2.5Y 5/2) clay that has common, medium, prominent, white (10YR 8/2) mottles, grayish brown (2.5Y 5/2) and has common, medium, prominent, white (10YR 8/2) mottles when moist; moderate, very coarse, prismatic structure; extremely hard, very firm, sticky, plastic; very few very fine roots; common very fine tubular pores; strongly alkaline; slightly effervescent, segregated lime in medium-sized soft masses; few slickensides; gradual, smooth boundary.

A13—22 to 37 inches, light-gray (10YR 6/1) clay, grayish brown (2.5Y 5/2) when moist; massive; extremely hard, very firm, sticky, plastic; very few very fine and medium roots; common very fine tubular pores; very strongly alkaline; very slightly effervescent, segregated lime in medium-sized soft masses; common intersecting slickensides; gradual, wavy boundary.

C1—37 to 46 inches, mottled light olive-gray (5Y 6/2) and light-yellowish brown (10YR 6/4) clay, mottled olive gray (5Y 5/2) and yellowish brown (10YR 5/4) when moist; massive; extremely hard, very firm, sticky, plastic; common very fine tubular pores; strongly alkaline; slightly effervescent, segregated lime in medium-sized soft masses; common intersecting slickensides; gradual, smooth boundary.

C2—46 to 61 inches, mottled greenish-gray (5GY 6/1) and brownish-yellow (10YR 6/6) heavy sandy clay loam, mottled greenish gray (5GY 6/1) and yellowish brown (10YR 5/6) when moist; massive; extremely hard, firm, sticky, plastic; common very fine tubular pores; strongly alkaline.

The A horizon ranges from light gray or dark gray to grayish brown in color. It is clay or silty clay in texture and 25 to 37 inches in thickness. The exchangeable sodium percentage ranges from 15 to 25 percent within a depth of 10 to 40 inches. The C horizon ranges from mottled light olive brown to mottled greenish gray in color, from sandy clay loam to clay in texture, and from strongly alkaline to moderately alkaline in reaction.

Willows clay (Wc).—This soil is in basins. It is moderately affected by alkali and is slightly saline in places. Included with this soil in mapping are small areas of Pescadero clay loam, Omni silty clay, and Capay clay.

Runoff is very slow, and erosion is a slight hazard.

This soil is used mostly for sugar beets and dryfarmed barley. It is also used for pasture, wildlife habitat, and recreation. Capability unit IVw–6 (17) ; not placed in a range site.

Yolo Series

The Yolo series consists of nearly level, well-drained soils on alluvial fans. These soils formed in mixed alluvium derived from sedimentary rocks. Where these soils are not cultivated, the vegetation is annual grasses and forbs. The average annual temperature is 60° to 62° F., the average annual rainfall is 18 to 25 inches, and the frost-free season is 240 to 260 days. Elevation ranges from 25 to 150 feet.

In a representative profile, the surface layer is dark grayish-brown silty clay loam about 28 inches thick. The next layer is brown clay loam about 8 inches thick. The substratum is brown loam that extends to a depth of more than 60 inches.

The effective rooting depth is more than 60 inches.

Yolo soils are used for orchards, irrigated row crops, forage crops, truck crops, dryfarmed small grain, wildlife habitat, and recreation.

Following is a representative profile of Yolo silty clay loam:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; massive; hard, friable, sticky, plastic; many very fine roots, few fine roots; common very fine pores; mildly alkaline; abrupt, wavy boundary.

A11—9 to 18 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable, sticky, plastic; few fine and very fine roots; few fine pores and common very fine pores; mildly alkaline; thin films on ped faces and in pores; gradual, wavy boundary.

A12—18 to 28 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, angular blocky structure; hard, friable, sticky, plastic; few fine and coarse roots; common fine pores; neutral; increase in films (may be organic staining) on ped faces; clear, wavy boundary.

AC—28 to 36 inches, brown (10YR 4/3) light clay loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and medium roots; many very fine and fine pores; mildly alkaline; thin very dark grayish-brown (10YR 3/2) films on ped faces; gradual, wavy boundary.

C1—36 to 44 inches, brown (10YR 5/3) loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine and coarse roots; common fine and very fine pores; mildly alkaline; thin films on ped faces; gradual, wavy boundary.

C2—44 to 60 inches, brown (10YR 5/3) loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky stucture; slightly hard, very friable, slightly sticky, slightly plastic; few fine and coarse roots; common fine and very fine pores; mildly alkaline; thin films (may be organic staining) on ped faces.

The A horizon ranges from dark grayish brown to grayish brown in color, from silty clay loam to loam in texture, from slightly acid to moderately alkaline in reaction, and from 18 to 36 inches in thickness. The C horizon ranges from brown to yellowish brown in color. It is loam or silt loam in texture and neutral to moderately alkaline in reaction.

Yolo loam (Yo).—This soil has a profile similar to the profile described as representative for the series, except that it has a loam texture throughout. Included with this soil in mapping are small areas of Reiff fine sandy loam, Brentwood clay loam, Yolo silty clay loam, and Sycamore silty clay loam.

Permeability is moderate. Runoff is slow, and erosion is a slight hazard. The available water capacity is 9 to 11 inches.

The soil is used mostly for almonds, peaches, apricots, walnuts, sugar beets, corn, tomatoes, and alfalfa (fig.15). It is also used for dryfarmed barley, urban development, wildlife habitat, and recreation. Capability unit I–1 (17); not placed in a range site.

Yolo loam, clay substratum (Yr).—This soil has a profile similar to the one described as representative for the series, except that the surface layer is loam and a buried clay subtratum is at a depth of 40 to 60 inches. Included with this soil in mapping are small areas of Reiff fine sandy loam, Yolo loam, Sycamore silty clay loam, Brentwood clay loam, and a soil that has a clay substratum at a depth of 20 to 40 inches.

Figure 15.—**Irrigated field corn on Yolo loam.**

Permeability is slow. Runoff is slow, and erosion is a slight hazard. The available water capacity is 9 to 11 inches.

This soil is used for irrigated sugar beets, tomatoes, grain sorghum, and alfalfa. It is also used for dryfarmed barley, wildlife habitat, and recreation. Capability unit IIs–3 (17); not placed in a range site.

Yolo silty clay loam (Ys).—This soil has the profile described as representative for the series. Included with it in mapping are small areas of Reiff fine sandy loam, Brentwood clay loam, and Sycamore silty clay loam.

Permeability is moderately slow. Runoff is slow, and erosion is a slight hazard. The available water capacity is 10 to 12 inches.

This soil is used mostly for almonds, peaches, sugar beets, tomatoes, alfalfa, walnuts, and dryfarmed barley. It is also used for urban development, wildlife habitat, and recreation. Capability unit I–1 (17); not placed in a range site.

Use and Management of the Soils

The system of capability classification commonly used by the Soil Conservation Service is described in this section. Modifications based on climatic differences of the three land resource areas in the county are also listed. The capability units are explained, and suggestions for managing the soils in each capability unit are given. Following this, predicted yields of the principal crops are given and the management required to obtain those yields is described. Then the Storie index and the vegetative soil groups are explained. Finally, management of the soils of the range

sites and wildlife groups is described, and engineering uses of the soils are discussed.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for common field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or to other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range or engineering.

In the capability system, the 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, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat. (None in Solano County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to grazing, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants 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; *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, saline, or stony; and *c*, used only in some parts of the United States but not in Solano County, shows that the chief limitation is climate that is too cold or too dry.

In capability class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only the subclasses indicated by w, s, and c, because the soils in this class 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 classes I through IV in California are given numbers to indicate the chief kind of limitation responsible for placement of the soils in the capability class and subclass. For this reason, some of the units in the subclasses are not numbered consecutively, and their symbols are a partial indication of soil features. In California the numerals used to designate units within the classes and subclasses are these:

0. A limitation caused by very gravelly material in the substratum.
1. An actual or potential erosion hazard.
2. A wetness limitation caused by poor drainage or flooding.
3. A limitation caused by slow permeability or very slow permeability in the subsoil.
4. A limitation caused by coarse soil texture or excessive gravel.
5. A limitation caused by fine soil texture.
6. A limitation caused by salt or alkali.
7. A limitation caused by stones or cobblestones.
8. A limitation caused by shallow depth of soil over bedrock or hardpan.
9. A limitation caused by low fertility.
10. A limitation caused by high content of organic matter.

Soils in classes VI through VIII are given the nonconnotative numeral 1.

Land resource areas

In Solano County, capability classification is further refined by designating the land resource area in which the soils in a unit occur. A land resource area is a broad geographic area that has a distinct combination of climate, soils, management needs, and cropping systems. The 48 conterminous States in the nation have been divided into 156 land resource areas. Parts of three of these areas are in Solano County. These areas are designated nationally as 15, 16, and 17 (*4*). Land resource area 15 is made up of the Central California

Coast Range, part of which is along the western side of Solano County. Land resource area 16 is made up of the California Delta, part of which is along the southern side of the county. Land resource area 17 is made up of the Sacramento Valley, which includes the eastern half of Solano County. The number of the resource area is added, in parentheses, to the class, subclass, and unit designation for complete identification of the capability unit.

It is necessary to make assumptions that affect management in a land resource area if soils are to be placed consistently in capability units. In the paragraphs that follow, those land resource areas having parts within Solano County are described so that local farming can be related to resource areas. Included in the discussion of each resource area are those conditions typical of the area that guided placement of the soils in capability classes and units.

Land resource area 15.—This area includes the mountainous uplands and the dissected terraces along the western and southeastern sides of the county. The soils in this resource area are gently sloping to extremely steep. Elevation ranges from 10 to 3,000 feet. Rainfall is 15 to 40 inches, but less than an inch falls in summer. The growing season is 220 to 290 days. The actual evapotranspiration (4Ea) of a soil in this resource area is 10 to 12 inches (*3*). Irrigation water generally is not available.

The gentler slopes are used mostly for dryland grain and pasture. The steeper slopes are used for range, wildlife habitat, and recreation. Irrigated soils within this resource area are treated the same as outlying sections of land resource area 17.

Land resource area 16.—This area includes the salt water marshes in the south-central part of the county and a small area of mineral soils that have high organic-matter content in the southeastern part of the county. Slopes are nearly level. Elevation ranges from 10 feet below sea level to 15 feet above sea level. Rainfall is 15 to 20 inches, but less than an inch falls in summer. The growing season is 240 to 280 days.

The salt water marsh is used mostly for waterfowl hunting and pasture. The rest of the soils of this resource area are irrigated for intensive cultivation.

Land resource area 17.—This area includes that part of the county that is in valleys and makes up about half of the county. Most areas of the soils are nearly level, but they range to hilly. Elevation ranges from 5 feet below sea level to 250 feet above sea level. Rainfall is 16 to 25 inches, but less than an inch falls in summer. The growing season is 240 to 320 days.

Most of this resource area is irrigated for intensive cultivation. The rest of the area is used for dryfarmed grain or pasture.

The land capability classification for this resource area is based primarily on the criteria for irrigated land.

Areas in the Sacramento River bypass that are subject to flooding are assumed to have a continuing overflow problem.

Content of salts or alkali, or both, in most soils can be reduced but not completely eliminated.

Management by capability units

In the following pages, the capability units of Solano County are described and suggestions for use and management are given. The soils in each unit are listed in the "Guide to Mapping Units" at the back of this survey. For more information on the use of the soils in capability classes VI through VIII for range, see the section "Range."

CAPABILITY UNIT I-1(17)

This unit consists of well-drained soils and of poorly drained soils on which the drainage has been improved so that the water table is no longer a limitation. These soils have a fine sandy loam to silty clay loam surface layer. They formed in alluvium from mixed sources on alluvial fans. Slopes are 0 to 2 percent. The average annual rainfall is 18 to 25 inches, and the frost-free season is 240 to 290 days. Permeability is moderately rapid to moderately slow. Runoff is slow to very slow. Erosion is a slight hazard. Available water capacity is 7.5 to 12 inches. The effective rooting depth is more than 60 inches.

Soils in this unit are suited to irrigated row crops, forage crops, and orchards, and to dryfarmed small grain. Sugar beets, tomatoes, alfalfa, almonds, apricots, prunes, and barley are the main crops grown (fig. 16).

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Returning all crop residue to the soil helps to maintain tilth. Proper tillage minimizes soil compaction. In orchards, soil tilth and water intake can be improved by growing cover crops and green-manure crops, and mulching, or by using a program for controlling weeds that does not include tillage. Leveling is needed for management of irrigation water, and this leveling can easily be accomplished. Good management of irrigation water conserves water and reduces the leaching of nutrients.

Nitrogen and phosphorus are needed for good crop growth. The supply of potassium is generally sufficient for most crops.

CAPABILITY UNIT IIe-1(17)

Brentwood clay loam, 2 to 9 percent slopes, is the only soil in this unit. This is a well-drained soil that formed in alluvium from mixed sources. It is on alluvial fans. The average annual rainfall is 18 to 25 inches, and the frost-free season is 260 to 280 days. Permeability is moderately slow. Runoff is medium. Erosion is a slight hazard. Available water capacity is 10 to 12 inches. The effective rooting depth is more than 60 inches.

This soil is used for irrigated field crops, dryfarmed field crops, and orchards. Apricots, prunes, walnuts, alfalfa, and barley are the main crops grown.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Crossslope cultivation is needed to reduce erosion. Returning all crop residue to the soil helps to maintain tilth. In orchards, soil tilth and water intake can be im-

Figure 16.—Alfalfa on Brentwood clay loam, 0 to 2 percent slopes.

proved by growing cover crops and green-manure crops, and mulching, or by using a program for controlling weeds that does not include tillage. Leveling for irrigation or for smoothing out irregularities of slope can be done without permanently damaging the soil. Good management of irrigation water conserves water and helps to control erosion. Sprinkler irrigation should be used on the steeper slopes.

Nitrogen and phosphorus are needed for good crop growth.

CAPABILITY UNIT IIe-3(17)

This unit consists of well-drained loams and clay loams that have a heavy clay loam subsoil. These soils formed in alluvium washed from soils derived from sedimentary rocks. They are on alluvial fans. Slopes are 2 to 9 percent. The average annual rainfall is 20 to 25 inches, and the frost-free season is 240 to 260 days. Permeability is slow. Runoff is slow to medium. Erosion is a slight hazard. Available water capacity is 9 to 12 inches. The effective rooting depth is more than 60 inches.

Soils in this unit are suited to irrigated field crops, orchards, and pasture, and to dryfarmed grain. Prunes, alfalfa, and barley are the main crops grown.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Returning all crop residue to the soil helps to maintain tilth, reduces runoff and erosion, and improves water intake. Cross-slope cultivation is needed to reduce erosion. Proper tillage minimizes soil compaction and reduces runoff and erosion. In orchards, soil tilth, control of erosion, and water intake can be improved by growing cover crops and green-manure crops, and mulching, or by using a program for controlling weeds that does not include tillage. Leveling should be done cautiously to avoid excessive exposure of the slowly permeable subsoil. Good management of irrigation water conserves water and helps to control erosion.

Nitrogen and phosphorus are needed for good crop growth.

CAPABILITY UNIT IIs-3(17)

This unit consists of well-drained to moderately well drained loams to silty clay loams. These soils have a heavy clay loam to clay subsoil or a buried clay substratum. They formed in alluvium from mixed sources on alluvial fans and in basins. Slopes are 0 to 2 percent. The average annual rainfall is 16 to 25 inches, and the frost-free season is 240 to 290 days. Permeability is slow. Runoff is slow to very slow, and erosion is a slight hazard. Available water capacity is 9 to 12 inches. The effective rooting depth is more than 60 inches.

Soils in this unit are suited to irrigated row crops, field crops, and some orchard crops, and to dryfarmed small grain. Sugar beets, tomatoes, alfalfa, almonds, prunes, and barley are the main crops grown.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Returning all crop residue to the soil helps to

maintain tilth and improves water intake. Proper tillage minimizes soil compaction. In orchards, soil tilth and water intake can be improved by growing cover crops and green-manure crops, and mulching, or by using a program for controlling weeds that does not include tillage. Leveling for irrigation can be done without permanently damaging the soil. Good management of irrigation water is essential to prevent waterlogging of the soils and to prevent the formation of a perched water table.

Nitrogen and phosphorus are needed for good crop growth.

CAPABILITY UNIT IIs-4(17)

Conejo gravelly loam is the only soil in this unit. This is a well-drained soil that formed in alluvium from basic igneous rock and is on alluvial fans. Slopes are 0 to 1 percent. Average annual rainfall is 20 to 25 inches, and the frost-free season is 260 to 290 days. Permeability is moderate, runoff is slow, and erosion is a slight hazard. The available water capacity is 7 to 9 inches. The effective rooting depth is more than 60 inches.

This soil is used for orchards. The main crops grown are cherries, peaches, and grapes.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning all crop residue to the soil helps to maintain tilth. In orchards, soil tilth and water intake can be improved by growing cover crops and green-manure crops, and mulching, or by using a program for controlling weeds that does not include tillage. Leveling can be done without damaging the soil. Good management of irrigation water conserves water and reduces the leaching of nutrients.

Nitrogen and phosphorus are needed for good crop growth.

CAPABILITY UNIT IIs-5(17)

This unit consists of moderately well drained soils. These soils formed in alluvium from mixed sources and are on basin rims and in basins. Slopes are 0 to 2 percent. Average annual rainfall is 16 to 22 inches, and the frost-free season is 260 to 290 days. Permeability is slow. Runoff is very slow, and there is no hazard of erosion. The available water capacity is 8 to 10 inches. The effective rooting depth is more than 60 inches.

These soils are used for irrigated row crops and field crops, and for dryfarmed field crops. Sugar beets, tomatoes, grain sorghum, alfalfa, and barley are the main crops (fig. 17).

A suitable conservation cropping system consists of legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning all crop residue to the soil helps to maintain tilth and to improve water intake. These soils can be tilled only when moist. If worked when too dry, the soils form large, hard clods, and if worked when too wet, the soils seal over. Leveling is needed for management of irrigation water, and surface drainage should be provided. Careful management of irrigation water is necessary to prevent waterlogging and the formation of a perched water table.

Figure 17.—**Irrigated sugar beets on Capay clay.**

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIw-2(17)

This unit consists of somewhat poorly drained to poorly drained fine sandy loams to silty clay loams and of normally well-drained clay loams and loams that now have a fluctuating water table. All the soils formed in alluvium from mixed sources and are on alluvial fans. Slopes are 0 to 2 percent. Average annual rainfall is 16 to 25 inches, and the frost-free season is 250 to 290 days. Permeability is moderately rapid to moderately slow. Runoff is slow to very slow. Erosion is a slight hazard. Available water capacity is 7.5 to 12.0 inches. The water table is at a depth of 36 to 60 inches.

The soils in this unit are suited to irrigated row crops, hay crops, and orchards, and to dryfarmed small grain. Sugar beets, tomatoes, alfalfa, pears, prunes, and barley are the main crops grown. Long-lived, deep-rooted, deciduous fruit and nut trees are not well suited to the soils in this unit.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Returning crop residue to the soil helps to maintain tilth. Proper tillage minimizes soil compaction (fig. 18). In orchards, soil tilth and water intake can be improved by growing cover crops and green-manure crops, and mulching, or by using a program for controlling weeds that does not include tillage. Leveling is easily accomplished and is essential for good irrigation water management. Excess surface water must be removed. Good management of irrigation

Figure 18.—Management of crop residue on Sycamore silty clay loam.

water prevents waterlogging of the soil and keeps the high water table from rising higher. Open drains and tile drains help to maintain the water table at a fairly uniform depth.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIIe-1(15)

Millsholm loam, moderately deep variant, 2 to 9 percent slopes, is the only soil in this unit. This is a well drained soil that is underlain by sandstone at a depth of 20 to 36 inches. Slopes are 2 to 9 percent. Average annual rainfall is 20 to 25 inches, and the frost-free season is 230 to 250 days. Permeability is moderate, runoff is medium, and erosion is a slight hazard. The available water capacity is 3.5 to 5.5 inches. The effective rooting depth is 20 to 36 inches.

This soil is used for dryfarmed small grain, pasture, hay, and some orchard crops. The main dryfarmed grain is barley. Lana vetch and Hardinggrass are excellent for dry-farmed pasture. Excess pasture can be cut for hay.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction and reduces runoff and erosion. Cross-slope tillage should be practiced. Leaving crop residue and stubble on or near the surface helps to control erosion, to maintain soil tilth, and to improve water intake. Grazing should be controlled to maintain ground cover and to protect the soil from erosion.

Plants respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIIe-3(15)

This unit consists of moderately well drained and well-drained soils that have a fine sandy loam to clay loam surface layer and a heavy clay loam to clay subsoil. These soils formed on terraces in mixed alluvium washed from soils derived from sedimentary rocks or on uplands from sandstone. Slopes are 2 to 9 percent. Average annual rainfall is 16 to 30 inches, and the frost-free season 225 to 280 days. Permeability is slow to very slow, runoff is medium, and erosion is a slight to moderate hazard. Available water capacity is 4 to 7 inches. The effective rooting depth is 20 to 30 inches to a clay subsoil or 30 to 40 inches to sandstone.

These soils are used for dryfarmed small grain, pasture, and hay, and for irrigated pasture. The main small grain is barley. Lana vetch and Hardinggrass are excellent for dryfarmed pasture. Shallow-rooted grasses and legumes grow well under irrigation. Excess pasture can be used for hay.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction and reduces runoff and erosion. Cross-slope tillage should be practiced. Leaving crop residue and stubble on or near the surface helps to control erosion, to maintain soil tilth, and to improve water intake. Careful management of irrigation water is necessary to avoid saturating the soil above the clay subsoil. Saturation could cause root rot, erosion, and leaching of plant nutrients. Leveling operations should be carefully planned to avoid deep cuts that would expose the clayey subsoil or sandstone. All outlets and waterways should be protected to prevent gullying.

Crops respond to a complete fertilizer containing nitrogen and phosphorus.

CAPABILITY UNIT IIIe-5(15 and 17)

This unit consists of well-drained clays or of poorly drained clays that are now drained. These soils formed on dissected terraces in weakly consolidated sediments or on alluvial fans in alluvium washed from soils derived from sedimentary rocks. Slopes are 2 to 9 percent. Average annual rainfall is 15 to 23 inches, and the frost-free season is 250 to 290 days. Permeability is slow, runoff is slow to medium, and erosion is a slight hazard. The available water capacity is 4 to 10 inches. The effective rooting depth is 28 inches to more than 60 inches.

These soils are used for dryfarmed small grain, pasture, and hay. The main dryfarmed grains are barley and wheat. Lana vetch and Hardinggrass are excellent for dryfarmed pasture. Excess pasture can be cut for hay.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction and reduces runoff and erosion. Crossslope tillage should be practiced. Leaving crop residue on or near the surface helps to maintain soil tilth, improves water intake, and aids in controlling erosion. Permanent vegetation protects waterways from erosion. Cover is needed in winter and in spring to control erosion. These soils form large cracks when dry, but the cracks close when the soils are thoroughly wetted. If these soils are tilled when too dry, they form large, hard clods, and if they are tilled when too wet, they seal over.

Crops respond to a complete fertilizer containing nitrogen and phosphorus.

CAPABILITY UNIT IIIs-3(17)

This unit consists of moderately well drained loams and fine sandy loams that have a clay or heavy clay loam subsoil. These soils formed on low terraces in alluvium washed from soils derived from sedimentary rocks. Slopes are 0 to 2 percent. Average annual rainfall is 16 to 22 inches, and the frost-free season is 250 to 280 days. Permeability is very slow, runoff is very slow, and erosion is not a hazard. The available water capacity is 4 to 6 inches. The effective rooting depth is 20 to 30 inches.

These soils are used for shallow-rooted, irrigated row crops, irrigated pasture, and dryfarmed grain. The main crops are sugar beets, grain sorghum, and barley.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil helps to maintain tilth and improves water intake. Leveling should be done carefully to avoid exposure of the clayey subsoil. Good management of irrigation water is essential to prevent temporary waterlogging of the soil and to prevent the formation of a perched water table.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIIs-4(17)

Tujunga fine sand is the only soil in this unit. This is an excessively drained soil that formed from mixed deposits dredged from the Sacramento River. Slopes are 0 to 3 percent. Average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Permeability is rapid, runoff is very slow, and erosion is a slight hazard. The available water capacity is 3.5 to 4.5 inches. The effective rooting depth is more than 60 inches.

This soil is used for limited dryland pasture and irrigated orchard.

A suitable conservation system includes legumes and crops that produce a large amount of residue. Returning crop residue to the surface layer helps to control soil blowing, improves tilth, and maintains fertility. In orchards, soil tilth and water intake can be improved by growing cover crops and green-manure crops, and mulching, or by using a program for controlling weeds that does not include tillage. Proper management of irrigation water requires careful planning to prevent the leaching of nutrients and the wasting of water. Sprinkler irrigation is suitable for this soil.

Crops respond to a complete fertilizer containing nitrogen, phosphorus, and potassium.

CAPABILITY UNIT IIIw-2(16)

Ryde clay loam is the only soil in this unit. This is a poorly drained soil that contains 10 to 30 percent organic matter. It formed from mixed alluvium and hydrophytic plant remains in delta areas. Slopes are 0 to 1 percent. The average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Permeability is moderate, runoff is very slow, and erosion is a slight hazard. Where this soil is drained, the available water capacity is 10 to 12 inches and the effective rooting depth is more than 60 inches. The water table is at a depth of 36 to 48 inches.

This soil is used for irrigated row crops and field crops and for dryfarmed grain. Corn, tomatoes, grain sorghum, small grain, safflower, and sugar beets are the main crops grown.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning all crop residue to the soil helps to maintain tilth and to improve water intake. Proper management of irrigation water requires careful planning to prevent the leaching of nutrients, waterlogging the soil, and raising the water table. Sprinkler irrigation is suitable for this soil. Open drains or tile drains are needed to keep the water table below the root zone for most crops (fig. 19).

Crops respond to lime and to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIIw-3(17)

Sacramento silty clay loam is the only soil in this unit. This is a poorly drained soil that formed in alluvium from mixed sources and was deposited over buried clay in basins. Slopes are 0 to 1 percent. Average annual rainfall is 16 to 18 inches, and the frost-free season is 250 to 270 days. Permeability is slow, runoff is slow, and erosion is a slight hazard. Where this soil is drained, the available water capacity is 9 to 11 inches and the effective rooting depth is 60 inches. The water table is at a depth of 36 to 48 inches.

This soil is used for irrigated row crops and field crops and for dryfarmed grain. Tomatoes, sugar beets, corn, and barley are the main crops.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil helps to maintain tilth and improves water intake. Open drains and tile drains are needed to control the water table and

Figure 19.—Drainage ditch on Ryde clay loam.

thereby maintain a favorable condition in the rooting zone. Drainage is needed to remove excess surface water. Leveling is easily accomplished and aids in good management of irrigation water. Careful management of irrigation water is necessary to conserve water, to prevent waterlogging, and to keep the water table from rising.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIIw-5(17)

This unit consists of poorly drained clays and silty clays. These soils formed in basins in alluvium from mixed sources. Slopes are 0 to 1 percent. Average annual rainfall is 16 to 22 inches, and the frost-free season is 250 to 290 days. Permeability is slow, runoff is very slow, and erosion is a slight hazard. Where these soils are drained, the available water capacity is 7 to 10 inches and the effective rooting depth is more than 60 inches. The water table is at a depth of 20 to 60 inches.

These soils are used for irrigated row crops and field crops and for dryfarmed grain. The main crops are sugar beets, tomatoes, corn, grain sorghum, and barley.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction (fig. 20). Returning crop residue to the soil helps to maintain tilth and improves water intake. Drainage is needed to keep the water table at a suitable depth and to remove excess surface water. Leveling for irrigation and for surface drainage is not difficult, and it aids in good management of irrigation water. Management of irrigation water should be carefully planned to prevent waterlogging and to keep the water table from rising. These soils form large, hard clods if worked when too dry, and they seal over if worked when too wet.

Figure 20.—Sacramento clay fall plowed and left rough during winter has a favorable water-intake rate.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIIw-6(16, 17)

This unit consists of somewhat poorly drained silty clay loams that are affected by soluble salts. These soils formed on alluvial fans in alluvium from mixed sources. Slopes are 0 to 1 percent. Average annual rainfall is 16 to 25 inches, and the frost-free season is 250 to 270 days. Permeability is slow to moderately slow, runoff is slow, and erosion is a slight hazard. The available water capacity is 4 to 8 inches. The effective rooting depth, where these soils are drained, is more than 60 inches. The water table is at a depth of 36 to 60 inches.

These soils are used for irrigated pasture and row crops, dryfarmed field crops, and dryland pasture. The main crops are barley, grain sorghum, and hay.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil helps to maintain soil tilth and improves water intake. Open drains should be used to keep the water table at a fairly uniform depth. Salts should be leached to lower levels. Leveling of these soils is not difficult and is needed for good management of irrigation water and for land reclamation. Management of irrigation water prevents waterlogging and keeps the water table from rising.

Crops respond to fertilizers containing nitrogen and phosphorus.

CAPABILITY UNIT IVe-1(15)

This unit consists of well-drained loams. These soils formed from sandstone or basic igneous rock. Slopes are 9 to 30 percent. Average annual rainfall is 20 to 25 inches, and the frost-free season is 230 to 260 days. Permeability is moderate to moderately slow, runoff is medium, and erosion is a moderate hazard. The available water capacity is 3.5 to 7.0 inches. The effective rooting depth is 20 to 40 inches.

These soils are used for range, pasture, dryfarmed grain, and grass hay. Lana vetch or Hardinggrass is well suited to dryland pasture. Barley is the main grain grown

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction and reduces runoff and erosion. Cross-slope tillage or plowing on the contour should be practiced. Returning crop residue to the soil and stubble-mulching on or near the surface help to reduce runoff, help to maintain tilth, and improve water intake. Grazing should be controlled to maintain ground cover and to protect the soil from erosion.

Plants respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVe-3(15,17)

This unit consists of well drained to moderately well drained fine sandy loams, loams, gravelly loams, or clay loams. These soils formed on terraces in mixed alluvium derived from sedimentary rocks or formed in

places from sandstone. Slopes are 2 to 15 percent on terraces and 2 to 30 percent on uplands. Average annual rainfall is 16 to 280 days. Permeability is slow to very slow, runoff is medium, and erosion is a slight to moderate hazard. Available water capacity is 2 to 7 inches. The effective rooting depth is 12 to 20 inches to the clayey subsoil or 20 to 40 inches to sandstone.

These soils are used for dryfarmed small grain, dryland pasture, range, and irrigated pasture. Barley is the main small grain grown. Lana vetch is very suitable for dryland pasture.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction and reduces erosion. Cross-slope tillage or plowing on the contour is recommended. Returning crop residue to the soil helps to maintain tilth, improves water intake, and reduces runoff and erosion. Sprinkler irrigation is suitable for these soils, and it aids in controlling erosion. Grazing should be controlled so that enough ground cover is left to protect the soils from erosion.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVe-5(15)

This unit consists of well-drained clays. These soils formed from weakly consolidated sediments on dissected terraces. Slopes are 9 to 30 percent. The average annual rainfall is 15 to 23 inches, and the frost-free season is 250 to 280 days. Permeability is slow, runoff is medium, and erosion is a moderate hazard. The available water capacity is 4 to 9 inches. The effective rooting depth is 28 to 60 inches.

These soils are used for dryfarmed small grain, dryland pasture, and hay. The main dryfarmed grains are barley and wheat. Lana vetch and Hardinggrass are very suitable for dryland pasture. Excess pasture can be cut for hay.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage, either across the slope or on the contour, minimizes soil compaction and reduces runoff and erosion. Returning crop residue to the soil at or near the surface helps to maintain soil tilth, improves water intake, and aids in controlling erosion. Waterways should be protected from erosion by permanent vegetation. Adequate ground cover is needed in winter and in spring to control erosion.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVs-3(15, 17)

This unit consists of moderately well drained sandy loams or loams that have a heavy clay loam or clay subsoil. These soils formed on old terraces in mixed alluvium derived from sedimentary rocks or in place from sandstone. Slopes are 0 to 2 percent. The average annual rainfall is 16 to 22 inches, and the frost-free season is 240 to 280 days. Permeability is very slow, runoff is very slow to slow, and erosion is a slight hazard. The available water capacity is 2.0 to 5.5 inches. Effective rooting depth is 12 to 30 inches for most plants.

