

SOIL SURVEY

San Diego Area, California

This is a scanned version of the text of the original soil survey report. The original maps are not included in this document. Although the original tables are included in this document, it is recommended that tables and maps be generated using SSURGO data from the Web Soil Survey or the Soil Data Mart, which contain the official data and information for the Field Office Technical Guide.

For additional information, please contact the California State Soil Scientist at (530) 792-5640.



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service and Forest Service
in cooperation with
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION
UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Indian Affairs
DEPARTMENT OF THE NAVY
United States Marine Corps

Issued December 1973

Major fieldwork for this survey was completed in the period 1960-67. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the San Diego Area in 1969. This survey was made cooperatively by the Soil Conservation Service and Forest Service; the University of California Agricultural Experiment Station; the Bureau of Indian Affairs; the United States Marine Corps; the Department of Housing and Urban Development; the County of San Diego Planning Department; and the Comprehensive Planning Organization. It was partly financed by the County of San Diego and the Department of Housing and Urban Development, under the provisions of Section 701 of the Housing Act of 1954, amended. It is part of the technical assistance furnished to the Soil Conservation Districts of San Diego County.

HOW TO USE THIS SOIL SURVEY

This soil survey for the San Diego Area consists of two parts and a separate map packet. Part I contains a detailed description of each soil in the Area and shows how the soils are classified according to the system currently used by the United States Department of Agriculture. Part II contains interpretations for selected urban, engineering, and agricultural uses of the soils. The map packet contains the general soil map for the Area, larger scale maps on an aerial base, and an Index to Map Sheets.

Locating Soils

All the soils of the San Diego Area are shown on the detailed map. This map consists of 76 sheets, each of which 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 survey area in alphabetic order by map symbol, shows the page where each soil is described, and gives the capability classification, the Storie index rating, and the range designation of each.

Much of the information in Part II is in tables that rate the soils for various urban and agricultural uses. The ratings are based on soil criteria

that are explained. A rating of slight means that soil properties are generally favorable for the rated use, or limitations are minor and easily overcome. Moderate means that some soil properties are unfavorable but can be overcome or modified by special planning and design. Severe indicates soil properties so unfavorable and so difficult to correct or overcome that major soil reclamation, special designs, or intensive maintenance is required.

In applying these ratings it is necessary to remember that they--

- Do not eliminate the need for detailed onsite investigation of the soil and site before designing, grading, or construction.
- Cover dominant slope of the mapping unit and therefore do not take into consideration the difference in suitability that can result if the slope in a given area is outside the dominant slope range of the mapping unit.
- Apply to soil in the undisturbed state, not soil altered through grading, compaction, or other manipulation.
- Take into account limitations of the soil, which is one of several factors to be considered in determining land use.

A major purpose of this survey is to serve as one of the essential guides in land-use planning. Such planning is more easily implemented through the use of colored interpretative maps. Colored map sheets showing suitability of the soils for most of the purposes considered in this survey are available in the offices of the Comprehensive Planning Organization. Individuals or planning organizations can make similar interpretative maps by using the detailed soil map in this survey and the information in the text for parts I and II.

Cover picture: Contour orange grove on Fallbrook rocky sandy loam, 9 to 30 percent slopes. Strips are planted with ryegrass.

CONTENTS

	<u>Page</u>
INTERPRETATIONS FOR URBAN USES-----	1
Shrink-Swell Behavior-----	1
Sewage Effluent Disposal-----	10
Homesites-----	12
SOURCES OF CONSTRUCTION MATERIAL-----	13
INTERPRETATIONS FOR RECREATIONAL USES-----	19
INTERPRETATIONS FOR LAND MANAGEMENT-----	31
Hydrologic Soil Groups-----	31
Soil Erodibility by Water-----	31
Conversion from Brush to Grass-----	39
USE OF THE SOILS IN ENGINEERING-----	40
Engineering Classification-----	40
Engineering Test Data-----	41
Estimates of Soil Properties Significant in Engineering-----	62
Engineering Interpretations-----	62
INTERPRETATIONS FOR FARMING AND RANCHING-----	79
Land Resource Areas-----	79
Crop Suitability-----	89
Storie Index-----	92
Capability Grouping-----	92
Management by Capability Units-----	93
Crop Management and Yields-----	106
Range-----	109
Range Sites-----	109
LITERATURE CITED-----	116
GLOSSARY-----	116
GUIDE TO MAPPING UNITS-----	Following 118

SOIL SURVEY OF THE SAN DIEGO AREA, CALIFORNIA, PART II
(San Diego County excluding the Anza-Borrego and Cuyamaca State Parks)

BY ROY H. BOWMAN, RALPH E. BISHOP, SOIL CONSERVATION SERVICE; AND ROY W. GRIFFIN,
MARVIN L. JONES, THE COUNTY OF SAN DIEGO PLANNING DEPARTMENT AND
THE COMPREHENSIVE PLANNING ORGANIZATION

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE,
IN COOPERATION WITH THE UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION, THE
UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS, THE DEPARTMENT OF
THE NAVY, UNITED STATES MARINE CORPS, THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT,
AND THE COUNTY OF SAN DIEGO PLANNING DEPARTMENT

SAN DIEGO COUNTY is in an area where land resources are limited, but where the population is increasing and the economy is expanding. Knowledge of the suitability or the limitations of the soils for selected uses can help in conserving these limited resources. It can also help in avoiding the economic losses, social costs, and severe individual hardships that result from structural damage to homes and failure of private sewage disposal systems caused by soil or geologic hazards; from preemption of prime agricultural land and lack of suitable sources of construction material near urban areas;

and from brush fires, soil erosion, and sedimentation.

In this part of the survey are interpretations that can aid in planning housing developments and recreational facilities; in locating sources of construction material in quantities available for extraction; in predicting potential runoff; in managing brushland and converting it to grass; in designing dams, reservoirs, highways, buildings, and other structures; and in managing the soils of the survey area as cropland and range.

INTERPRETATIONS FOR URBAN USES

Rapid urbanization of the San Diego Area has brought into sharp focus the need for efficient use of land resources. Information about the soils is essential in planning urban development. Particularly important are soil features that affect the stability of buildings and roads.

On the pages that follow and in table 1 are facts and ratings relating to the shrink-swell behavior of the soils in the Area, the soil properties that affect the efficiency of a septic tank disposal system, and the limitations of soils to be considered in selecting homesites.

The ratings of limitation shown in table 1 are based on a combination of criteria, the most limiting of which are indicated if the rating is moderate or severe.

Shrink-Swell Behavior

Shrink-swell is the change in volume that occurs in a soil with a change in moisture content. The volume change is determined mainly by the amount and kind of clay. In general, soil that has the highest content of expansive clay shrinks and swells the most with changes in moisture content.

The identification of soils that have a high shrink-swell potential is important in planning land

use and determining appropriate construction practices before development. Expansive soils, such as Diablo clay, present major problems in planning and constructing roads, homes, and many other types of structures (pl. I, top). Structures built on expansive soils without compensating for this condition have cracked or otherwise been damaged (pl. I, bottom). For this reason, the State Subdivision Map Act was amended to require that the presence of expansive soils be noted on the final subdivision map.

Soils having a high shrink-swell potential occur predominantly on the Coastal Plains, an area of dissected marine terraces and uplands. The soils along the major alluvial plains and along a narrow central coastal belt have a moderate or low potential.

In the Foothills, most of the soils have a moderate potential. Soils having a low potential occur on the major alluvial plains, in a large area south of Jamul, and in scattered, smaller areas. Soils having a high potential occur near Ramona, Escondido, and Rainbow, and northeast of Vista.

In the Mountain zone are extensive areas of soils having a low or moderate potential. Relatively small areas of soils having a high potential occur near Guatay and Pine Valley.

TABLE 1.--LIMITATIONS FOR HOMESITES

[Numerals indicate soil properties or qualities that adversely affect suitability for disposal of sewage effluent. Numeral 1 refers to slope; 4 to flooding, ponding, or overflow; 5 to natural drainage; 7 to permeability rate; and 9 to depth to hard rock, or a hardpan, or any layer that restricts permeability]

Map symbol	Soil name	Shrink-swell behavior	Degree and kind of limitation for homesites with-- 1/	
			Septic tank effluent disposal	Public sewerage system 2/
AcG	Acid igneous rock land-----	Low-----	Severe 9-----	Severe: runoff, slope.
AtC	Altamont clay, 5 to 9 percent slopes----	High-----	Severe 1-----	Severe: shrink swell.
AtD	Altamont clay, 9 to 15 percent slopes----	High-----	Severe 1-----	Severe: shrink swell.
AtD2	Altamont clay, 9 to 15 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell.
AtE	Altamont clay, 15 to 30 percent slopes--	High-----	Severe 1-----	Severe: shrink swell.
AtE2	Altamont clay, 15 to 30 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell.
AtF	Altamont clay, 30 to 50 percent slopes--	High-----	Severe 1-----	Severe: shrink swell, slope.
AuC	Anderson very gravelly sandy loam, 5 to 9 percent slopes.	Low-----	Moderate 1-----	Slight.
AuF	Anderson very gravelly sandy loam, 9 to 45 percent slopes.	Low-----	Severe 1-----	Severe: erosion, slope.
AvC	Arlington coarse sandy loam, 2 to 9 percent slopes.	Low-----	Severe 7-----	Slight.
AwC	Auld clay, 5 to 9 percent slopes-----	High-----	Severe 7-----	Severe: shrink swell.
AwD	Auld clay, 9 to 15 percent slopes-----	High-----	Severe 1-----	Severe: shrink swell.
AyE	Auld stony clay, 9 to 30 percent slopes--	High-----	Severe 1-----	Severe: shrink swell.
BaG	Badland-----	Low-----	Severe 1-----	Severe: runoff, slope.
BbE	Bancas stony loam, 5 to 30 percent slopes.	Moderate----	Severe 1-----	Moderate: erosion.
BbE2	Bancas stony loam, 5 to 30 percent slopes, eroded.	Moderate----	Severe 1-----	Moderate: erosion.
BbG	Bancas stony loam, 30 to 65 percent slopes.	Moderate----	Severe 1-----	Severe: slope, erosion.
BbG2	Bancas stony loam, 30 to 65 percent slopes, eroded.	Moderate----	Severe 1-----	Severe: slope, erosion.
BeE	Blasingame loam, 9 to 30 percent slopes--	Moderate----	Severe 1-----	Moderate: runoff.
BgE	Blasingame stony loam, 9 to 30 percent slopes.	Moderate----	Severe 1-----	Moderate: runoff.
BgF	Blasingame stony loam, 30 to 50 percent slopes.	Moderate----	Severe 1-----	Severe: slope, runoff.
B1C	Bonsall sandy loam, 2 to 9 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
B1C2	Bonsall sandy loam, 2 to 9 percent slopes, eroded.	High-----	Severe 7-----	Moderate: shrink swell.
B1D2	Bonsall sandy loam, 9 to 15 percent slopes, eroded.	High-----	Severe 7-----	Severe: shrink swell.
BmC	Bonsall sandy loam, thick surface, 2 to 9 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
BnB	Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
BoC	Boomer loam, 2 to 9 percent slopes-----	Moderate----	Severe 7-----	Moderate: shrink swell.
BoE	Boomer loam, 9 to 30 percent slopes-----	Moderate----	Severe 1-----	Moderate: shrink swell.
BrE	Boomer stony loam, 9 to 30 percent slopes.	Moderate----	Severe 1-----	Moderate: shrink swell.
BrG	Boomer stony loam, 30 to 65 percent slopes.	Moderate----	Severe 1-----	Severe: shrink swell, slope.
BsC	Bosanko clay, 2 to 9 percent slopes-----	High-----	Severe 7-----	Severe: shrink swell, runoff.
BsD	Bosanko clay, 9 to 15 percent slopes----	High-----	Severe 1-----	Severe: shrink swell, runoff.

TABLE 1.--LIMITATIONS FOR HOMESITES--Continued

Map symbol	Soil name	Shrink-swell behavior	Degree and kind of limitation for homesites with-- <u>1/</u>	
			Septic tank effluent disposal	Public sewerage system <u>2/</u>
BsE	Bosanko clay, 15 to 30 percent slopes---	High-----	Severe 1-----	Severe: shrink swell, runoff.
BtC	Bosanko stony clay, 5 to 9 percent slopes.	High-----	Severe 7-----	Severe: shrink swell, runoff.
BuB	Bull Trail sandy loam, 2 to 5 percent slopes.	Moderate-----	Slight-----	Slight.
BuC	Bull Trail sandy loam, 5 to 9 percent slopes.	Moderate-----	Moderate 1-----	Slight.
BuD2	Bull Trail sandy loam, 9 to 15 percent slopes, eroded.	Moderate-----	Severe 1-----	Moderate: erosion.
BuE2	Bull Trail sandy loam, 15 to 30 percent slopes, eroded.	Moderate-----	Severe 1-----	Moderate: erosion.
CaB	Calpine coarse sandy loam, 2 to 5 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
CaC	Calpine coarse sandy loam, 5 to 9 percent slopes.	Low-----	Moderate 1-----	Moderate: recent alluvium.
CaC2	Calpine coarse sandy loam, 5 to 9 percent slopes, eroded.	Low-----	Moderate 1-----	Moderate: recent alluvium.
CaD2	Calpine coarse sandy loam, 9 to 15 percent slopes, eroded.	Low-----	Severe 1-----	Moderate: recent alluvium.
CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes.	Low-----	Severe 9-----	Slight.
CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes.	Low-----	Severe 9-----	Slight.
CbD	Carlsbad gravelly loamy sand, 9 to 15 percent slopes.	Low-----	Severe 1-----	Moderate: erosion.
CbE	Carlsbad gravelly loamy sand, 15 to 30 percent slopes.	Low-----	Severe 1-----	Moderate: erosion.
CcC	Carlsbad-Urban land complex, 2 to 9 percent slopes.	Low-----	Severe 7-----	Slight.
CcE	Carlsbad-Urban land complex, 9 to 30 percent slopes.	Low-----	Severe 1-----	Moderate: erosion.
CeC	Carrizo very gravelly sand, 0 to 9 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
CfB	Chesterton fine sandy loam, 2 to 5 percent slopes.	Moderate-----	Severe 9-----	Moderate: runoff.
CfC	Chesterton fine sandy loam, 5 to 9 percent slopes.	Moderate-----	Severe 9-----	Moderate: runoff.
CfD2	Chesterton fine sandy loam, 9 to 15 percent slopes, eroded.	Moderate-----	Severe 1-----	Severe: runoff, erosion.
CgC	Chesterton-Urban land complex, 2 to 9 percent slopes.	Moderate-----	Severe 9-----	Moderate: runoff.
ChA	Chino fine sandy loam, 0 to 2 percent slopes.	Moderate-----	Moderate 5-----	Moderate: shrink swell.
ChB	Chino fine sandy loam, 2 to 5 percent slopes.	Moderate-----	Moderate 5-----	Moderate: shrink swell.
CkA	Chino silt loam, saline, 0 to 2 percent slopes.	Moderate-----	Moderate 5-----	Severe: shrink swell, overflow.
ClD2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded.	Low-----	Severe 1-----	Moderate: erosion.
ClE2	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Moderate: erosion.
ClG2	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded.	Low-----	Severe 1-----	Severe: slope, erosion.
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Moderate: erosion.
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes.	Low-----	Severe 1-----	Severe: slope, rockiness.

TABLE 1.--LIMITATIONS FOR HOMESITES--Continued

Map symbol	Soil name	Shrink-swell behavior	Degree and kind of limitation for homesites with-- <u>1/</u>	
			Septic tank effluent disposal	Public sewerage system <u>2/</u>
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Severe: erosion, shrink swell.
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded.	Low-----	Severe 1-----	Severe: erosion, slopes.
Co	Clayey alluvial land-----	High-----	Severe 7-----	Severe: shrink swell, runoff.
Cr	Coastal beaches-----	Low-----	Severe 4-----	Severe: recent alluvium, runoff.
CsB	Corralitos loamy sand, 0 to 5 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
CsC	Corralitos loamy sand, 5 to 9 percent slopes.	Low-----	Moderate 1-----	Moderate: recent alluvium.
CsD	Corralitos loamy sand, 9 to 15 percent slopes.	Low-----	Severe 1-----	Moderate: recent alluvium.
CtE	Crouch coarse sandy loam, 5 to 30 percent slopes.	Low-----	Severe-----	Slight.
CtF	Crouch coarse sandy loam, 30 to 50 percent slopes.	Low-----	Severe 1-----	Severe: erosion, slope.
CuE	Crouch rocky coarse sandy loam, 5 to 30 percent slopes.	Low-----	Severe 1-----	Slight.
CuG	Crouch rocky coarse sandy loam, 30 to 70 percent slopes.	Low-----	Severe 1-----	Severe: slope, erosion.
CvG	Crouch stony fine sandy loam, 30 to 75 percent slopes.	Low-----	Severe 1-----	Severe: slope, erosion.
DaC	Diablo clay, 2 to 9 percent slopes-----	High-----	Severe 7-----	Severe: shrink swell, runoff.
DaD	Diablo clay, 9 to 15 percent slopes-----	High-----	Severe 7-----	Severe: shrink swell, runoff.
DaE	Diablo clay, 15 to 30 percent slopes-----	High-----	Severe 1-----	Severe: shrink swell, runoff.
DaE2	Diablo clay, 15 to 30 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell, runoff.
DaF	Diablo clay, 30 to 50 percent slopes-----	High-----	Severe 1-----	Severe: shrink swell, slope.
DcD	Diablo-Urban land complex, 5 to 15 percent slopes.	High-----	Severe 1-----	Severe: shrink swell, runoff.
DcF	Diablo-Urban land complex, 15 to 50 percent slopes.	High-----	Severe 1-----	Severe: slope, runoff, shrink swell.
DoE	Diablo-Olivenhain complex, 9 to 30 percent slopes.	High-----	Severe 1-----	Severe: slope, runoff, shrink swell.
EdC	Elder shaly fine sandy loam, 2 to 9 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes.	Low-----	Moderate 9-----	Slight.
EsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.	Low-----	Severe 1-----	Moderate: rockiness.
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Moderate: rockiness.
EvC	Escondido very fine sandy loam, deep, 5 to 9 percent slopes.	Low-----	Moderate 9-----	Slight.
ExE	Exchequer rocky silt loam, 9 to 30 percent slopes.	Low-----	Severe 1-----	Moderate: rockiness.
ExG	Exchequer rocky silt loam, 30 to 70 percent slopes.	Low-----	Severe 1-----	Severe: rockiness, slope.
FaB	Fallbrook sandy loam, 2 to 5 percent slopes.	Moderate-----	Moderate 7-----	Slight.
FaC	Fallbrook sandy loam, 5 to 9 percent slopes.	Moderate-----	Moderate 7-----	Slight.