These soils are used for irrigated shallow-rooted row crops, field crops, and pasture, and for dryfarmed small grain. Grain sorghum, sugar beets, barley, and dryland pasture are the main crops.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil helps to maintain tilth and improves water intake. Leveling should be done with care to prevent cutting into the clayey subsoil. Proper management of irrigation water is necessary to prevent waterlogging and the formation of a temporary perched water table above the clayey subsoil. Frequent light applications of irrigation water are suggested because these soils have a low available water capacity.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVs-6(17)

This unit consists of somewhat poorly drained loams that have a dense clay loam subsoil that is moderately to strongly saline or alkali, or both. These soils formed on terraces and basin rims in alluvium from mixed sources. Slopes are 0 to 1 percent. The average annual rainfall is 16 to 20 inches, and the frost-free season is 250 to 270 days. Permeability is very slow, runoff is very slow, and erosion is not a hazard. Available water holding capacity is 1.5 to 2.5 inches. The effective rooting depth is 6 to 12 inches.

These soils are used for irrigated pasture, some irrigated row crops, and dryfarmed grain. Barley and sugar beets are the main crops. Irrigated pasture consists of salt-tolerant grasses and legumes.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil improves soil tilth. Drainage is needed to remove excess surface water. Leveling these soils is very difficult, but some smoothing is necessary for good management of irrigation water and for land reclamation. It is difficult to manage irrigation water on these soils, because the water intake rate is slow.

Crops respond to nitrogen and phosphorus fertilizers and to gypsum or other amendments containing sulfur.

CAPABILITY UNIT IVw-2(17)

Egbert silty clay loam, occasionally flooded, is the only soil in this unit. This is a poorly drained soil that is subject to flooding at least 1 year in 3. It formed in basins in alluvium from mixed sources. Slopes are 0 to 1 percent. The average annual rainfall is 16 to 18 inches, and the frost-free season is 260 to 280 days. Permeability is moderately slow, runoff is very slow, and erosion is a slight hazard. The available water capacity is 8 to 10 inches. The effective rooting depth, where this soil is drained, is more than 60 inches. The water table is at a depth of 48 to 60 inches.

This soil is used for irrigated row crops and field crops. The main crops are sugar beets, grain sorghum,

tomatoes, and safflower. Only summer crops should be grown, because of the hazard of flooding.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil helps to maintain tilth and improves water intake. Drainage is needed to remove excess surface water and to dry out the soils quickly after the wet season so that summer crops can be planted. Proper management of irrigation water prevents waterlogging and keeps the high water table from rising even higher. Leveling this soil is not difficult, but because material is deposited by floods, frequent leveling may be necessary.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVw-3(17)

This unit consists of poorly drained and somewhat poorly drained silty clay loams or loams that have a clay subsoil or buried saline silty clay loam soils. These soils formed in basins in alluvium from mixed sources. All the soils are subject to flooding at least 1 year in 3 for a duration of more than 48 hours. Slopes are 0 to 1 percent. The average annual rainfall is 16 to 25 inches, and the frost-free season is 250 to 270 days. Permeability is slow, runoff is slow, and erosion is a slight hazard. The available water capacity is 6 to 11 inches. The effective rooting depth is 36 to 60 inches or more. The water table is at a depth of 36 to 60 inches in places.

These soils are used in summer for growing irrigated row crops and field crops and for dryfarmed field crops. The main crops are sugar beets, grain sorghum, and safflower.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil helps to maintain tilth and improves water intake. Drainage is needed to rapidly remove excess surface and subsurface water so that summer crops can be planted at the correct time. Careful planning is necessary for good management of irrigation water to prevent waterlogging and to keep the water table from rising to near the surface. Leveling of these soils is not difficult, but because material is deposited by floods, frequent leveling may be necessary.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IVw-6(16, 17)

This unit consists of somewhat poorly drained and poorly drained silty clay loams to clays that are moderately to strongly saline or alkali, or both. These soils formed in alluvium from mixed sources along drainageways, in basins, and on marsh rims. Slopes are 0 to 1 percent. The average annual rainfall is 16 to 22 inches, and the frost-free season is 250 to 320 days. Permeability is slow, runoff is slow to ponded, and erosion is a slight hazard. The available water capacity is 5 to 12 inches. Where these soils are drained and reclaimed, the effective rooting depth is commonly more than 60 inches. The water table is at a depth of 24 to 60 inches.

These soils are used for irrigated pasture and row crops, for dryland pasture, and for dryfarmed field crops. The main crops grown are sugar beets and barley. Irrigated pasture consists of salt-tolerant grasses and legumes.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil improves soil tilth. Drainage is needed to remove excess surface and subsurface water. Accumulated salts should be leached to a lower level. Generally, the upper 12 inches of these soils can be reclaimed and maintained. The slow water intake rate makes it difficult to properly manage irrigation water. Leveling these soils is not difficult, and it is necessary for good management of irrigation water and for land reclamation.

Crops respond to nitrogen and phosphorus fertilizers and to gypsum or other amendments containing sulfur.

CAPABILITY UNIT IVw-9(16)

Reyes silty clay loam, drained, is the only soil in this unit. This is a poorly drained soil that has been improved through drainage and is acid and saline. It formed in basins in alluvium from mixed sources. Slopes are 0 to 2 percent. The average annual rainfall is 15 to 20 inches, and the frost-free season is 260 to 280 days. Permeability is slow, runoff is very slow, and erosion is not a hazard. The available water capacity is 7 to 8.5 inches. The effective rooting depth, where this soil is drained, is more than 60 inches. The water table is at a depth of 48 to 60 inches.

This soil is used for dryfarmed pasture, grain, and hay. The main crop is oats.

A suitable conservation cropping system includes legumes and crops that produce a large amount of residue. Proper tillage minimizes soil compaction. Returning crop residue to the soil helps to maintain soil tilth and organic-matter content and improves the water intake rate.

Crops respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT VIe-1(15, 17)

This unit consists of well-drained loams, clay loams, and clays on uplands or terraces. These soils are 10 to 40 inches deep over sandstone, basic igneous rocks, or consolidated sediments. Slopes are 15 to 50 percent. Average annual rainfall is 15 to 30 inches, and the frost-free season is 220 to 280 days. Permeability is moderate to very slow. The available water capacity is 1.5 to 7.0 inches. The effective rooting depth is 10 to 40 inches. Runoff is medium to rapid, and erosion is a moderate to high hazard.

These soils are used for range, dryland pasture, and wildlife habitat. Lana vetch is suitable for dryland pasture.

Proper management of these soils increases production. Returning residue to the soils helps to prevent

erosion. These soils must be protected against overgrazing, which increases erosion. Leaving stubble after grazing helps to control erosion.

The vegetation generally responds to nitrogen and phosphorus fertilizers, which increase the amount of usable forage and extend the grazing period.

CAPABILITY UNIT VIs-1(16)

This unit consists of somewhat poorly drained to very poorly drained soils. These are saline soils that formed in mixed alluvium and hydrophytic plant remains or from materials dredged from bodies of saline water. They are commonly very high in organic-matter content or are mostly peats and mucks. The average annual rainfall is 15 to 20 inches, and the frost-free season is 240 to 280 days. Permeability is rapid to slow. The available water capacity is 6 to 19 inches. The effective rooting depth is 10 inches or more. The rooting depth is affected by the water table.

These soils are used for wildlife habitat and limited dryland and irrigated pasture (fig. 21).

A suitable system of conservation management includes drainage and leaching of salt. Levees and tide gates are needed to control the water. Pastures are irrigated at high tide by opening the tide gates. As the salt content of the soils is lowered, the quantity of the desirable vegetative species increases. Only salt- and water-tolerant grasses and forbs are suitable for pasture improvement.

The vegetation responds to nitrogen and phosphorus fertilizers.

Figure 21.—Pampasgrass used for wildlife habitat on Tamba mucky clay.

CAPABILITY UNIT VIIe-1(15)

This unit consists of well-drained sandy loams or loams that are cobbly in places. These soils formed on uplands in materials derived from sandstone or basalt. Slopes are 15 to 75 percent. The average annual rainfall is 20 to 30 inches, and the frost-free season is 220 to 260 days. Permeability is rapid to moderately slow, runoff is medium to rapid, and erosion is a moderate to high hazard. The available water capacity is 1.0 to 3.5 inches. The effective rooting depth is 10 to 20 inches.

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

Fire prevention and suppression are the major measures to be taken in the management of these soils and for the protection of areas downstream. Proper use of the soils increases the quality and quantity or forage. Cover must be maintained to help control erosion.

CAPABILITY UNIT VIIs-1(15)

This unit consists of well-drained and somewhat excessively drained, very shallow and shallow stony loams. These strongly sloping to moderately steep soils formed on uplands in materials derived from tuff or basic igneous rock. Slopes are 9 to 30 percent. The average annual rainfall is 20 to 25 inches, and the frost-free season is 240 to 260 days. Permeability is moderate, runoff is medium, and erosion is a high hazard. The available water capacity is 1 to 2 inches. The effective rooting depth is 6 to 17 inches.

These soils are used for range and wildlife habitat.

Proper use of the vegetation increases the quantity of desirable plants and the usable forage. Care must be taken to prevent overgrazing, because adequate cover is needed to control erosion. During years of light rainfall, it may be necessary to avoid grazing to maintain enough residue for erosion control and to insure that the annual plants will reseed themselves. Emergency seeding may be necessary to control erosion.

CAPABILITY UNIT VIIIs-1(15)

This unit consists of well-drained and somewhat excessively drained, very shallow loams and stony loams. These soils are on uplands. Slopes are 15 to 75 percent. The average annual rainfall is 20 to 40 inches, and the frost-free season is 220 to 260 days. Permeability is moderate, runoff is rapid, and erosion is a very high hazard. The available water capacity is less than 1 to 2.5 inches. The effective rooting depth is 5 to 15 inches.

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

Fire prevention and suppression are the major measures to be taken in the management of these soils and for the protection of areas downstream.

CAPABILITY UNIT VIIIw-1(16, 17)

This unit consists of Riverwash and Tidal marsh. Riverwash consists of excessively drained sandy and gravelly stream deposits that are subject to flooding and deposition. Tidal marsh is very poorly drained, strongly saline, stratified mineral and organic sedi-

ments that are subject to inundation by tidal flow. Slopes are 0 to 1 percent. The average annual rainfall is 16 to 20 inches.

These land types are used for wildlife habitat and recreation, but they need to be protected for these uses.

Predicted Yields

Table 2 shows the predicted yields of the principal crops grown in the county under optimum management. Optimum management is the level of management that experience, field trials, and research findings have shown will give the highest possible yields at the present time.

The predicted yields are based on information furnished by farmers, on observations made by the soil scientists who surveyed the area, and on suggestions furnished by crop specialists in the Soil Conservation Service, the Agricultural Extension Service, and the California Agricultural Experiment Station. More information was available for some soils than for others. If little or no information was available for a particular soil, or if the specified crop is not grown on the soil, yield estimates were made by comparison with similar soils.

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. In any given year, the yield may be considerably higher or lower than the average. Third, there is considerable variation within some soils, and this was considered in making the predictions.

The information on yields provided in this part of the survey is most relevant when the survey is first published. New developments in crop breeding, in control of insects and disease, in use of fertilizer, and in tillage, irrigation, and drainage practices may change many of these yield estimates.

The management practices used to obtain the predicted yields listed in table 2 are given in the following paragraphs.

IRRIGATED ALFALFA

A typical cropping sequence consists of 3 to 5 years of alfalfa and 1 year each of sugar beets, tomatoes, corn or milo, and barley. In preparing the seedbed, the soil is deep chiseled when dry, disked, landplaned, border checked, irrigated to germinate weeds and then spring toothed to control the weeds, seed planted, and harrowed or rolled. At seeding time, about 15 pounds of seed per acre is planted by drilling and 15 to 25 pounds of phosphorus is applied. Six cuttings are made annually at about 0.1 bloom. Insects and diseases are controlled as necessary.

The soil is not worked when too wet. Tillage operations are combined wherever possible. Alfalfa is spring-tooth harrowed during the dormant stage.

Specific management practices by capability units follow:

Group 1.—In this group are soils in capability units I–1 (17), IIe–1 (17), IIe–3 (17), IIs–3 (17), IIs–4 (17), and IIs–5 (17). About 4.5 acre-feet of water per acre is applied annually. The water is applied about every 15 days, or twice between cuttings. Border irrigation is used where slopes are 0 to 1 percent, and sprinkler irrigation is used where slopes are 0 to 9 percent.

Group 2.—Soils in this group are in capability units IIw–2 (17), IIIw–3 (17), and IIIw–5 (17). About 4 acre-feet of water per acre is applied annually by border or sprinkler irrigation. The water is applied about every 14 days. Open-ditch or tile drains are used to keep the water table below the root zone.

IRRIGATED ALMONDS

Each year almond trees are selectively pruned, and 40 to 60 pounds of nitrogen per acre is applied. A cover crop of 20 pounds per acre of purple vetch, or 40 pounds of horse beans, or 8 pounds of Cucamonga brome, or 4 pounds of Blando brome, or 8 pounds of Wimmera 62 ryegrass, or 30 pounds of cereal grains per acre is grown. Frost is controlled by use of wind machines or smudge pots. Almonds are harvested in August and September by mechanical windrow and pickup.

The soil is not worked when too wet. Tillage operations are combined wherever possible. As needed, the soil is chiseled to break the plowpan, and the trees are sprayed to control diseases and insects.

Specific management practices by capability units follow:

Group 1.—Soils in this group are in capability units I–1 (17), IIe–1 (17), IIe–3 (17), IIs–3 (17), IIs–4 (17), IIIe–1 (15), and IIIe–3 (15). About 1.7 acre-feet of water per acre is used annually for irrigation. Water is applied about every 42 days. Basin, border, or furrow irrigation is used where slopes are 0 to 2 percent, and sprinkler irrigation is used where slopes are 0 to 9 percent. In preparation for harvest, the soil is disked twice, spring toothed three times, and landplaned or the cover crop is mowed and the residue left on the soil.

Group 2.—Soils in this group are in capability unit IIIs–4 (17). These soils are irrigated about every 10 days and receive about 4 acre-feet of water per acre annually. The cover crop is mowed and left as a mulch.

IRRIGATED APRICOTS

Apricots are selectively pruned each year. About 40 to 60 pounds of nitrogen per acre is applied annually. A cover crop of 20 pounds per acre of purple vetch, or 40 pounds of horse beans, or 8 pounds of Cucamonga brome, or 4 pounds of Blando brome, or 8 pounds of Wimmera 62 ryegrass, or 30 pounds of cereal grains for acre is grown. Frost is controlled by use of wind machines or smudge pots. Apricots are handpicked between May 20 and June 20.

The soil is not worked when too wet, and as many tillage practices as practicable are combined. As needed, plowpans are chiseled, and the trees are sprayed to help control insects and diseases.

Specific management practices by capability units follow:

Group 1.—Soils in capability units I–1 (17), IIe–1 (17), IIe–3 (17), IIs–3 (17), IIs–4 (17), IIIe–1 (15), and IIIe–3 (15) are in this group. These soils are irrigated about every 40 days, and about 1.7 acre-feet of water per acre is applied annually. Basin, border, or furrow irrigation is used where slopes are 0 to 2 percent, and sprinkler irrigation is used where slopes are 0 to 9 percent. Before the harvest, the soils are disked twice and spring toothed three times or the cover crop is mowed and left as a mulch.

Group 2.—Soils in capability unit IIIs–4 (17) are in this group. These soils are irrigated about every 10 days, and about 4 acre-feet of water per acre is applied annually. Water is applied by sprinkler irrigation. Before the harvest the cover crop is mowed, without tilling the soil, and is retained as a mulch.

IRRIGATED LIMA BEANS

In preparing the seedbed, the soil is chiseled, landplaned, disked twice, furrowed, and irrigated. About 65 pounds of improved varieties of seed per acre is planted between June 10 and July 10. These seeds are treated for protection against soil-borne diseases and insects. About 80 pounds of nitrogen per acre is applied during the growing season. Weeds are controlled by two or three shallow cultivations. Insecticides are applied as needed. Dry lima beans are harvested in August and September by combine harvesters. Crop residue is returned to the soil. Tillage operations are combined wherever feasible.

Specific management practices by capability units follow:

Group 1.—Soils in capability units I–1 (17), IIw–2 (17), and IIs–3 (17) are in this group. A suitable conservation cropping system consists of 3 to 5 years of alfalfa and 1 year each of sugar beets, lima beans, tomatoes, and barley. About 1.3 acre-feet of water per acre is applied annually. The water is applied about every 18 days by furrow or sprinkler irrigation.

Group 2.—Soils in this group are in capability unit IIIw–3 (17). The same cropping system as used in group 1 is used for the soils in this unit. On these soils, 1.5 acre-feet of water per acre is applied annually. The water is applied by furrow or sprinkler irrigation about every 17 days. Open-ditch or tile drains are used to control the height of the water table.

Group 3.—Soils in this group are in capability units IVs–3 (17), IVw–2 (17), and IVw–3 (17). A suitable conservation cropping system consists of 1 year each of lima beans, tomatoes, corn, and sugar beets. About 1.3 acre-feet of water per acre is applied annually by sprinkler or furrow irrigation. The irrigation water is applied about every 18 days. Open-ditch or tile drains help to keep the water table below the root zone.

IRRIGATED CORN

In preparing the seedbed, the soil is chiseled in fall, plowed, landplaned, disked, and furrowed. The seed is planted between April 1 and April 25. About 15 pounds per acre of adapted hybrid seed is planted. The seed is treated for protection against soil-borne diseases and insects. About 200 pounds per acre of nitrogen and 40 pounds per acre of phosphorus are applied. Weeds are controlled by two or three shallow cultivations during the growing season. Insecticides are applied as needed. Corn is harvested by November 1. If the moisture content is more than 15 percent, the grain must be dried. Crop residue is returned to the soil, and nitrogen is added to help decompose the residue. Tillage operations are combined wherever feasible.

Specific management practices by capability units follow:

Group 1.—Soils in capability units I–1 (17), IIs–3 (17), and IIw–2 (17) are in this group. A suitable conservation cropping system consists of 3 to 5 years of alfalfa and 1 year each of sugar beets, tomatoes, corn, and barley. About 3 acre-feet of water per acre is applied annually. Water is applied every 12 to 18 days by furrow or sprinkler irrigation.

Group 2.—Soils in capability units IIIw–2 (16), IIIw–3 (17), IIIw–5 (17), and IVw–2 (17), and IVw–3 (17) are in this group. A suitable conservation cropping system consists of 3 to 5 years of alfalfa and 1 year each of sugar beets, tomatoes, corn, and barley. About 3 to 3.5 acre-feet of water per acre is used annually. Irrigation water is applied by furrow or sprinkler irrigation every 14 to 20 days. Drainage facilities are needed to keep the water table below a depth of 4 feet.

IRRIGATED GRAIN SORGHUM

Between May 1 and June 15, treated seed of an adapted hybrid variety is planted at a rate of 15 to 20 pounds per acre. Nitrogen is applied at a rate of 75 to 125 pounds per acre, and phosphorus at a rate of 25 to 50 pounds per acre. Weeds are controlled by two or three shallow mechanical cultivations. Grain sorghum is harvested with a combine harvester by November 1. Crop residue is then returned to the soil, and nitrogen is added to aid decomposition. The soil is not worked when too wet. Tillage operations are combined wherever feasible.

Specific management practices by capability units follow:

Group 1.—Soils in this group are in capability units I–1 (17), IIs–3 (17), IIs–5 (17), and IIw–2 (17). A typical cropping sequence consists of 3 to 5 years of alfalfa and 1 year each of sugar beets, tomatoes, grain sorghum, and barley. The seedbed is disked, chiseled, landplaned, furrowed, pre-irrigated, harrowed, rolled, and then planted. From 3.0 to 3.5 acre-feet of water per acre is applied annually by furrow, border, or sprinkler irrigation. The water is applied every 14 to 23 days.

Group 2.—Soils in this group are in capability units IIIw–2 (16), IVw–2 (17), and IVw–3 (17). A typical conservation cropping sequence consists of 1 year each of corn, sugar beets, tomatoes, wheat, and grain sorghum. The seedbed is plowed and disked and then planted. From 3.0 to 3.5 acre-feet of water is used annually. The water is applied every 14 to 20 days. A suitable method is subirrigation or sprinkler irrigation. Drainage facilities are installed to keep the

TABLE 2.—*Predicted average acre yields of*

[No estimates are given for soils on which a particular

Soil	Irrigated crops				
	Alfalfa	Almonds	Apricots	Lima beans	Corn
	Tons	*Pounds*	*Tons*	*Hundredweight*	*Hundredweight*
Altamont clay, 2 to 9 percent slopes					
Altamont clay, 9 to 30 percent slopes					
Altamont clay, 30 to 50 percent slopes, eroded					
Altamont-San Ysidro-San Benito complex, 2 to 9 percent slopes					
Altamont-San Ysidro-San Benito complex, 9 to 30 percent slopes					
Altamont-Diablo clays, 2 to 9 percent slopes					
Altamont-Diablo clays, 9 to 30 percent slopes, eroded					
Alviso silty clay loam					
Antioch-San Ysidro complex, 0 to 2 percent slopes				15	
Antioch-San Ysidro complex, 2 to 9 percent slopes					
Antioch-San Ysidro complex, thick surface, 0 to 2 percent slopes					
Antioch-San Ysidro complex, thick surface, 2 to 9 percent slopes					
Brentwood clay loam, 0 to 2 percent slopes	8.5	2,200	8.0	30	100
Brentwood clay loam, 2 to 9 percent slopes	8.5	2,200	8.0		
Capay silty clay loam	7.5			25	60
Capay clay	7.0				
Clear Lake clay, 0 to 2 percent slopes	7.0				
Clear Lake clay, 2 to 5 percent slopes					
Clear Lake clay, saline, 0 to 2 percent slopes					
Columbia fine sandy loam	8.0				110
Conejo loam	8.5	2,100	7.0	30	95
Conejo gravelly loam	8.5	1,500	5.0		
Conejo clay loam	8.5	2,100	7.0	30	95
Conejo soils, wet	7.5			30	90
Corning gravelly loam, 2 to 15 percent slopes, eroded					
Diablo-Ayar clays 2 to 9 percent slopes					
Diablo-Ayar clays, 9 to 30 percent slopes, eroded					
Dibble-Los Osos loams, 2 to 9 percent slope		1,200	4.0		
Dibble-Los Osos loams 9 to 30 percent slopes					
Dibble-Los Osos clay loams, 2 to 9 percent slopes		1,200	4.0		
Dibble-Los Osos clay loams, 9 to 30 percent slopes					
Egbert silty clay loam	8.0				110
Egbert silty clay loam, occasionally flooded				30	100
Gilroy loam, 9 to 30 percent slopes					
Joice muck					
Joice muck, clay subsoil variant					
Millsap sandy loam, 0 to 2 percent slopes					
Millsap-Los Osos complex, 2 to 9 percent slopes					
Millsholm loam, moderately deep variant, 2 to 9 percent slopes		1,200	4.0		
Millsholm loam, moderately deep variant, 9 to 30 percent slopes					
Omni clay loam					
Omni silty clay	7.0				100
Pescadero clay loam					
Pescadero clay					
Reiff fine sandy loam	8.5	2,250	8.0	30	100
Reyes silty clay loam, drained					
Reyes silty clay					
Rincon loam, 2 to 9 percent slopes	7.0	1,800	6.0		
Rincon clay loam, 0 to 2 percent slopes	7.5	1,800	6.0	25	60
Rincon clay loam, 2 to 9 percent slopes	7.0	1,800	6.0		
Ryde clay loam					110
Sacramento silty clay loam	7.5			30	100
Sacramento silty clay loam, occasionally flooded				30	90
Sacramento clay	7.0				100
San Ysidro sandy loam, 0 to 2 percent slopes					
San Ysidro sandy loam, 2 to 5 percent slopes					
San Ysidro sandy loam, thick surface, 0 to 2 percent slopes					
Solano loam					
Solano-Pescadero complex					
Solano loam, dark surface variant					

See footnotes at end of table.

principal crops under optimum management

crop is not grown or for soils to which a crop is not suited]

Irrigated crops—Continued					Dryfarmed crops		Pasture	
Grain sorghum	Pears	Prunes, dry	Sugar beets	Tomatoes	Barley	Wheat	Irrigated	Dryfarmed
Hundredweight	*Tons*	*Tons*	*Tons*	*Tons*	*Hundredweight*	*Hundredweight*	*Animal-unit-months* [1]	*Animal-unit-months* [1]
					35	25		5.0
					32	23		5.0
					20			4.0
					18			4.0
					35	25		5.0
					33	23		5.0
					12		8	[2] 1.0
45			10		14		12	3.0
					14		12	3.0
55			12		18		12	3.5
					18		12	3.5
65		1.8	26	30	36		20	
		1.7			35		20	
60			25	27	30		16	
60			25	25	30		16	
60			25	25	30		16	
					25		16	5.0
					15		12	[2] 2.0
65	12		25	30	35	25		
65	12	1.8	30	30	35		20	
		1.0						
65	12	1.8	30	30	35		20	
65	10		24	25	28		18	
					13			2.5
					35	25		5.0
					30	23		5.0
					20		12	4.5
					18			4.5
					20		12	4.5
					18			4.5
65			30	30	35	25	20	
65			30	27				
								4.0
							[3] 6	
							[3] 6	
					10		10	2.5
								2.0
					20			4.0
					18			4.0
					12		10	[2] 1.5
60			24	30	35		18	
					15		10	[2] 1.0
					12		9	[2] 1.0
65			27	20	30		18	
								[2] 2.0
							[3] 6	
		1.7			30		18	3.0
65			25	27	30		18	
		1.8			30		18	3.0
65			25	25	30	45		
60			25	30	35		18	
60			23	27	35		18	
60			24	30	35		18	
45			10		15		12	3.0
45			10		15		12	3.0
55			12		20		14	3.5
			10		15		12	[2] 1.5
			8		15		12	[2] 1.5
					15		12	[2] 1.5

TABLE 2.—*Predicted average acre yields of*

Soil	Irrigated crops				
	Alfalfa	Almonds	Apricots	Lima beans	Corn
	Tons	*Pounds*	*Tons*	*Hundredweight*	*Hundredweight*
Suisun peaty muck					
Sycamore silty clay loam	8.0			30	90
Sycamore silty clay loam, drained	8.5	2,300	8.0	30	95
Sycamore silty clay loam, saline					
Sycamore complex, occasionally flooded				30	90
Tamba mucky clay					
Trimmer loam, 9 to 30 percent slopes					
Tujunga fine sand		1,500	5.0		
Valdez silt loam, drained	8.0			30	100
Valdez silty clay loam					
Valdez silty clay loam, wet					
Valdez silty clay loam, clay substratum					
Willows clay					
Yolo loam	8.5	2,300	8.0	30	100
Yolo loam, clay substratum	7.5	2,000	7.0	30	90
Yolo silty clay loam	8.5	2,300	8.0	30	100

[1] Animal-unit-month is a term used to express the carrying capacity of pasture. It is the number of animal units, or 1,000 pounds of live weight, that can be grazed on an acre of pasture for a period of 30 days.

[2] These soils are affected by varying amounts of salts and alkali, and intensive pasture management is not economically feasible.

water table below a depth of 3 feet in soils of unit IIIw–2 (16) and below a depth of 4 feet in soils of units IVw–2 (17) and IVw–3 (17).

Group 3.—Soils in this group are in capability units. IIIw–3 (17) and IIIw–5 (17). A typical conservation cropping sequence consists of 3 to 5 years of alfalfa and 1 year each of sugar beets, tomatoes, grain sorghum, and barley. The seedbed is disked, chiseled, landplaned, furrowed, pre-irrigated, harrowed, rolled, and then planted. From 3.0 to 3.5 acre feet of water per acre is applied annually by border, furrow, or sprinkler irrigation. The water is applied every 14 to 20 days. Drainage facilities keep the water table below a depth of 4 feet.

Group 4.—Soils in this group are in capability units IIIs–3 (17) and IVs–3 (17). A typical conservation cropping sequence consists of 1 year each of grain sorghum, sugar beets, and barley. The seedbed is disked, chiseled, landplaned, furrowed, pre-irrigated, harrowed, rolled, and then planted. About 3.8 acre-feet of water per acre is applied annually by border, furrow, or sprinkler irrigation. Water is applied about every 10 days.

IRRIGATED PEARS

Pears are grown only on soils in capability units I–1 (17) and IIw–2 (17). The trees are selectively pruned each year. About 40 to 60 pounds of nitrogen per acre is applied annually. About 2 acre-feet of water per acre is applied annually. Water is applied about every 40 days by basin, furrow, border, or sprinkler irrigation. A cover crop of 20 pounds per acre of purple vetch, or 40 pounds of horse beans, or 8 pounds of Cucamonga brome, or 4 pounds of blando brome, or 8 pounds of Wimmera 62 ryegrass, or 30 pounds of cereal grains per acre is grown. The cover crop is disked twice and spring toothed three times or is mowed and left as a mulch before the harvest. The August harvest is handpicked. Insects and diseases are controlled as necessary. The soils are not worked when wet. Plowpans are chiselled wherever possible.

IRRIGATED PRUNES

Irrigated prunes are grown on soils in capability units I–1 (17) IIe–1 (17), IIe–3 (17), IIw–2 (17), IIs–3 (17), and IIs–4 (17). The trees are selectively pruned each year. About 40 to 60 pounds of nitrogen per acre is applied annually. About 2 acre-feet of water per acre is used annually. It is applied about every 40 days by basin, border, or furrow irrigation where slopes are 0 to 2 percent, and by sprinkler irrigation where slopes are 0 to 9 percent. A cover crop of 20 pounds of purple vetch, or 40 pounds of horsebeans, or 8 pounds of Cucamonga brome, or 4 pounds of blando brome, or 8 pounds of Wimmera 62 ryegrass, or 30 pounds of cereal grains per acre is grown. Before the harvest, the soil is disked twice and spring toothed three times or the cover crop is mowed without tillage and is left as a mulch. Prunes are harvested from August 20 to September 30 by mechanical shaking. Diseases and insects are controlled as necessary. The soils are not worked when wet. Plowpans are chiseled wherever necessary.

IRRIGATED SUGAR BEETS

In preparing the seedbed, the soil is chiseled, landplaned, disked, spring toothed, harrowed, and bed rolled. Four to 8 pounds per acre of fungicide-treated seed is planted between March 15 and May 15. About 100 pounds of nitrogen per acre is applied as a gas or liquid during the growing season. Thinning is done either mechanically or by hand. Weeds are controlled by four to six shallow cultivations. The fall harvesting is done in October and November, and the spring har-

principal crops under optimum management—Continued

Irrigated crops—Continued					Dryfarmed crops		Pasture	
Grain sorghum	Pears	Prunes, dry	Sugar beets	Tomatoes	Barley	Wheat	Irrigated	Dryfarmed
Hundredweight	*Tons*	*Tons*	*Tons*	*Tons*	*Hundredweight*	*Hundredweight*	*Animal-unit-months* [1]	*Animal-unit-months* [1]
							[3] 2	
65	11		24	30	30		20	
65	12	1.8	30	30	36		20	
					20		16	4.5
60			23	27			20	
							[3] 6	
					18			4.0
							12	1.5
65	12		25	30	35		20	2.0
					15		10	[2] 2.0
								[2] 1.0
					12		10	[2] 1.5
			25		16		14	[2] 2.0
65		1.8	28	26	35		20	
65		1.5	25	27	30		18	
65		1.8	30	30	36		20	

[3] Most areas of this soil are flooded each fall for duckponds. Where this soil is used for grazing, high tides are used to irrigate it until the middle of summer.

vesting is done in March and April. All harvesting is by mechanical means. Crop residue is returned to the soil. Tillage operations are combined wherever possible. The soil is not worked when wet.