TABLE 1.--LIMITATIONS FOR HOMESITES--Continued

Map symbol	Soil name	Shrink-swell behavior	Degree and kind of limitation for homesites with-- <u>1/</u>	
			Septic tank effluent disposal	Public sewerage system <u>2/</u>
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded.	Moderate-----	Moderate 7-----	Slight.
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded.	Moderate-----	Severe 1-----	Moderate: erosion.
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded.	Moderate-----	Severe 1-----	Moderate: erosion.
FaE3	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded.	Moderate-----	Severe 1-----	Moderate: erosion.
FeC	Fallbrook rocky sandy loam, 5 to 9 percent slopes.	Moderate-----	Moderate 7-----	Slight.
FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes.	Moderate-----	Severe 1-----	Moderate: erosion.
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded.	Moderate-----	Severe 1-----	Moderate: erosion.
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes.	Moderate-----	Severe 1-----	Moderate: erosion.
FvE	Fallbrook-Vista sandy loams, 15 to 30 percent slopes.	Moderate-----	Severe 1-----	Moderate: erosion.
FwF	Friant fine sandy loam, 30 to 50 percent slopes.	Low-----	Severe 1-----	Severe: rockiness, slope.
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes.	Low-----	Severe 1-----	Moderate: rockiness.
FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes.	Low-----	Severe 1-----	Severe: rockiness, slope.
GaE	Gaviota fine sandy loam, 9 to 30 percent slopes.	Low-----	Severe 1-----	Moderate: erosion.
GaF	Gaviota fine sandy loam, 30 to 50 percent slopes.	Low-----	Severe 1-----	Severe: slope, erosion.
GoA	Grangeville fine sandy loam, 0 to 2 percent slopes.	Low-----	Moderate 5-----	Moderate: recent alluvium.
GrA	Greenfield sandy loam, 0 to 2 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
GrB	Greenfield sandy loam, 2 to 5 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
GrC	Greenfield sandy loam, 5 to 9 percent slopes.	Low-----	Moderate 1-----	Moderate: recent alluvium.
GrD	Greenfield sandy loam, 9 to 15 percent slopes.	Low-----	Severe 1-----	Moderate: recent alluvium.
HaG	Hambright gravelly clay loam, 30 to 75 percent slopes.	Moderate-----	Severe 1-----	Severe: slope, erosion.
HmD	Holland fine sandy loam, 5 to 15 percent slopes.	Moderate-----	Severe 1-----	Moderate: erosion.
HmE	Holland fine sandy loam, 15 to 30 percent slopes.	Moderate-----	Severe 1-----	Moderate: erosion.
HnE	Holland stony fine sandy loam, 5 to 30 percent slopes.	Moderate-----	Severe 1-----	Moderate: erosion.
HnG	Holland stony fine sandy loam, 30 to 60 percent slopes.	Moderate-----	Severe 1-----	Severe: slope, erosion.
HoC	Holland fine sandy loam, deep, 2 to 9 percent slopes.	Moderate-----	Severe 7-----	Moderate: shrink swell.
HrC	Huerhuero loam, 2 to 9 percent slopes-----	High-----	Severe 7-----	Moderate: shrink swell.
HrC2	Huerhuero loam, 5 to 9 percent slopes, eroded.	High-----	Severe 7-----	Moderate: shrink swell.
HrD	Huerhuero loam, 9 to 15 percent slopes-----	High-----	Severe 1-----	Severe: shrink swell, runoff.
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell, runoff.
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell, runoff.

TABLE 1.--LIMITATIONS FOR HOMESITES--Continued

Map symbol	Soil name	Shrink-swell behavior	Degree and kind of limitation for homesites with-- <u>1/</u>	
			Septic tank effluent disposal	Public sewerage system <u>2/</u>
HuC	Huerhuero-Urban land complex, 2 to 9 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
HuE	Huerhuero-Urban land complex, 9 to 30 percent slopes.	High-----	Severe 1-----	Severe: shrink swell, runoff.
InA	Indio silt loam, 0 to 2 percent slopes-----	Low-----	Slight-----	Slight.
InB	Indio silt loam, 2 to 5 percent slopes-----	Low-----	Slight-----	Slight.
IoA	Indio silt loam, saline, 0 to 2 percent slopes.	Low-----	Moderate 5-----	Slight.
IsA	Indio silt loam, dark variant-----	Low-----	Slight-----	Slight.
KcC	Kitchen Creek loamy coarse sand, 5 to 9 percent slopes.	Low-----	Moderate 1-----	Slight.
KcD2	Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded.	Low-----	Severe 1-----	Slight.
LaE2	La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Slight.
LaE3	La Posta loamy coarse sand, 5 to 30 percent slopes, severely eroded.	Low-----	Severe 1-----	Slight.
LcE	La Posta rocky loamy coarse sand, 5 to 30 percent slopes.	Low-----	Severe 1-----	Slight.
LcE2	La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Slight.
LcF2	La Posta rocky loamy coarse sand, 30 to 50 percent slopes, eroded.	Low-----	Severe 1-----	Severe: slope, erosion.
LdE	La Posta-Sheephead complex, 9 to 30 percent slopes.	Low-----	Severe 1-----	Slight.
LdG	La Posta-Sheephead complex, 30 to 65 percent slopes.	Low-----	Severe 1-----	Severe: slope, erosion.
LeC	Las Flores loamy fine sand, 2 to 9 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded.	High-----	Severe 7-----	Moderate: shrink swell.
LeD	Las Flores loamy fine sand, 9 to 15 percent slopes.	High-----	Severe 1-----	Severe: shrink swell, runoff.
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell, runoff.
LeE	Las Flores loamy fine sand, 15 to 30 percent slopes.	High-----	Severe 1-----	Severe: shrink swell, runoff.
LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell, runoff.
LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded.	High-----	Severe 1-----	Severe: shrink swell, runoff.
LfC	Las Flores-Urban land complex, 2 to 9 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
LfE	Las Flores-Urban land complex, 9 to 30 percent slopes.	High-----	Severe 1-----	Severe: shrink swell, runoff.
LpB	Las Posas fine sandy loam, 2 to 5 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
LpC	Las Posas fine sandy loam, 5 to 9 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, eroded.	High-----	Severe 7-----	Moderate: shrink swell.
LpD2	Las Posas fine sandy loam, 9 to 15 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell.
LpE2	Las Posas fine sandy loam, 15 to 30 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell.
LrE	Las Posas stony fine sandy loam, 9 to 30 percent slopes.	High-----	Severe 1-----	Severe: shrink swell.
LrE2	Las Posas stony fine sandy loam, 9 to 30 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell.

TABLE 1.--LIMITATIONS FOR HOMESITES--Continued

Map symbol	Soil name	Shrink-swell behavior	Degree and kind of limitation for homesites with-- <u>1/</u>	
			Septic tank effluent disposal	Public sewerage system <u>2/</u>
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slopes.	High-----	Severe 1-----	Severe: slope, shrink swell.
LsE	Linne clay loam, 9 to 30 percent slopes----	Moderate-----	Severe 1-----	Moderate: shrink swell.
LsF	Linne clay loam, 30 to 50 percent slopes----	Moderate-----	Severe 1-----	Severe: slope, erosion.
Lu	Loamy alluvial land-----	Low-----	Severe 5-----	Moderate: recent alluvium.
LvF3	Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded.	Low, high----	Severe 1-----	Severe: slope, runoff.
Md	Made land-----	Variable-----	Severe, variable.	Variable.
MlC	Marina loamy coarse sand, 2 to 9 percent slopes.	Low-----	Moderate 1-----	Slight.
MlE	Marina loamy coarse sand, 9 to 30 percent slopes.	Low-----	Severe 1-----	Slight.
MnA	Mecca coarse sandy loam, 0 to 2 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
MnB	Mecca coarse sandy loam, 2 to 5 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
MoA	Mecca sandy loam, saline, 0 to 2 percent slopes.	Low-----	Moderate 5-----	Moderate: recent alluvium.
MpA2	Mecca fine sandy loam, 0 to 2 percent slopes, eroded.	Low-----	Slight-----	Moderate: recent alluvium.
MrG	Metamorphic rock land-----	Low-----	Severe 9-----	Severe: rockiness, slope.
MvA	Mottsville loamy coarse sand, 0 to 2 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
MvC	Mottsville loamy coarse sand, 2 to 9 percent slopes.	Low-----	Moderate 1-----	Moderate: recent alluvium.
MvD	Mottsville loamy coarse sand, 9 to 15 percent slopes.	Low-----	Severe 1-----	Moderate: recent alluvium.
MxA	Mottsville loamy coarse sand, wet, 0 to 2 percent slopes.	Low-----	Severe 4-----	Moderate: recent alluvium, runoff.
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes.	Moderate-----	Severe 7-----	Moderate: shrink swell.
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes.	Moderate-----	Severe 1-----	Severe: shrink swell, runoff.
OhF	Olivenhain cobbly loam, 30 to 50 percent slopes.	Moderate-----	Severe 1-----	Severe: slope, shrink swell.
OkC	Olivenhain-Urban land complex, 2 to 9 percent slopes.	Moderate-----	Severe 7-----	Moderate: shrink swell.
OkE	Olivenhain-Urban land complex, 9 to 30 percent slopes.	Moderate-----	Severe 1-----	Severe: shrink swell, runoff.
PeA	Placentia sandy loam, 0 to 2 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
PeC	Placentia sandy loam, 2 to 9 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
PeC2	Placentia sandy loam, 5 to 9 percent slopes, eroded.	High-----	Severe 7-----	Moderate: shrink swell.
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded.	High-----	Severe 1-----	Severe: shrink swell, erosion.
PfA	Placentia sandy loam, thick surface, 0 to 2 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
Py	Playas-----	High-----	Severe 4-----	Severe: flooding.
RaA	Ramona sandy loam, 0 to 2 percent slopes----	Moderate-----	Severe 7-----	Slight.
RaB	Ramona sandy loam, 2 to 5 percent slopes----	Moderate-----	Severe 7-----	Slight.

TABLE 1.--LIMITATIONS FOR HOMESITES--Continued

Map symbol	Soil name	Shrink-swell behavior	Degree and kind of limitation for homesites with-- <u>1/</u>	
			Septic tank effluent disposal	Public sewerage system <u>2/</u>
RaC	Ramona sandy loam, 5 to 9 percent slopes----	Moderate-----	Severe 7-----	Slight.
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded.	Moderate-----	Severe 7-----	Slight.
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded.	Moderate-----	Severe 1-----	Moderate: erosion.
RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes.	Moderate-----	Severe 1-----	Moderate: erosion.
RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes.	Moderate-----	Severe 1-----	Moderate: erosion.
RdC	Redding gravelly loam, 2 to 9 percent slopes.	High-----	Severe 9-----	Moderate: runoff.
ReE	Redding cobbly loam, 9 to 30 percent slopes.	High-----	Severe 1-----	Severe: runoff, shrink swell.
RfF	Redding cobbly loam, dissected, 15 to 50 percent slopes.	High-----	Severe 1-----	Severe: slope, shrink swell.
RhC	Redding-Urban land complex, 2 to 9 percent slopes.	High-----	Severe 9-----	Moderate: shrink swell.
RhE	Redding-Urban land complex, 9 to 30 percent slopes.	High-----	Severe 1-----	Severe: runoff, shrink swell.
RkA	Reiff fine sandy loam, 0 to 2 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
RkB	Reiff fine sandy loam, 2 to 5 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
RkC	Reiff fine sandy loam, 5 to 9 percent slopes.	Low-----	Moderate 1-----	Moderate: recent alluvium.
Rm	Riverwash-----	Low-----	Severe 4-----	Severe: flooding.
RoA	Rositas fine sand, 0 to 2 percent slopes----	Low-----	Slight-----	Moderate: recent alluvium.
RrC	Rositas fine sand, hummocky, 5 to 9 percent slopes.	Low-----	Moderate 4-----	Moderate: recent alluvium.
RsA	Rositas loamy coarse sand, 0 to 2 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
RsC	Rositas loamy coarse sand, 2 to 9 percent slopes.	Low-----	Moderate 1-----	Moderate: recent alluvium.
RsD	Rositas loamy coarse sand, 9 to 15 percent slopes.	Low-----	Severe 1-----	Severe: recent alluvium, erosion.
RuG	Rough broken land-----	Variable-----	Severe 1-----	Severe: slope, erosion.
SbA	Salinas clay loam, 0 to 2 percent slopes----	Moderate-----	Severe 7-----	Slight.
SbC	Salinas clay loam, 2 to 9 percent slopes----	Moderate-----	Severe 7-----	Slight.
ScA	Salinas clay, 0 to 2 percent slopes-----	High-----	Severe 7-----	Moderate: shrink swell.
ScB	Salinas clay, 2 to 5 percent slopes-----	High-----	Severe 7-----	Moderate: shrink swell.
SmE	San Miguel rocky silt loam, 9 to 30 percent slopes.	High-----	Severe 1-----	Severe: rockiness, shrink swell.
SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes.	High, low---	Severe 1-----	Severe: rockiness, slope.
SpE2	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Moderate: erosion.
SpG2	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded.	Low-----	Severe 1-----	Severe: slope, erosion.
SrD	Sloping gullied land-----	High-----	Severe 1-----	Severe: recent alluvium, erosion.
SsE	Soboba stony loamy sand, 9 to 30 percent slopes.	Low-----	Severe 1-----	Moderate: recent alluvium.
StG	Steep gullied land-----	Variable-----	Severe 1-----	Severe: slope, erosion.

TABLE 1.--LIMITATIONS FOR HOMESITES--Continued

Map symbol	Soil name	Shrink-swell behavior	Degree and kind of limitation for homesites with-- 1/	
			Septic tank effluent disposal	Public sewerage system 2/
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes.	High-----	Severe 7-----	Moderate: shrink swell.
SvE	Stony land-----	Low-----	Severe 1-----	Moderate: recent alluvium.
TeF	Terrace escarpments-----	Variable----	Severe 1-----	Severe: slope, erosion.
Tf	Tidal flats-----	High-----	Severe 4-----	Severe: recent alluvium, erosion.
ToE2	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Slight.
ToG	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes.	Low-----	Severe 1-----	Severe: slope, erosion.
TuB	Tujung sand, 0 to 5 percent slopes-----	Low-----	Slight-----	Moderate: recent alluvium.
Ur	Urban land-----	Variable----	Variable-----	Variable.
VaA	Visalia sandy loam, 0 to 2 percent slopes---	Low-----	Slight-----	Moderate: recent alluvium.
VaB	Visalia sandy loam, 2 to 5 percent slopes---	Low-----	Slight-----	Moderate: recent alluvium.
VaC	Visalia sandy loam, 5 to 9 percent slopes---	Low-----	Moderate 1-----	Moderate: recent alluvium.
VaD	Visalia sandy loam, 9 to 15 percent slopes--	Low-----	Severe 1-----	Moderate: recent alluvium.
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes.	Low-----	Slight-----	Moderate: recent alluvium.
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes.	Low-----	Moderate 1-----	Slight.
VsC	Vista coarse sandy loam, 5 to 9 percent slopes.	Low-----	Moderate 1-----	Slight.
VsD	Vista coarse sandy loam, 9 to 15 percent slopes.	Low-----	Severe 1-----	Slight.
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded.	Low-----	Severe 1-----	Slight.
VsE	Vista coarse sandy loam, 15 to 30 percent slopes.	Low-----	Severe 1-----	Slight.
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded.	Low-----	Severe 1-----	Slight.
VsG	Vista coarse sandy loam, 30 to 65 percent slopes.	Low-----	Severe 1-----	Severe: slope, erosion.
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes.	Low-----	Severe 1-----	Slight.
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes.	Low-----	Severe 1-----	Slight.
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes.	Low-----	Severe 1-----	Severe: slope, erosion.
WmB	Wyman loam, 2 to 5 percent slopes-----	Moderate----	Severe 7-----	Slight.
WmC	Wyman loam, 5 to 9 percent slopes-----	Moderate----	Severe 7-----	Slight.
WmD	Wyman loam, 9 to 15 percent slopes-----	Moderate----	Severe 1-----	Moderate: shrink swell.

1/ If public sewerage is not available, consider entries in both the "Septic tank effluent disposal" and the "Public sewerage system" columns as data on which to base interpretations.

2/ Only the most limiting factors are noted.

Soils in the Desert have a low shrink-swell potential.

Soils having a high shrink-swell potential generally are most widespread in areas where urbanization is greatest and is likely to increase. This does not necessarily mean that such growth should cease, but rather that greater attention should be paid to soil conditions so that appropriate compensating design measures can be incorporated during construction.

The shrink-swell potential of each soil in the survey area is rated low, moderate, or high in table 1. Low potential means that shrinking and swelling is not a significant problem and the soil is suitable

for building sites if other factors are favorable. Moderate and high ratings indicate progressively greater limitations for building foundations, roads, or other structures and the need for compensating design measures.

Only the soil material between depths of 10 and 40 inches is considered in the ratings. The interpretations apply only to lightweight structures or single buildings of three stories or less. Limitations of soils for extensive residential use are described under the heading "Homesites." The ratings given in table 1 can be used in planning onsite soil tests and investigations. Criteria used for rating the shrink-swell potential of soils are given in table 2.

TABLE 2.-- CRITERIA FOR RATING SHRINK-SWELL POTENTIAL OF SOILS

Factors affecting shrink-swell potential	Shrink-swell potential		
	Low	Moderate	High
Amount of clay and predominant clay mineral.	0 to 18 percent clay and any clay mineral or 0 to 35 percent kaolinitic clay.	18 to 35 percent mixed or montmorillonitic clays or more than 35 percent kaolinitic clay.	More than 35 percent mixed or montmorillonitic clays.
Coefficient of linear extensibility (COLE) (in./in.).	Less than 0.03--	0.03 to 0.06-----	More than 0.06.

Sewage Effluent Disposal

Disposal of sewage in areas that are not served by a public sewage system depends on the ability of the soil to absorb effluent on a sustained basis. Knowledge of soil limitations for sewage effluent disposal has a variety of uses. To a potential home buyer, it is an indication of expected efficiency of a septic tank disposal system. To a subdivider, developer, or builder, it is one of the several important factors to be considered in determining the feasibility of residential construction in a particular area.

In the San Diego Area, the typical onsite system consists of a septic tank and filter field. The septic tank receives sewage directly from the household plumbing. Bacteria in the tank reduce the sewage and partly decompose it. Liquid effluent then flows from the tank into the filter field where it is distributed uniformly into the soil. Soil bacteria act on the effluent to further purify and oxidize it. Such a disposal system installed in suitable soils should function efficiently for several years.

Private disposal systems, when malfunctioning, can pollute the soil and the ground water. Where

many homes having individual disposal systems are constructed, there is a potential health hazard. For this reason, extreme care should be used in selecting the site for an individual subsurface sewage disposal system. Some moderately rapidly permeable soils, such as Reiff or Visalia soils, have few if any properties that limit their use for filter fields. Very slowly permeable soils, such as Huerhuero or Olivenhain soils, have severe limitations for this use. In very rapidly permeable soils, such as Soboba or Tujunga soils, effluent may penetrate to the ground water and contaminate a large area. Soils that are on 9 to 30 percent slopes and have bedrock or impervious layers at a depth of 3 to 20 inches, such as Friant or Gaviota soils, often emit effluent seepage downslope where it causes offensive odors and is a health hazard.

In general, the entire Area has severe limitations for sewage effluent disposal. There are, however, some exceptions worth mentioning. Along the major streams of the Coastal Plains and the Foothills are soils that have slight limitations. The Lake Henshaw drainage and the tributary drainage basin to the east comprise a large area where limitations are moderate. This area extends northwest and east along valleys floors. In the valleys of

the southern part of the Mountain zone are scattered areas of soils that have slight limitations. In the Desert zone are extensive areas of soils that formed in alluvium and have slight limitations.

Widespread severe limitations indicate the need for caution in locating and constructing sewage disposal systems. Nevertheless, some areas where limitations are severe have been developed for homesites served by individual systems. In these areas, other factors may have outweighed the soil limitations, the limitations may not have been considered when selecting the sites, or the limitations were compensated for through the use of larger filter fields or other design features.

The limitations of each soil for sewage effluent disposal are rated slight, moderate, or severe in table 1. Slight means that soil properties are generally favorable, or in other words, limitations are minor and easily overcome and the soil can support a

filter field of appropriate size that is properly installed and maintained. Moderate and severe indicate progressively greater limitations and the need for compensating measures. In some areas, enlargement of the filter field suffices, but in others, limitations may be severe enough to preclude the use of a standard septic tank-filter field disposal system.

The ratings apply to undisturbed soils. The most limiting horizon in the soil profile is the one rated. Considered in the ratings are such factors as seasonal water tables, the presence of impervious layers, and permeability. The ratings can supplement percolation tests now required by county ordinances and help in planning onsite investigations. The limitations of the soils for extensive residential use are rated under the heading "Homesites." Criteria used in rating the soils for sewage disposal are given in table 3.

TABLE 3.--CRITERIA FOR RATING SOILS FOR SEWAGE DISPOSAL

Factors affecting limitation	Limitation		
	Slight	Moderate	Severe
Permeability (in./hr.)--	More than 1 inch-----	1 to 0.63 inch-----	Less than 0.63 inch.
Depth to seasonal water table.	More than 6 feet-----	6 to 4 feet-----	Less than 4 feet.
Drainage class-----	Excessive, somewhat excessive, or good. <u>1/</u>	Moderately good or somewhat poor.	Poor or very poor.
Depth to impervious bedrock or hardpan or permanent water table.	More than 6 feet-----	6 to 4 feet-----	Less than 4 feet.
Slope-----	Less than 5 percent---	5 to 9 percent-----	More than 9 percent.
Overflow hazard-----	None-----	Less than once in 10 years.	Once or more in 10 years.
Overflow duration-----	None-----	48 hours or less-----	More than 48 hours.

1/ Contamination of the water supply is a hazard in coarse-textured soils.

Homesites^{1/}

The impact of urban expansion upon the environment, mainly a result of earth-moving operations, affects the drainage pattern, the terrain, and the plant cover. The potential environmental impact is already apparent in the San Diego Area, in the increasing erosion hazard and changes in depth to rock and slope of the soils.

The shrink-swell behavior of the soil, the potential runoff, and the tendency of certain alluvial soils to settle are all factors to be considered in urban planning. Repairing a foundation that has cracked because a soil, such as Diablo clay, shrinks and swells is costly.

In the paragraphs that follow are interpretations that express the relative limitation of the soils for single-family homes and other buildings that have similar structural requirements. These interpretations can serve as a guide in evaluating the potential environmental impact of residential development on the watershed and in encouraging residential development in those areas and at those densities for which the soils are best suited. The interpretations are based on a system whereby the degree of soil limitation for construction is determined according to criteria that can be applied to each soil in the Area.

Ratings in table 1 show the degree of limitation of the soils for homesites. A rating of slight indicates no limitation or only minor limitations that are easily overcome. A rating of moderate indicates limitations that can be overcome through use of appropriate design and construction. A rating of severe indicates limitations severe enough to require very close study. Limiting features are noted in table 1 for all moderate and severe ratings.

In applying the ratings shown in table 1, the user should be aware that--

Sewage effluent disposal, accessibility, availability of domestic water supply, value of view sites, suitability for landscaping, flood hazard, and geologic hazards, such as faults, earthquakes, unstable slopes, and subsidence, were not considered.

Favorable ratings in no way guarantee that local building inspectors can issue building permits.

Factors considered in determining the ratings were potential runoff, slope, shrink-swell behavior, and other special properties. All are explained in the following paragraphs.

Hydrologic Soil Groups--Hydrologic groupings are based on soil properties that affect runoff. Through such groupings it is possible to estimate the runoff potential of soils.

Soils in hydrologic groups A and B have a moderate to high infiltration rate when thoroughly wetted and have low to medium runoff potential. They have only a slight limitation for homesites. Soils in hydrologic group C have a slow infiltration rate and high runoff potential. They have moderate limitations for homesites. Soils in hydrologic group D are frequently waterlogged and produce the largest amount of runoff (pl. II, top). They are likely to remain wet for long periods. They have a very slow intake rate when thoroughly wetted. They either have very high runoff potential or are ponded.

Erosion Hazard--The hazard of erosion by water is based on soil properties, for example, slope, texture, and structure, that determine the potential rate at which the surface soil is removed when the soil is bare. Severe erosion problems can result in the wearing away of soil, landscaping, and foundations, as well as in extensive clogging of drains. The erosion hazard is only slight in clay soils that have strong structure and slopes of no more than 9 percent. It is severe in loamy sands or sands that have weak structure, are structureless, or have slopes of more than 30 percent.

Depth to Rock--Excavation costs increase in areas where soils are shallow over hard rock. Lawns, shrubs, and trees are difficult to establish and maintain on rocky sites, and topsoil has to be hauled in to support vegetation.

The degree of limitation for homesites in such areas is based on the hardness of the rock or on the presence of restrictive soil layers. The limitation is only slight in soils that formed in alluvium or in decomposed granite. It is moderate in soils over soft sandstone or weathered gabbro or a hardpan, and severe in soils over hard rock.

It is assumed that excavation work will be done by heavy earth-moving equipment and not by blasting.

Slope--Steep slopes increase the cost of home construction. Special problems arise in landscaping, in locating and constructing access roads, and in grading and excavating. Slopes of more than 9 percent create moderate problems. Slopes of more than 30 percent create severe problems (pl. II, bottom).

Only the dominant slopes within each mapping unit are considered in these interpretations, even though considerable variation within the unit is likely to occur. The length and shape of slopes and geologic factors, such as slump and downhill creep, are not considered.

Shrink-Swell Behavior--Shrink-swell behavior, the quality of the soil that determines its volume change with change in moisture content, is influenced by the amount of moisture change and the amount and kind of clay in the soil.

Special Properties--Soils that formed in recent alluvium tend to settle, which can cause considerable damage to homes. Settling is likely in Calpine, Carrizo, Corralitos, Elder, Grangeville, Greenfield, Indio, Indio variant, Mecca, Mottsville, Reiff, Rositas, Soboba, Tujunga, and Visalia soils. These soils are loose sands, sands and gravels, or sandy loams. All are low in clay.

^{1/} Prototype system for rating limitations of soils for homesites by San Diego County Planning Department. Ratings are for use in San Diego County only.

In areas that have been irrigated over a period of years, the soils generally have already settled. In nonirrigated areas, onsite investigation is needed before construction begins.

Sewage Effluent Disposal.--Information on the limitations of the soils for disposal of sewage

effluent is not applicable in areas served by a public sewerage system. For areas where such systems have not been established, refer to the interpretations under the heading "Sewage Effluent Disposal" on the preceding pages.

SOURCES OF CONSTRUCTION MATERIAL ^{2/}

The demand for construction materials is especially great in areas of urban growth. Large amounts of sand and gravel are required in making concrete for the construction of roads, bridges, flood-control structures, and building foundations. Decomposed granite is required for road base and road fill and for surfacing light-duty roads and driveways.

Construction materials are relatively abundant in the San Diego Area, but problems associated with their extraction are becoming more complex as urbanization spreads. Conflicts between extractive operations and urban residents occur more frequently (pl. III, top); potential deposits became inaccessible where built over or surrounded by urbanization; and construction materials become more costly as the distance between deposits and construction sites increases. Urban growth has forced many mining operations to relocate.

Knowledge of the location of potential sources of sand, gravel, and decomposed granite can help in establishing standards for the regulation of extractive operations; providing for the orderly utilization and conservation of these vital resources; planning investigations to determine the extent of deposits; rehabilitating sites that have been abandoned; and establishing natural resource zones or modifying existing zoning regulations.

In table 5 each soil has been rated suitable or unsuitable as a source of sand, gravel, or decomposed granite. The main factors considered in the ratings are the thickness and texture of the source material, the amount of usable material in the profile, and the kind of parent material. The ratings do not eliminate the need for onsite investigation to determine the extent and quality of deposits. The accessibility of the source material, the overburden, and the depth to the water table are not considered in the ratings. Generally the depth of overburden is less than 5 feet. The quantity, gradation, and quality of the material were not considered. Gravel may require crushing. The criteria for rating the soils as a source of construction material are given in table 4.

^{2/}

Prepared by the San Diego County Planning Department.

TABLE 4.--CRITERIA FOR RATING SOILS AS SOURCE OF CONSTRUCTION MATERIAL

Construction material	Suitable	Unsuitable
Gravel:		
Content-----	More than 15 percent (25 percent weight) gravel, cobblestones, or stones.	Less than 15 percent (25 percent by weight) gravel, cobblestones, or stones.
Thickness of deposit---	More than 3 feet-----	Less than 3 feet.
Sand:		
USDA texture-----	Sands, loamy sands-----	All other textures.
Unified-----	SW, SP, GP, GW; SM or GM (less than 25 percent fines). ^{1/}	ML, CL, MH, CH, OL, OH, SC, GC; GM or SM (more than 25 percent fines). ^{1/}
Thickness of deposit---	More than 3 feet-----	Less than 3 feet.
Decomposed granite:	Substratum material of soils forming from decomposed granite.	Soils not forming from decomposed granite.

^{1/} Fines less than 0.074 millimeter (200 mesh sieve).

TABLE 5.--SUITABILITY OF THE SOILS AS A SOURCE OF GRAVEL, SAND, AND DECOMPOSED GRANITE

[The letter G refers to gravel, S to sand; letters DG refer to decomposed granite; UN means unsuitable; V refers to varying amounts of gravel and sand. References do not imply that the specified construction material is available in all areas of a given soil]

Map symbol	Soil name	Suitability as source of--	Map symbol	Soil name	Suitability as source of--
AcG	Acid igneous rock land-----	UN	BrG	Boomer stony loam, 30 to 65 percent slopes.	UN
AtC	Altamont clay, 5 to 9 percent slopes.	UN	BsC	Bosanko clay, 2 to 9 percent slopes.	DG
AtD	Altamont clay, 9 to 15 percent slopes.	UN	BsD	Bosanko clay, 9 to 15 percent slopes.	DG
AtD2	Altamont clay, 9 to 15 percent slopes, eroded.	UN	BsE	Bosanko clay, 15 to 30 percent slopes.	DG
AtE	Altamont clay, 15 to 30 percent slopes.	UN	BtC	Bosanko stony clay, 5 to 9 percent slopes.	DG
AtE2	Altamont clay, 15 to 30 percent slopes, eroded.	UN	BuB	Bull Trail sandy loam, 2 to 5 percent slopes.	DG
AtF	Altamont clay, 30 to 50 percent slopes.	UN	BuC	Bull Trail sandy loam, 5 to 9 percent slopes.	DG
AuC	Anderson very gravelly sandy loam, 5 to 9 percent slopes.	G	BuD2	Bull Trail sandy loam, 9 to 15 percent slopes, eroded.	DG
AuF	Anderson very gravelly sandy loam, 9 to 45 percent slopes.	G	BuE2	Bull Trail sandy loam, 15 to 30 percent slopes, eroded.	DG
AvC	Arlington coarse sandy loam, 2 to 9 percent slopes.	UN	CaB	Calpine coarse sandy loam, 2 to 5 percent slopes.	UN
AwC	Auld clay, 5 to 9 percent slopes-	UN	CaC	Calpine coarse sandy loam, 5 to 9 percent slopes.	UN
AWD	Auld clay, 9 to 15 percent slopes.	UN	CaC2	Calpine coarse sandy loam, 5 to 9 percent slopes, eroded.	UN
AyE	Auld stony clay, 9 to 30 percent slopes.	UN	CaD2	Calpine coarse sandy loam, 9 to 15 percent slopes, eroded.	UN
BaG	Badland-----	UN	CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes.	S
BbE	Bancas stony loam, 5 to 30 percent slopes.	DG	CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes.	S
BbE2	Bancas stony loam, 5 to 30 percent slopes, eroded.	DG	CbD	Carlsbad gravelly loamy sand, 9 to 15 percent slopes.	S
BbG	Bancas stony loam, 30 to 65 percent slopes.	DG	CbE	Carlsbad gravelly loamy sand, 15 to 30 percent slopes.	S
BbG2	Bancas stony loam, 30 to 65 percent slopes, eroded.	DG	CcC	Carlsbad-Urban land complex, 2 to 9 percent slopes.	UN
BeE	Blasingame loam, 9 to 30 percent slopes.	UN	CcE	Carlsbad-Urban land complex, 9 to 30 percent slopes.	UN
BgE	Blasingame stony loam, 9 to 30 percent slopes.	UN	CeC	Carrizo very gravelly sand, 0 to 9 percent slopes.	G
BgF	Blasingame stony loam, 30 to 50 percent slopes.	UN	CfB	Chesterton fine sandy loam, 2 to 5 percent slopes.	UN
B1C	Bonsall sandy loam, 2 to 9 percent slopes.	DG	CfC	Chesterton fine sandy loam, 5 to 9 percent slopes.	UN
B1C2	Bonsall sandy loam, 2 to 9 percent slopes, eroded.	DG	CfD2	Chesterton fine sandy loam, 9 to 15 percent slopes, eroded.	UN
B1D2	Bonsall sandy loam, 9 to 15 percent slopes, eroded.	DG	CgC	Chesterton-Urban land complex, 2 to 9 percent slopes.	UN
BmC	Bonsall sandy loam, thick surface, 2 to 9 percent slopes.	DG	ChA	Chino fine sandy loam, 0 to 2 percent slopes.	UN
BnB	Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes.	DG	ChB	Chino fine sandy loam, 2 to 5 percent slopes.	UN
BoC	Boomer loam, 2 to 9 percent slopes.	UN			
BoE	Boomer loam, 9 to 30 percent slopes.	UN			
BrE	Boomer stony loam, 9 to 30 percent slopes.	UN			