Specific management practices by capability units follow:

Group 1.—Soils in capability units I–1 (17), IIs–3 (17), IIs–5 (17), and IIw–2 (17) are in this group. A suitable conservation cropping system consists of 3 to 5 years of alfalfa and 1 year each of sugar beets, tomatoes, grain sorghum, and barley. About 3.3 acre-feet of water per acre is used annually. Water is applied by sprinkler or furrow irrigation every 19 to 24 days.

Group 2.—Soils in this group are in capability units IIIw–3 (17), IIIw–5 (17), IVw–2 (17), IVw–3 (17), IVw–6 (17), and IIIw–2 (16). A suitable conservation cropping system consists of 1 year each of sugar beets, tomatoes, grain sorghum, and wheat. The seedbed is plowed and disked before planting. Water is applied every 12 to 20 days by sprinkler irrigation, by subirrigation, or by furrow irrigation. About 3.3 to 3.8 acre-feet of water per acre is applied annually. Drainage facilities are needed to lower the water table and to keep it below a depth of 3 to 4 feet.

Group 3.—Soils in this group are in capability units IIIs–3 (17), IVe–3 (17), IVs–3 (17), and IVs–6 (17). A suitable conservation cropping system consists of 1 year each of sugar beets, barley, and grain sorghum. About 3.8 acre-feet of water per acre is applied annually. It is applied every 8 to 10 days by furrow or sprinkler irrigation.

IRRIGATED TOMATOES

About a third of a pound per acre of fungicide-treated seed is planted between March 15 and 30. Weeds are controlled by three to five shallow cultivations. Thinning is done by mechanical means or by hand. Insects are controlled as necessary. About 125 to 175 pounds of nitrogen and phosphorus are applied as needed. Tomatoes are harvested in August and September. Crop residue is returned to the soil. Tillage operations are combined wherever feasible. The soil is not worked when wet.

Specific management practices by capability units follow:

Group 1.—Soils in capability units I–1 (17), IIs–3 (17), IIs–5 (17), and IIw–2 (17) are in this group. A suitable conservation cropping system consists of 3 to 5 years of alfalfa and 1 year each of tomatoes, corn or grain sorghum, and barley. The seedbed is disked, landplaned, chiseled, and left fallow through the winter. It is then disked, spring toothed, rolled, and planted. About 3.3 acre-feet of water per acre is applied each year. It is applied every 12 to 18 days by furrow irrigation.

Group 2.—Soils in capability units IIIw–2 (16), IIIw–3 (17), III–5 (17), IVw–2 (17), and IVw–3 (17) are in this group. A typical conservation cropping system consists of 1 year each of sugar beets, tomatoes, grain sorghum, and corn. The seedbed is prepared by plowing, disking, and spring toothing. Water is applied every 12 to 18 days by sprinkler irrigation or subirrigation. About 3.3 to 3.5 acre-feet of water per acre is applied annually. Drainage is needed to lower the water table and to keep it below a depth of 3 feet.

DRYFARMED BARLEY

Between November and December 15, seed of treated, improved varieties of barley is planted at a rate of 80 to 100 pounds per acre. Nitrogen is applied at an annual rate of 40 to 60 pounds per acre, commonly at planting time. Injurious weeds are controlled

as needed. Barley is harvested by combine in June. Crop residue is returned to the soil. Tillage operations are combined wherever feasible. The soil is not worked when too wet. For better control of moisture content, clay soils are subsoiled to a depth of 2 to 3 feet. Tillage operations are across the slope or on the contour.

Specific management practices by capability units follow:

Group 1.—Soils in this group are in capability units I–1 (17), IIe–1, (17), IIe–3 (17), IIs–3 (17), IIs–5 (17), IIw–2 (17), IIIw–3 (17), and IIIw–5 (17). A typical conservation cropping sequence consists of 3 to 5 years of alfalfa and 1 year each of sugar beets, tomatoes, corn or milo, and barley. The seedbed is disked twice, harrowed, and then planted.

Group 2.—Soils in this group are in capability units IIIe–1 (15), IIIe–3 (15), IIIe–5 (15), IIIs–3 (17), IIIw–2 (16), IIIw–3 (17), IIIw–5 (17), IIIw–6 (16), IIIw–6 (17), IVe–1 (15), IVe–3 (15), IVe–5 (15), IVs–3 (15), IVs–3 (17), IVs–6 (17), IVw–6 (16), and IVw–6 (17). A typical conservation cropping sequence consists of growing barley for 1 year followed by dryfarmed pasture and lana vetch for a variable number of years. The soil is plowed in spring after the spring feed period, disked to control weeds, and fallowed. The seed is planted by drilling, by airplane, or by broadcasting.

DRYFARMED WHEAT

The seedbed is plowed, disked, harrowed, and then planted. In November, seed of an adapted variety of wheat is planted at a rate of about 100 pounds per acre. Nitrogen is applied at a rate of 40 to 60 pounds per acre. Wheat is harvested by combine in June and July. Crop residue is then returned to the soil. The soil is not worked when wet. Tillage operations are combined wherever feasible.

Specific management practices by capability units follow:

Group 1.—Soils in this group are in capability units IIw–2 (17) and IIIw–2 (16). A typical cropping system consists of 3 to 5 years of alfalfa and 1 year each of wheat, sugar beets, tomatoes, and corn.

Group 2.—Soils in this group are in capability units IIIe–5 (15) and IVe–5 (15). A typical conservation cropping system consists of 1 year each of wheat, dryland pasture, and fallow. Only about 40 pounds of nitrogen per acre per year is required on these soils.

IRRIGATED PASTURE

Specific management practices for soils are discussed by capability units in the following paragraphs:

Group 1.—Soils in capability units I–1 (17), IIe–1 (17), IIe–3 (17), IIs–3 (17), and IIw–2 (17) are in this group. A typical conservation cropping system consists of 5 years of pasture and 1 year each of grain sorghum and barley. The seedbed is disked, chiseled, landplaned, spring toothed, bordered, harrowed, cultipacked, and planted. Varieties and seeding rates are 2 pounds of alfalfa or 3 pounds of narrow-leaf trefoil and 8 pounds of Goars fescue, or 6 pounds of Akoroa orchardgrass and 8 pounds of prairie brome. The seed is planted from October 15 to November 15. The grass seed is treated with a fungicide, and the legume seed is inoculated. Nitrogen is applied at an annual rate of 120 to 150 pounds per acre, and phosphorus is applied at a rate of 30 to 40 pounds per acre. They are applied in four or five applications prior to irrigation.

About 4.3 acre-feet of water per acre is used annually. It is applied by border or sprinkler irrigation where slopes are 0 to 2 percent, and by sprinkler irrigation where slopes are more than 2 percent. Water is applied every 8 to 10 days. New pastures are mowed to control weeds when the plants are 4 inches high, and they are grazed when the plants are 8 inches high. Pastures are not grazed when wet. The pastures are divided into three or more fields, and 21 to 35 days of regrowth is allowed after grazing. Animals are moved off a pasture when the plants are about 4 inches high. The maximum growth period and stocking rates are between April 15 and October 15. Between October 15 and April 15, the stocking rates are reduced. Coarse stems are mowed for uniform growth, and droppings are scattered by harrowing. Drains at the end of checks remove excess water, and tailwater return systems allow the reuse of irrigation water.

Group 2.—Soils in capability units IIIe–3 (17), IIIs–3 (17), IVe–3 (17), and IVs–3 (17) are in this group. A typical pasture seeding mixture on these soils consists of 2 pounds per acre of ladino clover or 3 pounds of narrowleaf trefoil and 8 pounds of Goars fescue, or 5 pounds of Akoroa rye grass, planted shallow. Except for the seeding mixture, these soils are managed the same as those in group 1.

Group 3.—Soils in this group are in capability units IIs–5 (17), IIIe–5 (17), IIIw–3 (17), IIIw–5 (17), and IVw–3 (17). The pasture seeding mixture used on these soils is 2 pounds per acre of ladino clover, or 3 pounds of narrowleaf trefoil and 8 pounds of Goars fescue, planted shallow. Except for the seeding mixture, these soils are managed the same as those in group 1.

Group 4.—Soils in capability units IIIw–6 (17), IVs–6 (17), and IVw–6 (17) are in this group. About 4,000 pounds of gypsum per acre is added to the soils to reduce the sodium content. A typical seeding mixture consists of 5 pounds of narrowleaf trefoil and 10 pounds of Goars fescue per acre. Deep open drains are used to aid in the reclamation of these soils. All other management practices are similar to those for soils in group 1.

Group 5.—The soils in this group are in capability unit IIIs–4 (17). On these soils irrigated pasture is not rotated with other crops. The initial seedbed is disked, landplaned, spring toothed, harrowed, cultipacked, and planted. A typical seeding mixture consists of 3 pounds per acre of narrowleaf trefoil and 8 pounds of Goars fescue. These soils are irrigated by sprinklers every 6 to 8 days. Other management practices are similar to those for soils in group 1.

Group 6.—Soils in capability unit VIw–1 (16) are in this group. Irrigated pasture is grown continuously on these soils. These soils are not planted to special pasture plants, and they are not fertilized. The soils

are wildflooded if the tides are high enough to cover the area, but late in summer and early in fall the salt content of the water is too high for irrigation water. Pastures are divided into two fields, and are allowed a period of 15 to 25 days for regrowth. The period of maximum growth and use is between May 1 and August 15. Open drainage ditches aid in controlling the water table.

DRYLAND PASTURE

Management of dryland pasture is essentially the same for most soils in capability classes I through IV. Although the soils vary somewhat, they are generally managed as described in the following paragraphs.

The seedbed is prepared by plowing or disking and harrowing, and the seed is drilled. Fields to be planted to Hardinggrass are summer fallowed the summer before the seedbed is prepared. Two basic seedings are used—10 pounds of lana vetch and 4 pounds of blando brome, or 4 pounds of Hardinggrass. The best time for seeding is just before the rainy season. In the first year, about 65 pounds of nitrogen per acre and 35 pounds of phosphorus are applied to the lana vetch-blando brome pastures. No fertilizer is applied to Hardinggrass the first year. In successive years about 30 pounds of nitrogen and 20 pounds of phosphorus are applied annually to both types of pasture.

Dryland pastures are grazed when the plants reach a height of 4 to 6 inches. They are grazed to a height of about 2 inches, when the stubble has a patchy appearance.

Storie Index Ratings [2]

In the "Guide to Mapping Units", the soils of the county are listed in alphabetic order and are rated according to the Storie index (*14*). This index expresses numerically the relative degree of suitability, or value, of a soil for intensive general 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 explained in the following paragraphs.

Factor A. Profile characteristics.—Factor A expresses relative suitability of a profile for the growth of plant roots. Soils that have deep, permeable profiles are rated 100 percent. Those that have a dense clay layer, or a hardpan, or are shallow over bedrock are rated less than 100 percent. The rating depends upon the extent to which root penetration is limited.

Factor B. Texture of the surface soil.—Factor B is rated according to the texture of the surface soil, which affects the ease of tillage and the capacity of the soil to hold water. The moderately coarse and medium textures—fine sandy loam, loam, and silt loam—are the most desirable and are rated 100 percent. The coarser and finer textures, such as sand and clay, are rated less than 100 percent.

Factor C. Slope.—Factor C is particularly important if the soil is irrigated. The amount of water that runs off a soil and its susceptibility to erosion are influenced by the slope of the soil. Smooth, nearly level or very gently sloping soils are rated 100 percent. The rating decreases as the slope increases.

Factor X, Other conditions.—Factor X is used to evaluate any limitations to use of the soil, such as poor drainage or a high water table, erosion, salts or alkali, low fertility, acidity, or unfavorable microrelief. If more than one limitation exists, the values of each are multiplied together to get the X factors.

The index rating of a soil is obtained by multiplying the four factors A, B, C, and X; thus, any one factor may dominate or control the final rating. For example, a soil may have an excellent profile justifying a rating of 100 percent for factor A, excellent texture of the surface soil justifying 100 percent for factor B, a smooth, nearly level surface justifying 100 percent for factor C, but a 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 farming 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 to farming.

Vegetative Soil Groups

Vegetative soil groups are groupings of soils that have similar properties and qualities from the standpoint of plant adaptation and use. Vegetative soil groups are used chiefly for determining the plants most suitable for conservation practices and for forage production when the major soil limitations are known. The system is statewide, and nine of the vegetative soil groups are recognized in Solano County.

[2] By DR. FRANK HARRADINE, professor emeritus of soil morphology, Department of Soils and Plant Nutrition, University of California, Davis, California.

The vegetative soil group in which each soil has been placed is listed in the "Guide to Mapping Units" at the back of this survey. These groups are defined in the following paragraphs.

Group A. Choice of plants not limited by the soil.—Soils are deep to very deep, moderately coarse textured to medium textured, moderately well drained to well drained, and moderately rapid to moderately slow in permeability. Soils in this group have a slowly permeable subsoil where the subsoil is moderately fine textured.

Group B. Choice of plants limited by droughtiness and low fertility.—Soils are coarse textured and excessively drained and have an available water capacity of less than 6 inches in the root zone.

Group C. Choice of plants limited by fine texture.—Soils are deep to very deep, moderately fine textured to fine textured, well drained to moderately well drained, and moderately slow to slow in permeability.

Group D. Choice of plants limited by very slowly permeable subsoil (claypan).—Soils are well drained to somewhat poorly drained and have slow or very slow permeability in the subsoil.

Group E. Choice of plants limited by wetness.—Soils are somewhat poorly drained to very poorly drained. Drained soils are placed in appropriate groups according to their current drainage status. They are slightly saline or alkali, or both, in some places.

Group F. Choice of plants limited by salinity or alkali.—Soils are moderately to strongly saline-alkali and are generally somewhat poorly drained to poorly drained.

Group G.—Choice of plants limited by depth.—Soils are shallow to moderately deep, are well drained, and are underlain by a hardpan, by bedrock, or by other unfractured, dense material.

Group H. Choice of plants limited by low pH; soils are very strongly acid to extremely acid.—pH is less than 5.1.

Group J. Choice of plants dependent upon onsite investigation.—Soils include miscellaneous land types in the nonarable category, such as Riverwash.

Range

About 85,000 acres in Solano County are used for rangeland. This is approximately 16 percent of the total acreage in farms and ranches. This acreage generally is not suitable for cultivation, but forage production can be increased in selected areas by fertilization, brush control, and seeding adapted grasses and legumes.

Most of the important range plants in the county are introduced annuals. Some remnant perennials grow at the higher elevations. Forage plants on the annual ranges are grouped into three classes—desirable, less desirable, and undesirable. The term annual range is used in California to denote rangeland in the Mediterranean-type climate zone.

Livestock are selective in their grazing and tend to graze on the more palatable and nutritious plants. Grazing must be somewhat limited to allow the desirable plants to reseed themselves. Otherwise, less desirable plants will become plentiful. If excessive grazing continues, the less desirable plants are replaced by the undesirable plants. Continuous overgrazing causes the plant cover to be dominated by mostly undesirable species, or it may leave the soil barren and susceptible to water erosion.

Range sites

Range sites are distinctive kinds of rangeland that have a certain potential for producing range plants. To receive the maximum benefits from range, it is necessary to know the soils, the more important range plants, and the conditions under which they grow. This information helps to determine if range is producing at potential, is improving, or is deteriorating.

Important changes in the kinds and amounts of plants are often influenced by management. The range operator should use the soil, water, and plant management practices that will maintain the range at its highest productive level. The range sites for soils used as range are given in the "Guide to Mapping Units" at the back of this survey.

Total annual production on an air-dry basis for each site is based on a limited number of clippings and estimates. Extremes in weather conditions can cause greater fluctuations in production. The production figures are for unfertilized soils.

The rangeland of Solano County has been grouped into five range sites, which are described in the following paragraphs.

FINE LOAMY RANGE SITE

This site consists of loams and clay loams that have a loam, clay loam, or light clay subsoil. Sandstone or basic igneous rock generally is at a depth of 20 to 40 inches. Slopes are mostly 30 to 50 percent but are less than 30 percent in places. Elevation ranges from 100 to 2,000 feet. The average annual precipitation is 20 to 30 inches. This site occupies about 48,000 acres in the county.

The available water capacity is 3 to 7 inches. Reaction is neutral to medium acid.

The plant cover on this site typically is open grass or grass and oak trees (fig. 22). The vegetation is mostly annual grasses and forbs, but scattered oak trees and a few shrubs are also present. Where production is at its potential, about 70 per cent of the herbage is a mixture of desirable plants, including soft chess, wild oats, needlegrass, California brome, blue wild-rye, burclover, filaree, annual clover, and Spanish clover. About 20 percent of the vegetation is less desirable plants, including ripgut, red brome, wild barley, squirreltail, and annual lupine. The rest is a combination of annual fescues, medusahead, dogtailed grass, nitgrass, silver hairgrass, tarweed, popcorn flower, fiddleneck, turkeymullein, thistle, and other undesirable plants. In poor condition this site contains

Figure 22.—**Farm pond on Dibble-Los Osos clay loams, 9 to 30 percent slopes.**

some desirable and less desirable plants, but it contains mostly undesirable plants. In places there are thick stands of buckbrush, manzanita, and oak, especially where the exposure is northerly.

Where an adequate seedbed can be prepared, the soils in this site can be seeded to Hardinggrass or reseeded to annual grases and legumes. Plants on these soils respond well to applications of nitrogen, phosphorus, and sulfur. On slopes where equipment can be used safely, clearing brush increases forage production.

The estimated total annual air-dry production on this site is 3,300 pounds per acre in favorable years and 1,600 pounds per acre in less favorable years. About 85 percent of this production is from plants that furnish forage for cattle, sheep, or deer.

CLAYEY RANGE SITE

This site consists of clay loams and clays that are generally 25 to 35 inches deep over softly consolidated material or sandstone. Slopes are 30 to 50 percent. Elevation ranges from 50 to 500 feet. The average annual precipitation is 15 to 23 inches. This site occupies about 3,000 acres in the county. It includes areas of clay soils that are used for range and have slopes of less than 30 percent.

Available water capacity is 4 to 6 inches. Permeability is moderately slow to slow. Reaction is generally slightly acid to moderately alkaline in the surface layer and moderately alkaline and calcareous in the substratum. These soils are subject to erosion if the plant cover is not maintained.

The plant cover on this site typically is open grass or grass and scattered oak trees. Small areas, especially where the exposure is northerly, have dense stands of blue oak, live oak, manzanita, and buckbrush. The vegetation on this site is mostly annual grasses and forbs. If production is at its potential, about 70 percent of the herbage is a mixture of desirable plants, including

soft chess, ryegrass, filaree, annual clovers, remnants of perennial grasses, and an excellent stand of burclover and wild oats. About 20 percent of the vegetation is less desirable plants, including ripgut brome, red brome, wild barley, squirreltail, and annual lupine. The remaining 10 percent consists of undesirable plants, including annual fescues, medusahead, nitgrass, dogtail, tarweed, fiddleneck, popcorn flower, vinegarweed, turkeymullein, thistles, and mustard. In poor condition this site contains some desirable and less desirable plants, but the undesirable plants are dominant. Woody plants commonly increase and replace herbaceous plants as the condition of the site declines.

Where an adequate seedbed can be prepared, the soils in this site can be seeded to Hardinggrass or reseeded to annual grasses and legumes. These soils respond well to applications of nitrogen, phosphorus, and sulfur.

The estimated total annual air-dry production on this site is 3,600 pounds per acre in favorable years and 2,000 pounds per acre during less favorable years. About 90 percent of this production is from plants that furnish forage for cattle, sheep, and deer.

CLAYPAN RANGE SITE

This site consists of gravelly loams and sandy loams that are 14 to 30 inches deep to a dense clay subsoil. Slopes are 2 to 30 percent. Elevation rages from 25 to 250 feet. The average annual precipitation is 16 to 25 inches. This site occupies about 3,100 acres in the county. It includes a sizable acreage of soils that have a claypan and are arable but are being used for range.

The available water capacity is 2.0 to 4.5 inches, but some additional moisture is slowly available to some plant roots in the clay subsoil. Reaction is strongly acid to slightly acid in the surface layer and neutral to strongly acid in the subsoil.

The plant cover on this site typically is open grass or grass and oak trees. The vegetation is mostly annual grasses and forbs, but a limited amount of brush grows on some north-facing slopes. Among the woody plants are live oak, blue oak, buckrush, and manzanita. These woody plants normally are in open, scattered stands or in small patches where the exposure is northerly.

If production is at its potential, about 70 percent of the herbage on this site is a mixture of desirable plants, including soft chess, wild oats, filaree, Spanish clover, annual clovers, a small amount of burclover, and remnants of perennial grasses. About 20 percent of the vegetation is less desirable plants, including ripgut brome, red brome, wild barley, wild carrot, and annual lupine. The remaining 10 percent consists of annual fescues, medusahead, dogtail, silver hairgrass, nitgrass, plantain, fiddleneck, tarweed, popcorn flower, and other undesirable plants. In poor condition this site contains some desirable and less desirable plants, but undesirable plants are dominant. Woody plants commonly increase as the condition of the site declines.

The soils in this site can be reseeded to annual grasses and legumes. Plants on these soils respond well to applications of nitrogen, phosphorus, and sulfur.

The estimated total annual air-dry production on this site is 2,000 pounds per acre in favorable years and 1,000 pounds per acre in less favorable years. About 70 percent of this production is from plants that furnish forage for cattle. Almost 90 percent is forage that is useful to sheep and deer.

SHALLOW LOAMY RANGE SITE

This site consists of loams and cobbly clay loams that are 10 to 20 inches deep over sandstone or basic igneous rock. Slopes are 15 to 75 percent, but only about 10 per cent of the area has slopes that are less than 30 percent. Elevation ranges from 300 to 2,300 feet. The average annual precipitation is 20 to 30 inches. This site occupies about 25,000 acres in the county.

The available water capacity is 1.5 to 3.5 inches. Reaction is slightly acid to medium acid.

The plant cover on this site typically is open grass or grass and oak trees (fig. 23). Some areas, especially where the exposure is northerly, are covered by dense brush. Except for scattered oak trees and occasional dense patches of oak, buckbrush, and manzanita, the vegetation is mostly annual grasses and forbs.

If production is at its potential, about 70 percent of the herbage on this site is a mixture of desirable plants, including soft chess, wild oats, remnant perennials, filaree, burclover, annual clovers, Spanish clover, and annual lupine. About 20 percent of the vegetation is less desirable plants, including ripgut brome, wild barley, wild carrot, yarrow, and lupine. As much as 10 percent of the vegetation is undesirable plants, including annual fescues, nitgrass, silver hairgrass, dogtail, popcorn flower, fiddleneck, tarweed, and thistle. In poor condition this site contains some desirable and less desirable plants, but undesirable plants are dominant. Woody plants commonly increase as the condition of the site declines.

Figure 23.—**Shallow Loamy range site on Millsholm loam, 15 to 30 percent slopes.**

The soils in this site can be reseeded to annual grasses and legumes as emergency seedings in case of wildfire burns and where slopes are less than 30 percent. The steepness of the slopes makes clearing the brush and fertilizing the soils only marginally effective on this site.

The estimated total annual air-dry production on this site is 2,400 pounds per acre in favorable years and 1,200 pounds per acre in less favorable years. About 75 percent of this production is from plants that furnish forage for cattle. About 90 percent is forage useful to sheep and deer.

VERY SHALLOW LOAMY RANGE SITE

This site consists of sandy loams and stony loams that are 6 to 20 inches deep to sandstone or basic igneous rock. Slopes are 15 to 75 percent. Elevation ranges from 300 to 2,300 feet. The average annual precipitation is 20 to 30 inches. This site occupies about 2,800 acres in the county.

The available water capacity is 1 to 2 inches. Reaction is neutral to medium acid. This site dries out early in spring and in any prolonged dry period during the growing season.

The plant cover on this site typically is open grass or grass and oak trees. Blue oak and live oak are commonly scattered over this site. Slopes having a northerly exposure are covered by buckbrush, manzanita, and oaks in some places, and by dense brush in limited areas. The vegetation is mostly annual grasses and forbs.

If production is at its potential, about 70 percent of the herbage on this site is a mixture of desirable plants, including soft chess, wild oats, filaree, burclover, annual clovers, Spanish clover, and annual lupine. About 20 percent of the vegetation is less desirable plants, including ripgut brome, wild barley, wild carrot, yarrow, and lupine. As much as 10 percent of the vegetation is undesirable plants, including annual fescues, nitgrass, silver hairgrass, dogtail, popcorn flower, and fiddleneck. In poor condition this site contains some desirable and less desirable plants, but the undesirable plants are dominant. Woody plants, which are valued for wildlife food and cover, commonly increase as the site declines.

The soils in this site generally are not reseeded to annual grasses and legumes. The shallowness and low available water capacity of these soils generally limit the effectiveness of clearing brush and fertilizing the soils.

The estimated total annual air-dry production on this site is 1,200 pounds per acre in favorable years and 600 pounds per acre in less favorable years. About 75 percent of this production is from plants that furnish forage for cattle. Sheep and deer are able to use a large part of the production.

Wildlife

Wildlife and fish are important to Solano County and contribute directly and indirectly to the economy of the county. They provide recreation, help to control insects, and eat weed seeds.

Pheasant and mourning doves are hunted throughout the county in season. Several commercial hunting preserves release about 100,000 pheasant annually for their members in intensively managed areas. California quail is hunted in the western part of the county. Waterfowl are extremely important, and most areas suitable for waterfowl hunting are used by more than 200 private hunting clubs and are in a State wildlife area. Columbian black-tailed deer, the only big-game species in the county, is abundant in the western areas.

Putah Creek contains trout. Bass, bluegill, and some channel catfish have been stocked in local ponds and reservoirs. Striped bass, black bass, and some species of sunfish, catfish, and nongame fish are plentiful in the numerous delta sloughs in the southern part of the county. Salmon, steelhead, and sturgeon are in the Sacramento River. Other wildlife, including jackrabbits, ground squirrels, coyotes, meadowlarks, white-tailed kites, and many other birds, also is in the county.

The wildlife in Solano County occupies a wide variety of habitats. The particular habitat chosen depends on the soil, water, and character of the landscape, including the degree of farm development and urbanization. The characteristics of the soils have different influences on the quality of the habitat for any particular species, primarily through the food and cover plants that will grow on the soils.

The soils of the county are grouped into nine wildlife suitability groups according to their characteristics and qualities that affect the growth of plants that are important to the management of wildlife habitat. The wildlife suitability group for each soil in indicated in the "Guide to Mapping Units" at the back of this survey. No implication of relative value of the groups is intended, because specific wildlife species require various combinations of food, water, and cover for their maximum development.

Plants suited to the soils in each of the wildlife suitability groups and the suitability of these plants to specific wildlife species are indicated in table 3. Plants of major importance to wildlife in the county are rated as well suited to a soil group if they are naturally abundant or can be expected to grow well under normal methods of propagation, or both. Plants are rated as moderately suited to a soil group if they are fairly common or require a moderate to high degree of care and management to establish them in quantities large enough to be of value to wildlife, or both. Plants are rated as unsuited or unknown if they are not suited to the soil group or their suitability is not known.

Under the heading "Other game and nongame wildlife" in table 3, plants are rated as well suited for use in management for a particular kind of wildlife if they provide choice food or excellent cover, or both. They are rated as moderately suited if they provide fair food or cover, or both. Plants are rated as unsuited or unknown if they provide little or no food or cover of value to the kind of wildlife or if their value is not known.

Other game and nongame wildlife are defined in the following paragraphs.

TABLE 3.—*Suitability of specified plants for wildlife groups of soils and for specified kinds of wildlife*

[An Arabic number 1 means the plant named is suited to the wildlife group or has high value for the kind of wildlife; 2 means suitability of the plant is fair to marginal for the wildlife group or kind of wildlife; dashes in the columns mean the plant is not suited to soils of the wildlife group or its suitability is not known, or that the plant seldom is used by the particular kind of wildlife or its use is not known]

Plant	Wildlife group and rating									Kind of wildlife and rating								
	1	2	3	4	5	6	7	8	9	Deer	Pheasant	California quail	Mourning dove	Ducks	Geese	Other game and nongame wildlife		
																Open-land	Brush-land	Wet-land
Acacia, dwarf	1	2	2	1	2	2	2	1	2	–	2	1	2	–	–	2	1	–
Alfalfa	1	–	2	2	–	–	–	2	–	–	1	2	–	2	2	2	–	–
Alkali bulrush	1	–	1	1	1	1	–	–	1	1	2	–	2	1	1	–	–	1
Arizona cypress	1	2	2	1	2	–	2	1	–	–	2	1	2	–	–	2	1	–
Athel tree	1	2	–	1	2	1	–	1	2	–	2	2	2	–	–	2	2	–
Barley	1	1	1	1	1	2	2	1	–	2	1	1	2	1	1	1	1	2
Birchleaf mountain-mahogany	1	2	2	2	–	–	1	1	–	1	–	2	–	–	–	–	1	–
Blackberry	1	2	1	2	1	2	–	1	1	2	1	1	2	–	–	1	1	–
Bluegum, dwarf	1	2	2	1	2	2	–	1	2	–	2	1	2	–	–	2	1	–
Bottlebrush	1	2	1	1	2	2	2	1	2	–	2	2	2	–	–	2	2	–
Buckbrush	1	2	2	2	–	–	1	1	–	1	–	2	–	–	–	–	2	–
Chamise	–	2	–	1	–	–	1	1	–	1	–	–	–	–	–	–	–	–
Clovers, annual	1	1	1	1	1	2	1	1	–	1	2	1	2	–	–	2	2	–
Clover, bur	1	2	1	1	1	2	2	1	–	1	2	1	2	–	–	2	2	–
Corn, ear	1	–	1	1	1	–	–	2	–	1	1	2	2	1	1	2	2	2
Fat hen	1	–	1	2	1	2	–	–	1	–	1	1	1	1	1	1	1	1
Filaree	1	1	1	1	–	2	1	1	–	2	2	1	2	–	–	1	1	–
Grain sorghum	1	2	1	1	1	2	–	1	–	2	1	1	1	2	2	1	1	2
Hollyleaf cherry	1	2	–	–	–	–	2	2	–	1	2	1	1	–	–	2	1	–
Lupine, annual	1	1	2	1	–	2	2	1	–	2	2	1	1	–	–	1	1	–
Manzanita	1	–	–	1	–	–	1	1	–	2	–	2	–	–	–	–	2	–
Multiflora rose	1	–	1	2	1	–	–	2	–	–	1	1	2	–	–	1	1	–
Oaks	1	–	2	2	2	–	2	1	–	1	–	1	2	1	–	1	1	–
Oleander	1	–	1	1	1	2	2	1	–	–	2	2	2	–	–	1	1	–
Pampasgrass	1	1	1	1	1	1	2	1	2	–	2	2	2	–	–	1	2	–
Poison-oak	1	2	–	1	–	–	1	1	–	1	–	2	–	–	–	–	2	–
Pyracantha	1	–	1	2	2	–	–	1	–	1	1	1	1	–	–	1	1	–
Quailbush	1	1	1	1	1	1	2	1	2	2	1	1	1	–	–	1	1	–
Redmaids	1	1	1	1	2	2	2	1	–	–	2	1	1	–	–	1	1	–
Russian-olive	1	–	2	1	2	2	–	1	–	–	1	1	1	–	–	1	1	–
Ryegrass	1	1	1	1	1	2	1	1	–	2	1	2	–	–	2	2	2	–
Safflower	1	2	1	1	1	2	2	1	2	–	1	1	1	2	–	1	1	–
Saltcedar	1	1	1	1	1	1	–	1	1	–	2	2	2	–	–	2	2	–
Soft chess	1	1	1	1	2	2	1	1	–	2	–	2	–	–	–	2	2	–
Sunflower	1	2	1	1	1	–	–	1	–	–	1	1	1	–	–	1	1	–
Tarweed	1	1	1	1	2	1	1	1	–	–	2	1	2	–	–	1	1	–
Toyon	1	2	–	1	–	–	2	1	–	2	2	1	–	–	–	2	1	–
Trefoil	1	–	1	1	1	2	–	–	–	1	1	2	1	2	1	1	1	2
Turkeymullein	1	1	1	1	2	1	1	1	2	–	2	1	1	–	–	2	2	–
Vetch	1	2	1	1	2	2	1	1	–	1	1	1	1	–	–	1	1	–
Watergrass	1	–	1	1	1	–	–	2	–	–	1	1	1	1	1	1	1	1
Wheat	1	2	1	1	–	2	2	1	–	2	1	1	1	1	1	1	2	1
Wild oats	1	1	1	1	1	2	1	1	2	2	1	2	2	2	–	2	2	–

Open-land wildlife.—Birds and mammals that normally frequent cropland, pasture, lawns, and other areas where grasses and low shrubby growth predominate. Examples are meadowlarks, field sparrows, blackbirds, ground squirrels, skunks, and rabbits.