TABLE 5.--SUITABILITY OF THE SOILS AS A SOURCE OF GRAVEL, SAND, AND DECOMPOSED GRANITE--Continued

Map symbol	Soil name	Suitability as source of--	Map symbol	Soil name	Suitability as source of--
CkA	Chino silt loam, saline, 0 to 2 percent slopes.	UN	EsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.	UN
C1D2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded.	DG	EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes, eroded.	UN
C1E2	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.	DG	EvC	Escondido very fine sandy loam, deep, 5 to 9 percent slopes.	UN
C1G2	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded.	DG	ExE	Exchequer rocky silt loam, 9 to 30 percent slopes.	UN
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded.	DG	ExG	Exchequer rocky silt loam, 30 to 70 percent slopes.	UN
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes.	UN	FaB	Fallbrook sandy loam, 2 to 5 percent slopes.	DG
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded.	DG	FaC	Fallbrook sandy loam, 5 to 9 percent slopes.	DG
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded.	DG	FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded.	DG
Co	Clayey alluvial land-----	UN	FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded.	DG
Cr	Coastal beaches-----	V	FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded.	DG
CsB	Corralitos loamy sand, 0 to 5 percent slopes.	S	FaE3	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded.	DG
CsC	Corralitos loamy sand, 5 to 9 percent slopes.	S	FeC	Fallbrook rocky sandy loam, 5 to 9 percent slopes.	DG
CsD	Corralitos loamy sand, 9 to 15 percent slopes.	S	FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes.	DG
CtE	Crouch coarse sandy loam, 5 to 30 percent slopes.	DG	FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded.	DG
CtF	Crouch coarse sandy loam, 30 to 50 percent slopes.	DG	FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes.	DG
CuE	Crouch rocky coarse sandy loam, 5 to 30 percent slopes.	DG	FvE	Fallbrook-Vista sandy loams, 15 to 30 percent slopes.	DG
CuG	Crouch rocky coarse sandy loam, 30 to 70 percent slopes.	DG	FwF	Friant fine sandy loam, 30 to 50 percent slopes.	UN
CvG	Crouch stony fine sandy loam, 30 to 75 percent slopes.	DG	FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes.	UN
DaC	Diablo clay, 2 to 9 percent slopes.	UN	FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes.	UN
DaD	Diablo clay, 9 to 15 percent slopes.	UN	GaE	Gaviota fine sandy loam, 9 to 30 percent slopes.	UN
DaE	Diablo clay, 15 to 30 percent slopes.	UN	GaF	Gaviota fine sandy loam, 30 to 50 percent slopes.	UN
DaE2	Diablo clay, 15 to 30 percent slopes, eroded.	UN	GoA	Grangeville fine sandy loam, 0 to 2 percent slopes.	UN
DaF	Diablo clay, 30 to 50 percent slopes.	UN	GrA	Greenfield sandy loam, 0 to 2 percent slopes.	UN
DcD	Diablo-Urban land complex, 5 to 15 percent slopes.	UN	GrB	Greenfield sandy loam, 2 to 5 percent slopes.	UN
DcF	Diablo-Urban land complex, 15 to 50 percent slopes.	UN			
DoE	Diablo-Olivenhain complex, 9 to 30 percent slopes.	UN			
EdC	Elder shaly fine sandy loam, 2 to 9 percent slopes.	UN			
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes.	UN			

TABLE 5.--SUITABILITY OF THE SOILS AS A SOURCE OF GRAVEL, SAND, AND DECOMPOSED GRANITE--Continued

Map symbol	Soil name	Suitability as source of--	Map symbol	Soil name	Suitability as source of--
GrC	Greenfield sandy loam, 5 to 9 percent slopes.	UN	LcF2	La Posta rocky loamy coarse sand, 30 to 50 percent slopes, eroded.	DG
GrD	Greenfield sandy loam, 9 to 15 percent slopes.	UN	LdE	La Posta-Sheephead complex, 9 to 30 percent slopes.	UN
HaG	Hambright gravelly clay loam, 30 to 75 percent slopes.	UN	LdG	La Posta-Sheephead complex, 30 to 65 percent slopes.	UN
HmD	Holland fine sandy loam, 5 to 15 percent slopes.	UN	LeC	Las Flores loamy fine sand, 2 to 9 percent slopes.	UN
HmE	Holland fine sandy loam, 15 to 30 percent slopes.	UN	LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded.	UN
HnE	Holland stony fine sandy loam, 5 to 30 percent slopes.	UN	LeD	Las Flores loamy fine sand, 9 to 15 percent slopes.	UN
HnG	Holland stony fine sandy loam, 30 to 60 percent slopes.	UN	LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.	UN
HoC	Holland fine sandy loam, deep, 2 to 9 percent slopes.	UN	LeE	Las Flores loamy fine sand, 15 to 30 percent slopes.	UN
HrC	Huerhuero loam, 2 to 9 percent slopes.	UN	LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, eroded.	UN
HrC2	Huerhuero loam, 5 to 9 percent slopes, eroded.	UN	LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded.	UN
HrD	Huerhuero loam, 9 to 15 percent slopes.	UN	LfC	Las Flores-Urban land complex, 2 to 9 percent slopes.	UN
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded.	UN	LfE	Las Flores-Urban land complex, 9 to 30 percent slopes.	UN
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded.	UN	LpB	Las Posas fine sandy loam, 2 to 5 percent slopes.	DG
HuC	Huerhuero-Urban land complex, 2 to 9 percent slopes.	UN	LpC	Las Posas fine sandy loam, 5 to 9 percent slopes.	DG
HuE	Huerhuero-Urban land complex, 9 to 30 percent slopes.	UN	LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, eroded.	DG
InA	Indio silt loam, 0 to 2 percent slopes.	UN	LpD2	Las Posas fine sandy loam, 9 to 15 percent slopes, eroded.	DG
InB	Indio silt loam, 2 to 5 percent slopes.	UN	LpE2	Las Posas fine sandy loam, 15 to 30 percent slopes, eroded.	DG
IoA	Indio silt loam, saline, 0 to 2 percent slopes.	UN	LrE	Las Posas stony fine sandy loam, 9 to 30 percent slopes.	DG
IsA	Indio silt loam, dark variant.	UN	LrE2	Las Posas stony fine sandy loam, 9 to 30 percent slopes, eroded.	DG
KcC	Kitchen Creek loamy coarse sand, 5 to 9 percent slopes.	DG	LrG	Las Posas stony fine sandy loam, 30 to 65 percent slopes.	DG
KcD2	Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded.	DG	LsE	Linne clay loam, 9 to 30 percent slopes.	UN
LaE2	La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.	DG	LsF	Linne clay loam, 30 to 50 percent slopes.	UN
LaE3	La Posta loamy coarse sand, 5 to 30 percent slopes, severely eroded.	DG			
LcE	La Posta rocky loamy coarse sand, 5 to 30 percent slopes.	DG			
LcE2	La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded.	DG			

TABLE 5.--SUITABILITY OF THE SOILS AS A SOURCE OF GRAVEL, SAND, AND DECOMPOSED GRANITE--Continued

Map symbol	Soil name	Suitability as source of--	Map symbol	Soil name	Suitability as source of--
Lu	Loamy alluvial land-----	UN	RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded.	UN
LvF3	Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded.	UN	RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes.	UN
Md	Made land-----	UN	RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes.	UN
M1C	Marina loamy coarse sand, 2 to 9 percent slopes.	S	RdC	Redding gravelly loam, 2 to 9 percent slopes.	G
M1E	Marina loamy coarse sand, 9 to 30 percent slopes.	S	ReE	Redding cobbly loam, 9 to 30 percent slopes.	G
MnA	Mecca coarse sandy loam, 0 to 2 percent slopes.	UN	RfF	Redding cobbly loam, dissected, 15 to 50 percent slopes.	G
MnB	Mecca coarse sandy loam, 2 to 5 percent slopes.	UN	RhC	Redding-Urban land complex, 2 to 9 percent slopes.	G
MoA	Mecca sandy loam, saline, 0 to 2 percent slopes.	UN	RhE	Redding-Urban land complex, 9 to 30 percent slopes.	G
MpA2	Mecca fine sandy loam, 0 to 2 percent slopes, eroded.	UN	RkA	Reiff fine sandy loam, 0 to 2 percent slopes.	UN
MrG	Metamorphic rock land-----	UN	RkB	Reiff fine sandy loam, 2 to 5 percent slopes.	UN
MvA	Mottsville loamy coarse sand, 0 to 2 percent slopes.	S	RkC	Reiff fine sandy loam, 5 to 9 percent slopes.	UN
MvC	Mottsville loamy coarse sand, 2 to 9 percent slopes.	S	Rm	Riverwash-----	V
MvD	Mottsville loamy coarse sand, 9 to 15 percent slopes.	S	RoA	Rositas fine sand, 0 to 2 percent slopes.	S
MxA	Mottsville loamy coarse sand, wet, 0 to 2 percent slopes.	S	RrC	Rositas fine sand, hummocky, 5 to 9 percent slopes.	S
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes.	G	RsA	Rositas loamy coarse sand, 0 to 2 percent slopes.	S
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes.	G	RsC	Rositas loamy coarse sand, 2 to 9 percent slopes.	S
OhF	Olivenhain cobbly loam, 30 to 50 percent slopes.	G	RsD	Rositas loamy coarse sand, 9 to 15 percent slopes.	S
OkC	Olivenhain-Urban land complex, 2 to 9 percent slopes.	G	RuG	Rough broken land-----	UN
OkE	Olivenhain-Urban land complex, 9 to 30 percent slopes.	G	SbA	Salinas clay loam, 0 to 2 percent slopes.	UN
PeA	Placentia sandy loam, 0 to 2 percent slopes.	UN	SbC	Salinas clay loam, 2 to 9 percent slopes.	UN
PeC	Placentia sandy loam, 2 to 9 percent slopes.	UN	ScA	Salinas clay, 0 to 2 percent slopes.	UN
PeC2	Placentia sandy loam, 5 to 9 percent slopes, eroded.	UN	ScB	Salinas clay, 2 to 5 percent slopes.	UN
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded.	UN	SmE	San Miguel rocky silt loam, 9 to 30 percent slopes.	UN
PfA	Placentia sandy loam, thick surface, 0 to 2 percent slopes.	UN	SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes.	UN
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes.	UN	SpE2	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded.	UN
Py	Playas-----	UN	SpG2	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded.	UN
RaA	Ramona sandy loam, 0 to 2 percent slopes.	UN	SrD	Sloping gullied land-----	UN
RaB	Ramona sandy loam, 2 to 5 percent slopes.	UN	SsE	Soboba stony loamy sand, 9 to 30 percent slopes.	G
RaC	Ramona sandy loam, 5 to 9 percent slopes.	UN	StG	Steep gullied land-----	UN
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded.	UN			

TABLE 5.--SUITABILITY OF THE SOILS AS A SOURCE OF GRAVEL, SAND, AND DECOMPOSED GRANITE--Continued

Map symbol	Soil name	Suitability as source of--	Map symbol	Soil name	Suitability as source of--
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes.	UN	VsC	Vista coarse sandy loam, 5 to 9 percent slopes.	DG
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes.	UN	VsD	Vista coarse sandy loam, 9 to 15 percent slopes.	DG
SvE	Stony land-----	G	VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded.	DG
TeF	Terrace escarpments-----	UN	VsE	Vista coarse sandy loam, 15 to 30 percent slopes.	DG
Tf	Tidal flats-----	UN	VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded.	DG
ToE2	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded.	UN	VsG	Vista coarse sandy loam, 30 to 65 percent slopes.	DG
ToG	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes.	UN	VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes.	DG
TuB	Tujunga sand, 0 to 5 percent slopes.	S	VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes.	DG
Ur	Urban land-----	UN	VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes.	DG
VaA	Visalia sandy loam, 0 to 2 percent slopes.	UN	WmB	Wyman loam, 2 to 5 percent slopes.	UN
VaB	Visalia sandy loam, 2 to 5 percent slopes.	UN	WmC	Wyman loam, 5 to 9 percent slopes.	UN
VaC	Visalia sandy loam, 5 to 9 percent slopes.	UN	WmD	Wyman loam, 9 to 15 percent slopes.	UN
VaD	Visalia sandy loam, 9 to 15 percent slopes.	UN			
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes.	UN			
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes.	UN			

INTERPRETATIONS FOR RECREATIONAL USES

The demand for outdoor recreational facilities in the San Diego Area is increasing rapidly. Because recreational facilities require a large investment of capital and land, knowledge about soil limitations for recreational uses is indispensable in selecting and planning the development of suitable sites. For low cost development of large areas, level soils relatively free of rock outcrops or stones are required. Rocky and strongly sloping soils have severe limitations for play areas. Silt loams, such as those of the Chino series, are dusty in summer, a condition that limits their suitability for campsites or picnic areas.

The limitations of each soil for intensive play areas, picnic areas, campsites, and hiking trails and bridle paths are rated in table 7. The ratings are slight, moderate, and severe. Slight means that only normal site inspection and precautions during planning and construction are required. Development costs should be somewhat less than average. Moderate means that careful site inspection, more than normal

precautions, and above average expenditures are required to overcome the limitations. Severe means that development costs are high and another site may be more suitable. In some instances, the esthetic value or location of a site will justify the expenditures required to overcome moderate or severe limitations.

The rating of limitation shown in table 7 is based on a combination of criteria, the most limiting of which is indicated if the rating is moderate or severe.

Intensive Play Areas--These are playgrounds planned for organized games, such as baseball, football, badminton, and volleyball. The soils must support intensive foot traffic. A nearly level firm surface and good drainage generally are required. Rock outcrops and coarse fragments are not desirable. It is assumed that good vegetative cover can be established and maintained. Criteria for rating soils for use as play areas are shown in table 6.

TABLE 6.--CRITERIA FOR RATING SOILS FOR USE AS PLAY AREAS

Factors affecting limitation	Limitation		
	None to slight	Moderate	Severe
Drainage-----	Excessive, somewhat excessive, good, or moderately good.	Moderately good or somewhat poor.	Somewhat poor, poor, or very poor.
Water table during season of use.	30 inches or below----	20 inches or below----	Above 20 inches.
Flooding during season of use.	None-----	Once in 2 years-----	More than once in 2 years.
Permeability (in./hr.)-	More than 20.0 inches to 0.63 inch.	0.63 to 0.06 inch----	Less than 0.06 inch.
Slope-----	Less than 2 percent----	2 to 5 percent-----	More than 5 percent.
Surface layer texture--	Sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam.	Clay loam, sandy clay loam, silty clay loam, or loamy sands.	Sandy clay, silty clay, clay, organic material, sands, or loamy sands subject to blowing.
Depth to bedrock-----	More than 40 inches----	40 to 20 inches-----	Less than 20 inches.
Gravel and cobblestones on surface.	Relatively free-----	20 percent or less----	More than 20 percent.
Stones on surface-----	Less than .01 percent--	.01 to 3 percent-----	More than 3 percent.
Rocks on surface-----	Less than 2 percent----	2 to 10 percent-----	More than 10 percent.

TABLE 7.--DEGREE AND KIND OF LIMITATION FOR RECREATION

[Numerals indicate soil properties or qualities that limit the listed recreational uses. Numeral 1 refers to slope; 2 to texture of surface layer; 3 to stones, cobblestones, and rocks on the surface; 4 to flooding, ponding, or overflow; 5 to natural drainage; 7 to permeability rate; 8 to percent of organic matter; and 9 to depth to hard rock, or a hardpan, or any layer that restricts permeability. Urban land, Made land, and Urban land complexes are not evaluated]

Map symbol	Soil	Interpretation			
		Play areas	Campsites	Picnic areas	Paths and trails
AcG	Acid igneous rock land-----	Severe 3----	Severe 3----	Severe 3-----	Severe 3.
AtC	Altamont clay, 5 to 9 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
AtD	Altamont clay, 9 to 15 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
AtD2	Altamont clay, 9 to 15 percent slopes, eroded.	Severe 2----	Severe 2----	Severe 2-----	Slight.
AtE	Altamont clay, 15 to 30 percent slopes-----	Severe 1----	Severe 2----	Severe 2-----	Moderate 1.
AtE2	Altamont clay, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 2----	Severe 2-----	Moderate 1.
AtF	Altamont clay, 30 to 50 percent slopes-----	Severe 1----	Severe 1----	Severe 2-----	Severe 1.
AuC	Anderson very gravelly sandy loam, 5 to 9 percent slopes.	Severe 1----	Severe 2----	Severe 3-----	Severe 2.
AuF	Anderson very gravelly sandy loam, 9 to 45 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 2.
AvC	Arlington coarse sandy loam, 2 to 9 per- cent slopes.	Severe 1----	Severe 7----	Moderate 1---	Slight.
AwC	Auld clay, 5 to 9 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
AwD	Auld clay, 9 to 15 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
AyE	Auld stony clay, 9 to 30 percent slopes---	Severe 1----	Severe 1----	Severe 2-----	Moderate 1.
BaG	Badland-----	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
BbE	Bancas stony loam, 5 to 30 percent slopes-	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
BbE2	Bancas stony loam, 5 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
BbG	Bancas stony loam, 30 to 65 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
BbG2	Bancas stony loam, 30 to 65 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
BeE	Blasingame loam, 9 to 30 percent slopes---	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
BgE	Blasingame stony loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
BgF	Blasingame stony loam, 30 to 50 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
B1C	Bonsall sandy loam, 2 to 9 percent slopes.	Severe 1----	Severe 7----	Moderate 1---	Slight.
B1C2	Bonsall sandy loam, 2 to 9 percent slopes, eroded.	Severe 1----	Severe 7----	Moderate 1---	Slight.
B1D2	Bonsall sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Severe 7----	Moderate 1---	Slight.
BmC	Bonsall sandy loam, thick surface, 2 to 9 percent slopes.	Severe 1----	Severe 7----	Moderate 1---	Slight.
BnB	Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes: Bonsall----- Fallbrook-----	Severe 7---- Moderate 7--	Severe 7---- Moderate 7--	Moderate 1--- Slight-----	Slight. Slight.
BoC	Boomer loam, 2 to 9 percent slopes-----	Severe 1----	Moderate 7--	Moderate 1---	Slight.
BoE	Boomer loam, 9 to 30 percent slopes-----	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
BrE	Boomer stony loam, 9 to 30 percent slopes-	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
BrG	Boomer stony loam, 30 to 65 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
BsC	Bosanko clay, 2 to 9 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
BsD	Bosanko clay, 9 to 15 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.

TABLE 7.--DEGREE AND KIND OF LIMITATION FOR RECREATION--Continued

Map symbol	Soil	Interpretation			
		Play areas	Campsites	Picnic areas	Paths and trails
BsE	Bosanko clay, 15 to 30 percent slopes-----	Severe 1----	Severe 1----	Severe 2-----	Moderate 1.
BtC	Bosanko stony clay, 5 to 9 percent slopes.	Severe 1----	Severe 2-----	Severe 2-----	Severe 3.
BuB	Bull Trail sandy loam, 2 to 5 percent slopes.	Moderate 1--	Slight-----	Slight-----	Slight.
BuC	Bull Trail sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
BuD2	Bull Trail sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
BuE2	Bull Trail sandy loam, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
CaB	Calpine coarse sandy loam, 2 to 5 percent slopes.	Moderate 1--	Slight-----	Slight-----	Slight.
CaC	Calpine coarse sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
CaC2	Calpine coarse sandy loam, 5 to 9 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
CaD2	Calpine coarse sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes.	Moderate 8--	Moderate 2--	Moderate 2---	Slight.
CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 2---	Slight.
CbD	Carlsbad gravelly loamy sand, 9 to 15 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
CbE	Carlsbad gravelly loamy sand, 15 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
CeC	Carrizo very gravelly sand, 0 to 9 percent slopes.	Severe 1----	Severe 2-----	Severe 2-----	Severe 2.
CfB	Chesteron fine sandy loam, 2 to 5 percent slopes.	Moderate 9--	Moderate 2--	Moderate 2---	Moderate 5.
CfC	Chesteron fine sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 2---	Moderate 5.
CfD2	Chesteron fine sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Moderate 5.
ChA	Chino fine sandy loam, 0 to 2 percent slopes.	Moderate 5--	Moderate 5--	Moderate 5---	Moderate 5.
ChB	Chino fine sandy loam, 2 to 5 percent slopes.	Moderate 5--	Moderate 5--	Moderate 5---	Moderate 5.
CkA	Chino silt loam, saline, 0 to 2 percent slopes.	Severe 2-----	Severe 2-----	Severe 2-----	Moderate 5.
ClD2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
ClE2	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
ClG2	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded: Cieneba----- Fallbrook-----	Severe 1----	Severe 1----	Severe 1-----	Severe 3. Severe 3.

TABLE 7.--DEGREE AND KIND OF LIMITATION FOR RECREATION--Continued

Map symbol	Soil	Interpretation			
		Play areas	Campsites	Picnic areas	Paths and trails
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded: Cieneba----- Fallbrook-----	Severe 1----	Severe 1----	Severe 1-----	Severe 1. Severe 1.
Co	Clayey alluvial land-----	Severe 2----	Severe 2----	Severe 2-----	Moderate 5.
Cr	Coastal beaches-----	Severe 2----	Severe 2----	Severe 2-----	Severe 2.
CsB	Corralitos loamy sand, 0 to 5 percent slopes.	Moderate 2--	Moderate 2--	Moderate 2---	Slight.
CsC	Corralitos loamy sand, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 2---	Slight.
CsD	Corralitos loamy sand, 9 to 15 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
CtE	Crouch coarse sandy loam, 5 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
CtF	Crouch coarse sandy loam, 30 to 50 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
CuE	Crouch rocky coarse sandy loam, 5 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
CuG	Crouch rocky coarse sandy loam, 30 to 70 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
CvG	Crouch stony fine sandy loam, 30 to 75 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
DaC	Diablo clay, 2 to 9 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
DaD	Diablo clay, 9 to 15 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
DaE	Diablo clay, 15 to 30 percent slopes-----	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
DaE2	Diablo clay, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
DaF	Diablo clay, 30 to 50 percent slopes-----	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
DoE	Diablo-Olivenhain complex, 9 to 30 percent slopes: Diablo----- Olivenhain-----	Severe 1----	Severe 1----	Severe 1-----	Severe 3. Moderate 3.
EdC	Elder shaly fine sandy loam, 2 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes.	Severe 1----	Severe 2----	Moderate 1---	Slight.
EsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Severe 2----	Moderate 1---	Slight.
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
EvC	Escondido very fine sandy loam, deep, 5 to 9 percent slopes.	Severe 1----	Severe 2----	Moderate 1---	Slight.
ExE	Exchequer rocky silt loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
ExG	Exchequer rocky silt loam, 30 to 70 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
FaB	Fallbrook sandy loam, 2 to 5 percent slopes.	Moderate 7--	Moderate 7--	Slight-----	Slight.
FaC	Fallbrook sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.

TABLE 7.--DEGREE AND KIND OF LIMITATION FOR RECREATION--Continued

Map symbol	Soil	Interpretation			
		Play areas	Campsites	Picnic areas	Paths and trails
FaE3	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
FeC	Fallbrook rocky sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 3--	Moderate 3---	Moderate 3.
FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Severe 3.
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes:				
	Fallbrook-----	Severe 1----	Moderate 1--	Moderate 1---	Slight.
	Vista-----	Severe 1----	Moderate 1--	Moderate 1---	Slight.
FvE	Fallbrook-Vista sandy loams, 15 to 30 percent slopes:				
	Fallbrook-----	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
	Vista-----	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
FwF	Friant fine sandy loam, 30 to 50 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
GaE	Gaviota fine sandy loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
GaF	Gaviota fine sandy loam, 30 to 50 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
GoA	Grangeville fine sandy loam, 0 to 2 percent slopes.	Moderate 5--	Moderate 5--	Moderate 5---	Moderate 5.
GrA	Greenfield sandy loam, 0 to 2 percent slopes.	Slight-----	Slight-----	Slight-----	Slight.
GrB	Greenfield sandy loam, 2 to 5 percent slopes.	Moderate 1--	Slight-----	Slight-----	Slight.
GrC	Greenfield sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
GrD	Greenfield sandy loam, 9 to 15 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
HaG	Hambright gravelly clay loam, 30 to 75 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
HmD	Holland fine sandy loam, 5 to 15 percent slopes.	Severe 1----	Moderate 2--	Moderate 1---	Slight.
HmE	Holland fine sandy loam, 15 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
HnE	Holland stony fine sandy loam, 5 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
HnG	Holland stony fine sandy loam, 30 to 60 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
HoC	Holland fine sandy loam, deep, 2 to 9 percent slopes.	Severe 1----	Moderate 2--	Moderate 1---	Slight.
HrC	Huerhuero loam, 2 to 9 percent slopes-----	Severe 1----	Severe 7----	Moderate 1---	Slight.
HrC2	Huerhuero loam, 5 to 9 percent slopes, eroded.	Severe 1----	Severe 7----	Moderate 1---	Slight.
HrD	Huerhuero loam, 9 to 15 percent slopes-----	Severe 1----	Severe 7----	Moderate 1---	Slight.
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded.	Severe 1----	Severe 7----	Moderate 1---	Slight.
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 7----	Severe 1-----	Moderate 1.
InA	Indio silt loam, 0 to 2 percent slopes----	Severe 2----	Severe 2----	Severe 2-----	Slight.
InB	Indio silt loam, 2 to 5 percent slopes----	Severe 2----	Severe 2----	Severe 2-----	Slight.

TABLE 7.--DEGREE AND KIND OF LIMITATION FOR RECREATION--Continued

Map symbol	Soil	Interpretation			
		Play areas	Campsites	Picnic areas	Paths and trails
IoA	Indio silt loam, saline, 0 to 2 percent slopes.	Severe 2----	Severe 2----	Severe 2----	Moderate 4.
IsA	Indio silt loam, dark variant-----	Severe 2----	Severe 2----	Severe 2----	Slight.
KcC	Kitchen Creek loamy coarse sand, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 2---	Slight.
KcD2	Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
LaE2	La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1----	Moderate 1.
LaE3	La Posta loamy coarse sand, 5 to 30 percent slopes, severely eroded.	Severe 1----	Severe 1----	Severe 1----	Moderate 1.
LcE	La Posta rocky loamy coarse sand, 5 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1----	Moderate 3.
LcE2	La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1----	Moderate 3.
LcF2	La Posta rocky loamy coarse sand, 30 to 50 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1----	Severe 1.
LdE	La Posta-Sheephead complex, 9 to 30 percent slopes:				
	La Posta-----	Severe 1----	Severe 1----	Severe 1----	Moderate 3.
	Sheephead-----	Severe 1----	Severe 1----	Severe 1----	Moderate 3.
LdG	La Posta-Sheephead complex, 30 to 65 percent slopes:				
	La Posta-----	Severe 1----	Severe 1----	Severe 1----	Severe 1.
	Sheephead-----	Severe 1----	Severe 1----	Severe 1----	Severe 1.
LeC	Las Flores loamy fine sand, 2 to 9 percent slopes.	Severe 1----	Severe 7----	Moderate 2---	Slight.
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded.	Severe 1----	Severe 7----	Moderate 2---	Slight.
LeD	Las Flores loamy fine sand, 9 to 15 percent slopes.	Severe 1----	Severe 7----	Moderate 1---	Slight.
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.	Severe 1----	Severe 7----	Moderate 1---	Slight.
LeE	Las Flores loamy fine sand, 15 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1----	Moderate 1.
LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1----	Moderate 1.
LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded.	Severe 1----	Severe 1----	Severe 1----	Moderate 1.
LpB	Las Posas fine sandy loam, 2 to 5 percent slopes.	Moderate 1--	Moderate 7--	Moderate 2---	Slight.
LpC	Las Posas fine sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 7--	Moderate 1---	Slight.
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, eroded.	Severe 1----	Moderate 7--	Moderate 1---	Slight.
LpD2	Las Posas fine sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Moderate 7--	Moderate 1---	Slight.
LpE2	Las Posas fine sandy loam, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1----	Moderate 1.
LrE	Las Posas stony fine sandy loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1----	Moderate 3.
LrE2	Las Posas stony fine sandy loam, 9 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1----	Moderate 3.
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slopes.	Severe 1----	Severe 1----	Severe 1----	Severe 1.
LsE	Linne clay loam, 9 to 30 percent slopes----	Severe 1----	Severe 1----	Severe 1----	Moderate 1.
LsF	Linne clay loam, 30 to 50 percent slopes---	Severe 1----	Severe 1----	Severe 1----	Severe 1.
Lu	Loamy alluvial land-----	Moderate 1--	Moderate 4--	Moderate 2---	Moderate 4.

TABLE 7.--DEGREE AND KIND OF LIMITATION FOR RECREATION--Continued

Map symbol	Soil	Interpretation			
		Play areas	Campsites	Picnic areas	Paths and trails
LvF3	Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded: Loamy alluvial land----- Huerhuero-----	Severe 1----	Severe 1----	Severe 1----- Severe 1-----	Severe 1. Severe 1. Slight.
MIC	Marina loamy coarse sand, 2 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 2---	Moderate 1.
MIE	Marina loamy coarse sand, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Slight.
MnA	Mecca coarse sandy loam, 0 to 2 percent slopes.	Slight-----	Slight-----	Slight-----	Slight.
MnB	Mecca coarse sandy loam, 2 to 5 percent slopes.	Moderate 1--	Slight-----	Slight-----	Slight.
MoA	Mecca sandy loam, saline, 0 to 2 percent slopes.	Moderate 4--	Severe 4----	Moderate 4---	Moderate 4.
MpA2	Mecca fine sandy loam, 0 to 2 percent slopes, eroded.	Moderate 2--	Moderate 2--	Moderate 2---	Slight.
MrG	Metamorphic rock land-----	Severe 3----	Severe 3----	Severe 3-----	Severe 3. Slight.
MvA	Mottsville loamy coarse sand, 0 to 2 percent slopes.	Moderate 2--	Moderate 2--	Moderate 2---	Slight.
MvC	Mottsville loamy coarse sand, 2 to 9 percent slopes.	Severe 1----	Moderate 2--	Moderate 2---	Slight.
MvD	Mottsville loamy coarse sand, 9 to 15 percent slopes.	Severe 1----	Moderate 2--	Moderate 1---	Slight.
MxA	Mottsville loamy coarse sand, wet, 0 to 2 percent slopes.	Severe 4----	Severe 4----	Severe 4-----	Severe 4.
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes.	Severe 3----	Severe 3----	Severe 3-----	Moderate 3.
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
OhF	Olivenhain cobbly loam, 30 to 50 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
PeA	Placentia sandy loam, 0 to 2 percent slopes.	Severe 7----	Severe 7----	Moderate 2---	Slight.
PeC	Placentia sandy loam, 2 to 9 percent slopes.	Severe 1----	Severe 7----	Moderate 2---	Slight.
PeC2	Placentia sandy loam, 5 to 9 percent slopes, eroded.	Severe 1----	Severe 7----	Moderate 1---	Slight.
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Severe 7----	Moderate 1---	Slight.
PfA	Placentia sandy loam, thick surface, 0 to 2 percent slopes.	Severe 7----	Severe 7----	Moderate 2---	Slight.
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes.	Severe 1----	Severe 7----	Moderate 2---	Slight.
Py	Playas-----	Severe 4----	Severe 4----	Severe 4-----	Severe 4. Slight.
RaA	Ramona sandy loam, 0 to 2 percent slopes--	Moderate 7--	Moderate 7--	Moderate 2---	Slight.
RaB	Ramona sandy loam, 2 to 5 percent slopes--	Moderate 7--	Moderate 7--	Moderate 2---	Slight.
RaC	Ramona sandy loam, 5 to 9 percent slopes--	Severe 1----	Moderate 1--	Moderate 1---	Slight.
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
RdC	Redding gravelly loam, 2 to 9 percent slopes.	Severe 7----	Severe 7----	Moderate 1---	Slight.