Brushland wildlife.—Birds and mammals that normally frequent the oak grassland, chaparral, orchards, and other areas of large shrubs and trees. Examples are thrushes, warblers, foxes, coyotes, and bobcats.

Wetland wildlife.—Birds and mammals that normally frequent wet areas such as ponds, marshes, and sloughs. Examples are coots, herons, sandpipers, musrats, and otters.

The recreational or economic potential for developing or using the soils for major species of upland game, deer, waterfowl, and other wildlife is considered in the wildlife suitability groups discussed in the following paragraphs.

Specific wildlife species are not discussed if most of the soils in a group are not suited to management for them. The suitability for fishponds is included where applicable.

WILDLIFE SUITABILITY GROUP 1

This group consists of well-drained to poorly drained soils that are nearly level to moderately sloping on alluvial fans. These soils are very deep and have a gravelly fine sandy loam or loam to silty clay loam surface layer. The group includes the better farming soils in the county. Irrigation water generally is available. Soils of this group occupy about 120,000 acres.

Permeability is moderately rapid to slow. The available water capacity is more than 7.0 inches.

These soils are well suited to management of habitat for upland games, such as pheasant, quail, and dove, and open-land nongame wildlife. The soils are moderately suited to the ponding of water for waterfowl areas or fishponds, depending upon the soil permeability. Deer use these soils for feeding, mainly where the soils are adjacent to upland areas. This can cause depredation problems. If not in urban areas, these soils are generally used for orchards or are intensively cropped, thereby limiting their use by wildlife. Leasing of hunting rights for pheasants and doves on these soils has good potential for economic return.

WILDLIFE SUITABILITY GROUP 2

This group consists of moderately well drained to excessively drained, droughty soils that are in small tracts in the county. These soils are more than 14 inches deep and range from gravelly loam to fine sand in the surface layer. Irrigation water is available in some areas. Soils of this group occupy about 12,000 acres.

Permeability is rapid to very slow. The available water capacity is 2.0 to 4.5 inches.

Annual plants are the most common vegetation on these soils. The soils are moderately suited to management of habitat or open-land nongame wildlife, quail, and dove if adequate drinking water and roosting cover are available or are provided. These soils are moderately well suited to management of habitat for pheasants if irrigation water is available. The soils are used by deer for feeding in winter and spring where adjacent escape cover is available.

WILDLIFE SUITABILITY GROUP 3

This group consists of moderately well drained to poorly drained, nearly level clay soils on basin rims and in basins. These soils are more than 20 inches deep. Irrigation water is generally available. Soils of this group occupy about 53,000 acres.

Permeability is slow. The available water capacity is 8 to 10 inches.

These soils are used mainly for row crops or irrigated pasture, but they are well suited to the management of habitat for waterfowl and wetland nongame wildlife and to the ponding of water for fish. The soils are also well suited to the management of habitat for pheasants and open-land nongame wildlife. Because these soils tend to become waterlogged during wet periods and when overirrigated, extra care is needed to establish shrubs and trees for wildlife cover. The soils crack widely when dry, and this allows young roots to dry out to a considerable depth. The development of ponds for waterfowl or fish or both, must compete favorably with crop uses or be done in conjunction with crop uses. Development of hunting preserves or leasing of hunting rights for upland game and waterfowl has good potential for economic return.

WILDLIFE SUITABILITY GROUP 4

This group consists of moderately well drained, nearly level to gently rolling claypan soils on terraces. These soils are fine sandy loam to loam and are 12 to 30 inches deep over clay. Irrigation water is generally available. Soils of this group occupy 58,000 acres.

Permeability is very slow. The available water capacity is 2 to 6 inches.

These soils are used mainly for pasture, grain, and some row crops, but they are well suited to the management of habitat for quails, doves, and open-land nongame wildlife if adequate drinking water and roosting cover are available or are provided. Where irrigated, these soils are moderately suited to management for pheasant. The nearly level soils in this group are well suited to the ponding of shallow water for waterfowl. They are moderately suited to the development of ponds for fish. Development of duck clubs in the nearly level areas and management of pheasant hunting areas where irrigation water is available have good potential for economic return.

WILDLIFE SUITABILITY GROUP 5

This group consists of somewhat poorly drained to poorly drained, nearly level, wet soils in basins and on basin rims and on some alluvial fans. These soils are more than 60 inches deep and have a silty clay loam to clay surface layer. Irrigation water is generally available. Soils of this group occupy 25,000 acres.

Permeability is slow to moderate. The available water capacity is 6 to 12 inches.

These soils are used mainly for irrigated pasture or row crops, but they are well suited to ponding of water and management for waterfowl, fish, and wetland nongame wildlife. The soils are well suited to the management of habitat for pheasants and moderately suited to the management of habitat for doves, quails, and open-land nongame wildlife. Development of duck clubs and management of areas for pheasant hunting have good potential for economic return, as does development of commercial fishponds.

WILDLIFE SUITABILITY GROUP 6

This group consists of somewhat poorly drained to poorly drained, nearly level soils that are affected by salts or alkali, or both. These soils are in basins and on basin rims, in narrow drainageways, along marsh rims, on old terraces, and on alluvial fans. The soils have a rooting depth of more than 6 inches and have a loam to clay surface layer.

Permeability is slow to very slow. The available water capacity is 2 to 10 inches.

These soils are well suited to the ponding of water for waterfowl, fish, and wetland nongame wildlife. The soils are moderately suited to management of habitat for upland game, such as pheasants, quails, and doves, and for open-land nongame wildlife. The salt and alkali content of these soils limits the kinds of plants that can be used for wildlife habitat management, especially where irrigation water is not available. Development and management of these soils as habitat for waterfowl and for commercial fish production have good potential for economic return where adequate water is available.

WILDLIFE SUITABILITY GROUP 7

This group consists of well-drained to somewhat excessively drained, shallow, strongly sloping to very steep soils on mountainous uplands along the western side of the county. These soils are less than 20 inches deep and have a sandy loam to clay loam surface layer that is stony or cobbly in places. Irrigation water is not generally available. Soils of this group occupy about 45,000 acres.

Permeability is rapid to moderately slow. The available water capacity ranges from less than 1 inch to 3.5 inches.

These soils, which are mostly in chaparral, are suited mainly to the management of existing habitat for deer, quails, and brushland nongame wildlife. There is a shortage of water for wildlife in the area, and the potential for development of small ponds for wildlife drinking water, for fish, and for fire protection is very limited. Leasing of hunting rights for deer and quails has good potential for economic return.

WILDLIFE SUITABILITY GROUP 8

This group consists of well-drained to poorly drained, moderately deep to deep, gently sloping to steep soils. These soils are mainly in the Montezuma and Potrero Hills and on the lower foothills in the western part of the county. They are more than 20 inches deep and have a loam to clay surface layer. Irrigation water generally is not available. Soils of this group occupy about 122,000 acres.

Permeability is moderate to moderately slow. Available water capacity is 3 to 10 inches.

These soils are generally used for annual grain and pasture. They are well suited to management for quails and doves and moderately suited to management for pheasants if adequate water and cover are available or are provided. They are well suited to brushland and open-land nongame wildlife and to management for deer in the lower foothills. The soils are well suited to impoundment of water for fish and for general recreational uses where there are adequate sites. These soils are moderately suited to impoundment of water for waterfowl habitat. The development and use of these soils as habitat for deer, quail, dove, and pheasant hunting preserves have good potential for economic return.

WILDLIFE SUITABILITY GROUP 9

This group consists of poorly drained to very poorly drained, saline-acid soils that are mainly in the Suisun and Sears Point marshes near sea level. These soils are more than 60 inches deep and range from clay mineral soils to organic soils. Irrigation water is available in some areas. Soils of the group occupy 56,000 acres.

These soils are strongly saline and strongly acid to extremely acid. Permeability is slow to rapid. The available water capacity generally is more than 3.0 inches.

Soils in this group are used mainly for waterfowl habitat and are well suited to this use, as well as to use by wetland nongame wildlife (fig. 24). The mineral soils are moderately suitable for pheasant habitat where fresh water is available. The development and management of these soils for use as waterfowl habitat and pheasant preserves has good potential for economic return, but the kinds of plants suitable for use in habitat management are limited by the high salt content of the soils. These soils are well suited to the permanent impoundment of water for fish, though the salt content of the water limits the number of species that can be produced.

Figure 24.—**Duckpond on Joice muck.**

Engineering Uses of the Soils

This section is useful to those who need information about soils used as structural material or as foundations upon which structures are built. Planning commissions, town and city managers, land developers, engineers, contractors, farmers, and others can benefit from the information in this section.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with the properties of the soils on which they are built for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 4, 5, and 6, which show results of engineering laboratory tests on soil samples, several estimated soil properties significant to engineering, and interpretations for various engineering uses.

This information, if used with the soil map and other parts of the survey, can help in making interpretations in addition to those given in tables 4 and 5, and it can also be used to make other useful maps.

This information however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. In addition, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit contain small areas of other soils that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meanings to soil scientists that are not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying soils for engineering are the Unified system, used by engineers of the Soil Conservation Service, Department of Defense, and others (18), and the AASHO system, adopted by the American Association of State Highway Officials (1).

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of eight basic groups ranging from A–1 through A–8 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and are the poorest soils for subgrade; A–8 soils are highly organic soils. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 4; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

Engineering test data

To help evaluate the soils for engineering purposes, samples from 12 soils series in Solano County were tested by the California Division of Highways. The results of these tests are shown in table 4. The table shows the specific location where samples were taken, the depth at which sampling was done, moisture density, mechanical analysis, liquid limit, plasticity index, and AASHO and Unified classifications.

Moisture density shows the relationship between the moisture content and the density to which a soil maderial can be compacted. 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 and the density to which a soil matedecreases as the moisture content increases. The moisture content at which the maximum dry density is obtained is the optimum moisture content.

TABLE 4.—*Engineering*

[Tests performed by California

Soil name and location	Parent material	California report No.	Depth	Moisture density [1]	
				Maximum dry density	Optimum moisture
			Inches	*Lb. per cu. ft.*	*Pct.*
Antioch loam: SW¼SE¼SW¼ sec. 29, T. 5 N., R. 1 W. (Modal)	Alluvium from sedimentary rocks.	65–0075	0–5	115	13
		65–0076	19–34	112	16
		65–0077	60–76	118	12
Capay clay: 200 feet E. and 50 feet N. of SW. corner of sec. 16, T. 6 N., R. 1 E. (Modal)	Alluvium from sedimentary rocks.	65–0064	5–21	109	13
		65–0065	62–81	116	14
Dibble clay loam: 450 feet N. of radar station, sec. 32, T. 6 N., R. 1 W. (Modal)	Sandstone.	65–0043	0–4	109	15
		65–0044	13–23	114	15
Egbert silty clay loam: 0.7 miles W. and 2.2 miles N. of W. end of Ryer Island Ferry. (Modal)	Alluvium from sedimentary rocks.	67–4231	0–6	94	23
		67–4225	31–45	82	25
		67–4222	45–60	86	27
Gilroy loam: SE¼NW¼SW¼ sec. 1, T. 5 N., R. 3 W. (Modal)	Igneous rock.	67–4227	0–12	110	15
		67–4226	12–38	108	17
Hambright loam: NE¼NW¼SE¼ sec. 24, T. 5 N., R. 3 W. (Modal)	Igneous rock.	67–4224	0–5	110	17
		67–4229	5–19	116	14
Millsholm loam: 1,050 feet W. and 850 feet N. of SE. corner of sec. 30, T. 7 N., R. 1 W. (Modal)	Sandstone.	65–0045	0–8	120	12
		65–0046	8–17	123	14
Pescadero clay loam: 200 feet S. of NW. corner of NE¼NE¼NW¼ sec. 36, T. 6 N., R. 1 E. (Modal)	Alluvium from sedimentary rocks.	65–0066	0–4	104	15
		65–0067	14–22	116	12
		65–0068	47–58	117	9
Ryde clay loam: 1.5 miles E. and 1.2 miles N. of E. end of Ryer Island Ferry. (Modal)	Mixed alluvium and plant remains.	67–4228	0–8	71	38
		67–4223	41–44	53	65
San Ysidro fine sandy loam: 900 feet S. and 300 feet W. of NE. corner of NW¼ sec. 29, T. 7 N., R. 1 E. (Modal)	Alluvium from sedimentary rocks.	65–0061	0–7	122	13
		65–0062	14–28	114	13
		65–0063	40–54	115	12
Solano loam: NE. corner sec. 3, T. 4 N., R. 1 W. (Modal)	Alluvium from sedimentary rocks.	65–0072	0–4	108	16
		65–0073	9–21	118	11
		65–0074	48–62	114	14
Toomes sandy loam: ¾ mile W. and ¼ mile N. of Pierce Harbor fishing resort. (Modal)	Igneous rock.	67–4230	0–13	103	11

[1] Based on the method of test for relative compaction of untreated and treated soils and aggregates, test method No. Calif. 216E.

[2] Mechanical analyses by the Calif. Division of Highways Method 202 and 203. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

test data

Division of Highways]

Mechanical analysis [2]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—					Percentage smaller than—							
⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified [4]
		100	96	65	60	46	25	17	23	3	A–4(4)	ML
			100	84	79	67	50	42	43	25	A–7–6(22)	CL
		100	98	67	62	51	33	24	26	9	A–4(5)	CL
			100	97	90	75	63	44	49	21	A–7–6(24)	CL
		100	97	83	80	69	51	40	45	31	A–7–6(25)	CL
		100	97	89	84	69	48	34	36	13	A–6(12)	CL
		100	97	88	83	69	50	36	51	32	A–7–6(22)	CH
		100	98	94	93	83	63	42	61	27	A–7–5(31)	OH
		100	97	93	92	85	71	53	79	30	A–7–5(39)	MH
		100	98	96	96	90	74	59	80	39	A–7–5(48)	MH
[5] 97	94	83	73	58	55	44	29	15	33	5	A–4(4)	ML
[5] 99	98	80	71	58	55	45	29	19	35	9	A–4(4)	ML
	100	96	87	69	66	49	22	16	31	[6]	A–4(6)	ML
	100	94	84	68	65	54	29	15	29	8	A–4(5)	CL
		100	94	41	38	21	20	15	22	[6]	A–4(1)	SM
		100	93	42	40	23	21	17	22	[6]	A–4(1)	SM
		100	98	91	84	68	45	33	44	15	A–7–6(17)	ML
		100	98	87	82	70	53	43	54	40	A–7–6(36)	CH
	100	98	96	79	73	61	45	37	40	22	A–6(16)	CL
	100	97	87	71	69	59	42	25	75	8	A–5(11)	OH
	100	97	92	84	83	72	59	44	101	29	A–7–5(32)	OH
	100	98	94	50	48	37	21	15	18	[6]	A–4(2)	ML–SM
		100	97	65	62	54	42	38	40	25	A–6(14)	CL
		100	98	50	46	40	30	23	33	27	A–6(8)	CL–SC
		100	97	77	70	53	27	19	30	[6]	A–4(7)	ML
		100	98	81	77	64	44	37	33	16	A–6(12)	CL
	100	95	92	83	78	64	43	34	56	36	A–7–5(32)	CH
[5] 96	91	76	57	38	35	29	16	8	[7]	[7]	A–4(6)	SM

[3] Based on AASHO Designation M 145–49(*1*).

[4] Based on the Unified soil classification system (*18*). SCS and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points from A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are ML–SM and CL–SC.

[5] 100 percent passed the ¾-inch sieve.

[6] Nonplastic.

[7] Not determined.

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in the first column

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Classification			Percentage greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Ft.	*Ft.*	*In.*				
*Altamont: AcC, AcE, AcF2, AlC, AlE, AmC, AmE2. For San Ysidro and San Benito parts of AlC and AlE, see their respective series. For Diablo part of AmC and AmE2, see Diablo series.	2–3½	(1)	0–28 28–38 38	Clay Silty clay loam Siltstone.	CH CL	A–7 A–6	0 0
Alviso: An	5+	2–3	0–60	Silty clay loam	CL	A–6	0
*Antioch: AoA, AoC, AsA, AsC. For San Ysidro part, see San Ysidro series.	5+	(1)	0–19 19–60	Loam Clay	ML or CL CL	A–4 A–7	0 0
Ayar. Mapped only with Diablo soils.	3½–5+	(1)	0–41 41–51 51	Clay Clay loam Weakly consolidated sediments.	CH CL	A–7 A–6	0 0
Brentwood: BrA, BrC	5+	(1)	0–60	Heavy clay loam	CL	A–7	0
Capay:							
Ca	5+	(1)	0–60	Silty clay loam	CL	A–6 or A–7	0
Cc	5+	(1)	0–60	Clay	CL or CH	A–7	0
Clear Lake: CeA, CeB, ClA	5+	4–5+	0–60	Clay	CH	A–7	0
Columbia: Cm	5+	4–5+	0–60	Fine sandy loam, thin strata of sand to silty clay loam.	SM or SC	A–4	0
Conejo:		(1)					
Cn, Cs	5+	(3–5 in Cs)	0–60	Loam	ML or CL	A–4	0
Co	5+	(1)	0–60	Gravelly loam	SM or SC	A–4	0
Cr	5+	(1)	0–60	Clay loam	CL	A–6	0
Corning: CvD2, CvE2	5+	(1)	0–17 17–26 26–60	Gravelly loam Clay Very gravelly sandy loam.	SM or SC CL SM or GM	A–4 A–7 A–1 or A–2	0–5 0 0
*Diablo: DaC, DaE2. For Ayar part, see Ayar series.	2½–4	(1)	0–36 36	Clay Consolidated sediments.	CH	A–7	0
*Dibble:							
DbC, DbE, DbF2. For Los Osos part, see Los Osos series.	1½–3½	(1)	0–18 18–36 36	Loam Light clay Sandstone.	ML or CL CH	A–4 A–7	0 0
DlC, DlE, DlF2. For Los Osos part, see Los Osos series.	2–3½	(1)	0–13 13–30 30	Clay loam Light clay Sandstone.	CL CH	A–6 A–7	0 0
Egbert: Eb, Ec	5+	4–5	0–60	Silty clay loam	MH or OH	A–7	0

See footnotes at end of table.

significant to engineering

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring of this table. The symbol < means less than]

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plastic index						
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos./ cm. at 25°C.*		
100	100	90–100	75–95	50–60	30–40	0.06–0.2	0.14–0.16	6.1–8.4	0–2	High	High.
100	100	95–100	85–95	30–40	15–25	0.06–0.2	0.19–0.21	7.4–8.4	0–2	Moderate	High.
100	100	95–100	90–95	30–40	15–25	0.06–0.2	0.07–0.10	6.6–8.4	8–30	High	High.
100	100	90–100	60–70	20–30	0–10	0.63–2.0	0.15–0.17	5.6–6.5	0–1	Low	Low.
100	100	95–100	80–90	40–50	20–30	<0.06	0.04–0.06	5.6–9.0	0–2	High	High.
100	100	90–100	75–95	50–60	30–40	0.06–0.2	0.14–0.16	7.9–8.4	0–2	High	High.
100	100	90–100	70–80	30–40	10–20	0.06–0.2	0.18–0.20	7.9–8.4	0–2	Moderate	Moderate.
100	100	95–100	90–100	40–50	15–25	0.2–0.63	0.19–0.21	6.1–8.4	0–2	High	High.
100	100	95–100	90–95	30–45	15–25	0.06–0.2	0.16–0.18	6.1–8.4	0–2	High	High.
100	100	95–100	80–100	40–55	20–35	0.06–0.2	0.14–0.16	6.1–8.4	0–2	High	High.
100	95–100	90–100	80–95	50–70	35–55	0.06–0.20	0.14–0.16 (0.10–0.12 in CIA)	6.1–8.4	0–15	High	High.
100	100	70–85	40–50	0–20	0–10	2.0–6.3	0.13–0.15	6.1–8.4	0–1	Low	Moderate.
100	100	85–95	60–75	20–30	0–10	0.20–2.0	0.16–0.18	6.1–7.8	0–1	Moderate	Moderate.
65–75	55–70	50–65	40–50	20–30	0–10	0.63–2.0	0.12–0.14	6.1–7.8	0–1	Low	Low.
100	100	90–100	70–80	30–40	20–30	0.2–0.63	0.19–0.21	6.1–7.8	0–1	Moderate	Moderate.
65–75	55–70	50–65	40–50	20–30	0–10	0.63–2.0	0.13–0.15	5.1–6.0	0–1	Low	Low.
70–95	65–95	60–95	50–90	40–50	25–35	<0.06	0.03–0.05	5.6–6.5	0–2	High	High.
50–90	45–90	30–55	15–30	(2)	(2)	<0.06	0.03–0.05	6.6–8.4	0–1	Low	Moderate.
100	100	90–100	75–95	60–70	40–50	0.06–0.20	0.14–0.16	6.1–8.4	0–2	High	High.
100	100	85–95	60–70	20–30	0–10	0.63–2.0	0.16–0.18	5.6–6.5	0–1	Moderate	Low.
100	100	95–100	85–95	50–60	30–40	0.06–0.20	0.15–0.17	6.1–7.3	0–2	High	High.
100	100	95–100	80–90	30–40	10–20	0.2–0.63	0.18–0.20	5.6–6.5	0–1	Moderate	Moderate.
100	100	95–100	85–95	50–60	30–40	0.06–0.2	0.15–0.17	6.1–7.3	0–2	High	High.
100	100	95–100	90–100	60–80	25–40	0.2–0.63	0.19–0.21	5.6–6.5	0–1	High	High.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Classification			Percentage greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Ft.	*Ft.*	*In.*				
Gaviota: GaG2	½–1	(1)	0–12 12	Sandy loam Sandstone and shale.	SM	A–2	0
Gilroy: GlE	1½–3½	(1)	0–38 38	Loam Igneous rock.	ML or CL	A–4 or A–6	0–20
*Hambright: HaF, HtE For Toomes part of HtE, see Toomes series.	½–1½	(1)	0–19 19	Loam and cobbly loam. Basic igneous rock.	ML or CL	A–4	5–65
Joice: Ja	5+	1–2½	0–60	Clayey muck (organic and mineral mixture).	Pt	A–8	
Joice, clay subsoil variant: Jb	5+	1–2½	0–29 29–60	Muck (organic and mineral mixture). Clay	Pt CH	A–8 A–7	 0
Los Gatos Mapped only with Maymen soils.	1½–2	(1)	0–12 12–22 22	Loam Clay loam Sandstone.	ML or CL CL	A–4 A–6	0 0
Los Osos Mapped only with Dibble and Millsap soils.	1½–3½	(1)	0–7 7–25 25	Clay loam Light clay Sandstone.	CL CH or CL	A–6 A–7	0 0
Made land: Ma. Too variable to rate.							
*Maymen: MeG3 For Los Gatos part, see Los Gatos series.	1–1½	(1)	0–10 10	Loam Sandstone.	ML or CL	A–4	0
*Millsap: MkA, MlC For Los Osos part of MlC, see Los Osos series.	1½–2½	(1)	0–16 16–28 28	Sandy loam Clay Sandstone.	SM CL	A–2 A–6	0 0
Millsholm and Millsholm variant: MmE, MmG2, MnC, MnE.	1–3	(1)	0–17 17	Loam Sandstone.	SM or ML	A–4	0
Omni: Om, On	5+	1½–4	0–60	Silty clay (clay loam surface layer in places.)	MH or CH	A–7	0
Pescadero: Pc, Pe	5+	(1)	0–34 34–69	Clay Clay loam	CH CL	A–7 A–6 or A–7	0 0
Reiff: Ra	5+	(1)	0–60	Fine sandy loam	SM or ML	A–4	0
Reyes: Rd, Re	5+	4–5+ (2–4 in Re)	0–60	Silty clay loam or silty clay.	MH or OH	A–7	0
Rincon: RnC, RoA, RoC	5+	(1)	0–60	Clay loam and heavy clay loam (loam surface layer in places).	CL	A–6	0

See footnotes at end of table.

significant to engineering—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plastic index						
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos./ cm. at 25°C.*		
95–100	90–100	60–70	25–35	(2)	(2)	2.0–6.3	0.10–0.12	6.1–7.3	0–1	Low	Low.
90–100	80–90	70–80	55–65	30–40	5–15	0.63–2.0	0.16–0.18	5.6–6.5	0–1	Moderate	Low.
90–100	90–100	80–90	65–75	25–35	0–15	0.63–2.0	0.08–0.16	5.6–7.3	0–1	Low to moderate.	Low.
						2.0–6.3	0.23–0.25	4.5–8.4	15–50	High shrink, low swell.	High.
						2.0–6.3	0.23–0.25	4.5–8.4	15–50	High shrink, low swell.	High.
100	95–100	90–100	80–95	50–70	35–55	<0.06	0.03–0.05	7.4–8.4	15–50	High	High.
100	100	85–95	60–75	20–30	0–10	0.63–2.0	0.14–0.16	5.6–6.5	0–1	Moderate	Low.
100	100	90–100	70–80	30–40	15–25	0.2–0.63	0.19–0.21	5.6–6.5	0–1	Moderate	Moderate.
100	100	90–100	80–90	30–40	10–20	0.2–0.63	0.18–0.20	5.6–6.5	0–1	Moderate	Moderate.
100	100	95–100	85–95	40–60	30–40	0.06–0.20	0.15–0.17	6.1–7.3	0–2	High	High.
100	100	85–95	60–75	20–30	0–10	0.63–2.0	0.14–0.16	5.6–6.5	0–1	Moderate	Low.
100	100	60–70	25–35	(2)	(2)	2.0–6.3	0.11–0.13	5.1–6.0	0–1	Low	Low.
100	100	90–100	80–90	30–40	20–30	<0.06	0.05–0.07	6.1–7.3	0–1	High	High.
100	100	90–100	40–60	15–25	0–15	0.63–2.0	0.16–0.18	6.1–7.3	0–1	Low to moderate.	Low.
100	100	95–100	90–95	50–60	20–35	0.06–0.2	0.12–0.14	6.6–8.4	0–8	High	High.
100	100	95–100	85–95	50–60	35–45	0.06–0.2	0.17–0.19	7.9–9.0+	4–8	High	High.
100	95–100	90–100	75–85	35–45	20–30	0.06–0.2	0.03–0.05	7.9–9.0+	4–8	Moderate	High.
100	100	90–100	45–55	20–30	0–15	2.0–6.3	0.13–0.15	6.1–8.4	0–1	Low	Low.
100	90–100	85–95	70–80	50–60	15–25	0.06–0.20	0.12–0.14	<4.5–8.4	15–40	High	High.
100	100	90–100	70–90	25–40	10–30	0.06–0.2	0.15–0.17	6.1–7.8	0–2	High	High.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Classification			Percentage greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Ft.	*Ft.*	*In.*				
Riverwash: Rw. Too variable to rate.							
Ryde: Ry	5+	3–4	0–72	Clay loam and loam high in organic matter.	MH or OH	A–5 or A–7	0
Sacramento: Sa, Sc, Sd	5+	3–4	0–61	Clay (silty clay loam surface layer in places.)	CH or MH	A–7	0
San Benito. Mapped only with Altamont and San Ysidro soils.	2–3½	(1)	0–25 25	Clay loam Weakly consolidated sediments.	CL	A–6 or A–7	0
San Ysidro: SeA, SeB, SfA	5+	(1)	0–14 14–68	Sandy loam Clay loam	SM or ML CL or ML	A–4 A–6 or A–7	0 0
*Solano: Sh, Sk. For Pescadero part of Sk, see Pescadero series.	5+	(1)	0–9 9–62	Loam Clay loam	ML or CL CL or CH	A–4 A–6 or A–7	0 0
Solano, dark surface variant: Sm	5+	(1)	0–7 7–13 13–55 55–63	Loam Clay loam Loam Loamy sand	ML or CL CL or CH ML or CL SM	A–4 A–6 or A–7 A–4 A–2	0 0 0 0
Suisun: Sp	5+	1–1½	0–60	Muck	Pt	A–8	
Sycamore: Sr, Ss, St, Su	5+	3–5+	0–60	Silty clay loam	CL	A–6 or A–7	0
Tamba: Ta	5+	1–3	0–72	Mucky clay	OH	A–7 or A–8	0
Tidal marsh: Td. Too variable to rate.							
Toomes: ToG2	½–1½	(1)	0–17 17	Loam Tuff.	SM	A–4	20–65
Trimmer: TrE	2–3½	(1)	0–20 20–40 40	Loam Clay loam Basic igneous rock.	ML or CL CL	A–4 A–6	0–30 0–30
Trimmer, shallow variant: TsF2	1–1½	(1)	0–13 13	Cobbly clay loam and cobbly clay. Basalt.	CL	A–6	30–65
Tujunga: Tu	5+	(1)	0–60	Sand and fine sand	SP–SM or SM.	A–1	0
Valdez:							
Va	5+	4–5	0–60	Silt loam	ML or CL	A–4	0
Vc, Vd	5+	3–5 in Vc, 1–1½ in Vd	0–60	Silty clay loam	CL	A–6	0
Ve	5+	3–5	0–40 40–60	Silty clay loam Clay	CL CH	A–6 A–7	0 0
Willows: Wc	5+	(1)	0–46 46–61	Clay Heavy sandy clay loam.	CH CL	A–7 A–6	0 0

See footnotes at end of table.

significant to engineering—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plastic index						
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos./ cm. at 25°C.*		
100	95–100	85–95	70–85	75–105	5–30	0.63–2.0	0.25–0.30	5.1–7.8	0–8	High shrink, low swell.	High.
100	100	90–100	90–100	60–70	30–40	0.06–0.2	0.14–0.16	6.1–8.4	0–2	High	High.
100	100	90–100	85–95	35–50	25–35	0.2–0.63	0.19–0.21	5.6–8.4	0–2	Moderate	Moderate.
100	90–100	85–95	40–60	10–20	0–15	2.0–6.3	0.13–0.15	5.6–6.5	0–1	Low	Low.
100	100	95–100	50–65	30–45	15–30	<0.06	0.03–0.05	6.1–8.4	0–4	High	High.
100	100	90–100	65–80	20–30	0–10	0.63–2.0	0.14–0.16	5.1–6.5	2–10	Moderate	High.
100	95–100	90–100	75–85	30–55	15–35	<0.06	0.04–0.06	6.6–9.0	2–10	Moderate	High.
100	100	90–100	65–80	20–30	0–10	0.63–2.0	0.14–0.16	5.6–9.0	4–15	Low	High.
100	95–100	90–100	75–85	30–55	15–35	<0.06	0.04–0.06	7.9–9.0+	4–15	Moderate	High.
100	100	90–100	65–80	20–30	0–10	0.06–0.20	0.08–0.10	7.9–9.0	4–10	Low	High.
100	100	50–60	15–25	(2)	(2)	0.2–6.3	0.06–0.08	7.9–9.0	4–10	Low	High.
						6.3–20.0	0.25–0.27	4.5–9.0	15–50	High shrink, low swell.	High.
100	100	85–100	80–90	35–45	15–25	[3] 0.2–0.63	0.19–0.21	6.1–8.4	[4] 0–2	Moderate	High.
100	100	90–100	75–95	60–70	20–30	0.63–2.0	0.15–0.17	4.5–8.4	15–40	High shrink, low swell.	High.
85–95	70–80	55–65	35–45	(2)	(2)	0.63–2.0	0.10–0.12	5.6–6.5	0–1	Low	Low.
90–100	80–90	70–80	55–65	20–30	0–10	0.63–2.0	0.16–0.18	5.6–6.5	0–1	Moderate	Low.
90–100	80–90	75–85	60–70	30–40	15–25	0.2–0.63	0–19–0.21	6.1–7.3	0–1	Moderate	Moderate.
80–90	75–85	70–80	55–65	30–40	15–25	0.06–0.20	0.14–0.16	5.6–8.4	0–1	Moderate	Moderate.
100	95–100	40–50	5–15	(2)	(2)	6.3–20.0	0.06–0.08	6.1–7.3	0–1	Low	Low.
100	100	90–100	60–70	20–30	0–10	0.2–0.63	0.18–0.20	5.6–8.4	0–1	Moderate	Moderate.
100	100	95–100	85–95	30–40	15–25	0.2–0.63 in Vc, 0.06–0.2 in Vd	0.11–0.13	5.6–8.4	4–30	Moderate	High.
100	100	95–100	85–95	30–40	15–25	0.2–0.63	0.11–0.13	5.6–8.4	8–15	Moderate	High.
100	100	90–100	85–95	50–70	35–50	0.06–0.20	0.09–0.11	5.6–8.4	8–30	High	High.
100	100	95–100	85–95	60–70	30–50	0.06–0.20	0.12–0.14	7.9–9.0+	0–8	High	High.
100	100	80–90	50–60	30–40	10–20	0.20–0.63	0.10–0.12	7.9–9.0+	0–8	Moderate	High.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Classification			Percentage greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Ft.	*Ft.*	*In.*				
Yolo:							
Yo	5+	(1)	0–60	Loam	ML or CL	A–4	0
Yr	5+	(1)	0–40	Loam	ML or CL	A–4	0
			40–60	Clay	CH	A–7	0
Ys	5+	(1)	0–36	Silty clay loam	CL	A–6 or A–7	0
			36–60	Loam	ML or CL	A–4	0

[1] No water table within depth of observation. Normally it is at a depth of about 5 feet, unless limited by bedrock or hardpan.
[2] Nonplastic.