TABLE 7.--DEGREE AND KIND OF LIMITATION FOR RECREATION--Continued

Map symbol	Soil	Interpretation			
		Play areas	Campsites	Picnic areas	Paths and trails
ReE	Redding cobbly loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
RfF	Redding cobbly loam, dissected, 15 to 50 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
RkA	Reiff fine sandy loam, 0 to 2 percent slopes.	Moderate 2--	Moderate 2--	Moderate 2---	Slight.
RkB	Reiff fine sandy loam, 2 to 5 percent slopes.	Moderate 1--	Moderate 2--	Moderate 2---	Slight.
RkC	Reiff fine sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
Rm	Riverwash-----	Severe 2----	Severe 2----	Severe 2-----	Severe 2.
RoA	Rositas fine sand, 0 to 2 percent slopes--	Severe 2----	Severe 2----	Severe 2-----	Severe 2.
RrC	Rositas fine sand, hummocky, 5 to 9 percent slopes.	Severe 1----	Severe 2----	Severe 2-----	Severe 2.
RsA	Rositas loamy coarse sand, 0 to 2 percent slopes.	Moderate 2--	Moderate 2--	Moderate 2---	Slight.
RsC	Rositas loamy coarse sand, 2 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 2---	Slight.
RsD	Rositas loamy coarse sand, 9 to 15 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
RuG	Rough broken land-----	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
SbA	Salinas clay loam, 0 to 2 percent slopes--	Moderate 2--	Moderate 2--	Moderate 2---	Slight.
SbC	Salinas clay loam, 2 to 9 percent slopes--	Severe 1----	Moderate 2--	Moderate 2---	Slight.
ScA	Salinas clay, 0 to 2 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
ScB	Salinas clay, 2 to 5 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Slight.
SmE	San Miguel rocky silt loam, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes: San Miguel----- Exchequer-----	Severe 1----	Severe 1----	Severe 1-----	Severe 1. Severe 1.
SpE2	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
SpG2	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
SrD	Sloping gullied land-----	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
SsE	Soboba stony loamy sand, 9 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
StG	Steep gullied land-----	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes.	Severe 8----	Severe 7----	Moderate 2---	Slight.
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes.	Severe 8----	Severe 7----	Moderate 2---	Slight.
SvE	Stony land-----	Severe 3----	Severe 3----	Severe 3-----	Severe 3.
TeF	Terrace escarpments-----	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
Tf	Tidal flats-----	Severe 4----	Severe 4----	Severe 4-----	Severe 4.
ToE2	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 3.
ToG	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
TuB	Tujunga sand, 0 to 5 percent slopes-----	Severe 2----	Severe 2----	Severe 2-----	Severe 2.
VaA	Visalia sandy loam, 0 to 2 percent slopes.	Slight-----	Slight-----	Moderate 2---	Slight.
VaB	Visalia sandy loam, 2 to 5 percent slopes.	Moderate 2--	Slight-----	Moderate 2---	Slight.
VaC	Visalia sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.

TABLE 7.--DEGREE AND KIND OF LIMITATION FOR RECREATION--Continued

Map symbol	Soil	Interpretation			
		Play areas	Campsites	Picnic areas	Paths and trails
VaD	Visalia sandy loam, 9 to 15 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes.	Moderate 8--	Moderate 2--	Moderate 2---	Slight.
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
VsC	Vista coarse sandy loam, 5 to 9 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
VsD	Vista coarse sandy loam, 9 to 15 percent slopes.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded.	Severe 1----	Moderate 1--	Moderate 1---	Slight.
VsE	Vista coarse sandy loam, 15 to 30 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded.	Severe 1----	Severe 1----	Severe 1-----	Moderate 1.
VsG	Vista coarse sandy loam, 30 to 65 percent slopes.	Severe 1----	Severe 1----	Severe 1-----	Severe 1.
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes.	Severe 1----	Severe 3----	Moderate 3---	Moderate 3.
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes.	Severe 1----	Severe 3----	Severe 1-----	Moderate 3.
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes.	Severe 1----	Severe 3----	Severe 1-----	Severe 1.
WmB	Wyman loam, 2 to 5 percent slopes-----	Moderate 1--	Moderate 2--	Moderate 2---	Slight.
WmC	Wyman loam, 5 to 9 percent slopes-----	Severe 1----	Moderate 1--	Moderate 1---	Slight.
WmD	Wyman loam, 9 to 15 percent slopes-----	Severe 1----	Moderate 1--	Moderate 1---	Slight.

Picnic Areas.--These are places where people eat meals outdoors and can be close to nature and enjoy the quiet seclusion of country life. Accessibility, water supply, and sewage disposal

were not considered in the ratings in table 7. Criteria for rating soils for use as picnic areas are shown in table 8.

TABLE 8.--CRITERIA FOR RATING SOILS FOR USE AS PICNIC AREAS

Factors affecting limitation	Limitation		
	None to slight	Moderate	Severe
Drainage-----	Excessive, somewhat excessive, good, or moderately good.	Moderately good or somewhat poor.	Poor or very poor.
Water table during season of use.	20 inches or below-----	Above 20 inches for short periods.	Above 20 inches and often near the surface for a month or more.
Flooding during season of use.	No flooding-----	Once or twice for short periods.	More than twice.
Slope-----	Less than 9 percent-----	9 to 15 percent-----	More than 15 percent.
Surface layer texture-	Sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam.	Clay loam, sandy clay loam, silty clay loam, loamy sands, or sands other than loose sand.	Sandy clay, silty clay, clay, loose sands, or organic material subject to severe blowing.
Gravel and cobblestones on surface.	Less than 20 percent----	20 to 50 percent-----	More than 50 percent.
Stones on surface-----	Less than 3 percent-----	3 to 15 percent-----	More than 15 percent.
Rocks on surface-----	Less than 10 percent----	10 to 25 percent-----	More than 25 percent.

Campsites--These are areas used intensively for tent and small camp trailer sites and the accompanying activities of outdoor living. The best sites require little preparation other than shaping and leveling tent sites and parking areas. Sites should be suitable for heavy traffic by humans, horses, or

vehicles. The suitability of the soil for supporting vegetation, for sewage disposal, for water supply, and for access roads was not considered in the ratings shown in table 7. Criteria for rating soils for use as campsites are shown in table 9.

TABLE 9.--CRITERIA FOR RATING SOILS FOR USE AS CAMPSITES

Factors affecting limitation	Limitation		
	None to slight	Moderate	Severe
Drainage-----	Excessive, somewhat excessive, good, or moderately good.	Moderately good or somewhat poor.	Somewhat poor, poor, or very poor.
Water table during season of use.	Below 30 inches-----	Below 20 inches-----	Above 20 inches.
Flooding during season of use.	No flooding-----	No flooding-----	Flooding.
Permeability (in./hr.).	More than 20.0 inches to 0.63 inch.	0.63 to 0.06 inch-----	Less than 0.06 inch.
Slope-----	Less than 9 percent-----	9 to 15 percent-----	More than 15 percent.
Texture of surface layer.	Sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam.	Clay loam, sandy clay loam, silty clay loam, loamy sands, or sands other than loose sand.	Organic material, sandy clay, silty clay, clay, loose sands, or other soil material subject to severe blowing.
Gravel and cobbles on surface.	Less than 20 percent----	20 to 50 percent-----	More than 50 percent.
Stones on surface-----	Less than 0.1 percent----	0.1 to 3 percent-----	More than 3 percent.
Rocks on surface-----	Less than 2 percent-----	2 to 25 percent-----	More than 25 percent.

Paths and Trails.--These are foot trails, cross-country hiking and bridle paths, and extensive areas where people walk at random. In rating the soils for paths and trails, it is assumed that the soils are to be used as they occur in nature and that little site preparation will be required. The ratings in table 7 are based only on soil properties and qualities.

Other features that may be important in selecting sites are not considered. The esthetic value in locations where soil limitations are severe may justify additional preparation and maintenance, such as installing a guardrail at a mountain lookout. Criteria for rating soils for use as paths and trails are shown in table 10.

TABLE 10.--CRITERIA FOR RATING SOILS FOR USE AS PATHS AND TRAILS

Factors affecting limitation	Limitation		
	None to slight	Moderate	Severe
Drainage-----	Excessive, somewhat excessive, good, or moderately good.	Somewhat poor-----	Poor or very poor.
Water table during season of use.	Below 20 inches-----	Above 20 inches for short periods.	Above 20 inches and often near surface for a month or more.
Flooding during season of use.	Once a year-----	Two or three times a year.	More than three times a year.
Slope-----	Less than 15 percent----	15 to 30 percent-----	More than 30 percent.
Surface layer texture.	Sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam.	Silty clay loam, sandy clay loam, clay loam, or loamy sands.	Sandy clay, silty clay, clay, sands, or organic soil material.
Gravel and cobblestones on surface.	Less than 20 percent----	20 to 50 percent-----	More than 50 percent.
Stones on surface-----	Less than 0.1 percent---	0.1 to 3 percent-----	More than 3 percent.
Rocks on surface-----	Less than 10 percent----	10 to 25 percent-----	More than 25 percent.

Soil erosion, floods, silting of reservoirs and ponds, and disastrous brush fires are hazards that confront land managers, engineers, farmers, ranchers, and homeowners in the San Diego Area. This section describes the hydrologic soil groups used to estimate the runoff potential of the soils, rates the erodibility of the soils, and indicates the degree of soil limitations for conversion from brush vegetation to grass. The information presented can be used by planners in estimating the effect of water and runoff on the soils and in determining whether grass cover can be established in areas of brush for controlling fires and erosion.

Hydrologic Soil Groups

Surface runoff and soil erosion create serious problems in engineering and agriculture. Hydrologic studies are invaluable for estimating the runoff from a given area and designing flood-control structures adequate to handle the runoff water.

Four hydrologic groups are used for estimating the runoff potential of soils. Group A has the lowest runoff potential, and Group D has the highest. Groupings are based on soil properties that influence runoff, such as the water infiltration rate, texture, natural drainage or wetness, and the presence of a restrictive underlying layer or rock material. The runoff potential is calculated on the basis of water intake at the end of a long-duration storm that occurs after prior wetting and opportunity for swelling of a soil not protected by vegetation.

- Group A. Soils have high infiltration rate when thoroughly wetted; chiefly deep, well-drained to excessively drained sand, gravel, or both. Rate of water transmission is high; thus runoff potential is low.
- Group B. Soils have moderate infiltration rate when thoroughly wetted; chiefly soils that are moderately deep to deep, moderately well drained to well drained, and moderately coarse textured. Rate of water transmission is moderate.
- Group C. Soils have slow infiltration rate when thoroughly wetted; chiefly soils that have a layer impeding downward movement of water, or moderately fine to fine textured soils that have a slow infiltration rate. Rate of water transmission is slow.
- Group D. Soils have very slow infiltration rate when thoroughly wetted; chiefly clays that have a high shrink-swell potential, soils that have a high permanent water

table, soils that have a claypan or clay layer at or near the surface, or soils that are shallow over nearly impervious material. Rate of water transmission is very slow.

Detailed hydrologic soil maps are available from the San Diego County Planning Department. The hydrologic group designation for each soil in the Area is given in table 11.

Ground Cover.--The amount of runoff produced during a storm depends on the ability of the soils to absorb water and on the kind of ground cover. Plant cover increases absorption of water and slows runoff (8). ^{3/} Manmade cover usually decreases absorption of water, increases runoff, modifies the natural drainage patterns, and intensifies the chances of flooding. For example, a paved parking lot produces more runoff than an unpaved field. Excess runoff in areas of manmade cover increases the load of drainage systems, which may lack the capacity to handle floodwater.

Although the type of cover is not considered in the hydrologic groups, it is an important factor in estimating runoff. The ground cover of the watershed in the western part of the San Diego Area has been divided into eighteen categories according to the dominant kinds of plant cover and land use that affect hydrologic characteristics. The categories include barren land, developed land, wild land, and cultivated land. Atlas maps that show these areas are available at the San Diego County Planning Department.

Soil Erodibility by Water

Water erosion affects all uses of the soils. Runoff erodes agricultural land and undercuts roadbanks, landfills, and riverbanks. Eroded materials fill reservoirs, ponds, and drainage ditches and silt up harbors, streams, and rivers (9).

The erodibility of soils must be considered in planning land use. It is especially important in selecting homesites. Where erosion is a severe problem, proper precautions can be taken or other uses can be considered.

The erodibility of each soil in the Area is rated in table 11. The ratings are slight, moderate, and severe. A rating of slight indicates that water erosion is a minor problem and the soil is suitable for building sites or other intensive use if other factors are favorable. Ratings of moderate and severe indicate that protective and corrective measures are needed before and during the time the soil is used.

^{3/} Underscored numbers in parentheses refer to Literature Cited, page 116.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT

[Numerals indicate soil properties or qualities that affect erodibility. Numeral 1 refers to slope; 2 to surface layer texture; 9 to depth to hard rock, or a hardpan, or any layer that restricts permeability; 16 to grade of structure in the surface layer. Absence of rating means no valid interpretations can be made]

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
AcG	Acid igneous rock land-----	D	Severe 1----	Severe.
AtC	Altamont clay, 5 to 9 percent slopes-----	D	Slight-----	Slight. <u>1/</u>
AtD	Altamont clay, 9 to 15 percent slopes-----	D	Slight-----	Slight. <u>1/</u>
AtD2	Altamont clay, 9 to 15 percent slopes, eroded-----	D	Slight-----	Slight. <u>1/</u>
AtE	Altamont clay, 15 to 30 percent slopes-----	D	Moderate 1---	Slight. <u>1/</u>
AtE2	Altamont clay, 15 to 30 percent slopes, eroded-----	D	Moderate 1---	Slight. <u>1/</u>
AtF	Altamont clay, 30 to 50 percent slopes-----	D	Severe 1-----	Moderate. <u>1/</u>
AuC	Anderson very gravelly sandy loam, 5 to 9 percent slopes.	A	Severe 16----	Slight.
AuF	Anderson very gravelly sandy loam, 9 to 45 percent slopes.	A	Severe 16----	Moderate. <u>2/</u>
AvC	Arlington coarse sandy loam, 2 to 9 percent slopes-----	C	Severe 16----	Slight.
AwC	Auld clay, 5 to 9 percent slopes-----	D	Slight-----	Slight.
AwD	Auld clay, 9 to 15 percent slopes-----	D	Slight-----	Slight.
AyE	Auld stony clay, 9 to 30 percent slopes-----	D	Moderate 1---	Slight.
BaG	Badland-----	D	Severe 1-----	Severe.
BbE	Bancas stony loam, 5 to 30 percent slopes-----	C	Severe 16----	Moderate.
BbE2	Bancas stony loam, 5 to 30 percent slopes, eroded-----	C	Severe 16----	Moderate.
BbG	Bancas stony loam, 30 to 65 percent slopes-----	C	Severe 1-----	Moderate.
BbG2	Bancas stony loam, 30 to 65 percent slopes, eroded-----	C	Severe 1-----	Moderate.
BeE	Blasingame loam, 9 to 30 percent slopes-----	D	Severe 16----	Slight.
BgE	Blasingame stony loam, 9 to 30 percent slopes-----	D	Severe 16----	Moderate.
BgF	Blasingame stony loam, 30 to 50 percent slopes-----	D	Severe 1-----	Moderate.
B1C	Bonsall sandy loam, 2 to 9 percent slopes-----	D	Severe 9-----	Slight.
B1C2	Bonsall sandy loam, 2 to 9 percent slopes, eroded-----	D	Severe 9-----	Slight.
B1D2	Bonsall sandy loam, 9 to 15 percent slopes, eroded-----	D	Severe 9-----	Slight.
BmC	Bonsall sandy loam, thick surface, 2 to 9 percent slopes.	D	Moderate 2---	Slight.
BnB	Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes: Bonsall----- Fallbrook-----	D C	Severe 9----- Severe 9-----	Slight. Slight.
BoC	Boomer loam, 2 to 9 percent slopes-----	C	Moderate 2---	Slight.
BoE	Boomer loam, 9 to 30 percent slopes-----	C	Moderate 1---	Slight.
BrE	Boomer stony loam, 9 to 30 percent slopes-----	C	Moderate 1---	Slight.
BrG	Boomer stony loam, 30 to 65 percent slopes-----	C	Severe 1-----	Moderate.
BsC	Bosanko clay, 2 to 9 percent slopes-----	D	Moderate 16--	Slight. <u>1/</u>
BsD	Bosanko clay, 9 to 15 percent slopes-----	D	Moderate 16--	Slight. <u>1/</u>
BsE	Bosanko clay, 15 to 30 percent slopes-----	D	Moderate 1---	Slight. <u>1/</u>
BtC	Bosanko stony clay, 5 to 9 percent slopes-----	D	Moderate 16--	Slight. <u>3/</u>
BuB	Bull Trail sandy loam, 2 to 5 percent slopes-----	C	Severe 16----	Slight. <u>4/</u>
BuC	Bull Trail sandy loam, 5 to 9 percent slopes-----	C	Severe 16----	Slight. <u>4/</u>
BuD2	Bull Trail sandy loam, 9 to 15 percent slopes, eroded---	C	Severe 16----	Slight. <u>4/</u>
BuE2	Bull Trail sandy loam, 15 to 30 percent slopes, eroded---	C	Severe 16----	Slight. <u>4/</u>
CaB	Calpine coarse sandy loam, 2 to 5 percent slopes-----	B	Moderate 2---	Slight. <u>4/</u>
CaC	Calpine coarse sandy loam, 5 to 9 percent slopes-----	B	Moderate 2---	Slight. <u>4/</u>
CaC2	Calpine coarse sandy loam, 5 to 9 percent slopes, eroded.	B	Moderate 2---	Slight. <u>4/</u>

See footnotes at end of table.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
CaD2	Calpine coarse sandy loam, 9 to 15 percent slopes, eroded.	B	Moderate 2---	Slight. <u>4/</u>
CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes-----	C	Severe 2-----	Slight.
CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes-----	C	Severe 2-----	Slight.
CbD	Carlsbad gravelly loamy sand, 9 to 15 percent slopes-----	C	Severe 2-----	Slight.
CbE	Carlsbad gravelly loamy sand, 15 to 30 percent slopes----	C	Severe 2-----	Slight.
CcC	Carlsbad-Urban land complex, 2 to 9 percent slopes-----	D		
CcE	Carlsbad-Urban land complex, 9 to 30 percent slopes-----	D		
CeC	Carrizo very gravelly sand, 0 to 9 percent slopes-----	A	Severe 2	
CfB	Chesterton fine sandy loam, 2 to 5 percent slopes-----	D	Severe 9-----	Slight.
CfC	Chesterton fine sandy loam, 5 to 9 percent slopes-----	D	Severe 9-----	Slight.
CfD2	Chesterton fine sandy loam, 9 to 15 percent slopes, eroded.	D	Severe 9-----	Moderate.
CgC	Chesterton-Urban land complex, 2 to 9 percent slopes: Chesterton----- Urban land-----	D D		
ChA	Chino fine sandy loam, 0 to 2 percent slopes-----	C	Severe 16----	Slight.
ChB	Chino fine sandy loam, 2 to 5 percent slopes-----	C	Severe 16----	Slight.
CkA	Chino silt loam, saline, 0 to 2 percent slopes-----	C	Moderate 2---	Moderate.
C1D2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded.	B	Severe 16----	Severe.
C1E2	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.	B	Severe 16----	Severe.
C1G2	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded.	B	Severe 1-----	Severe.
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded.	B	Severe 16----	Severe.
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes.	B	Severe 1-----	Severe.
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded: Cieneba----- Fallbrook-----	B C	Severe 16---- Severe 16----	Severe. Severe.
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded: Cieneba----- Fallbrook-----	B C	Severe 1----- Severe 1-----	Severe. Severe.
Co	Clayey alluvial land-----	D	Moderate 2---	Slight.
Cr	Coastal beaches-----	A	Severe 2	
CsB	Corralitos loamy sand, 0 to 5 percent slopes-----	A	Severe 2-----	Slight.
CsC	Corralitos loamy sand, 5 to 9 percent slopes-----	A	Severe 2-----	Slight.
CsD	Corralitos loamy sand, 9 to 15 percent slopes-----	A	Severe 2-----	Slight.
CtE	Crouch coarse sandy loam, 5 to 30 percent slopes-----	B	Severe 16----	Slight.
CtF	Crouch coarse sandy loam, 30 to 50 percent slopes-----	B	Severe 1-----	Moderate.
CuE	Crouch rocky coarse sandy loam, 5 to 30 percent slopes.	B	Severe 16----	Moderate.
CuG	Crouch rocky coarse sandy loam, 30 to 70 percent slopes.	B	Severe 1-----	Moderate.
CvG	Crouch stony fine sandy loam, 30 to 75 percent slopes.	B	Severe 1-----	Moderate.
DaC	Diablo clay, 2 to 9 percent slopes-----	D	Slight-----	Slight. <u>1/</u>
DaD	Diablo clay, 9 to 15 percent slopes-----	D	Slight-----	Slight. <u>1/</u>
DaE	Diablo clay, 15 to 30 percent slopes-----	D	Moderate-----	Slight. <u>1/</u>
DaE2	Diablo clay, 15 to 30 percent slopes, eroded-----	D	Moderate 1---	Slight. <u>1/</u>
DaF	Diablo clay, 30 to 50 percent slopes-----	D	Severe 1-----	Moderate. <u>1/</u>

See footnotes at end of table.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
DcD	Diablo-Urban land complex, 5 to 15 percent slopes: Diablo----- Urban land-----	D D		
DcF	Diablo-Urban land complex, 15 to 50 percent slopes: Diablo----- Urban land-----	D D		
DoE	Diablo-Olivenhain complex, 9 to 30 percent slopes: Diablo----- Olivenhain-----	D D	Moderate 1--- Moderate 1---	Slight. Severe.
EdC	Elder shaly fine sandy loam, 2 to 9 percent slopes-----	B	Moderate 2---	Slight.
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes.	C	Severe 16---	Slight.
EsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.	C	Severe 16----	Slight.
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes, eroded.	C	Severe 16----	Slight.
EVC	Escondido very fine sandy loam, deep, 5 to 9 percent slopes.	C	Severe 16----	Slight.
ExE	Exchequer rocky silt loam, 9 to 30 percent slopes-----	D	Severe 9----	Severe.
ExG	Exchequer rocky silt loam, 30 to 70 percent slopes-----	D	Severe 1----	Severe.
FaB	Fallbrook sandy loam, 2 to 5 percent slopes-----	C	Severe 16----	Slight.
FaC	Fallbrook sandy loam, 5 to 9 percent slopes-----	C	Severe 16----	Slight.
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded----	C	Severe 16----	Slight.
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded----	C	Severe 16----	Slight.
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded---	C	Severe 16----	Slight.
FaE3	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded.	C	Severe 16----	Severe.
FeC	Fallbrook rocky sandy loam, 5 to 9 percent slopes-----	C	Severe 16----	Slight.
FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes-----	C	Severe 16----	Moderate.
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded.	C	Severe 16----	Moderate.
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes: Fallbrook----- Vista-----	C B	Severe 16---- Severe 16----	Slight. Moderate.
FvE	Fallbrook-Vista sandy loams, 15 to 30 percent slopes: Fallbrook----- Vista-----	C B	Severe 16---- Severe 16----	Slight. Moderate.
FwF	Friant fine sandy loam, 30 to 50 percent slopes-----	D	Severe 9----	Severe.
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes.	D	Severe 9----	Severe.
FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes.	D	Severe 1----	Severe.
GaE	Gaviota fine sandy loam, 9 to 30 percent slopes-----	D	Severe 9----	Severe.
GaF	Gaviota fine sandy loam, 30 to 50 percent slopes-----	D	Severe 1----	Severe.
GoA	Grangeville fine sandy loam, 0 to 2 percent slopes-----	B	Severe 16----	Slight.
GrA	Greenfield sandy loam, 0 to 2 percent slopes-----	B	Severe 16----	Slight.
GrB	Greenfield sandy loam, 2 to 5 percent slopes-----	B	Severe 16----	Slight.
GrC	Greenfield sandy loam, 5 to 9 percent slopes-----	B	Severe 16----	Slight.
GrD	Greenfield sandy loam, 9 to 15 percent slopes-----	B	Severe 16----	Slight.
HaG	Hambright gravelly clay loam, 30 to 75 percent slopes.	D	Severe 1----	Moderate.
HmD	Holland fine sandy loam, 5 to 15 percent slopes-----	C	Severe 16----	Slight.
HmE	Holland fine sandy loam, 15 to 30 percent slopes-----	C	Severe 16----	Slight.
HnE	Holland stony fine sandy loam, 5 to 30 percent slopes.	C	Severe 16----	Moderate.

See footnotes at end of table.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
HnG	Holland stony fine sandy loam, 30 to 60 percent slopes.	C	Severe 1-----	Moderate.
HoC	Holland fine sandy loam, deep, 2 to 9 percent slopes.	C	Severe 16----	Slight.
HrC	Huerhuero loam, 2 to 9 percent slopes-----	D	Severe 9-----	Slight.
HrC2	Huerhuero loam, 5 to 9 percent slopes, eroded-----	D	Severe 9-----	Slight.
HrD	Huerhuero loam, 9 to 15 percent slopes-----	D	Severe 9-----	Slight.
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded-----	D	Severe 9-----	Slight.
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded-----	D	Severe 9-----	Slight.
HuC	Huerhuero-Urban land complex, 2 to 9 percent slopes: Huerhuero----- Urban land-----	D D		
HuE	Huerhuero-Urban land complex, 9 to 30 percent slopes: Huerhuero----- Urban land-----	D D		
InA	Indio silt loam, 0 to 2 percent slopes-----	C	Severe 16	
InB	Indio silt loam, 2 to 5 percent slopes-----	C	Severe 16	
IoA	Indio silt loam, saline, 0 to 2 percent slopes-----	C	Severe 16	
IsA	Indio silt loam, dark variant-----	C	Severe 16	
KcC	Kitchen Creek loamy coarse sand, 5 to 9 percent slopes.	B	Severe 2-----	Slight. <u>4/</u>
KcD2	Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded.	B	Severe 2-----	Slight. <u>4/</u>
LaE2	La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.	A	Severe 2-----	Slight. <u>4/</u>
LaE3	La Posta loamy coarse sand, 5 to 30 percent slopes, severely eroded.	A	Severe 2-----	Severe. <u>4/</u>
LcE	La Posta rocky loamy coarse sand, 5 to 30 percent slopes.	A	Severe 2-----	Moderate. <u>4/</u>
LcE2	La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded.	A	Severe 2-----	Moderate. <u>4/</u>
LcF2	La Posta rocky loamy coarse sand, 30 to 50 percent slopes, eroded.	A	Severe 1-----	Moderate. <u>4/</u>
LdE	La Posta-Sheephead complex, 9 to 30 percent slopes: La Posta----- Sheephead-----	A C	Severe 2----- Severe 2-----	Moderate. <u>4/</u> Moderate. <u>4/</u>
LdG	La Posta-Sheephead complex, 30 to 65 percent slopes: La Posta----- Sheephead-----	A C	Severe 1----- Severe 1-----	Moderate. <u>4/</u> Moderate. <u>4/</u>
LeC	Las Flores loamy fine sand, 2 to 9 percent slopes-----	D	Severe 2-----	Slight.
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded.	D	Severe 2-----	Slight.
LeD	Las Flores loamy fine sand, 9 to 15 percent slopes-----	D	Severe 2-----	Slight.
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.	D	Severe 2-----	Slight.
LeE	Las Flores loamy fine sand, 15 to 30 percent slopes-----	D	Severe 2-----	Slight.
LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, eroded.	D	Severe 2-----	Slight.
LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded.	D	Severe 2-----	Severe.
LfC	Las Flores-Urban land complex, 2 to 9 percent slopes: Las Flores----- Urban land-----	D D		

See footnotes at end of table.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
LfE	Las Flores-Urban land complex, 9 to 30 percent slopes: Las Flores----- Urban land-----	D D		
LpB	Las Posas fine sandy loam, 2 to 5 percent slopes-----	D	Moderate 2----	Slight.
LpC	Las Posas fine sandy loam, 5 to 9 percent slopes-----	D	Moderate 2----	Slight.
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, eroded.	D	Moderate 2----	Slight.
LpD2	Las Posas fine sandy loam, 9 to 15 percent slopes, eroded.	D	Moderate 2----	Slight.
LpE2	Las Posas fine sandy loam, 15 to 30 percent slopes, eroded.	D	Moderate 1---	Slight.
LrE	Las Posas stony fine sandy loam, 9 to 30 percent slopes.	D	Moderate 1---	Moderate.
LrE2	Las Posas stony fine sandy loam, 9 to 30 percent slopes, eroded.	D	Moderate 1---	Moderate.
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slopes.	D	Severe 1-----	Moderate.
LsE	Linne clay loam, 9 to 30 percent slopes-----	C	Moderate 2---	Moderate.
LsF	Linne clay loam, 30 to 50 percent slopes-----	C	Severe 1-----	Moderate.
Lu	Loamy alluvial land-----	B	Severe 16----	Slight.
LvF3	Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded: Loamy alluvial land----- Huerhuero-----	D D	Severe 1----- Severe 1-----	Severe. Severe.
Md	Made land-----	D		
M1C	Marina loamy coarse sand, 2 to 9 percent slopes-----	A	Severe 2-----	Slight.
M1E	Marina loamy coarse sand, 9 to 30 percent slopes-----	A	Severe 2-----	Slight.
MnA	Mecca coarse sandy loam, 0 to 2 percent slopes-----	B	Severe 16	
MnB	Mecca coarse sandy loam, 2 to 5 percent slopes-----	B	Severe 16	
MoA	Mecca sandy loam, saline, 0 to 2 percent slopes-----	B	Severe 16	
MpA2	Mecca fine sandy loam, 0 to 2 percent slopes, eroded----	B	Severe 16	
MrG	Metamorphic rock land-----	D	Severe 1-----	Severe.
MvA	Mottsville loamy coarse sand, 0 to 2 percent slopes-----	A	Severe 2-----	Slight. $\frac{4}{4}$
MvC	Mottsville loamy coarse sand, 2 to 9 percent slopes-----	A	Severe 2-----	Slight. $\frac{4}{4}$
MvD	Mottsville loamy coarse sand, 9 to 15 percent slopes-----	A	Severe 2-----	Slight. $\frac{4}{4}$
MxA	Mottsville loamy coarse sand, wet, 0 to 2 percent slopes.	D	Severe 2-----	Slight. $\frac{4}{4}$
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes-----	D	Severe 16----	Slight.
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes-----	D	Severe 16----	Slight.
OhF	Olivenhain cobbly loam, 30 to 50 percent slopes-----	D	Severe 1-----	Moderate.
OkC	Olivenhain-Urban land complex, 2 to 9 percent slopes: Olivenhain----- Urban land-----	D D		
OkE	Olivenhain-Urban land complex, 9 to 30 percent slopes: Olivenhain----- Urban land-----	D D		
PeA	Placentia sandy loam, 0 to 2 percent slopes-----	D	Severe 9-----	Slight.
PeC	Placentia sandy loam, 2 to 9 percent slopes-----	D	Severe 9-----	Slight.
PeC2	Placentia sandy loam, 5 to 9 percent slopes, eroded-----	D	Severe 9-----	Slight.
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded-----	D	Severe 9-----	Slight.
PfA	Placentia sandy loam, thick surface, 0 to 2 percent slopes.	D	Severe 16----	Slight.
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes.	D	Severe 16----	Slight.
Py	Playas-----	D	Moderate 2	

See footnotes at end of table.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
RaA	Ramona sandy loam, 0 to 2 percent slopes-----	C	Severe 16----	Slight.
RaB	Ramona sandy loam, 2 to 5 percent slopes-----	C	Severe 16----	Slight.
RaC	Ramona sandy loam, 5 to 9 percent slopes-----	C	Severe 16----	Slight.
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded-----	C	Severe 16----	Slight.
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded-----	C	Severe 16----	Slight.
RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes-----	C	Severe 16----	Slight.
RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes-----	C	Severe 16----	Slight.
RdC	Redding gravelly loam, 2 to 9 percent slopes-----	D	Severe 9-----	Moderate.
ReE	Redding cobbly loam, 9 to 30 percent slopes-----	D	Severe 9-----	Moderate.
RfF	Redding cobbly loam, dissected, 15 to 50 percent slopes.	D	Severe 1-----	Moderate.
RhC	Redding-Urban land complex, 2 to 9 percent slopes: Redding----- Urban land-----	D D		
RhE	Redding-Urban land complex, 9 to 30 percent slopes: Redding----- Urban land-----	D D		
RkA	Reiff fine sandy loam, 0 to 2 percent slopes-----	B	Severe 16----	Slight.
RkB	Reiff fine sandy loam, 2 to 5 percent slopes-----	B	Severe 16----	Slight.
RkC	Reiff fine sandy loam, 5 to 9 percent slopes-----	B	Severe 16----	Slight.
Rm	Riverwash-----	A	Severe 2, 4--	Severe.
RoA	Rositas fine sand, 0 to 2 percent slopes-----	A	Severe 2	
RrC	Rositas fine sand, hummocky, 5 to 9 percent slopes-----	A	Severe 2	
RsA	Rositas loamy coarse sand, 0 to 2 percent slopes-----	A	Severe 2	
RsC	Rositas loamy coarse sand, 2 to 9 percent slopes-----	A	Severe 2	
RsD	Rositas loamy coarse sand, 9 to 15 percent slopes-----	A	Severe 2	
RuG	Rough broken land-----	D	Severe 1-----	Severe.
SbA	Salinas clay loam, 0 to 2 percent slopes-----	C	Moderate 2---	Slight. $\frac{1}{I}$
SbC	Salinas clay loam, 2 to 9 percent slopes-----	C	Moderate 2---	Slight. $\frac{1}{I}$
ScA	Salinas clay, 0 to 2 percent slopes-----	C	Slight-----	Slight. $\frac{1}{I}$
ScB	Salinas clay, 2 to 5 percent slopes-----	C	Slight-----	Slight. $\frac{1}{I}$
SmE	San Miguel rocky silt loam, 9 to 30 percent slopes-----	D	Severe 9-----	Moderate.
SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes: San Miguel----- Exchequer-----	D D	Severe 1----- Severe 1-----	Severe. Severe.
SpE2	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded.	C	Severe 16----	Moderate. $\frac{4}{I}$
SpG2	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded.	C	Severe 1-----	Moderate. $\frac{4}{I}$
SrD	Sloping gullied land-----	B	Severe 2-----	Severe. $\frac{4}{I}$
SsE	Soboba stony loamy sand, 9 to 30 percent slopes-----	A	Severe 2-----	Moderate.
StG	Steep gullied land-----	D	Severe 1-----	Severe.
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes-----	D	Moderate 2---	Slight.
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes-----	D	Moderate 2---	Slight.
SvE	Stony land-----	A	Severe 1-----	Severe.
TfF	Terrace escarpments-----	D	Severe 1-----	Severe.
Tf	Tidal flats-----	D	Severe 2, 4	
ToE2	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded.	C	Severe 9-----	Severe.
ToG	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes.	C	Severe 1-----	Severe.
TuB	Tujunga sand, 0 to 5 percent slopes-----	A	Severe 2-----	Slight.
Ur	Urban land-----	D		
VaA	Visalia sandy loam, 0 to 2 percent slopes-----	B	Severe 16----	Slight.