Mechanical analysis shows the percentage, by weight, of soil particles that pass through sieves of specific sizes. The clay fraction was determined by the hydrometer method. Sand and other coarse particles do not pass through a No. 200 sieve, but silt and clay do.

Plastic limit, liquid limit, and plasticity index indicate the effects of water on the strength and consistence of the soil material. As the moisture content of a clayey soil increases from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which a soil passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which soil material is plastic. The moisture content and liquid and plastic limits are expressed as a percentage of dry soil weight.

Estimated properties

Table 5 provides estimates of soil properties important to engineering practices. Estimates are based on field examination and descriptions, physical and chemical tests of selected samples, test data from similar soils in adjacent areas, and experience in working with the individual soils in the county. Because these estimates are for the typical soils, some variations from the listed values should be anticipated.

Depth to bedrock is shown to give an indication of the presence or absence of bedrock within a 5-foot depth. Where the depth to bedrock is noted as more than 5 feet, bedrock was not encountered within the 5-foot sampling depth.

Depth to seasonal high water table, expressed in feet, gives the observed or estimated range of depth from the surface to the shallowest level reached by the seasonal water table.

Permeability, expressed in inches per hour, relates only to the movement of water downward through undisturbed and uncompacted soil. It was estimated by comparison with soils of known permeability as described in the section "Descriptions of the Soils."

Available water capacity, expressed in inches per inch of soil depth, is the approximate amount of capillary water in the soil if wet to field capacity. When the soil is air-dry, this amount of water will wet the soil material described to a depth of 1 inch without deeper percolation.

Reaction is the degree of acidity or alkalinity of the soil, expressed as pH value. A range of pH 6.6 to 7.3 is neutral; lower values indicate acidity and higher values indicate alkalinity. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Salinity of the soil is based on the electrical conductivity of the saturated soil extract, as expressed in millimhos per centimeter (mmhos./cm.) at 25° C. Salinity may affect the stability of a soil when used as construction material, and it influences corrosivity.

Shrink-swell potential indicates the expected volume change in the soil that accompanies a change in moisture content. The volume change of soils is influenced by the amount of moisture change and the amount and kind of clay in the soil. The ratings provide an indication of the hazard to structures resulting from this volume change. The potential is rated low, moderate, or high.

Corrosivity, as used here, indicates the potential danger to uncoated steel structures through electrochemical action. Corrosivity correlates with the physical, chemical, and biological characteristics of the soil (12). The soil is evaluated in its undisturbed state. Where structures intersect different soil boundaries, the potential for corrosion is greater than in a uniform soil. Corrosivity is rated as low, moderate, or high, and is based on the soil properties of drainage class, texture, total acidity, and conductivity of the saturation extract.

significant to engineering—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity (uncoated steel)
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plastic index						
						In. per hr.	*In. per in. of soil*	*pH*	*Mmhos./cm. at 25°C.*		
100	100	85–95	60–75	20–30	0–10	0.63–2.0	0.16–0.18	6.1–8.4	0–1	Moderate	Low.
100	100	85–95	60–75	20–30	0–10	0.63–2.0	0.16–0.18	6.1–8.4	0–1	Moderate	Low.
100	100	90–100	75–85	55–65	25–35	0.06–0.2	0.15–0.17	6.6–8.4	0–1	High	High.
100	100	95–100	85–95	35–50	25–35	0.2–0.63	0.19–0.21	6.1–8.4	0–1	Moderate	Moderate.
100	100	85–95	65–75	20–30	0–10	0.63–2.0	0.16–0.18	6.1–8.4	0–1	Moderate	Low.

[3] Permeability is 0.06–0.2 in St and Su.
[4] Salinity is 8–30 in substratum of St and Su.

Engineering interpretations

Table 6 presents information useful to engineers and others who plan to use soil material in construction of roads, farm facilities, buildings, and septic tank filter fields. Specific features or characteristics that can affect the selection, design, construction, and maintenance of various projects and the suitability ratings for specific purposes are listed. The soil features shown are based on the typical profile for each soil as shown in table 4.

Topsoil is fertile soil or soil material that is ordinarily rich in organic matter and is used as a topdressing for lawns, gardens, and roadbanks. The ratings, good, fair, and poor, indicate the suitability of the soils for these uses.

Estimates of the suitability of soils for use as a source of road fill are based on the AASHO classification (see table 5), and shrink-swell potential, and on judgements of the appropriate soil properties. Ratings used are good, fair, and poor.

Road location is influenced by soil features that relate to the undisturbed soil as they affect construction and maintenance of unsurfaced roads.

In locating water retention structures, the suitability of the soils and site as a reservoir area as well as the presence of suitable material for the embankment must be considered. Factors such as shear strength, piping hazard, compressibility, and compacted permeability must be evaluated for the embankment, and soil factors such as permeability, depth to bedrock or water table, and slope are considered for the floor.

The features that affect agricultural drainage are indicated in table 6. Influencing factors include presence of a water table, permeability, depth to a restricting layer, and drainage class.

Suitability of a soil for irrigation is based chiefly on its available water capacity, water intake rate, permeability, and natural drainage.

Septic tank filter fields are affected most by soil depth, permeability, depth to water table, slope, and susceptibility to flooding (19). The hazard of contaminating water supplies is included in the evaluation. The limitations are rated slight, moderate, and severe.

Information useful to engineers in estimating storm runoff from the soils is shown in table 6, in the hydrologic soil group ratings. Four major groups are used. Soils are classified on the basis of intake of water at the end of a storm of long duration, after the soil is wet and has had an opportunity to swell and without the protection of vegetation. The hydrologic groupings are tentative and are subject to change as more data are obtained and evaluated. The four hydrologic soil groups are discussed in the following paragraphs.

Group A consists of soils that have a high infiltration rate when thoroughly wetted. These soils have a high rate of water transmission and low runoff potential. They are deep, well-drained to excessively drained sands and gravels.

Group B soils have a moderate infiltration rate when thoroughly wetted. These soils have a moderate rate of water transmission. They are moderately deep to deep, moderately well drained to well drained soils that are moderately fine textured to moderately coarse textured.

Group C soils have a slow infiltration rate when thoroughly wetted. These soils have a slow rate of water transmission. They have a layer that impedes the downward movement of water, or the soils are moderately fine textured to fine textured.

Group D soils have a very slow infiltration rate when thoroughly wetted. These soils have a very slow rate of water transmission and high runoff potential. In this group are clay soils that have a high swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material.

TABLE 6.—*Interpretations of the*

[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 such to other series that appear in

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Road location	Water retention structures: Embankments
*Altamont: AcC, AcE, AcF2, AlC, AlE, AmC, AmE2. For San Ysidro and San Benito parts of AlC and AlE and for Diablo part of AmC and AmE2, see their respective series.	Poor: clay	Poor: A-7 or A-6; high shrink-swell potential.	Siltstone at a depth of 2 to 3½ feet; slopes of 2 to 50 percent; high shrink-swell potential.	Low shear strength; high compressibility; low piping hazard; low permeability when compacted.
Alviso: An	Poor: silty clay loam; moderately saline.	Poor: A-6; high shrink-swell potential.	High shrink-swell potential.	Low to medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
*Antioch: AoA, AoC, AsA, AsC. For San Ysidro part, see San Ysidro series.	Poor: loam over clay at a depth of 15 to 30 inches.	Fair to poor: A-4 or A-7; high shrink-swell potential.	Slopes of 0 to 9 percent; high shrink-swell potential.	Low shear strength; high compressibility; low piping hazard; low permeability when compacted.
Ayar. Mapped only with Diablo soils.	Poor: clay	Poor: A-7 or A-6; high shrink-swell potential.	Weakly consolidated sediments at a depth of 3½ to 5 feet; slopes of 2 to 30 percent; high shrink-swell potential.	Low shear strength; high compressibility; low piping hazard; low permeability when compacted.
Brentwood: BrA, BrC	Fair: clay loam	Poor: A-7; high shrink-swell potential.	Slopes of 0 to 9 percent; high shrink-swell potential.	Low to medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Capay: Ca, Cc	Poor: silty clay loam or clay.	Poor: A-6 or A-7; high shrink-swell potential.	High shrink-swell potential.	Low to medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Clear Lake: CeA, CeB, ClA	Poor: clay	Poor: A-7; high shrink-swell potential.	Water table at a depth of 4 feet to more than 5 feet; high shrink-swell potential.	Low shear strength; high compressibility; low piping hazard; low permeability when compacted.
Columbia: Cm	Good	Fair: A-4; low shrink-swell potential.	Water table at a depth of 4 feet to more than 5 feet; low shrink-swell potential.	Medium shear strength; low to medium compressibility; medium to high piping hazard; low to medium permeability when compacted.

See footnote at end of table.

soils for engineering uses

mapping units may have different properties or limitations, and for this reason it is necessary to follow carefully the instructions for referring the first column of this table]

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil groups
Water retention structures—Continued	Agricultural drainage	Irrigation		
Reservoir areas				
Slow permeability; slopes of 2 to 50 percent; siltstone at a depth of 2 to 3½ feet.	Slow permeability; siltstone at a depth of 2 to 3½ feet; well drained.	Medium available water capacity; slow water intake; slopes of 2 to 50 percent; siltstone at a depth of 2 to 3½ feet.	Severe: slow permeability; bedrock at a depth of 2 to 3½ feet; slopes of 2 to 50 percent.	D
Slow permeability; slopes of 0 to 2 percent; water table at a depth of 2 to 3 feet.	Slow permeability; water table at a depth of 2 to 3 feet; poorly drained.	High available water capacity; slow water intake; slopes of 0 to 2 percent; water table at a depth of 2 to 3 feet.	Severe: water table at a depth of 2 to 3 feet; slow permeability.	D
Very slow permeability; slopes of 0 to 9 percent.	Very slow permeability; moderately well drained.	Medium available water capacity; medium water intake; slopes of 0 to 9 percent.	Severe: very slow permeability.	D
Slow permeability; slopes of 2 to 30 percent; weakly consolidated sediments at a depth of 3½ to 5 feet.	Slow permeability; weakly consolidated sediments at a depth of 3½ to 5 feet; well drained.	Medium to high available water capacity; slow water intake; slopes of 2 to 30 percent; weakly consolidated sediments at a depth of 3½ to 5 feet.	Severe: slow permeability	D
Moderately slow permeability; slopes of 0 to 9 percent.	Moderately slow permeability; well drained.	High available water capacity; moderately slow water intake; slopes of 0 to 9 percent.	Severe: moderately slow permeability.	B
Slow permeability; slopes of 0 to 2 percent.	Slow permeability; moderately well drained.	High available water capacity; slow water intake; slopes of 0 to 2 percent.	Severe: slow permeability	D
Slow permeability; slopes of 0 to 5 percent; water table at a depth of 4 feet to more than 5 feet.	Slow permeability; water table at a depth of 4 feet to more than 5 feet; poorly drained.	Medium to high available water capacity; slow water intake; slopes of 0 to 5 percent.	Severe: slow permeability	D
Moderately rapid permeability; slopes of 0 to 2 percent; water table at a depth of 4 feet to more than 5 feet.	Moderately rapid permeability; water table at a depth of 4 feet to more than 5 feet; somewhat poorly drained.	High available water capacity; moderately rapid water intake; slopes of 0 to 2 percent; water table at a depth of 4 feet to more than 5 feet.	Moderate: somewhat poorly drained; water table at a depth of 4 feet to more than 5 feet.	C

TABLE 6.—*Interpretations of the*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Road location	Water retention structures: Embankments
Conejo: Cn, Cs	Good	Fair: A-4; moderate shrink-swell potential.	Water table at a depth of 3 to 5 feet in Cs; moderate shrink-swell potential.	Low to medium shear strength; medium compressibility; medium to high piping hazard; medium to low permeability when compacted.
Co	Fair: gravelly loam.	Fair: A-4; low shrink-swell potential.	Low shrink-swell potential.	Medium shear strength; low to medium compressibility; medium to high piping hazard; medium to low permeability when compacted.
Cr	Fair: clay loam	Poor: A-6; moderate shrink-swell potential.	Moderate shrink-swell potential.	Medium to low shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Corning: CvD2, CvE2	Poor: gravelly loam over clay at a depth of 14 to 20 inches.	Good to poor: A-4, A-7, or A-2; high shrink-swell potential.	Slopes of 2 to 30 percent; high shrink-swell potential in subsoil.	Medium to high shear strength; low to medium compressibility; medium piping hazard; medium to low permeability when compacted.
*Diablo: DaC, DaE2. For Ayar part, see Ayar series.	Poor: clay	Poor: A-7; high shrink-swell potential.	2½ to 4 feet to consolidated sediments; slopes of 2 to 30 percent; high shrink-swell potential.	Low shear strength; high compressibility; low piping hazard; low permeability when compacted.
*Dibble: DbC, DbE, DbF2. For Los Osos part, see Los Osos series.	Poor: loam over clay at a depth of 10 to 18 inches.	Fair to poor: A-4 or A-7; high shrink-swell potential.	Sandstone at a depth of 1½ to 3½ feet; slopes of 2 to 50 percent.	Low to medium shear strength; medium to high compressibility; low to medium piping hazard; low permeability when compacted.
DIC, DIE, DIF2. For Los Osos part, see Los Osos series.	Poor: clay loam over clay at a depth of 10 to 18 inches.	Poor: A-6 or A-7; high shrink-swell potential.	Sandstone at a depth of 2 to 3½ feet; slopes of 2 to 50 percent; high shrink-swell potential.	Low to medium shear strength; medium to high compressibility; low to medium piping hazard; low permeability when compacted.
Egbert: Eb, Ec	Fair: silty clay loam.	Poor: A-7; high shrink-swell potential.	Water table at a depth of 4 feet to more than 5 feet; high shrink-swell potential.	Low shear strength; high compressibility; low to medium piping hazard; low to medium permeability when compacted.

soils for engineering uses—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil groups
Water retention structures—Continued	Agricultural drainage	Irrigation		
Reservoir areas				
Moderate permeability; slopes of 0 to 2 percent.	Moderate permeability; well drained; water table in Cs at a depth of 3 to 5 feet.	High available water capacity; moderate water intake; slopes of 0 to 2 percent; water table in Cs at a depth of 3 to 5 feet.	Moderate in Cn; moderate permeability. Severe in Cs: water table at a depth of 3 to 5 feet.	B in Cn C in Cs
Moderate permeability; slopes of 0 to 2 percent.	Moderate permeability; well drained.	Medium to high available water capacity; moderately rapid water intake; slopes of 0 to 2 percent.	Moderate: moderate permeability.	B
Moderately slow permeability; slopes of 0 to 2 percent.	Moderately slow permeability; well drained.	High available water capacity; moderately slow water intake; slopes of 0 to 2 percent.	Severe: moderately slow permeability.	B
Very slow permeability; slopes of 2 to 30 percent.	Very slow permeability; well drained.	Low available water capacity; moderate water intake; slopes of 2 to 30 percent.	Severe: very slow permeability; slopes of 2 to 30 percent.	D
Slow permeability; slopes of 2 to 30 percent; consolidated sediments at a depth of 2½ to 4 feet.	Slow permeability; consolidated sediments at a depth of 2½ to 4 feet; well drained.	Medium available water capacity; slow water intake; slopes of 2 to 30 percent; consolidated sediments at a depth of 2½ to 4 feet.	Severe: slow permeability; slopes of 2 to 30 percent; consolidated sediments at a depth of 2½ to 4 feet.	D
Slow permeability; slopes of 2 to 50 percent; sandstone at a depth of 1½ to 3½ feet.	Slow permeability; sandstone at a depth of 1½ to 3½ feet; well drained.	Low to medium available water capacity; moderate water intake; sandstone at a depth of 1½ to 3½ feet.	Severe: slow permeability; slopes of 2 to 50 percent; bedrock at a depth of 1½ to 3½ feet.	C
Slow permeability; slopes of 2 to 50 percent; sandstone at a depth of 2 to 3½ feet.	Slow permeability; sandstone at a depth of 2 to 3½ feet; well drained.	Medium available water capacity; moderate water intake; slopes of 2 to 50 percent; sandstone at a depth of 2 to 3½ feet.	Severe: slow permeability; slopes of 2 to 50 percent; bedrock at a depth of 2 to 3½ feet.	C
Moderately slow permeability; slopes of 0 to 2 percent; water table at a depth of 4 feet to more than 5 feet.	Moderately slow permeability; water table at a depth of 4 feet to more than 5 feet; poorly drained; Ec subject to occasional flooding.	High available water capacity; slow water intake; slopes of 0 to 2 percent; water table at a depth of 4 feet to more than 5 feet.	Severe: moderately slow permeability; poorly drained; water table at a depth of 4 feet to more than 5 feet.	C

TABLE 6.—*Interpretations of the*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Road location	Water retention structures: Embankments
Gaviota: GaG2	Poor: sandstone at a depth of 8 to 15 inches.	Good	Sandstone at a depth of 8 to 15 inches; slopes of 30 to 75 percent; low shrink-swell potential.	Medium shear strength; low to medium compressibility; medium to high piping hazard; medium to low permeability when compacted.
Gilroy: GlE	Fair: igneous rock at a depth of 1½ to 3½ feet.	Fair to poor: A-4 or A–6; moderate shrink-swell potential.	Igneous rock at a depth of 1½ to 3½ feet; slopes of 9 to 30 percent; moderate shrink-swell potential.	Medium to low shear strength; medium compressibility; medium to high piping hazard; medium to low permeability when compacted.
*Hambright: HaF, HtE For Toomes part of HtE, see Toomes series.	Poor: basic igneous rock at a depth of 6 to 20 inches; slopes of 5 to 65 percent; cobblestones.	Fair: A-4; low to moderate shrink-swell potential; 5 to 65 percent cobblestones.	Igneous rock at a depth of 6 to 20 inches; slopes of 9 to 40 percent; low to moderate shrink-swell potential; 5 to 65 percent cobblestones.	Medium to low shear strength; medium compressibility; medium to high piping hazard; medium to low permeability when compacted.
Joice: Ja	Poor: muck; strongly saline.	Poor: A-8; high shrink, low swell.	Water table at a depth of 1 to 2½ feet; highly organic; high shrink, low swell.	Highly organic materials; not suited to embankments.
Joice, clay subsoil variant: Jb	Poor: muck over clay; strongly saline.	Poor: A-8 over A-7; high shrink, low swell over high shrink-swell.	Water table at a depth of 1 to 2½ feet; highly organic over clay; high shrink, low swell over high shrink-swell.	Highly organic materials over clay; not suited to embankments.
Los Gatos Mapped only with Maymen soils.	Fair: loam over clay loam at a depth of 10 to 15 inches; sandstone at a depth of 1½ to 2 feet.	Fair to poor: A-4 or A-6; moderate shrink-swell potential.	Sandstone at a depth of 1½ to 2 feet; slopes of 15 to 75 percent; moderate shrink-swell potential.	Medium to low shear strength; medium compressibility; low to medium piping hazard; low to medium permeability when compacted.
Los Osos Mapped only with Dibble and Millsap soils.	Poor: loam or clay loam over clay at a depth of 7 to 18 inches.	Poor: A-6 or A-7; high shrink-swell potential.	Sandstone at a depth of 1½ to 3½ feet; slopes of 2 to 50 percent; high shrink-swell potential.	Low shear strength high compressibility; low piping hazard; low permeability when compacted.
Made land: Ma. Too variable to rate.				
*Maymen: MeG3 For Los Gatos part of MeG3, see Los Gatos series.	Poor: sandstone at a depth of 1 to 1½ feet.	Fair: A-4; moderate shrink-swell potential.	Sandstone at a depth of 1 to 1½ feet; slopes of 15 to 75 percent; moderate shrink-swell potential.	Medium to low shear strength; medium compressibility; medium to high piping hazard; low to medium permeability when compacted.

soils for engineering uses—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil groups
Water retention structures—Continued	Agricultural drainage	Irrigation		
Reservoir areas				
Moderately rapid permeability; slopes of 30 to 75 percent; sandstone at a depth of 8 to 15 inches.	Moderately rapid permeability; sandstone at a depth of 8 to 15 inches; well drained.	Low available water capacity; rapid water intake; slopes of 30 to 75 percent; sandstone at a depth of 8 to 15 inches.	Severe: slopes of 30 to 75 percent; sandstone at a depth of 8 to 15 inches.	D
Moderate permeability; slopes of 9 to 30 percent; igneous rock at a depth of 1½ to 3½ feet.	Moderate permeability; igneous rock at a depth of 1½ to 3½ feet; well drained.	Medium available water capacity; moderate water intake; slopes of 9 to 30 percent; igneous rock at a depth of 1½ to 3½ feet.	Severe: slopes of 9 to 30 percent; igneous rock at a depth of 1½ to 3½ feet.	C
Moderate permeability; slopes of 9 to 40 percent; igneous rock at a depth of 6 to 20 inches.	Moderate permeability; igneous rock at a depth of 6 to 20 inches; well drained.	Low available water capacity; moderate water intake; slopes of 9 to 40 percent; igneous rock at a depth of 6 to 20 inches.	Severe: slopes of 9 to 40 percent; igneous rock at a depth of 6 to 20 inches.	D
Moderately rapid permeability; slopes of 0 to 2 percent; water table at a depth of 1 to 2½ feet.	Moderately rapid permeability; water table at a depth of 1 to 2½ feet; very poorly drained; organic soil.	Very high available water capacity; rapid water intake; slopes of 0 to 2 percent; water table at a depth of 1 to 2½ feet; organic soil.	Severe: water table at a depth of 1 to 2½ feet; very poorly drained.	D
Very slow permeability; slopes of 0 to 2 percent; water table at a depth of 1 to 2½ feet.	Very slow permeability; water table at a depth of 1 to 2½ feet; very poorly drained; organic soil.	Medium to high available water capacity; rapid water intake; slopes of 0 to 2 percent; water table at a depth of 1 to 2½ feet; organic soil.	Severe: water table at a depth of 1 to 2½ feet; very slow permeability; very poorly drained.	D
Moderately slow permeability; slopes of 15 to 75 percent; sandstone at a depth of 1½ to 2 feet.	Moderately slow permeability; sandstone at a depth of 1½ to 2 feet; well drained.	Low available water capacity; moderate water intake; slopes of 15 to 75 percent; sandstone at a depth of 1½ to 2 feet; severely eroded.	Severe: moderately slow permeability; sandstone at a depth of 1½ to 2 feet; slopes of 15 to 75 percent.	C
Slow permeability; slopes of 2 to 50 percent; sandstone at a depth of 1½ to 3½ feet.	Slow permeability; sandstone at a depth of 1½ to 3½ feet; well drained.	Low to medium available water capacity; moderate water intake; slopes of 2 to 50 percent; sandstone at a depth of 1½ to 3½ feet.	Severe: slow permeability; sandstone at a depth of 1½ to 3½ feet; slopes of 2 to 50 percent.	C
Moderate permeability; slopes of 15 to 75 percent; sandstone at a depth of 1 to 1½ feet.	Moderate permeability; sandstone at a depth of 1 to 1½ feet; somewhat excessively drained.	Low available water capacity; moderate water intake; slopes of 15 to 75 percent; sandstone at a depth of 1 to 1½ feet.	Severe: sandstone at a depth of 1 to 1½ feet; slopes of 15 to 75 prcent.	D

TABLE 6.—*Interpretations of the*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Road location	Water retention structures: Embankments
*Millsap: MkA, MlC For Los Osos part of MlC, see Los Osos series.	Poor: sandy loam over clay at a depth of 20 to 30 inches.	Good to poor: A-2 or A-6.	Sandstone at a depth of 1½ to 2½ feet; slopes of 0 to 9 percent; high shrink-swell-potential.	Medium shear strength; medium compressibility; medium to low piping hazard; low permeability when compacted.
Millsholm and Millsholm variant: MmE, MmG2, MnC, MnE.	Poor: sandstone at a depth of 1 to 3 feet.	Fair: A-4; low to moderate shrink-swell potential.	Sandstone at a depth of 1 to 3 feet; slopes of 2 to 75 percent; low to moderate shrink-swell potential.	Medium to low shear strength; medium to low compressibility; medium to high piping hazard; medium to low permeability when compacted.
Omni: Om	Poor: clay loam over clay at a depth of 10 to 20 inches; saline.	Poor: A-7; high shrink-swell potential.	Water table at a depth of 1½ to 4 feet; high shrink-swell potential.	Low shear strength; high compressibility; low to medium piping hazard; low to medium permeability when compacted.
On	Poor: silty clay; saline.	Poor: A-7; high shrink-swell potential.	Water table at a depth of 1½ to 4 feet; high shrink-swell potential.	Fair to poor stability; high to very high compressibility; low to medium shear strength; poor to good resistance to piping and cracking.
Pescadero: Pc, Pe	Poor: clay over clay loam; saline.	Poor: A-6 or A-7; high shrink-swell potential.	High shrink-swell potential.	Low shear strength; high compressibility; low piping hazard; low permeability when compacted.
Reiff: Ra	Good	Fair: A-4; low shrink-swell potential.	Low shrink-swell potential.	Medium to low shear strength; medium to low compressibility; medium to high piping hazard; low to medium permeability when compacted.
Reyes: Rd, Re	Poor: silty clay loam or silty clay; strongly saline.	Poor: A-7; high shrink-swell potential.	Water table at a depth of 2 to more than 5 feet; high shrink-swell potential.	High organic-matter content necessitates onsite evaluation.
Rincon: RnC, RoA, RoC	Fair: clay or clay loam over heavy clay loam at a depth of 12 to 30 inches.	Poor: A-6; high shrink-swell potential.	Slopes of 0 to 9 percent; high shrink-swell potential.	Medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Riverwash: Rw. Too variable to rate.				
Ryde: Ry	Poor: loam and clay loam; high organic-matter content; saline in places.	Poor: A-5 or A-7; high shrink, low swell.	Water table at a depth of 3 to 4 feet; high shrink, low swell.	High organic-matter content necessitates onsite evaluation.

soils for engineering uses—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil groups
Water retention structures—Continued	Agricultural drainage	Irrigation		
Reservoir areas				
Very slow permeability; slopes of 0 to 9 percent; sandstone at a depth of 1½ to 2½ feet.	Very slow permeability; slopes of 0 to 9 percent; sandstone at a depth of 1½ to 2½ feet; moderately well drained.	Low available water capacity; moderate water intake; slopes of 0 to 9 percent; sandstone at a depth of 1½ to 2½ feet.	Severe: very slow permeability; sandstone at a depth of 1½ to 2½ feet.	D
Moderate permeability; slopes of 2 to 75 percent; sandstone at a depth of 1 to 3 feet.	Moderate permeability; sandstone at a depth of 1 to 3 feet; well drained.	Low available water capacity; moderate water intake; slopes of 2 to 75 percent; sandstone at a depth of 1 to 3 feet.	Severe: sandstone at a depth of 1 to 1½ feet; slopes of 2 to 75 percent.	D
Slow permeability; slopes of 0 to 2 percent; water table at a depth of 1½ to 4 feet.	Slow permeability; water table at a depth of 1½ to 4 feet; poorly drained.	High available water capacity; moderately slow water intake; slopes of 0 to 2 percent; water table at a depth of 1½ to 4 feet.	Severe: slow permeability; poorly drained; water table at a depth of 1½ to 4 feet.	D
Slow permeability; slopes of 0 to 2 percent; water table at a depth of 1½ to 4 feet.	Slow permeability; water table at a depth of 1½ to 4 feet; poorly drained.	High available water capacity; slow water intake; slopes of 0 to 2 percent; water table at a depth of 1½ to 4 feet.	Severe: slow permeability; poorly drained; water table at depth of 1½ to 4 feet.	D
Slow permeability; slopes of 0 to 2 percent.	Slow permeability; somewhat poorly drained.	High available water capacity; slow water intake; slopes of 0 to 2 percent.	Severe: slow permeability	C
Moderately rapid permeability; slopes of 0 to 2 percent.	Moderately rapid permeability; well drained.	High available water capacity; moderately rapid water intake; slopes of 0 to 2 percent.	Slight	B
Slow permeability; slopes of 0 to 2 percent; water table at a depth of 2 feet to more than 5 feet.	Slow permeability; water table at a depth of 2 feet to more than 5 feet; poorly drained.	Medium to high available water capacity; slow water intake; slopes of 0 to 2 percent.	Severe: slow permeability; water table at a depth of 2 feet to more than 5 feet.	D
Slow permeability; slopes of 0 to 9 percent.	Slow permeability; well drained.	High available water capacity; moderately slow water intake; slopes of 0 to 9 percent.	Severe: slow permeability	C
Moderate permeability; slopes of 0 to 2 percent; water table at a depth of 3 to 4 feet.	Moderate permeability; water table at a depth of 3 to 4 feet; poorly drained.	High available water capacity; moderate water intake; slopes of 0 to 2 percent; water table at a depth of 3 to 4 feet.	Severe: water table at a depth of 3 to 4 feet; poorly drained.	D

TABLE 6.—*Interpretations of the*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Road location	Water retention structures: Embankments
Sacramento: Sa, Sc, Sd	Poor: silty clay loam over clay at a depth of 10 to 20 inches or clay throughout.	Poor: A-7; high shrink-swell potential.	Water table at a depth of 3 to 4 feet; high shrink-swell potential.	Low shear strength; high compressibility; low piping hazard and low permeability when compacted.
San Benito Mapped only with Altamont and San Ysidro soils.	Fair: clay loam	Poor: A-6 or A-7; moderate shrink-swell potential.	Weakly consolidated sediments at a depth of 2 to 3½ feet; slopes of 2 to 30 percent; moderate shrink-swell potential.	Medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
San Ysidro: SeA, SeB, SfA	Fair: sandy loam over clay loam at a depth of 12 to 30 inches.	Fair to poor: A-4; A-6, or A-7; high shrink-swell potential.	Slopes of 0 to 30 percent; high shrink-swell potential.	Medium to low shear strength; medium compressibility; medium piping hazard; low to medium permeability when compacted.
*Solano: Sh, Sk For Pescadero part of Sk, see Pescadero series.	Poor: loam over clay loam at a depth of 6 to 12 inches; saline.	Fair to poor: A-4, A-6, or A-7; moderate shrink-swell potential.	Moderate shrink-swell potential.	Medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Solano, dark surface variant: Sm	Poor: loam over clay loam at a depth of 6 to 12 inches.	Good to poor: A-4, A-6, A-7, or A-2; moderate shrink-swell potential.	Moderate shrink-swell potential.	Medium to low shear strength; medium compressibility; medium to high piping hazard; medium to low permeability when compacted.
Suisun: Sp	Poor: muck: strongly saline.	Poor: A-8; high shrink, low swell.	Water table at a depth of 1 to 1½ feet; highly organic; high shrink, low swell.	Highly organic; not suited to embankments.
Sycamore: Sr, Ss, St, Su	Fair: silty clay loam.	Poor: A-6 or A-7; moderate shrink-swell potential.	Water table at a depth of 3 feet to more than 5 feet; moderate shrink-swell potential.	Medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Tamba: Ta	Poor: mucky clay; strongly saline.	Poor: A-7 or A-8; high shrink, low swell.	Water table at a depth of 1 to 3 feet; high shrink, low swell.	High organic-matter content necessitates onsite evaluation.
Tidal marsh: Td. Too variable to rate.				

soils for engineering uses—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil groups
Water retention structures—Continued	Agricultural drainage	Irrigation		
Reservoir areas				
Slow permeability; slopes of 0 to 2 percent; water table at a depth of 3 to 4 feet.	Slow permeability; water table at a depth of 3 to 4 feet; poorly drained; Sc subject to flooding.	High available water capacity; slow water intake; slopes of 0 to 2 percent; water table at a depth of 3 to 4 feet.	Severe: slow permeability; water table at a depth of 3 to 4 feet; poorly drained.	D
Moderately slow permeability; slopes of 2 to 30 percent; weakly consolidated sediments at a depth of 2 to 3½ feet.	Moderately slow permeability; weakly consolidated sediments at a depth of 2 to 3½ feet; well drained.	Low to medium available water capacity; moderately slow water intake; slopes of 2 to 30 percent; weakly consolidated sediments at a depth of 2 to 3½ feet.	Severe: moderately slow permeability; weakly consolidated sediments at a depth of 2 to 3½ feet.	C
Very slow permeability; slopes of 0 to 30 percent.	Very slow permeability; moderately well drained.	Low to medium available water capacity; moderately rapid water intake; slopes of 0 to 30 percent.	Severe: very slow permeability; slopes of 0 to 30 percent.	D
Very slow permeability; slopes of 0 to 2 percent.	Very slow permeability; somewhat poorly drained.	Low available water capacity; moderate water intake; slopes of 0 to 2 percent.	Severe: very slow permeability.	D
Very slow permeability; slopes of 0 to 2 percent.	Very slow permeability; somewhat poorly drained.	Low available water capacity; moderate water intake; slopes of 0 to 2 percent.	Severe: very slow permeability to slow permeability.	D
Rapid permeability; slopes of 0 to 2 percent; water table at a depth of 1 to 1½ feet.	Rapid permeability; water table at a depth of 1 to 1½ feet; very poorly drained.	Very high available water capacity; rapid water intake; slopes of 0 to 2 percent; water table at depth of 1 to 1½ feet; organic soil.	Severe: water table at a depth of 1 to 1½ feet; very poorly drained.	D
Moderately slow to slow permeability; slopes of 0 to 2 percent; water table at a depth of 3 feet to more than 5 feet.	Moderately slow to slow permeability; water table at a depth of 3 feet to more than 5 feet; moderately well drained to somewhat poorly drained; Su subject to flooding.	Medium to high available water capacity; moderately slow water intake; slopes of 0 to 2 percent; water table at a depth of 3 feet to more than 5 feet.	Severe: moderately slow to slow permeability; water table at a depth of 3 feet to more than 5 feet.	C
Moderate permeability; slopes of 0 to 2 percent; water table at a depth of 1 to 3 feet.	Moderate permeability; slopes of 0 to 2 percent; water table at a depth at 1 to 3 feet; very poorly drained.	High available water capacity; moderate water intake; slopes of 0 to 2 percent; water table at a depth of 1 to 3 feet.	Severe: water table at a depth of 1 to 3 feet; very poorly drained.	D

TABLE 6.—*Interpretations of the*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Road location	Water retention structures: Embankments
Toomes: ToG2	Poor: loam; tuff at a depth of 5 to 17 inches; 20 to 65 percent cobblestones.	Fair: A-4; low shrink-swell potential; 20 to 65 percent cobblestones.	Tuff at a depth of 5 to 17 inches; slopes of 9 to 75 percent; low shrink-swell potential; 20 to 65 percent cobblestones.	Medium shear strength; medium compressibility; medium to high piping hazard; medium to low permeability when compacted.
Trimmer: TrE	Poor: loam over clay loam at a depth of 12 to 20 inches; basic igneous rock at a depth of 2 to 3½ feet; 0 to 30 percent cobblestones throughout.	Fair to poor: A-4 or A-6; moderate shrink-swell potential; 0 to 30 percent cobblestones.	Basic igneous rock at a depth of 2 to 3½ feet; slopes of 9 to 30 percent; moderate shrink-swell potential; 0 to 30 percent cobblestones.	Medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Trimmer shallow variant: TsF2	Poor: cobbly clay loam over cobbly clay at a depth of 5 to 10 inches; basalt at a depth of 1 to 1½ feet; 30 to 65 percent cobblestones.	Poor: A-6: moderate shrink-swell potential; 30 to 65 percent cobblestones.	Basalt at a depth of 1 to 1½ feet; slopes of 15 to 50 percent; moderate shrink-swell potential; 30 to 65 percent cobblestones.	Medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Tujunga: Tu	Poor: sand and fine sand.	Good	Low shrink-swell potential.	Medium shear strength; low compressibility; medium to high piping hazard; medium to high permeability when compacted.
Valdez:				
Va	Fair: silt loam	Fair: A-4; moderate shrink-swell potential.	Water table at a depth of 4 to 5 feet; moderate shrink-swell potential.	Medium to low shear strength; medium compressibility; medium to high piping hazard; medium to low permeability when compacted.
Vc, Vd	Poor: silty clay loam; saline.	Poor: A-6; moderate shrink-swell potential.	Water table at a depth of 1 to 5 feet; moderate shrink-swell potential.	Medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.
Ve	Poor: silty clay loam over clay at a depth of 35 to 50 inches; saline.	Poor: A-6 or A-7; high shrink-swell potential.	Water table at a depth of 3 to 5 feet; high shrink-swell potential.	Low shear strength; high compressibility; low piping hazard; low permeability when compacted.
Willows: Wc	Poor: mostly clay; saline and alkaline.	Poor: A-7 or A-6; high shrink-swell potential.	High shrink-swell potential.	Low shear strength; high compressibility; low piping hazard; low permeability when compacted.

soils for engineering uses—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil groups
Water retention structures—Continued	Agricultural drainage	Irrigation		
Reservoir areas				
Moderate permeability; slopes of 9 to 75 percent; tuff at a depth of 5 to 17 inches.	Moderate permeability; tuff at a depth of 5 to 17 inches; somewhat excessively drained.	Low available water capacity; moderate water intake; slopes of 9 to 75 percent; tuff at a depth of 5 to 17 inches.	Severe: tuff at a depth of 5 to 17 inches; slopes of 9 to 75 percent.	D
Moderately slow permeability; slopes of 9 to 30 percent; basic igneous rock at a depth 2 to 3½ feet.	Moderately slow permeability; basic igneous rock at a depth of 2 to 3½ feet; well drained.	Low to medium available water capacity; moderate water intake; slopes of 9 to 30 percent; basic igneous rock at a depth of 2 to 3½ feet.	Severe: moderately slow permeability; basic igneous rock at a depth of 2 to 3½ feet; slopes of 9 to 30 percent.	C
Slow permeability; slopes of 15 to 50 percent; basalt at a depth of 1 to 1½ feet.	Slow permeability; basalt at a depth of 1 to 1½ feet; well drained.	Low available water capacity; moderately slow water intake; slopes of 15 to 50 percent; basalt at a depth of 1 to 1½ feet.	Severe: slow permeability; basalt at a depth of 1 to 1½ feet; slopes of 15 to 50 percent.	D
Rapid permeability; slopes of 0 to 2 percent.	Rapid permeability; excessively drained.	Low available water capacity; rapid water intake; slopes of 0 to 2 percent.	Slight [1]	A
Moderately slow permeability; slopes of 0 to 2 percent; water table at a depth of 4 to 5 feet.	Moderately slow permeability; water table at a depth of 4 to 5 feet; somewhat poorly drained.	High available water capacity; moderate water intake; slopes of 0 to 2 percent; water table at a depth of 4 to 5 feet.	Severe: moderately slow permeability; water table at a depth of 4 to 5 feet; somewhat poorly drained.	C
Moderately slow to slow permeability; slopes of 0 to 2 percent; water table at a depth of 1 to 5 feet.	Moderately slow to slow permeability; water table at a depth of 1 to 5 feet; somewhat poorly drained.	Medium to high available water capacity; moderately slow water intake; slopes of 0 to 2 percent; water table at a depth of 1 to 5 feet.	Severe: moderately slow and slow permeability; water table at a depth of 1 to 5 feet.	C(Vc), D(Vd)
Slow permeability; slopes of 0 to 2 percent; water table at a depth of 3 to 5 feet.	Slow permeability; water table at a depth of 3 to 5 feet; somewhat poorly drained.	Medium available water capacity; moderately slow water intake; slopes of 0 to 2 percent; water table at a depth of 3 to 5 feet.	Severe: slow permeability; water table at a depth of 3 to 5 feet.	C
Slow permeability; slopes of 0 to 2 percent.	Slow permeability; poorly drained.	Medium to high available water capacity; slow water intake; slopes of 0 to 2 percent.	Severe: slow permeability; poorly drained.	D

TABLE 6.—*Interpretations of the*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road fill	Road location	Water retention structures: Embankments
Yolo:				
Yo	Good	Fair: A-4; moderate shrink-swell potential.	Moderate shrink-swell potential.	Medium to low shear strength; medium compressibility; high piping hazard; medium to low permeability when compacted.
Yr	Fair: loam over clay at a depth of 40 to 60 inches.	Fair to poor: A-4 or A-7; high shrink-swell potential.	High shrink-swell potential.	Medium shear strength; medium to high compressibility; medium to low piping hazard; low permeability when compacted.
Ys	Fair: silty clay loam over loam.	Poor to fair: A-6, A-7, or A-4.	Moderate shrink-swell potential.	Medium shear strength; medium compressibility; low to medium piping hazard; low permeability when compacted.

[1] May contaminate ground water.

Formation and Classification of the Soils

In this section the factors that affect the formation and composition of the soils in Solano County are discussed, and the morphology of the soils is described. Then, the classification of the soils by higher categories is given.

Factors of Soil Formation

Soil is a natural formation on the earth's surface that contains living matter and supports or is capable of supporting plants. Soils differ in different localities and even within short distances. The differences are the result of the interaction of five soil-forming factors: parent material, relief, climate, living organisms, and time. The relative effect of each of these factors varies from one soil to another.

The processes of soil formation are complex. Their influence and relationship are more easily described by relating soils within areas of similar landform, or geomorphic units. In the following discussion, the climate is described separately and then the factors of parent material, relief, time, and biological activity are considered in the relationship of the soils within geomorphic units.

Climate

The climate is fairly uniform throughout the county. The effect of climate on different soils varies because there is a complex interaction among factors, but some properties are common to many soils because of the similarity in climate.

Solano County is warm to hot and dry in summer and moderately cool and moist in winter. The average air temperature at Vacaville is 46.8° F. in January and 74° in July. The average annual rainfall in the county ranges from 16 to 40 inches, and 90 percent of it falls during the months of November through April. The rainfall is heavy at times during some winter storms.

During the rainy period, the soils become saturated and lose moisture through runoff or deep percolation. The soils rarely, if ever, freeze. In most years, soil moisture in the uppermost 20 inches falls below the wilting point late in May or in June. The soils become dry unless irrigated, and they remain dry until the fall rains.

Data from soil moisture calculations at Vacaville and Sacramento (2) show that about 3 to 5 inches of the precipitation is not lost by evapotranspiration during the winter months. Some soils in the county store 4 inches of moisture available to plants. Soils that have greater available water capacity are common in the county, but they have less surplus moisture for percolation.

The small amount of surplus moisture prevents active leaching of the soils. The rate of redistribution of carbonates and translocation of clays by this process is therefore slow. Most of the soils have a good supply of bases, and many of the soils lack prominent argillic horizons. The alternate wet and dry periods cause soils that are high in montmorillonitic clays to shrink

soils for engineering uses—Continued

Soil features affecting—Continued			Soil limitations for septic tank filter fields	Hydrologic soil groups
Water retention structures—Continued	Agricultural drainage	Irrigation		
Reservoir areas				
Moderate permeability; slopes of 0 to 2 percent.	Moderate permeability; well drained.	High available water capacity; moderate water intake; slopes of 0 to 2 percent.	Slight to moderate: moderate permeability.	B
Slow permeability; slopes of 0 to 2 percent.	Slow permeability; well drained.	High available water capacity; moderate water intake; slopes of 0 to 2 percent.	Severe: slow permeability	C
Moderately slow permeability; slopes of 0 to 2 percent.	Moderately slow permeability; well drained.	High available water capacity; moderately slow water intake; slopes of 0 to 2 percent.	Slight to moderate: moderate permeability in substratum.	B

and swell. Wide cracks form during summer in soils such as those of the Diablo series. The sloughing of soil from the surface layer into cracks mixes the surface layer with the horizons below and restricts textural differentiation in the profile.

The warm temperature when the soils are moist, and the generally warm temperature throughout the year, provides a suitable environment for rapid decomposition of organic matter and soil minerals. The surface layer is not well granulated, partly because it is not subject to freezing and thawing. The soils are dry to a depth of 20 inches or more for several months in summer unless they are irrigated. Biological processes and some chemical processes are retarded during this dry period. Most of the soils have a surface layer that is structureless. It is crusted and hard when dry but is friable when moist.

Soil formation by geomorphic units

Solano County lies within the Sacramento and San Joaquin Valleys and a small part of the Coast Ranges (*8*). Solano County has been classified into six separate geomorphic units (*11*): delta; flood plains and natural levees; flood basins; low alluvial plains, fans, and low terraces; low hills and dissected terraces; and uplands of the Coast Ranges. The relationship of soil-forming factors varies within each unit.

DELTA

The delta is at or below sea level west of Steamboat Slough, a few miles north of Rio Vista, and in the Suisun Marsh, adjacent to Suisun, Grizzly, and Honker Bays. Tidal sloughs form a network of waterways through the delta. A system of artificial levees encloses much of the area. Water is regulated by a system of levees, tidal gates, canals, drainage ditches, and pumps. Salinity varies with the distance from the bays and with the seasonal dilution by runoff from the Sacramento River, the San Joaquin River, and tributary streams.

The soils that formed in the delta are mostly mixtures of hydrophytic plant remains and mineral sediments. The poorly drained delta areas support a dense growth of tule and reed plants. The organic remains from these plants accumulate over a long period of time. As the organic-matter content increases, the underlying mineral base slowly subsides and the organic deposits eventually become quite thick. Mineral sediments are added to the organic deposits by tidal action and by deposition from turbid water during floods. The resulting soils range from organic soils that contain a small amount of mineral matter, commonly as thin silt and clay lenses, to mineral soils that are low in organic-matter content. The higher mineral content generally is associated with soils adjacent to sloughs and channels.

The natural vegetation is mostly aquatic plants such as tules, cattails, and rushes.

The delta geomorphic unit includes Egbert, Joice, Reyes, Ryde, Suisun, and Tamba soils. Egbert and Ryde soils are mineral soils that have a high content of hydrophytic plant remains. They formed far enough inland to have been little affected by brackish water. Ryde soils formed under poorer drainage than

Egbert soils and contain more hydrophytic plant remains. Suisun, Joice, Reyes, and Tamba soils have been affected by brackish tidal water. The Reyes soils are mineral soils adjacent to the sloughs. The mineral sediments were deposited on existing vegetation as high tidal waters and floodwaters spread outward from the sloughs. Tamba soils are adjacent to Reyes soils, but they are further from the sloughs and at a slightly lower elevation. They have poorer drainage and less mineral sediments, resulting in a high ratio of organic matter to mineral matter. Joice soils are even further from the sloughs and at a slightly lower elevation. They have even less mineral sediments. Suisun soils are furthest from the sloughs, at the lowest elevation, and have a low mineral content and high organic-matter content.

Lowering the water table through drains and by pumping has caused surface cracking and subsidence. The soils that formed in brackish water are associated with cat clays, and some of the soils have properties of these clays. Lowering the water table has allowed the upper horizons to oxidize and has resulted in strongly acid soils, especially in the Reyes and Tamba soils.

Ryde and Egbert soils have been intensively cultivated. The organic-matter content has been depleted by oxidation. Losses by soil blowing during dry periods have occurred and are evident when the air fills with finely pulverized peat dust. Although burning is no longer practiced, it also contributes to subsidence. The soils now have a much higher mineral content than when they were first cultivated.

FLOOD PLAINS AND NATURAL LEVEES

The flood plains and natural levees are along Steamboat and Miner Sloughs and in a narrow band on Grizzly Island. Steamboat and Miner Sloughs are confined by narrow artificial levees and broader natural levees that gently slope away from the sloughs. In some places the surface of the sloughs is as high or higher than the flood basins and delta that lie beyond the levees. Artificial levees now protect nearly all the acreage from the frequent overflows. Drainage has been improved in most areas, but the soils range from well drained to somewhat poorly drained. The water table fluctuates as the level of stream flow changes.

The alluvium deposited as natural levees is mostly moderately coarse textured to moderately fine textured. The sediments are very recent heterogenous deposits. Some are the result of hydraulic mining operations that choked the river channels with debris. At the height of hydraulic mining, millons of cubic yards of material were dumped into the upper tributaries, and the material was carried in suspension into the rivers. As a result, the tailings encroached in valleys and filled riverbeds (*9*). Sediments are still accumulating from these and more recent sources.

Natural vegetation along Steamboat and Miner Sloughs was mostly cottonwood trees, willows, and grapevines. Natural vegetation on Grizzly Island was salt-tolerant grasses and forbs.

The soils of the Columbia and Valdez series formed on flood plains and natural levees. These soils have few prominent morphological features, and they are distinguished mainly by differences in the texture of the control section. Columbia soils are stratified but are mostly fine sandy loam. Valdez soils are stratified silty clay loam, silt loam, and fine sandy loam. Columbia and Valdez soils are recent, and the surface layer has the pale color of the parent alluvium. A fluctuating water table has formed mottles of high chroma in the lower horizons. Valdez soils have a substratum that has a pronounced platy structure.

FLOOD BASINS

The large flood basins of Solano County lie west of Miner Slough and are between the natural levees and the low alluvial plains further to the west. Several smaller isolated basins are on the alluvial plains where the surface was slightly depressed or where drainage was blocked by small ridges. The principal basin, Yolo basin, is in the east-central part of the county. One of the smaller basins on the alluvial plains is southeast of Dixon, and it is represented by the Capay-Clear Lake association on the general soil map. Tributary streams that flow from the Coast Ranges eastward empty into the basins. The basins are nearly level but have small depressions and low ridges formed by tributaries emptying into them. Along their western edge, the basins gradually merge with the alluvial plains. This outer perimeter is the basin rim, where the elevation is slightly higher or the natural drainage was somewhat better than in the basin itself.

Originally, the Sacramento River and its tributaries overflowed and filled the basins. As the flooding subsided, the water drained slowly back into the main channels. Today, artificial levees prevent some areas from flooding. Parts of the natural basins are diked and form channels to convey floodwater. These are known as bypasses, through which part of the river-flow is diverted from its natural channel during flooding.

Before reclamation the basins were swampy and in places had a cover of marsh grasses and tules. Along the basin rims, the vegetation was similar to the prairie vegetation and consisted mostly of perennial grasses. The smaller isolated basins on the alluvial plains had vegetation, mostly perennial grasses, similar to that on basin rims.

The parent material of the basin soils is rather recent in geologic time. It consists mostly of clay and silt that settled out of suspension from slack water left after floods. In the bypass areas, fresh sediments are still being deposited in layers of pale-colored silts and clays. These form an overwash that contrasts with the darker underlying soils of the original basin surface.

The soils in the basins were poorly drained to somewhat poorly drained. These poorly drained conditions were favorable for the reduction of iron compounds, particularly in the swampy areas. Drainage has been altered by reclamation works and structures and, in some cases, by natural processes.

Capay, Clear Lake, Omni, Pescadero, Sacramento, and Willows soils are in the flood basins. The Capay soils are at the somewhat higher elevations of the

basin rims. The Pescadero and Willows soils are on basin rims at slightly lower elevations. The Clear Lake, Omni, and Sacramento soils are at the lower elevations in the basins.

The Clear Lake, Omni, and Sacramento soils have a dark A horizon that is high to moderately high in organic-matter content. The organic matter has accumulated from the dense vegetative cover of marsh grasses and tules. The soils have colors of low chroma, they are mottled, and they have an olive or gleyed substratum. Ground water has left concentrated deposits of carbonates in some areas of the soils. The location of these carbonates in the profile is related to the former position of a once-stable water table. The Omni soils are calcareous near the surface, indicating that lime was concentrated in the soil from the capillary fringe of a former high water table. Sacramento soils are not so calcareous as Omni soils, and lime is at a lower depth. The Clear Lake soils formed under an intermittent high water table that drops as low as 4 to 10 feet below the surface in the dry season.

LOW ALLUVIAL PLAINS, FANS, AND LOW TERRACES

This geomorphic unit was formed as streams eroded the adjacent Coast Ranges, low hills, and dissected terraces (*6*, *7*). The streams continually shifted their drainage courses as they deposited their sediments. The older alluvium was left as low terraces, which were surrounded by areas of younger alluvium. In places the difference in relief between the two is slight.

A dense oak forest once covered the plains along the streams, such as Putah Creek, and their alluvial fans. The higher fans and the low terraces then had more open stands of oak and perennial grasses (*5*).

The soils in this geomorphic unit include the Brentwood, Conejo, Reiff, Sycamore, and Yolo, which formed in younger alluvium; and the Antioch, Rincon, San Ysidro, and Solano, which formed in older alluvium. The Brentwood, Sycamore, and Yolo soils are high in silt content. The Reiff soils are sandy, and the Conejo soils are loamy. Both have a thick A horizon that is darkened by organic matter. The Antioch, Rincon, San Ysidro, and Solano soils have formed argillic horizons.

None of the soils in this geomorphic unit are old in geological terms. Most of the landscapes have been formed since the Pleistocene age. However, the older alluvium has had sufficient time to form fine-textured horizons through the translocation of silicate clays. The Rincon soils have only a slight increase in clay content from the A horizon to the B horizon. The increase is greatest in the Antioch, San Ysidro, and Solano soils, which have abrupt boundaries and a clay increase of more than 20 percent from the A horizon to the B horizon.

Many of these soils have been altered by leveling and irrigation. The A horizon has been mixed, but the cuts and fills have generally been shallow. Soils such as the Brentwood, Conejo, Reiff, Sycamore, and Yolo have few morphological features other than a thick, dark A horizon, so leveling and plowing have not caused much change. The soils are mapped and classified as they were before leveling. Fertilizer, insecticides, and the plowpans that have formed have altered the physical and chemical properties of many of these soils. These manmade influences are important considerations in the use and management of the soils.

LOW HILLS AND DISSECTED TERRACES

This geomorphic unit rises in the west above the alluvial plains, fans, and low terraces and extends from Putah Creek to Vacaville. It includes the Montezuma Hills, an isolated area west of Rio Vista and north of the mouth of the Sacramento River (*11*).

The hills of this unit formed in material from the Tehama and Montezuma Formations (*6*, *7*). The Tehama Formation consists of interbedded fine-grained sands, silts, and clays that are compact but not cemented. The Montezuma Formation consists of slightly consolidated clayey sand, crossbedded pebbly sand, clay, and gravel. Several cycles of gentle uplifting followed by erosion formed the hilly and rolling relief. The native vegetation was perennial grasses and open stands of oak at the higher elevations (*5*). The perennial grasses have been replaced by annual grasses and forbs.

Altamont, Ayar, Corning, Diablo, and San Benito soils formed on the Tehama and Montezuma Formations. The Ayar soils are on hill crests, where geologic erosion has been rapid. The calcareous parent material has caused the soils to be calcareous throughout. The Diablo and Altamont soils are on foot slopes and have a fine texture. Their location has allowed them to receive more moisture, and calcium carbonate has been leached from the upper part of their profile. The recent origin and high shrink-swell potential of the Altamont, Ayar, and Diablo soils have prevented the formation of argillic horizons in these soils. The San Benito soils formed in recent, moderately fine textured, calcareous sediments. They have received sufficient moisture for calcium carbonate to have been leached out of the A horizon, although they are not old enough to have formed argillic horizons.

In the process of geologic erosion, remnants of the Red Bluff Formation were left as sloping to nearly level terraces. These terraces have not been completely removed, because their gravelly surfaces are resistant to erosion. These are some of the older land surfaces in Solano County. The soils have had more time for intensive weathering and the translocation of silicate clays than other soils in the county.

The Corning soils formed on these terraces. The Corning soils have a gravelly loam A horizon and an abrupt increase in clay from the A horizon to the Bt horizon. Numerous fragments of chert, quartzite, and other siliceous metamorphic rocks are present. These materials are highly resistant to weathering.

Most of the soils in this unit have been planted to grain. Erosion has been accelerated by tillage operations. Erosion is particularly noticeable on the Ayar soils, especially on ridge crests where white, calcareous parent material has been exposed.

UPLANDS OF THE COAST RANGES

This geomorphic unit consists of a segment of rugged terrain that parallels the western boundary of

the county. It consists of several ridges and intervening narrow valleys that trend in a northwestern direction (*6, 7*).

Drainage channels parallel the ridges and then turn eastward into the Sacramento Valley or southward into the marshland. Elevation is 300 feet to about 3,000 feet along the ridge crest that forms the boundary with Napa County on the west. The bedrock consists of interbedded sandstone and shale that have been folded and faulted, and of a complex series of lava flows and tuff beds. The vegetation consists of oak trees and grass and of stands of chaparral that are open to thick (*5*).

Dibble, Gaviota, Gilroy, Hambright, Los Gatos, Los Osos, Maymen, Millsholm, Toomes, and Trimmer soils are in this geomorphic unit. The Gaviota, Maymen, and Millsholm soils formed in residuum from sandstone in steep areas. They are shallow soils because geologic erosion has kept pace with soil formation. The Dibble, Los Gatos, and Los Osos soils formed in residuum from easily weathered sandstone. Slopes are less steep, erosion is less a hazard, and the soils are deeper. These soils have been subjected to more weathering and translocation of silicate clays and have formed argillic horizons. The Gilroy, Hambright, and Trimmer soils formed in residuum from andesite. Hambright soils are shallow because geologic erosion has kept pace with soil formation. Gilroy and Trimmer soils formed in easily weathered volcanic material. Erosion is not a serious hazard, and the soils are deep. These soils have been subjected to more weathering and translocation of clays than Hambright soils and have formed a textural Bt horizon. Toomes soils formed on volcanic tuff and are shallow because geologic erosion has kept pace with soil formation.

Livestock grazing and fires have reduced the effectiveness of plant cover in erosion control. The Gaviota, Maymen, Millsholm, and Toomes soils have some truncation in the A horizon, and scattered gullies and small erosion scars are evident.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

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 work; 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 classification system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 (*16*). The soil series of Solano County are placed in the current system in table 7. The classes in the current system are briefly defined in the paragraphs that follow. Then the soil orders represented in Solano County are described.

ORDERS: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions, Entisols and Histosols, occur in many different climates.

SUBORDERS: Each order is divided 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 are chiefly chemical or physical properties that reflect the presence or absence of waterlogging or soil differences resulting from the climate and vegetation.

GREAT GROUPS: Each suborder is subdivided into great groups according to the presence or absence of certain significant genetic horizons, certain significant properties of these horizons, if present, or certain significant soil properties at specified depths.

SUBGROUPS: Each great group is subdivided into subgroups. One of these subgroups represents the central (typic) segment of the great group, and the others, called intergrades, contain those soils having some properties of soils in another group, suborder, or order.

FAMILIES: Each subgroup is subdivided into families, primarily on the basis of properties important to the growth of plants but also relevant to the behavior of soils used in other ways. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of specified horizons or defined layers.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, consistence, reaction, and mineralogical and chemical composition.

New soil series must be established and older ones must be revised in the course of the nationwide soil survey program. Most of the soil series described in this publication were established earlier. All the series have been classified and correlated according to 1970 criteria.

Six soil orders are represented in Solano County—Entisols, Vertisols, Inceptisols, Mollisols, Alfisols, and Histosols. These are discussed in the following paragraphs.

Entisols.—Entisols are soils that show little, if any, alteration of the parent material. They are subdivided into two suborders based on the presence or absence of waterlogging. These are the Aquents and the Orthents.

The Fluvaquents are very poorly drained, are commonly saturated to near the surface, and are subject to some flooding unless dikes are constructed. The

TABLE 7.—*Classification of soil series*

Series	Family	Subgroup	Order
Altamont	Fine, montmorillonitic, thermic	Typic Chromoxererts	Vertisols.
Alviso	Fine, mixed nonacid, isomesic	Tropic Fluvaquents	Entisols.
Antioch	Fine, montmorillonitic, thermic	Typic Natrixeralfs	Alfisols.
Ayar	Fine, montmorillonitic, thermic	Typic Chromoxererts	Vertisols.
Brentwood	Fine, montmorillonitic, thermic	Typic Xerochrepts	Inceptisols.
Capay	Fine, montmorillonitic, thermic	Typic Chromoxererts	Vertisols.
Clear Lake	Fine, montmorillonitic, thermic	Typic Pelloxererts	Vertisols.
Columbia	Coarse-loamy, mixed, nonacid, thermic	Aquic Xerofluvents	Entisols.
Conejo	Fine-loamy, mixed, thermic	Pachic Haploxerolls	Mollisols.
Corning	Fine, montmorillonitic, thermic	Typic Palexeralfs	Alfisols.
Diablo	Fine, montmorillonitic, thermic	Chromic Pelloxererts	Vertisols.
Dibble	Fine, montmorillonitic, thermic	Typic Haploxeralfs	Alfisols.
Egbert	Fine, mixed, thermic	Fluvaquentic Haplaquolls	Mollisols.
Gaviota	Loamy, mixed, nonacid, thermic	Lithic Xerorthents	Entisols.
Gilroy	Fine-loamy, mixed, thermic	Typic Argixerolls	Mollisols.
Hambright	Loamy-skeletal, mixed, thermic	Lithic Haploxerolls	Mollisols.
Joice	Clastic, euic, thermic	Typic Medisaprists	Histosols.
Joice, clay subsoil variant	Clayey, mixed, euic, thermic	Terric Medisaprists	Histosols.
Los Gatos	Fine-loamy, mixed, mesic	Typic Argixerolls	Mollisols.
Los Osos	Fine, montmorillonitic, thermic	Typic Argixerolls	Mollisols.
Maymen	Loamy, mixed, mesic	Dystric Lithic Xerochrepts	Inceptisols.
Millsap [1]	Fine, mixed, thermic	Typic Palexeralfs	Alfisols.
Millsholm	Loamy, mixed, thermic	Lithic Xerochrepts	Inceptisols.
Millsholm, moderately deep variant.	Coarse-loamy, mixed, thermic	Typic Xerochrepts	Inceptisols.
Omni	Fine, montmorillonitic, calcareous, thermic	Fluvaquentic Haplaquolls	Mollisols.
Pescadero	Fine, montmorillonitic, thermic	Aquic Natrixeralfs	Alfisols.
Reiff	Coarse-loamy, mixed, nonacid, thermic	Typic Xerofluvents	Entisols.
Reyes	Fine, mixed, acid, thermic	Sulfic Haplaquepts	Inceptisols.
Rincon	Fine, montmorillonitic, thermic	Mollic Haploxeralfs	Alfisols.
Ryde	Fine-loamy, mixed, thermic	Cumulic Haplaquolls	Mollisols.
Sacramento	Fine, montmorillonitic, thermic	Vertic Haplaquolls	Mollisols.
San Benito	Fine-loamy, mixed, thermic	Calcic Pachic Haploxerolls	Mollisols.
San Ysidro	Fine, montmorillonitic, thermic	Typic Palexeralfs	Alfisols.
Solano	Fine-loamy, mixed, thermic	Typic Natrixeralfs	Alfisols.
Solano, dark surface variant	Fine-loamy, mixed, thermic	Typic Natrixerolls	Mollisols.
Suisun	Euic, thermic	Typic Medihemists	Histosols.
Sycamore	Fine-silty, mixed, nonacid, thermic	Aeric Haplaquepts	Inceptisols.
Tamba	Fine, mixed, acid, thermic	Typic Haplaquepts	Inceptisols.
Toomes	Loamy, mixed, thermic	Lithic Ruptic-Xerorthentic Xerochrepts	Inceptisols.
Trimmer	Fine-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Trimmer, shallow variant	Clayey, skeletal, mixed, thermic	Lithic Argixerolls	Mollisols.
Tujunga	Mixed, thermic	Typic Xeropsamments	Entisols.
Valdez	Fine-silty, mixed, nonacid, thermic	Aeric Haplaquepts	Inceptisols.
Willows	Fine, montmorillonitic, thermic	Typic Pelloxererts	Vertisols.
Yolo	Fine-silty, mixed, thermic	Typic Xerochrepts	Inceptisols.

[1] In Solano County, Millsap soils are slightly more acid and grayer than the defined range for the Millsap series; however, they are like Millsap soils in morphology, composition and behavior.

soils are stratified and have more organic matter in some layers than in others. Displacement and mixing of the soil by roots and other biological activities have not progressed far enough to mix most of the thinner layers.

Tropic Fluvaquents are near large bodies of water where the soil temperature varies by less than 9° F. from summer to winter. The Alviso series is classified in this subgroup. As mapped in this area, Alviso soils are marginal as compared with soils that are slightly warmer and have a temperature difference of 9° or 10° from summer to winter.

The Orthents are subdivided into Xerorthents, Xerofluvents, and Xeropsamments. Each has the same moisture regime. In most years the soils are moist from late in October to May. They are dry the rest of the year unless irrigated.

The Xerorthents are simple soils that are fairly uniform in composition and appearance. The only subgroup in the county is a Lithic Xerorthents. Hard rock is at a depth of less than 20 inches. Except for some darkening of the surface soil from a small accumulation of organic matter, there is no evidence of soil horizon development. These soils have fairly steep slopes, and soil is removed about as fast as new soil material is weathered from the parent rock. The Gaviota series is in this subgroup.

The Xerofluvents are young, loamy soils on flood plains. Differences in the depositional material or accumulations near the surface that are subsequently buried by floods causes a slight variation in the organic-matter content from layer to layer. Insufficient time has elapsed for the mixing of the fine layers by roots and for other biological activities to take place in the

soil. The Typic Xerofluvents are well-drained Xerofluvents. The Reiff series is in this subgroup.

The Aquic Xerofluvents are somewhat poorly drained. If they are not protected by levees and drainage systems, they are subject to flooding. If flooded, they become saturated to a depth of 20 to 40 inches for about a month. The Columbia series is in this subgroup.

The Xeropsamments are excessively drained sandy soils. They lack evidence of significant weathering or clay movement. Their finest texture is sand or loamy sand. The Typic Xeropsamments are deep and well drained and do not have even thin genetic horizons or fragments. The Tujunga series is in this subgroup.

Vertisols.—Vertisols are clayey soils that have little or no change in texture throughout the profile. These soils are cracked to a depth of more than 20 inches. Unless irrigated, soils in the suborder Xererts have open cracks from about May until late in October, during this dry period, soil falls into the cracks. If wetted, the clay swells and causes squeezing and displacement. The presence of slickensides is evidence of soil churning. The normal tendency to form distinct soil horizons is greatly hindered or is prevented as a result of churning. The soils have about the same characteristics from the surface down to the depth of the larger cracks. Two great groups, based on color differences related to drainage, are observed. These are the brownish Chromoxererts and the grayish Pelloxererts.

The dark-brown and dark grayish-brown Typic Chromoxererts have been darkened by organic matter to a depth of more than 12 inches. Lower parts of the profile are lighter brown in color. Mottles and other indications of wetness are lacking, and the soils are well drained. The Altamont, Ayar, and Capay series are in this subgroup. Altamont are sloping soils on hills, and Ayar are gently sloping soils above the valley basin. The Capay soils are on the basin rim.

Typic Pelloxererts are gray, dark-gray, very dark gray, or black soils. The gray colors extend to a depth of 10 inches or more, or the soils have mottles in or near the darkest A horizons. The gray colors and mottles indicate the presence of organic matter and the lack of soil aeration. Originally, the water table was within 20 inches of the surface during the wet season. Late in summer the water table receded and the soil dried or cracked to a depth of several feet. In recent times the water table has been lowered several feet by artificial means, but the evidence of wetter conditions remains in the soil. The Clear Lake and Willows soils are in this subgroup in the valley basin.

Chromic Pelloxererts have colors that suggest a drainage and moisture condition halfway between the Chromoxererts and the Pelloxererts. These soils are gray to very dark gray to a depth of more than 12 inches. Above a depth of 40 inches, they are brownish or grayish brown and do not have mottles. The Diablo soils are in this subgroup. They formed on hill slopes, commonly in association with Altamont soils, but the Diablo soils are mostly on concave slopes or slopes having a northern exposure. Diablo soils stay moist longer than the Altamont soils that are on convex slopes and on slopes having a southern exposure.

Inceptisols.—Inceptisols are soils that have slight indications of weathering and alterations of the soil material. Distinct horizons have formed, but they are weakly expressed and the measure of change is small. Change is evident at a greater depth than is the darkening of the surface in some Entisols. Layers have not been mixed as in the Vertisols. There are two subgroups. The soils that are saturated all or most of the year are in the suborder Aquepts. The soils that are not saturated are in the suborder Ochrepts.

The Typic Haplaquepts formed under conditions of very poor drainage. Ground water is at or near the surface for long periods, but it drops to a depth of 1 to 2 feet late in fall. A considerable amount of organic matter has accumulated, but the A horizon is pale in color. Mottling close to the surface indicates some solution, movement, and oxidation of iron. Artificial drainage has lowered the ground water in some areas. The Tamba series is in this subgroup.

Sulfic Haplaquepts formed under conditions of poor drainage and under some influence of sea water. Organic-matter content is high in places but averages less than 15 percent, and the A horizon is pale in color. These soils are extremely acid and contain a large amount of sulfic derivatives. The Reyes series is in this subgroup.

The Aeric Haplaquepts are not so wet as the Typic Haplaquepts. These soils are brownish to a depth of 30 inches, indicating that the soils are fairly well aerated to this depth. The surface layer is hard and massive when dry because of compaction resulting from intensive tillage. The ground water level has been lowered in many areas. These soils are slightly acid to mildly alkaline. The Sycamore series is in this subgroup.

All of the Ochrepts have about the same moisture regime and are in the great group of Xerochrepts. These soils are moist from late in October or in November until about May. They are dry the rest of the year unless irrigated.

The Typic Xerochrepts are well drained, moderately deep to deep, and are on a landscape that has been stable for some time. The A horizon is darkened by organic matter. If dry, the surface is hard and massive as a result of intensive tillage; long, hot, dry summers; and the absence of frost action. The B horizon has a discernible structure, and parts of other horizons have structure in places. Any original thin stratum in the upper part of the profile has been broken, mixed, and displaced by the action of roots and by other biological activity. In places there are signs of translocations of small amounts of clay. The Brentwood, Millsholm, moderately deep variant, and Yolo series are in this subgroup.

The Lithic Xerochrepts are hard rock at a depth of less than 20 inches. The surface layer generally is pale. In places it is darkened by organic matter, but the darkened layer is only a few inches thick. The base saturation is more than 60 percent ammonium acetate. The Millsholm series is in this subgroup.

The Dystric Lithic Xerochrepts are very similar in most features to the Lithic Xerochrepts. The soils in this subgroup have a base saturation of less than 60

percent. A lower level of bases is mostly an indication of more rainfall and leaching. The Maymen series is in this subgroup.

The Lithic Ruptic-Xerorthentic Xerochrepts have properties of two subgroups—Lithic Xerorthents and Lithic Xerochrepts. More than half the soils have a B horizon that has very slight clay enrichment or has brighter colors than does the A horizon, and this B horizon has structure. The soils having a B horizon are 10 to 20 inches deep over hard rock. In the rest of the soils, the B horizon is interrupted by bedrock that is at a depth of 4 to 10 inches. The change from a profile that has a B horizon to one that does not occurs irregularly over a very short distance. The Toomes series is in this subgroup.

Mollisols.—Mollisols are soils that have an A horizon that is darkened significantly by organic matter to a depth of 7 to 10 inches or more. This A horizon has structure. The organic compounds bind the soils and produce soil aggregates that resist destruction and form again after cultivation. Soil moisture is adequate for plant growth. The soils have accumulated at least 1 percent organic matter to a depth of 7 to 10 inches or more. The quantity of water that has passed through the soil is not large. Base saturation is at least 50 percent ammonium acetate throughout the soil profile.

There are two suborders—Aquolls and Xerolls. The Aquolls formed under conditions of poor drainage. Ground water is close enough to the surface that the soils are saturated for several months in spring and summer. Other evidence of wetness is also indicated by the presence of mottles and the dull-gray color in, or immediately below, the surface soil. The Xerolls are dry from about May until late in October or early in November, unless irrigated. They are moist the rest of the year.

The Fluvaquentic Haplaquolls formed in low areas where flooding sometimes occurs. Thin deposits cover the surface layer, which has been darkened by accumulation of organic matter. The amount of organic matter decreases irregularly with increasing depth. Variations in soil material from layer to layer have resulted in stratification. Generally, there is less than 1 percent organic matter to a depth of 23 inches and less than one-half of a percent at a depth of 50 inches. In Solano County, only about 1½ to 4 percent organic matter is in the upper part of the soil profile, except for a few thin layers. The Egbert and Omni series are in this subgroup. Some areas have artificial drainage and are protected by levees.

The Vertic Haplaquolls also formed in low areas, but floods have left soil material of nearly uniform texture. These soils have a clay texture to a depth of 30 inches to more than 50 inches. Large cracks, more than 20 inches deep, develop in fall as the soils dry. Artificial drainage makes the cracks wider and deeper in many areas. Though granules of soil fall into the cracks, there is little or no evidence that the layers are mixing through soil swelling and the accompanying displacement and overturning. If the thick, dark surface layers were a result of mixing rather than wetness and deposition, the soils would be classed in the Typic or Chromic Pelloxerert subgroup. The Sacramento series is in the Vertic Haplaquoll subgroup.

The Cumulic Haplaquolls are similar in most respects to the Fluvaquentic Haplaquoll subgroup. The A horizon extends to a depth of more than 24 inches. It is 2 to 25 percent organic matter in all horizons to a depth of 40 inches or more. In places a large amount of organic matter is in thin layers as much as 3 inches thick. The soils formed under conditions of wetness. Plant growth was plentiful, and deposition of mineral soils by flood waters was relatively slow. Pumps and levees now regulate the water in most areas. The Ryde series is in this subgroup.

The Pachic Haploxerolls have a surface horizon that is dark and contains a significant amount of organic matter to a depth of more than 20 inches. These soils are well drained. The organic-matter content decreases regularly and reaches a level of less than one-half of a percent at a depth of 50 inches. If there ever was slight layering in the surface horizon, biological activity has since mixed the soils so that the thin layers cannot be recognized. Little or no change, except the enrichment of the A horizon by organic matter, has taken place in the soil profile. The Conejo series is in this subgroup.

The Calcic Pachic Haploxerolls have soil features that are similar to these of the Pachic Haploxerolls. In addition to the features of the preceding subgroup, they have visual lime in the form of powdery, soft masses or small concretions at a depth of 20 to 40 inches. The soils of this subgroup in Solano County had more lime in their original soil material than the soils of the other subgroup in the county. The thick, dark surface and the presence of lime suggest that there is enough moisture to grow a considerable amount of grasses and forbs. Not enough moisture passes through the soil profile, however, to completely leach the bases from the soil. The San Benito series is in this subgroup.

The Lithic Haploxerolls formed in shallow soil material. Because the parent rock is hard and weathers slowly, and because slopes are steep and soil is lost, these soils are less than 20 inches deep over rock. Organic matter has enriched and darkened the upper 6 to 10 inches of the soils, but no other changes have taken place. The Hambright series is in this subgroup.

The Typic Argixerolls have all the features of the great group of Haploxerolls and, in addition, have a genetic B2t horizon that is clay enriched. Water has weathered clay-forming minerals and moved some clay downward. The clay-enriched B2t horizon retains moisture longer than the A horizon, so there is additional weathering of the clay-forming minerals to clay in the B2t horizon. Depth to hard or soft rock is 20 to 40 inches. The Gilroy, Los Gatos, and Los Osos series are in this subgroup.

The Lithic Argixerolls are similar to the Typic Argixerolls, except that the soils in the Lithic subgroup are less than 20 inches deep to hard rock. The parent rock generally is more resistant to weathering, or the slopes and average rate of erosion are greater. The typical deeper profile has not had time to develop. The Trimmer series, shallow variant, is in this subgroup.

The Typic Natrixerolls have about the same appearance and the A horizon is similar to that of soils in the Typic Argixeroll subgroup. The clay-enriched B2t horizon has more than 15 percent exchangeable sodium, and it also has prismatic or columnar structure. The latter feature is not common to the Agrixeroll great group. Because sodium is in the B horizon, few roots enter this horizon and permeability is very slow. The Solano series, dark surface variant, is in this subgroup.

Alfisols.—Alfisols are soils that have an A horizon that contains very slight accumulations of organic matter. The surface layer of some of the soils shows no noticeable darkening and is less than 1 percent organic matter. The upper 10 to 15 inches or more in other soils is darkened and is more than 1 percent organic matter. However, even the darker soils do not have enough organic matter to keep the soil from becoming hard and massive after prolonged drying. In most places the pale A horizon is hard and massive when dry.

Soils in this order have formed a B2t horizon that is significantly enriched by clay. An insufficient amount of water has passed through the soils to thoroughly leach them. Base saturation is more than 50 percent ammonium acetate. All the Alfisols in Solano County are well drained and are in the suborder of Xeralfs. These soils are moist from late in October or November until about May. The soils are dry the rest of the year unless irrigated. The Xeralfs are divided into three great groups based on the properties of the B horizon. They are Haploxeralfs, Palexeralfs, and Natrixeralfs.

The Typic Haploxeralfs have a pale A horizon. The natural plant growth generally has not been sufficient to add significant amounts of organic matter. Lack of rainfall, southern exposure, and runoff are the main limitations to producing a large volume of plant growth and significant accumulation of organic matter. Not enough water has passed through the soil to remove the soluble bases. Base saturation is more than 75 percent (sum of bases) in the B horizon. The upper boundary of the B horizon is clear or gradual. The increase in clay content of the B horizon is less than 15 percent, and less than 35 percent of the upper few inches is clay. The Dibble series is in the Typic Haploxeralf subgroup.

The Mollic Haploxeralfs, have a dark A horizon. Otherwise, they are similar to the Typic Haploxeralfs. Soils in this subgroup generally receive a little more moisture because they receive more rainfall, they have less runoff, or native plant growth is more vigorous and voluminous. The soils are transitional to the Typic Argixerolls and would be classed in the order of Mollisols if the A horizon had structure instead of being hard and massive when dry. The Rincon and Trimmer series are in this subgroup.

The Typic Palexeralfs have a B2t horizon that is more than 35 percent clay. This is 15 percent more clay than in the A horizon. The upper boundary of the B2t horizon is abrupt. The A horizon is pale in color and, except for the upper 1 or 2 inches, contains less than 1 percent organic matter. Plant growth is less vigorous than on the Mollic Haploxeralfs. The soils generally are nearly level, so there is little runoff. Most rainwater passes into the soil, where it is used by plants or evaporates. The landforms are old, and forces have combined to produce an extremely strongly expressed B2t horizon. The Corning, Millsap, and San Ysidro series are in this subgroup.

The Typic Natrixeralfs have all the properties of both the Typic Haploxeralfs and the Palexeralfs. The distinct, clay-enriched B2t horizon has prismatic or columnar structure. More than 15 percent of the exchangeable bases is sodium. Although the A horizon is leached and commonly low in bases, very little water passes through the soil profile, Most plant roots are confined to the A horizon. The Antioch and Solano series are in this subgroup.

The Aquic Natrixeralfs have the same properties as the Typic Natrixeralfs. In addition, these soils are poorly drained and are saturated to within 20 inches of the surface for several months in winter. Mottles and dull colors are indications of this wetness. These soils are in basins, and little water passes through them. Artificial drainage has improved growing conditions in some areas. The Pescadero series is in this subgroup.

Histosols.—Histosols are soils that are very high in organic-matter content and formed under prolonged periods of water saturation. The organic-matter content is more than 20 to 30 percent by dry weight. This minimum amount varies with the proportion of clay in the mineral fraction of the soil. A layer of organic soil material extends from the surface to a depth of more than 16 inches, and organic soil makes up more than half the layers to a depth of more than 32 inches.

Suborders of Histosols are based mostly on the degree of decomposition of the organic material. One suborder is based on depth to rock. In Solano County there are two suborders—Hemists and Saprists. In the Hemists, the organic matter has decomposed so thoroughly that the botanic origins of most of the material cannot be determined. Most of the remaining fibers are easily broken by rubbing. In the Saprists the plant material is almost completely decomposed. The soils are commonly black and have a higher bulk density than do other Histosols.

The Typic Medihemists have an average annual soil temperature of about 63° F., and the temperature varies from summer to winter by more than 9°. These soils are strongly acid or very strongly acid in the upper part, but they lack significant amounts of sulfur, mainly in the form of sulfides, at a depth above 40 inches. Layers of mineral soil are very thin or are entirely lacking to a depth of more than 50 inches. There is no significant change in the kind of organic material throughout the profile. Dikes and levees control the level of ground water and flooding, but the soils are not cultivated. The Suisun series is in this subgroup.

The Typic Medisaprists have an average annual soil temperature of about 63°. Some sulfidic material is present in places. The organic material extends to a depth of 50 inches or more. There are few if any thin mineral layers. Unlike the Medihemists, the organic

materials in these soils are very well decomposed. If these soils are drained, subsidence is slower than in some of the other Histosols. The Joice series is in this subgroup.

The Terric Medisaprists have the same properties as the Typic Medisaprists, except that the organic soil layer extends to a depth of only 28 to 36 inches and is underlain by a clay mineral soil. The Joice series, clay subsoil variant, is in this subgroup.

Laboratory Analyses

The results of the physical and chemical analyses and clay mineralogy of selected soils of the county are given in tables 8 and 9. The information is for five soil series that are extensive in the county. It is based on the profile described as representative for each series in the section "Descriptions of the Soils." The samples were analyzed by the Soil Survey Laboratory, Soil Conservation Service, Riverside, California.

All samples are from carefully selected sites, and only the soil material smaller in grain size than 1 inch was taken from the field. If the soil consisted of fragments larger than 1 inch, the volume of these materials was estimated.

The soil samples were air dried and crushed with a rolling pin so the material would pass through a 2-millimeter, round-hole sieve. Gravel and stones larger than 2 millimeters in diameter were reported as a weight percentage of the total sample. Except for bulk density, all determinations were made on the soil material smaller than 2 millimeters in diameter. All results were expressed on an ovendry basis. Methods used to obtain the data are described briefly in the paragraphs that follow. They are described in detail in Soil Survey Investigations Report No. 1 (*17*).

In table 8 particle-size distribution and moisture data are given.

Size class and particle diameter.—Separation of particles into size classes and ranges of diameters for particle-size distribution data were made by sieve and pipette analyses. The pipette method was used in the soil survey laboratory. After treatment of the sample to remove organic matter and soluble salts, particles were dispersed with sodium hexametaphosphate and mechanical shaking.

Particles larger than 2 millimeters were removed from the samples by a 2-millimeter, round-hole sieve.

Bulk density.—The bulk densities for one-third bar water content and for ovendryness are for saran-coated natural soil clods. The clod was equilibrated to a one-third bar water content on a pressure plate apparatus, and the volume of the clod was determined by the displacement of water. If the clod contained gravel-size particles, calculations were made to correct for their weight and volume and the data were reported on the soil fabric smaller than 2 millimeters.

Water content.—The water content at one-third bar was determined from saran-coated clods, and at 15 bars, the water content on the fragmented soil material was determined by the use of a pressure membrane apparatus.

In table 9 chemical data and clay mineralogy are given.

Percent organic carbon.—The percentage of organic carbon was determined by acid-dichromate digestion and ferrous sulfate titration, a modification of the Walkley-Black method.

Percent total nitrogen.—The total nitrogen in the soil sample was determined by Kjeldahl analysis.

Percent carbonate.—The percentage of carbonate, reported as equivalent to calcium carbonate, was measured from the amount of carbon dioxide produced when acid was mixed with the soil sample.

Extensibility.—Extensibility is an estimate of the change in dimension that occurs in a natural soil clod if the water content changes. The coefficient of linear extensibility (COLE) of the soil fabric is estimated from laboratory bulk density data and the coarse-fragment conversion factor.

Reaction.—Soil reaction, expressed as pH value, was obtained by a glass electrode pH meter using soil-water ratios of 1:1 and 1:10.

Extractable bases.—Calcium, magnesium, sodium, and potassium were extracted with neutral, normal ammonium acetate. Calcium was precipitated as an oxalate and titrated, magnesium was determined gravimetrically as magnesium pyrophosphate, and sodium and potassium were verified by a flame photometer.

Cation-exchange capacity.—The cation-exchange capacity was determined after the sample had been saturated with sodium by mixing it with a solution of sodium acetate. The amount of exchangeable sodium that was later extracted by ammonium acetate represented the cation-exchange capacity.

Water extract from saturated paste.—The ions in the saturation extract, expressed as milliequivalents per liter, were determined by analyzing the water extracted from saturated soil paste. The saturated paste was made by adding water to the soil until the mixture just began to flow. The percentage of moisture at saturation represents a weight difference between the soil paste and the ovendried subsample. The water was removed by vacuum filtration, and the soluble ions were determined by the following procedures: calcium and magnesium by the versenate method; bicarbonate by titration with acid; chloride by titration with silver nitrate; and sodium and potassium by flame photometer.

Electrical conductivity.—Electrical conductivity, given as an estimate of soluble salts in the saturation extract, was determined by the Wheatstone bridge. The conductivity is reported in millimhos per centimeter at the standard temperature of 25° C.

Exchangeable sodium percentage.—The exhangeable sodium percentage, or the degree of sodium saturation of the exchange complex, is a value derived by dividing the exchangeable sodium by the cation-exchange capacity and multiplying the result by one hundred.

Data on montmorillonite, vermiculite, mica, and kaolinite were determined by X-ray diffraction.

TABLE 8.—*Particle-size distribution*

[Analyses by Soil Survey Laboratory, Riverside, California.

Soil name and sample number	Depth from surface	Size class and particle diameter							
		Total			Sand				
		Sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (0.002 mm.)	Very coarse (2.0–1.0 mm.)	Coarse (1.0–0.5 mm.)	Medium (0.5–0.25 mm.)	Fine (0.25–0.1 mm.)	Very fine (0.1–0.05 mm.)
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Antioch loam:									
S64 Calif. 48–8–1 through 11.	0–5	39.2	45.4	15.4	0.3	1.8	4.9	19.6	12.6
	5–14	39.8	43.1	17.1	.2	1.9	5.0	20.1	12.6
	14–19	41.8	42.5	15.7	.4	2.3	5.2	20.4	13.5
	19–34	20.2	39.5	40.3	(1)	.3	1.4	6.8	11.7
	34–37	19.1	44.7	36.2	(1)	.2	.8	4.9	13.2
	37–46	19.6	47.5	32.9	(1)	.2	.5	3.6	15.3
	46–60	11.7	54.4	33.9	.8	.6	.8	3.7	5.8
	60–72	43.9	34.5	21.6	.4	1.7	4.9	19.5	17.4
Capay clay:									
S64 Calif. 48–2–1 through 9.	0–5	4.3	42.0	53.7	.1	.2	.4	1.2	2.4
	5–21	3.2	42.0	54.8	.1	.1	.2	.9	1.9
	21–32	3.8	45.5	50.7	.3	.3	.3	.9	2.1
	32–40	3.5	51.3	45.2	(1)	.1	.1	1.0	2.3
	40–50	7.0	55.1	37.9	(1)	.1	.1	3.2	3.6
	50–62	7.8	54.0	38.2	(1)	(1)	.2	2.8	4.8
	62–80	25.9	38.1	36.0	.3	2.1	6.1	11.1	6.3
Pescadero clay loam:									
S64 Calif. 48–3–1 through 9.	0–4	9.2	58.4	32.4	.3	.5	.9	2.8	4.7
	4–14	19.3	41.5	39.2	.1	.3	1.0	7.3	10.6
	14–22	18.1	40.9	41.0	(1)	.2	.7	6.9	10.3
	22–34	20.0	40.4	39.6	.2	.4	.9	7.5	11.0
	34–47	23.0	42.1	34.9	.5	.8	1.0	8.0	12.7
	47–58	31.2	39.4	29.4	1.3	1.6	1.5	11.4	15.4
	58–69	29.4	39.9	30.7	1.9	1.8	1.8	10.8	13.1
S64 Calif. 48–5–1 through 9.	0–4								
	4–14								
	14–21								
	21–30								
	30–34								
	34–49								
	49–62								
	62–72								
	86–102								
San Ysidro sandy loam:									
S64 Calif. 48–1–1 through 9.	0–7	55.8	33.8	10.4	.6	3.7	8.5	26.1	16.9
	7–14	56.1	32.4	11.5	.4	3.3	8.6	26.0	17.8
	14–28	38.6	24.2	37.2	.3	1.5	5.2	19.3	12.3
	28–40	47.1	22.3	30.6	(1)	.8	3.9	27.0	15.4
	40–54	55.1	21.5	23.4	.2	1.3	5.2	30.0	18.4
	54–68	28.7	43.2	28.1	(1)	.5	1.9	10.6	15.7
Solano loam:									
S24 Calif. 48–7–1 through 8.	0–4	31.8	53.3	14.9	.2	1.1	3.0	12.8	14.7
	4–9	31.4	52.7	15.9	.2	1.0	2.5	12.2	15.5
	9–21	26.0	43.3	30.7	.1	.8	2.4	10.7	12.0
	21–32	36.4	32.6	31.0	(1)	1.0	4.0	15.8	15.6
	32–48	23.7	44.1	32.5	2.8	2.3	1.5	7.0	10.1
	48–62	17.4	50.4	32.2	2.5	2.9	1.3	3.7	7.0

[1] Trace.

and moisture data for selected soils

Dashes indicate that determinations were not made]

Size class and particle diameter—Continued				Bulk density		Water content	
Silt							
0.05–0.02 mm.)	0.02–0.002 mm.)	0.2–0.02 mm.	2.0–0.1 mm.	1/3 bar	Ovendry	1/3 bar	15 bars
Percent	*Percent*	*Percent*	*Percent*	*Gm./cc.*	*Gm./cc.*	*Percent*	*Percent*
22.5	22.9	45.7	26.6	1.59	1.63	17.8	6.6
21.1	22.0	44.9	27.0	1.60	1.64	16.3	6.5
20.5	22.0	45.0	28.3	1.68	1.72	14.3	6.5
19.0	20.5	35.1	8.5	1.56	1.87	24.1	19.5
23.6	21.1	40.2	5.9	1.52	1.84	28.5	20.3
24.9	22.6	42.9	4.3	1.61	1.78	21.9	18.3
21.5	32.9	29.7	5.9	1.62	1.78	22.0	19.7
18.2	16.3	47.8	26.5	1.76	1.83	14.8	9.7
11.7	30.3	14.9	1.9				19.5
10.2	31.8	12.7	1.3	1.51	1.95	26.0	19.7
11.5	34.0	14.2	1.7	1.49	1.89	25.9	20.4
11.9	39.4	14.9	1.2				19.0
15.5	39.6	21.3	3.4	1.52	1.78	24.9	19.1
14.7	39.3	21.4	3.0				18.3
12.0	26.1	23.7	19.6	1.62	1.81	21.5	16.6
17.2	41.2	23.5	4.5	1.44	1.56	23.9	11.0
18.3	23.2	34.1	8.7	1.47	1.87	24.7	14.4
17.5	23.4	32.8	7.8	1.44	1.82	27.3	16.3
16.7	23.7	33.2	9.0	1.49	1.84	23.6	17.2
17.0	25.1	35.7	10.3	1.63	1.93	19.7	17.8
19.7	19.7	43.6	15.8	1.73	1.95	18.1	18.1
19.8	20.1	40.6	16.3	1.71	1.87	18.0	15.1
							15.9
							19.9
							18.5
							15.9
				1.70	1.87	18.6	14.5
							12.8
18.6	15.2	50.6	38.9	1.59	1.70	13.6	4.3
17.5	14.9	50.5	38.3	1.66	1.71	12.3	4.6
13.0	11.2	37.0	26.3	1.54	1.88	22.8	15.2
12.4	9.9	45.0	31.7	1.62	1.90	21.0	13.9
12.4	9.1	49.8	36.7	1.69	1.83	17.7	10.9
19.5	23.7	42.6	13.0	1.65	1.83	20.1	14.8
24.0	29.3	46.9	17.1				6.7
22.7	30.0	46.1	15.9				6.2
19.6	23.7	38.5	14.0				17.5
15.3	17.3	40.3	20.8				16.6
19.3	24.8	34.4	13.6				17.8
18.0	32.4	27.5	10.3				17.6

TABLE 9.—*Chemical data and clay*

[Analyses by Soil Survey Laboratory, Riverside, California. One dash indicates that determination was made but

Soil name and sample number	Depth	Organic carbon	Nitrogen	Carbonate as $CaCO_3$	Extensibility (COLE)	Reaction		Extractable bases (Meq./100 grams of soil)				Sum of bases	Cation-exchange capacity (sodium acetate)
						1:1	1:10	Ca	Mg	Na	K		
	Inches	*Percent*	*Percent*	*Percent*	*In. per in.*	*pH*	*pH*					*Meq. per 100 grams of soil*	*Meq. per 100 grams of soil*
Antioch loam:													
S64 Calif. 48–8–1 through 11.	0–5	1.35	0.127	—	0.010	5.8	6.2	7.7	2.0	0.3	0.4	10.4	14.1
	5–14	.54	.064	—	.008	6.2	6.4	6.8	2.3	.4	.2	9.7	13.7
	14–19	.28	.042	—	.006	6.5	6.8	6.1	2.7	.8	.1	9.7	12.4
	19–34	.28	.047	—	.062	6.2	7.1	13.8	7.3	7.0	.3	28.4	34.3
	34–37	.10	----	—	.066	7.5	8.4	15.6	8.4	8.8	.3	33.1	34.7
	37–46	.09	----	—	.035	8.1	8.9	15.5	8.1	8.4	.2	32.2	33.4
	46–60	.07	----	—	.033	8.4	9.2	17.7	8.7	8.8	.2	35.4	35.3
	60–72	.04	----	—	.013	8.6	9.3	10.8	4.5	4.1	.1	19.5	18.0
Capay clay:													
S64 Calif. 48–2–1 through 9.	0–5	1.09	.103	—	----	7.1	7.7	19.7	19.8	1.2	.7	41.4	43.0
	5–21	.79	.078	[2]	.090	7.9	8.6	25.4	17.3	1.6	.5	44.8	42.4
	21–32	.52	.057	1	.083	8.4	9.1	25.6	18.2	3.6	.4	47.8	42.5
	32–40	.30	----	[2]	----	8.3	9.1	23.3	14.8	4.4	.4	42.9	40.1
	40–50	.24	----	[2]	.054	8.3	9.0	19.8	13.4	5.1	.3	38.6	37.6
	50–62	.23	----	—	----	8.2	8.9	18.8	13.0	5.9	.3	38.0	36.9
	62–80	.11	----	1	.038	8.2	9.2	18.5	11.2	5.2	.3	35.2	33.3
Pescadero clay loam:													
S64 Calif. 48–3–1 through 9.	0–4	2.13	.184	—	.032	5.9	6.7	8.2	10.8	3.0	.5	22.5	32.3
	4–14	.54	.052	1	.083	8.5	9.7	11.3	12.3	18.3	.6	42.5	28.6
	14–22	.24	.029	1	.080	8.6	9.7	9.9	13.7	22.1	.5	46.2	29.3
	22–34	.12	----	1	.073	8.5	9.5	3.6	13.2	22.5	.3	39.6	27.5
	34–47	.07	----	3	.058	8.5	9.6	3.9	13.8	20.2	.2	38.1	26.4
	47–58	.06	----	5	.042	8.7	9.8	6.5	12.0	16.5	.2	35.2	23.7
	58–69	.04	----	5	.032	8.5	9.8	7.2	12.9	14.2	.2	34.5	25.8
S64 Calif. 48–5–1 through 11.	0–4	----	----	—	----	----	----	6.6	9.5	.9	.5	17.5	23.5
	4–14	----	----	—	----	----	----	5.7	25.1	3.5	.4	34.7	41.4
	14–21	----	----	—	----	----	----	5.1	24.4	7.2	.4	37.1	37.2
	21–30	----	----	—	----	----	----	4.7	24.6	11.0	.4	40.7	36.7
	30–34	----	----	—	----	----	----	45.0	23.7	13.1	.4	82.2	31.2
	34–49	----	----	—	----	----	----	4.8	23.2	12.3	.4	40.7	30.9
	49–62	----	----	—	----	----	----	13.4	19.8	10.5	.4	41.1	27.7
	62–72	----	----	—	----	----	----	12.4	17.8	7.8	.3	38.3	27.0
	86–102	----	----	—	----	----	----	11.7	16.6	4.6	.3	33.2	22.3
San Ysidro sandy loam:													
S64 Calif. 48–1–1 through 9.	0–7	.69	.064	—	.022	6.4	6.6	4.0	2.5	.2	.5	7.2	9.8
	7–14	.36	.045	—	.010	5.7	6.3	4.7	1.8	.2	.2	6.9	9.5
	14–28	.32	.052	—	.064	6.6	7.2	13.9	9.5	1.0	.4	24.8	25.3
	28–40	.14	----	—	.053	7.0	7.7	12.8	8.8	1.4	.3	23.3	23.8
	40–54	.07	----	—	.027	7.2	7.8	10.6	7.9	1.8	.2	20.5	26.7
	54–68	.07	----	—	.036	7.4	5.1	16.5	11.8	2.9	.2	31.4	32.4
Solano loam:													
S64 Calif. 48–7–1 through 8.	0–4	2.25	.177	—	----	5.6	6.0	5.2	2.1	.7	.2	8.2	15.7
	4–9	.90	.080	—	----	5.7	6.4	4.5	2.8	1.1	.1	8.5	14.9
	9–21	.39	.050	—	----	6.8	7.6	6.0	7.6	7.5	.2	21.3	22.8
	21–32	.14	----	—	----	8.3	8.9	5.2	9.6	14.1	.3	29.2	28.0
	32–48	.07	----	9	----	8.7	9.8	13.6	11.6	15.6	.3	41.1	33.3
	48–62	.05	----	11	----	8.8	9.9	16.9	12.3	11.9	.3	41.4	34.1

[1] The symbol x means a small amount was found; xx means that a moderate amount was found; xxx means an abundant amount was found; and xxxx means the element was dominant.

[2] Trace.

mineralogy of selected soils

reportable amount was not found. More than one dash in a column indicates that determination was not made]

Water extract from saturated paste (Meq./liter)								Electrical conductivity	Water at saturation	Sodium absorption ratio	Exchangeable sodium	Exchangeable sodium	Clay mineralogy [1]			
Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4						Montmorillonite	Vermiculite	Mica	Kaolinite
								Mmhos. per cm. at 25°C.	*Percent*		*Percent*	*Meq. per 100 grams of soil*				
2.0	0.8	2.8	0.4	—	0.2	2.9	—	0.67	40.1	2	1	0.2				
.8	.6	2.4	.2	—	.2	1.8	—	.42	33.1	3	2	.3		xx	x	x
.7	.6	4.4	.1	—	.2	3.5	—	.64	31.2	5	5	.6				
.4	.7	10.8	.2	—	.4	7.9	—	1.31	63.8	15	18	6.3				
.6	.3	14.4	.3	—	.6	11.1	—	1.61	66.0	21	23	7.9				
.7	.3	12.4	.2	—	1.9	8.9	—	1.38	59.0	18	23	7.7				
.6	.2	11.7	(2)	—	2.6	7.6	—	1.31	58.7	18	23	8.1	xxxx			x
.4	.4	8.5	.3	—	4.4	2.8	—	.80	38.4	13	21	3.7				
1.1	1.0	2.6	.1	—	1.8	.8	—	.48	53.9	3	3	1.1				
.8	.8	3.6	.1	—	3.2	.2	—	.50	53.7	4	3	1.4				
.5	.6	9.3	.1	—	3.4	.6	—	.78	55.0	11	7	3.1				
2.8	.6	8.5	.2	—	3.4	.6	5.9	1.08	54.7	7	10	4.0				
1.1	1.1	11.0	.2	—	3.6	.6	7.6	1.22	59.8	10	12	4.4				
1.9	2.1	15.2	.3	—	2.7	.4	15.6	1.79	56.4	11	14	5.0				
3.0	2.0	17.9	.3	—	2.2	.6	19.8	2.18	52.3	11	13	4.3				
.3	.2	6.6	.1	—	.5	5.6	1.8	.91	51.0	13	8	2.6	xxxx			xx
.5	1.9	91.2	.2	—	4.2	15.4	30.2	5.33	107.1	83	30	8.5				
1.0	2.9	68.5	.3	—	2.9	30.0	49.0	7.80	116.0	49	48	14.2	xxxx			x
.8	2.0	71.5	.3	—	2.4	27.5	44.6	7.10	135.6	60	46	12.8				
.6	2.0	57.2	.3	—	3.0	24.8	37.9	6.30	123.6	50	50	13.1				
.5	1.2	40.5	.3	—	3.2	18.2	24.6	4.58	114.1	44	50	11.9	xxxx			xx
.6	1.5	40.0	.3	—	3.1	19.6	20.6	4.30	99.4	39	40	10.2				
1.0	2.0	3.7	.2	—	.3	3.2	2.3	.79	41.3	3	3	.8				
5.9	31.8	31.0	.2	—	.9	22.3	52.8	5.88	64.2	7	4	1.5				
1.0	5.2	24.5	.2	—	.8	19.2	11.2	3.29	67.0	14	15	5.5				
6.9	43.0	75.8	.2	—	2.4	58.3	77.8	10.90	65.0	15	17	6.1				
32.4	62.5	74.8	.2	—	1.9	43.6	136.0	13.00	60.0	11	28	8.6				
8.4	58.5	105.0	.2	—	2.4	89.3	89.1	14.60	60.7	18	47	14.6				
4.2	26.1	70.0	.1	—	2.9	64.2	37.4	9.80	61.5	18	22	6.2				
2.3	11.3	45.0	.1	—	3.1	45.4	13.5	6.00	55.5	17	20	5.3				
.8	3.6	15.7	.1	—	2.7	14.7	2.2	2.18	53.8	11	17	3.7				
1.0	.8	1.3	.3	—	.4	1.2	------	.35	32.6	1	1	.1				
.3	.4	9.5	(2)	—	.2	.8	------	1.52	29.5	2	—	—	—	xx	xx	x
11.4	12.4	21.9	1.1	—	.5	10.1	36.9	4.02	49.8	6	—	—				
.7	.6	3.9	.1	—	.6	3.0	------	.59	50.5	5	5	1.2	xxxx	—	—	x
.5	.5	4.3	(2)	—	.5	3.1	------	.59	48.3	6	7	1.6				
2.0	1.6	8.8	.1	—	.6	10.5	------	1.41	55.1	7	9	4.5	xxxx	—	—	x
.8	.5	3.7	.1	—	.2	2.5	1.2	.68	46.8	5	4	.6	xx	—	—	x
.5	.1	4.0	.1	—	.2	3.1	.8	.57	36.4	7	6	.9				
.5	.9	17.5	.1	—	.5	15.1	3.0	2.13	60.9	21	28	6.4				
.7	1.3	36.6	.5	—	1.4	26.1	5.8	3.57	101.6	36	37	10.4	xxxx	—	—	x
.5	.6	25.6	.5	—	3.3	19.7	2.8	2.86	101.4	34	39	13.0	xxxx			x
.5	.3	12.6	(2)	—	4.3	8.3	.9	1.49	84.6	20	32	10.8				

General Nature of the County

This section provides general information about the physiography and drainage, climate, water supply, population and history, farming and development and vegetation of the county.

Physiography and Drainage

The western part of the county consists of hilly to very steep mountainous uplands of the Coast Ranges that have a maximum elevation of 2,819 feet above sea level. The rest of the county is on the floor of the Sacramento Valley. Except for an isolated area of low, rolling hills in the southeast corner of the county, the valley areas of Solano County are level or gently sloping alluvial plains and marshes. They are near sea level along the eastern and southern borders and rise to an elevation of about 100 feet at the foot of the mountains. A large area of tidal flats and marshland is adjacent to Suisun Bay. This area has been cut into islands by a maze of natural drainage channels.

About two-thirds of Solano County is drained eastward to the Sacramento River by a number of intermittent streams, such as Putah, Sweeney, and Ulatis Creeks. The rest of the county is drained southward into Suisun Bay by intermittent streams, such as Green Valley, Suisun, and Ledgewood Creeks.

Climate [3]

The climate of Solano County is strongly influenced by its location and topography. The Sacramento Valley, to the east and north, has hot, dry summers and cool winters; the area near the Pacific Ocean, to the south and west, has cool, humid summers and moderate winters.

In summer there is a steady marine wind that blows up the Carquinez Strait. Velocities of 15 to 25 knots or more are common late in the afternoon and in the evening, but the winds are mostly 10 knots or less late in the morning. The jet of air sweeping eastward through the strait curls northward in the vicinity of the Sacramento River. By afternoon it frequently forms an eddy that draws northerly winds across the eastern part of the county.

The moderating influence of the marine air is reflected in the average annual temperature, which is 58° F. in the vicinity of the strait but is 61° or more in the somewhat protected northern parts of the county. The differences are most pronounced in midsummer. The July average maximum is about 80° in the San Pablo Bay area but reaches 96° or more in the Lake Solano-Winters area. Average minimums are more uniform, ranging from 55° in the south to 58° in the northwest. In January the average maximum temperature is about 53° and the average minimum is about 38° near the water and 36° inland.

Average annual precipitation ranges from 16 inches in some of the southern parts of the county to as much as 30 inches at the top of the Vaca Mountains. About 17 to 20 inches per year falls on the eastern half of the county. In the driest years, about 1 year in 20, the annual total precipitation is as little as 9 inches in the southeast and 18 inches in the mountains. In the wettest years, 25 to 50 inches falls in the same areas. Measurable precipitation falls on 50 to 60 days per year. Approximately 95 percent of the total precipitation falls in October through April. Additional data on temperature and precipitation are given in table 10.

Snow commonly does not fall on the lowlands. Snow falls at the higher elevations every 2 or 3 years, but it generally lasts only a few hours to a few days.

The last day of freezing (32°) temperatures in spring ranges from February 1 in the San Pablo Bay area to March 10 in the interior. The first day of freezing temperatures in fall ranges from November 20 to December 20. The growing season, therefore, is 240 to 300 days. Based on a minimum of 28°, the growing season is 300 to 360 days. The last spring freeze is in January and the first fall freeze is in December, on the average. Additional data on probabilities of last freezing temperatures in spring and first in fall are given in table 11.

Soil temperature recorded at Davis, at a depth of 4 inches, averages 45° in January and 88° in July. The average daily range is 6° in winter and 19° in summer. The annual soil temperature extremes are 30° and 107°.

Sunshine averages about 3,000 hours per year. In January the sun shines 50 percent of the time, and in July it shines about 75 percent of the time. Energy received from the sun averages about 150 langleys per day in January and about 660 langleys per day in July.

In winter the relative humidity averages about 90 percent at night and about 70 percent in the afternoon. When the humidity is near 100 percent, periods of fog occur and last several days to 2 weeks or more. In July the relative humidity averages about 75 percent early in the morning and drops to 55 percent in the afternoon with the influx of marine air, and to about 35 percent in the drier interior. Some dry north winds cause the humidity to drop below 10 percent.

Annual evaporation from ponds or lakes averages 47 to 53 inches, the greater evaporation occurring in inland areas. Approximately 70 percent of this water evaporates during the period of May to October. The potential evapotranspiration, computed by the Thornthwaite method, totals 29 inches near Carquinez Strait and about 34 inches near Winters; when limited to the 32° growing season, it totals 28 and 30 inches, respectively. Using a figure of 4 inches as representative of the available moisture stored in the root zone, a computed value of evapotranspiration, as limited by natural precipitation, totals 11 to 13 inches for the year and only 8 to 12 inches for the growing season. These figures suggest that grasses would normally dry around May 30 in the east and around June 10 in the mountains.

[3] By C. ROBERT ELFORD and JOHN E. STILZ, climatologists for California, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Temperature and precipitation data, Vacaville, Calif.*[1]

Month	Temperature				Precipitation		
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
January	55	36	65	26	5.3	1.4	10.6
February	60	38	70	28	5.1	1.0	11.5
March	66	41	79	31	3.1	.6	6.9
April	73	43	87	35	1.8	(2)	5.0
May	81	48	95	39	.6	0	1.6
June	89	53	103	45	.1	0	.5
July	96	56	107	50	(2)	0	(2)
August	95	54	106	47	(2)	0	(2)
September	91	52	105	45	.2	0	.9
October	80	46	94	36	1.2	(2)	3.7
November	67	39	81	29	2.2	(2)	4.9
December	56	37	67	26	5.5	.8	14.2
Year	76	45	[3] 110	[4] 23	25.2	11.5	35.9

[1] Data from period of 1931–60.
[2] Trace.
[3] Average annual maximum.
[4] Average annual minimum.

Water Supply

Solano County has three main sources of fresh water—Lake Berryessa, ground water, and the several sloughs that empty into the Sacramento River.

Lake Berryessa, which was formed by the Monticello Dam on Putah Creek, has a potential to supply an estimated 247,000 acre-feet of water to Solano County each year. Of this, 219,800 acre-feet is used for irrigating about 70,000 acres of farmland. Irrigation water for the remaining 74,200 acres in irrigated farms comes from wells and the sloughs that empty into the Sacramento River.

The ground water supply is replenished by Putah Creek in the northern part of the county and by Suisun and Green Valley Creeks west and north of Fairfield.

Population and History

Solano County was occupied by the Patwin Indians at the time the Spanish arrived (*10*). The Patwins

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall, Vacaville, Calif.*[1]

Probability	Dates for given probabilities and temperatures				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	(2)	January 1	February 15	March 19	April 23
2 years in 10 later than	(2)	(2)	February 1	March 3	April 11
5 years in 10 later than	(2)	(2)	(2)	February 8	March 21
Fall:					
1 year in 10 earlier than	(3)	(3)	November 16	November 7	October 18
2 years in 10 earlier than	(3)	(3)	November 26	November 15	October 25
5 years in 10 earlier than	(3)	(3)	(3)	November 30	November 7

[1] Data from period of 1931–60.
[2] Earlier than January 1.
[3] Later than December 31.

lived in villages and got their food from the native plants and animals. Smallpox brought by the Spanish killed most of the Indians in the epidemics of 1837–39. The Patwin Indians left the county more than a century ago.

The first settlements were on Spanish land grants along Putah Creek, in Vaca and Suisun Valleys, and in the Benicia-Vallejo area. John R. Wolfskill, among the first settlers, brought fruit tree seeds and cuttings from Pueblo Los Angeles in 1842. These were planted along Putah Creek. From this start Solano County grew into an important farming area.

The population of Solano County increased from 24,143 in 1900 to about 134,597 in 1960.

Farming and Development

Farming is very important to the economy of the county. The Solano County Agricultural Crop Report for 1968 lists approximately 43 different crops that are grown on a commercial scale. These include tree fruits, nuts, and field, vegetable, forage, and seed crops.

Livestock and livestock products are a principal source of farm income in the county. In 1968 there were 52,900 cattle, 130,000 sheep, 1,000 hogs, and 140,000 poultry.

Although farming is important to the economy of Solano County, income from farms is much less than that from the military installations located in the county.

Private industry in the county has maintained a moderately rapid rate of development in recent years, and industrial sites have been purchased by several major industries. There were 163 industries in Solano County in 1968, and of these 67 had 20 employees or more (*13*).

Vegetation

The valley portion of the county is intensively farmed to row crops, field crops, and orchards. There are very few small areas where remnants of the native vegetation remain. Some areas that are irrigable lack a dependable water supply and are used for dry-farmed grain. The rolling terraces are used for dry-farmed grain and annual grass pasture. The mountainous uplands are generally covered by annual grasses and oak-type vegetation, but areas of brush grow on the severely eroded soils.

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Glossary

Aeration soil. The process by which air in the soil is replaced by air from the atmosphere. The air in a well-aerated soil is similiar to that in the atmosphere. Poorly aerated soils generally contain a much higher percentage of carbon dioxide and a correspondingly lower percentage of oxygen than the atmosphere. The rate of aeration depends largely on the volume and continuity of pores within the soil.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvial soil. A soil forming from recently deposited alluvium.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Amendment. Any material, such as lime, gypsum, sawdust, or synthetic conditioner, that is worked into the soil to make it more productive. Any such substance used for this purpose. Strictly speaking, fertilizers constitute a special group of soil amendments.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Buried soil. A developed soil, once exposed but now overlain by more recently formed soil.

Calcareous soil. Soil containing enough calcium carbonate (often with magensium 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.

Claypan. A dense, compact layer in the subsoil having a much higher clay content than the overlying material, from which it is separated by a sharply defined boundary; formed by downward movement of clay or by synthesis of clay in place during soil formation. Claypans are usually hard when dry and plastic and sticky when wet. They generally impede the movement of water and air and the growth of roots.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Dryfarming. Production of crops that require some tillage in a subhumid or semiarid region, without irrigation. Usually involves use of periods of fallow, during which time enough moisture accumulates in the soil to allow production of a cultivated crop.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

Evapotranspiration. The combined loss of water from a given area, and during a specific period of time, by evaporation from the soil surface and through transpiration from plants.

Flood plain. The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Gleyed soil. A soil in which waterlogging, reduction of iron and other elements, 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.

Gravelly soil material. From 15 to 50 percent of material, by volume, consists of rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

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 sequioxides (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.

Illuvial horizon. A soil layer or horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension. The layer of accumulation.

Infiltration. The downward entry of water into the immediate surface of the soil.

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.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Ped. An individual natural soil aggregate, such as a crumb, prism, block, or granule, formed by natural processes (in contrast with a clod, which is formed artificially).

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

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. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without

sinking in is called surface runoff; that which enter the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The salts, exchangeable sodium, and alkaline reaction occur in the soil in such location that growth of most crops is less than normal.

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 any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Structure, soil. The combination or arrangement of primary soil particles into secondary particles, units, or peds. These secondary units may be, but generally are not, arranged in the profile in such a manner as to give a distinctive characteristic pattern. The secondary units are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades, respectively.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. That part of the soil below the solum. The parent material or other layers unlike the parent material that lie below the B horizon.

Surface soil. The uppermost part of the soil, ordinarily moved in tillage, or its equivalent in uncultivated soils, about 5 to 8 inches thick. The plowed layer.

Terrace. An old alluvial plain, ordinarily nearly level or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Variant soil. A soil having properties sufficiently different from other known soils to justify a new series, but comprising such a limited geographic area that creation of a new series is not justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. Dashes in a column mean that the particular mapping unit is not suitable for that use. For information on vegetative soil groups and Storie index ratings, see page 63. For information on wildlife, see section beginning or page 67. Other information is given in tables as follows:

Acreage and extent, table 1, page 8.
Predicted yields, table 2, page 58.
Engineering, tables 4, 5, and 6, pages 72 to 95.

Map symbol	Mapping unit	Page	Capability unit		Vegetative soil group	Wildlife group	Range site		Storie index rating
			Symbol	Page	Symbol	Number	Name	Page	Number
AcC	Altamont clay, 2 to 9 percent slopes	9	IIIe-5 (15)	50	C	8		--	38
AcE	Altamont clay, 9 to 30 percent slopes	9	IVe-5 (15)	53	C	8		--	30
AcF2	Altamont clay, 30 to 50 percent slopes, eroded	9	VIe-1 (15)	54	C	8	Clayey	65	14
AlC	Altamont-San Ysidro-San Benito complex, 2 to 9 percent slopes	9	IIIe-5 (15)	50	--	--		--	36
	Altamont part	--		--	C	8		--	--
	San Ysidro part	--		--	D	4		--	--
	San Benito part	--		--	G	8		--	--
AlE	Altamont-San Ysidro-San Benito complex, 9 to 30 percent slopes	9	IVe-5 (15)	53	--	--		--	30
	Altamont part	--		--	C	8		--	--
	San Ysidro part	--		--	D	4		--	--
	San Benito part	--		--	G	8		--	--
AmC	Altamont-Diablo clays, 2 to 9 percent slopes	10	IIIe-5 (15)	50	C	8		--	38
AmE2	Altamont-Diablo clays, 9 to 30 percent slopes, eroded	10	IVe-5 (15)	53	C	8		--	30
An	Alviso silty clay loam	11	IVw-6 (17)	54	F	6		--	37
AoA	Antioch-San Ysidro complex, 0 to 2 percent slopes	12	IVs-3 (17)	53	D	4		--	38
AoC	Antioch-San Ysidro complex, 2 to 9 percent slopes	12	IVe-3 (17)	52	D	4		--	35
AsA	Anitoch-San Ysidro complex, thick surface, 0 to 2 percent slopes	12	IIIs-3 (17)	51	D	4		--	42
AsC	Antioch-San Ysidro complex, thick surface, 2 to 9 percent slopes	12	IIIe-3 (15)	50	D	4		--	37
BrA	Brentwood clay loam, 0 to 2 percent slopes	13	I-1 (17)	47	A	1		--	81
BrC	Brentwood clay loam, 2 to 9 percent slopes	14	IIe-1 (17)	47	A	1		--	73
Ca	Capay silty clay loam	15	IIs-3 (17)	48	A	1		--	69
Cc	Capay clay	16	IIs-5 (17)	49	C	3		--	46
CeA	Clear Lake clay, 0 to 2 percent slopes	16	IIs-5 (17)	49	C	3		--	49
CeB	Clear Lake clay, 2 to 5 percent slopes	16	IIIe-5 (17)	50	C	8		--	41
ClA	Clear Lake clay, saline, 0 to 2 percent slopes	16	IVw-6 (17)	54	F	6		--	32
Cm	Columbia fine sandy loam	17	IIw-2 (17)	49	E	1		--	90

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Vegetative soil group	Wildlife group	Range site		Storie index rating
			Symbol	Page	Symbol	Number	Name	Page	Number
Cn	Conejo loam	18	I-1 (17)	47	A	1	----------	--	100
Co	Conejo gravelly loam	18	IIs-4 (17)	49	A	1	----------	--	75
Cr	Conejo clay loam	18	I-1 (17)	47	A	1	----------	--	85
Cs	Conejo soils, wet	18	IIw-2 (17)	49	E	1	----------	--	77
CvD2	Corning gravelly loam, 2 to 15 percent slopes, eroded	19	IVe-3 (17)	52	D	2	----------	--	21
CvE2	Corning gravelly loam, 15 to 30 percent slopes, eroded	19	VIe-1 (17)	54	D	2	Claypan	66	18
DaC	Diablo-Ayar clays, 2 to 9 percent slopes	19	IIIe-5 (15)	50	C	8	----------	--	43
DaE2	Diablo-Ayar clays, 9 to 30 percent slopes, eroded	19	IVe-5 (15)	53	C	8	----------	--	35
DbC	Dibble-Los Osos loams, 2 to 9 percent slopes	20	IIIe-3 (15)	50	G	8	Fine Loamy	64	65
DbE	Dibble-Los Osos loams, 9 to 30 percent slopes	20	IVe-3 (15)	52	G	8	Fine Loamy	64	51
DbF2	Dibble-Los Osos loams, 30 to 50 percent slopes, eroded	20	VIe-1 (15)	54	G	8	Fine Loamy	64	14
DlC	Dibble-Los Osos clay loams, 2 to 9 percent slopes	20	IIIe-3 (15)	50	G	8	Fine Loamy	64	55
DlE	Dibble-Los Osos clay loams, 9 to 30 percent slopes	20	IVe-3 (15)	52	G	8	Fine Loamy	64	44
DlF2	Dibble-Los Osos clay loams, 30 to 50 percent slopes, eroded	21	VIe-1 (15)	54	G	8	Fine Loamy	64	20
Eb	Egbert silty clay loam	21	IIw-2 (17)	49	E	1	----------	--	63
Ec	Egbert silty clay loam, occasionally flooded	21	IVw-2 (17)	53	E	5	----------	--	54
GaG2	Gaviota sandy loam, 30 to 75 percent slopes, eroded	22	VIIe-1 (15)	55	J	7	Very Shallow Loamy	67	8
GlE	Gilroy loam, 9 to 30 percent slopes	22	IVe-1 (15)	52	G	8	Fine Loamy	64	50
HaF	Hambright loam, 15 to 40 percent slopes	22	VIe-1 (15)	54	G	7	Shallow Loamy	66	24
HtE	Hambright-Toomes stony loams, 9 to 30 percent slopes	23	VIIs-1 (15)	55	J	7	Very Shallow Loamy	67	18
Ja	Joice muck	23	VIw-1 (16)	55	J	9	----------	--	18
Jb	Joice muck, clay subsoil variant	24	VIw-1 (16)	55	J	9	----------	--	16
Ma	Made land	25	Variable	--	--	--	----------	--	Variable

Map symbol	Mapping unit	Page	Capability unit	Page	Vegetative soil group	Wildlife group	Range site	Page	Storie index rating
			Symbol		Symbol	Number	Name		Number
MeG3	Maymen-Los Gatos loams, 15 to 75 percent slopes, severely eroded	25	VIIIs-1 (15)	55	J	--	----------	--	6
	Maymen part	--	--------	--	--	7	----------	--	--
	Los Gatos part	--	--------	--	--	8	----------	--	--
MkA	Millsap sandy loam, 0 to 2 percent slopes	26	IVs-3 (15)	53	D	4	----------	--	38
MlC	Millsap-Los Osos complex, 2 to 9 percent slopes	26	IVe-3 (15)	52	--	--	----------	--	41
	Millsap part	--	--------	--	D	2	Claypan	66	--
	Los Osos part	--	--------	--	G	8	Fine Loamy	64	--
MmE	Millsholm loam, 15 to 30 percent slopes	26	VIe-1 (15)	54	G	7	Shallow Loamy	66	27
MmG2	Millsholm loam, 30 to 75 percent slopes, eroded	27	VIIe-1 (15)	55	J	7	Shallow Loamy	66	8
MnC	Millsholm loam, moderately deep variant, 2 to 9 percent slopes	27	IIIe-1 (15)	50	G	8	----------	--	51
MnE	Millsholm loam, moderately deep variant, 9 to 30 percent slopes	27	IVe-1 (15)	52	G	8	----------	--	38
Om	Omni clay loam	28	IVw-6 (17)	54	F	6	----------	--	47
On	Omni silty clay	28	IIIw-5 (17)	52	E	5	----------	--	36
Pc	Pescadero clay loam	29	IVw-6 (17)	54	F	6	----------	--	35
Pe	Pescadero clay	29	IVw-6 (17)	54	F	6	----------	--	24
Ra	Reiff fine sandy loam	30	I-1 (17)	47	A	1	----------	--	100
Rd	Reyes silty clay loam, drained	30	IVw-9 (16)	54	H	9	----------	--	37
Re	Reyes silty clay	30	VIw-1 (16)	55	H	9	----------	--	25
RnC	Rincon loam, 2 to 9 percent slopes	31	IIe-3 (17)	48	A	1	----------	--	77
RoA	Rincon clay loam, 0 to 2 percent slopes	31	IIs-3 (17)	48	A	1	----------	--	72
RoC	Rincon clay loam, 2 to 9 percent slopes	31	IIe-3 (17)	48	A	1	----------	--	65
Rw	Riverwash	31	VIIIw-1 (17)	55	J	2	----------	--	<5
Ry	Ryde clay loam	32	IIIw-2 (16)	51	E	5	----------	--	61
Sa	Sacramento silty clay loam	33	IIIw-3 (17)	51	E	5	----------	--	65
Sc	Sacramento silty clay loam, occasionally flooded	33	IVw-3 (17)	54	E	5	----------	--	34
Sd	Sacramento clay	33	IIIw-5 (17)	52	E	5	----------	--	43
SeA	San Ysidro sandy loam, 0 to 2 percent slopes	35	IVs-3 (17)	53	D	4	----------	--	46
SeB	San Ysidro sandy loam, 2 to 5 percent slopes	35	IVe-3 (17)	52	D	4	----------	--	43
SfA	San Ysidro sandy loam, thick surface, 0 to 2 percent slopes	35	IIIs-3 (17)	51	D	4	----------	--	49
Sh	Solano loam	37	IVs-6 (17)	53	F	6	----------	--	38
Sk	Solano-Pescadero complex-	37	IVw-6 (17)	54	F	6	----------	--	34

Map symbol	Mapping unit	Page	Capability unit	Page	Vegetative soil group	Wildlife group	Range site	Page	Storie index rating
			Symbol		Symbol	Number	Name		Number
Sm	Solano loam, dark surface variant	37	IVs-6 (17)	53	F	6	----------	--	38
Sp	Suisun peaty muck	38	VIw-1 (16)	55	J	9	----------	--	27
Sr	Sycamore silty clay loam	39	IIw-2 (17)	49	E	1	----------	--	68
Ss	Sycamore silty clay loam, drained	40	I-1 (17)	47	A	1	----------	--	85
St	Sycamore silty clay loam, saline	40	IIIw-6 (17)	52	F	6	----------	--	45
Su	Sycamore complex, occasionally flooded	40	IVw-3 (17)	54	E	5	----------	--	39
Ta	Tamba mucky clay	41	VIw-1 (16)	55	J	9	----------	--	30
Td	Tidal marsh	41	VIIIw-1 (16)	55	J	9	----------	--	5
ToG2	Toomes stony loam, 30 to 75 percent slopes, eroded	41	VIIIs-1 (15)	55	J	7	----------	--	6
TrE	Trimmer loam, 9 to 30 percent slopes	42	IVe-1 (15)	52	G	8	Fine Loamy	64	48
TsF2	Trimmer cobbly clay loam, shallow variant, 15 to 50 percent slopes, eroded	42	VIIe-1 (15)	55	J	7	Shallow Loamy	66	12
Tu	Tujunga fine sand	42	IIIs-4 (17)	51	B	2	----------	--	41
Va	Valdez silt loam, drained	43	IIw-2 (17)	49	E	1	----------	--	77
Vc	Valdez silty clay loam	43	IIIw-6 (16)	52	F	6	----------	--	62
Vd	Valdez silty clay loam, wet	43	VIw-1 (16)	55	F	6	----------	--	34
Ve	Valdez silty clay loam, clay substratum	44	IVw-6 (16)	54	F	6	----------	--	39
Wc	Willows clay	44	IVw-6 (17)	54	F	6	----------	--	39
Yo	Yolo loam	45	I-1 (17)	47	A	1	----------	--	100
Yr	Yolo loam, clay substratum	45	IIs-3 (17)	48	A	1	----------	--	85
Ys	Yolo silty clay loam	45	I-1 (17)	47	A	1	----------	--	90

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