See footnotes at end of table.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
VaB	Visalia sandy loam, 2 to 5 percent slopes-----	B	Severe 16----	Slight.
VaC	Visalia sandy loam, 5 to 9 percent slopes-----	B	Severe 16----	Slight.
VaD	Visalia sandy loam, 9 to 15 percent slopes-----	B	Severe 16----	Slight.
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes-----	B	Severe 16----	Slight.
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes-----	B	Severe 16----	Slight.
VsC	Vista coarse sandy loam, 5 to 9 percent slopes-----	B	Moderate 2---	Slight.
VsD	Vista coarse sandy loam, 9 to 15 percent slopes-----	B	Moderate 2---	Slight.
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded.	B	Moderate 2---	Slight.
VsE	Vista coarse sandy loam, 15 to 30 percent slopes-----	B	Moderate 2---	Slight.
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded.	B	Moderate 2---	Slight.
VsG	Vista coarse sandy loam, 30 to 65 percent slopes-----	B	Severe 1-----	Moderate.
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes.	B	Moderate 2----	Moderate. <u>3/</u>
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes.	B	Moderate 2----	Moderate. <u>3/</u>
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes.	B	Severe 1-----	Moderate. <u>3/</u>
WmB	Wyman loam, 2 to 5 percent slopes-----	C	Moderate 2----	Slight.
WmC	Wyman loam, 5 to 9 percent slopes-----	C	Moderate 2----	Slight.
WmD	Wyman loam, 9 to 15 percent slopes-----	C	Moderate 2----	Slight.

1/ Typically a grassland soil; conversion from brush usually not necessary.

2/ Moderate if slope is more than 30 percent, slight if less than 30 percent.

3/ Stoniness or rockiness not a serious impediment to use of grass-planting equipment.

4/ On desert-facing mountain slopes and in valleys, in the eastern part of land resource area 20, the degree of limitation is severe because of climate, regardless of soil properties.

Only soil properties are considered in the ratings in table 11. Climate, plant cover, and physiographic features are not considered. For this reason, the ratings of erodibility may not agree with the ratings of erosion hazard

given in the soil descriptions in Part I of this survey or with the erosion hazard indicated under the heading "Homesites" in Part II. The criteria used for rating soil erodibility are shown in table 12.

TABLE 12.--CRITERIA FOR RATING SOIL ERODIBILITY

Soil properties affecting erodibility	Erodibility		
	Slight	Moderate <u>1/</u>	Severe <u>1/ 2/</u>
Surface layer texture <u>3/</u> ----	Clay-----	Clay loam, sandy loams, or loam.	Sands, or loamy sands.
Grade of granular, crumb, or blocky structure in the surface layer.	Strong-----	Moderate-----	Weak and massive and single grain.
Depth to material that restricts permeability.	More than 40 inches--	40 to 20 inches-----	Less than 20 inches.
Slope-----	Less than 15 percent-	15 to 30 percent-----	More than 30 percent.

1/ Rating is slight for clay loam, sandy loams, loam, sands, and loamy sands if coarse fragments cover more than 75 percent of surface.

2/ Rating is moderate for sands and loamy sands if coarse fragments cover 25 to 75 percent of surface.

3/ Rating is according to surface layer texture if coarse fragments cover only 1 to 25 percent of surface.

4/
Conversion from Brush to Grass

The primary benefit of converting areas of brush to grass is the prevention and control of fires. Other benefits include a decrease in runoff and an improvement in wildlife habitat and recreational areas. Conversion to grass or grass and legumes is stressed because these are the major adapted plants for which seed is readily available and techniques have been developed for establishing this type of cover after the brush has been destroyed (4).

The establishment of a grass cover adequate for soil protection depends on the climate and soil properties. The climate of the western and central parts of the survey area, land resource area 19 and the western part of land resource area 20, is suited to adapted annual grasses and, in some locations, to perennial grasses. However, the Desert, land resource area 30, is not climatically

suited to grass. The desert-facing mountain slopes and valleys in the eastern part of land resource area 20 are subject to high temperatures and desiccating winds, and the establishment of new cover is more difficult there than in the western part. Within a suitable climatic zone, the properties of the soils affect the relative difficulty of establishing and maintaining a grass cover that is adequate for erosion control and fire abatement once the brush is removed.

In table 11, the limitations of each soil for conversion from brush to grass are rated slight, moderate, and severe. Ratings are based on such soil properties as slope, rooting depth, available water holding capacity, presence of rock outcrops or stones, and degree of erosion. Ratings are not given for desert soils or for soils and land types on which conversion is not applicable, such as Coastal beaches or Urban land. All other soils and land types are rated regardless of present use or plant cover.

In determining the ratings in table 11, it is assumed that--

4/
By IRVING L. SEALANDER, range conservationist, Soil Conservation Service. Interpretations are for use in San Diego County only.

1. Adapted annual grasses or grasses and legumes will be used. Varieties of wheatgrass, hardinggrass, and other perennials are not considered, although they have been used successfully in part of the survey area.
2. Regrowth of brush will be controlled by chemical or mechanical means or by a combination of the two.
3. Seeding will be done by drill or other mechanical means more favorable for establishing new cover than broadcast seeding.

Management for Eradication of Brush.--Brushland in the area is also being converted to orchards, housing developments, and other uses. The topography is generally hilly to mountainous. The soils are moderately deep to very shallow and have a low to moderate available water holding capacity and medium to very rapid runoff.

The brush vegetation, usually called chaparral, provides fair to moderate protection from erosion

under natural conditions. The disturbance of this cover, if not properly managed, can cause severe erosion.

Erosion can be kept to a minimum if the brush is left on the surface as a mulch or is mixed into the surface layer by disking or chaining. Where converting to orchards, this practice prevents detrimental loss of soil before some type of cover crop can be established.

The practice of removing all the brush and some of the topsoil, usually by bulldozing, leaves the soil unprotected. Where brush and loose soil are bulldozed into gullies and narrow swales, the first heavy rain generally produces enough runoff to form gullies in the unprotected areas and deposit harmful amounts of loose soil and brush in the lower lying areas. Establishing vegetation is difficult and expensive where gullies have formed and the soils have become shallow through erosion. The practice of eradicating brush and leaving the land idle is poor management.

USE OF THE SOILS IN ENGINEERING

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. Among the properties most important to engineers are permeability, shear strength, compaction characteristics, shrink-swell behavior, available water capacity, texture, plasticity, piping and cracking potential, and soil reaction. Depth to unconsolidated materials, slope, and infiltration rates are also important.

Information concerning these and related soil properties is given in tables 13 and 14. The estimates and interpretations in these tables can be used to--

1. Make preliminary estimates of the engineering properties of soils in planning irrigation systems, drainage systems, small dams and reservoirs, and similar works.
2. Make preliminary evaluations of soils that will aid in selecting sites for highways, airports, rural roads, pipelines, and cables and in planning detailed investigations at selected locations.
3. Develop other preliminary estimates for construction purposes pertinent to the particular area.
4. Supplement other publications, such as maps, reports, and aerial photographs, that are used in preparing engineering reports for a specific area.
5. Correlate performance of soil mapping units to develop information that will be useful in designing and maintaining engineering structures.

Laboratory test data for 15 representative soils are given in table 13, and the estimated soil properties significant in engineering are given for all the soils in table 14. The soils are rated only to a depth of 5 feet, or to bedrock if it occurs within this depth.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works. Even in these situations, however, the soil map is useful in planning more detailed field investigations and in indicating the kinds of problems that may be expected.

Some of the terms used by soil scientists have special meanings in soil science that may not be familiar to engineers. These terms are defined in the Glossary.

Engineering Classification

The two systems most commonly used in classifying soils for engineering are the systems approved by the American Association of State Highway Officials (AASHO) and the Unified system.

The AASHO system (1) is used to classify soils according to those properties that affect use in highway construction. In this system all soil material is classified in seven principal groups. The groups range from A-1, which consists of soils that have the highest bearing strength and are the best soils for subgrade, to A-7, which consists of soils that have the lowest strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. The numbers range from 0, for the best material, to 20, for the poorest. The group index number is shown in parentheses following the soil group system (see table 13).

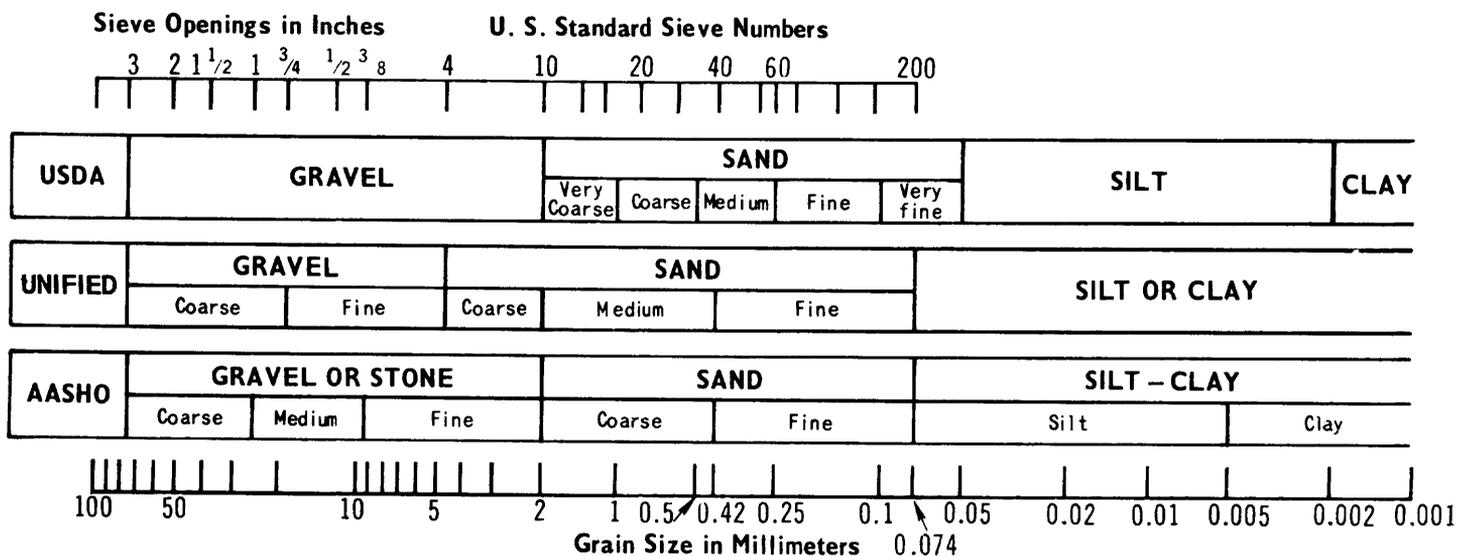
In the Unified system (10) soils are classified according to their texture and plasticity and their performance as engineering construction material. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. GP and GW are clean gravels, and GM and GC are gravels that include, respectively, an appreciable amount of nonplastic and plastic fines. SP and SW are clean sands. SM and SC are sands that include fines of silt and clay. ML and CL are silts and clays that have a low liquid limit and MH and CH are silts and clays that have a high liquid limit. Soils on the borderline between two

classes are designated by symbols for both classes; for example, ML-CL.

Soil scientists use the USDA textural classification (7). In this, the texture of the soil is determined according to the proportion of soil particles smaller than 2 millimeters in diameter, that is, the proportion of sand, silt, and clay. Textural modifiers, such as gravelly, stony, shaly, and cobbly, are used as needed.

Table 13 shows the AASHO and Unified classification of specified soils in the Area, as determined by laboratory tests. Table 14 shows the estimated classification of all the soils in the Area according to all three systems of classification. The following chart shows a comparison of the particle sizes used for each classification.

COMPARISON OF PARTICLE SIZE SCALES



Engineering Test Data

Selected horizons from 15 representative soils in the San Diego Area were tested in order to evaluate the soil properties significant in engineering. Results of these tests are shown in table 13.

The sieve sizes used by the California Division of Highways do not correspond to the sieve sizes used in the Unified and AASHO classification systems. Thus, data were plotted and interpolated. Interpolated data are shown in table 13.

The water table is high late in winter and early in spring in Arlington, Chino, and Grangeville soils. It is high for short periods after heavy rainfall in Mottsville, Tujunga, and Visalia soils.

Mechanical Analysis.--The size and distribution of soil particles affect the behavior of the soils for various engineering uses. The California Division of Highways uses the sieve and hydrometer method in determining grain size. The Soil Survey laboratory uses the sieve and pipette method.

Moisture-Density Relations.--In a moisture-density or compaction test, a soil sample is compacted several times at the same compactive effort, but each time at successively higher moisture content. The dry density, or unit weight, of the compacted material increases as the moisture content increases until the optimum moisture content is reached; after that, the dry density decreases with an increase in

[Tests performed by the California Division of Highways. Some interpolations

Soil and location	Parent material	Calif- ornia Divi- sion of High- ways sample number	Depth	Moisture- density data 1/		Mechanical analysis 2/		
				Maximum dry density	Optimum moisture	Percentage passing sieve--		
						3/4 in.	3/8 in.	No. 4 (4.7 mm.)
			<u>In.</u>	<u>Lb./cu. ft.</u>	<u>Pct.</u>			
Bancas stony loam: SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 34, T. 16 S., R. 4 E., SBBM.	Mica schist-----	3626	21-37	125	11	---	---	100
Bonsall sandy loam: 2 $\frac{1}{4}$ miles S. and 3/4 mile E. of Fallbrook, NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 31, T. 9 S., R. 3 W., SBBM.	Coarse-textured granodiorite or tonalite.	3628 3629	14-27 48-60	122 121	12 14	---	---	100 100
Crouch coarse sandy loam: 1,400 ft. W., 1,200 ft. N. of SW. corner sec. 32, T. 17 S., R. 5 E., SBBM.	Granodiorite.	3623 3624	7-26 34-60	134 131	10 8	---	100 100	97 95
Diablo clay: 200 ft. S. of Telegraph Canyon Rd. and $\frac{1}{4}$ mile W. of entrance to Otay Ranch headquarters NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 8, T. 18 S., R. 1 W., SBBM.	Marine sandstone and shale (weakly consolidated).	65-100	3-15	108	16	---	---	---
Fallbrook sandy loam: NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 31, T. 9 S., R. 3 W., SBBM.	Granodiorite or tonalite.	3634	12-20	129	9	---	---	100
Holland fine sandy loam: 1,350 ft. SW. of NE. corner sec. 26, T. 13 S., R. 3 E., SBBM, about 1,000 ft. NNW. of Pine Hills Guard Station.	Deeply weathered, micaceous schist.	3631 3632 3633	0-7 17-25 35-47	115 118 117	15 15 16	100 ---	97 100 100	95 97 98
Huerhuero loam: 1,230 ft. E. and 2,020 ft. S. of NW. corner sec. 32, T. 10 S., R. 5 W., SBBM.	Marine sand and gravel.	65-102 65-103	19-32 68-83	123 109	11 14	---	---	100 100

See footnotes at end of table.

TEST DATA

have been made from the basic data as explained in footnotes 2, 3, and 4]

Mechanical analysis 2/--Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve--Continued				Percentage smaller than--						AASHTO 3/	Unified 4/
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
								<u>Pct.</u>			
99	92	83	52	47	36	24	17	39	15	A-6(6)	CL
99	86	80	62	58	46	39	35	41	27	A-7-6(14)	CL
98	76	61	27	25	18	10	6	31	16	A-2-6(0)	SC
89	52	43	20	18	13	7	4	28	5	A-2-4(0)	SM
78	32	23	10	9	5	3	1	--	5/ NP	A-1-b(0)	SW-SM
100	94	86	66	--	--	41	34	56	37	A-7-6(24)	CH
97	77	69	51	48	39	30	24	27	14	A-6(5)	CL
92	70	60	35	31	21	11	6	--	NP	A-2-4(0)	SM
94	79	73	49	46	35	24	20	36	14	A-6(4)	SC
96	81	71	39	33	22	13	10	--	NP	A-4(0)	SM
98	90	83	68	--	--	37	32	40	26	A-6(16)	CL
97	80	68	38	--	--	17	17	27	9	A-4(1)	SC

Soil and location	Parent material	Calif. ornia- Divi- sion of High- ways sample number	Depth	Moisture- density data <u>1/</u>		Mechanical analysis <u>2/</u>		
				Maximum dry density	Optimum moisture	Percentage passing sieve--		
						3/4 in.	3/8 in.	No. 4 (4.7 mm.)
			<u>In.</u>	<u>Lb./cu. ft.</u>	<u>Pct.</u>			
Indio silt loam: 2,500 ft. W. and 1,750 ft. S. of NE. corner sec. 9, T. 14 S., R. 6 E., SBBM.	Alluvium from acid, igneous and mica schist rocks.	3636	6-45	108	17	---	---	100
La Posta loamy coarse sand: 1,000 ft. W. of SE. corner sec. 18, T. 11 S., R. 5 E., SBBM, 75 ft. N. of Montezuma Valley Rd. at entrance to Chimney Rock Ranch.	Deeply weathered, granitic rock.	3637	6-19	123	14	---	100	95
Mecca sandy loam: 2,660 ft. S. and 700 ft. E. of NW. corner sec. 18, T. 14 S., R. 6 E., SBBM.	Alluvium from acid, igneous rocks.	3625	10-62	128	10	---	100	98
Mottsville loamy coarse sand: 1,300 ft. W. and 800 ft. N. of SE. corner sec. 16, T. 17 S., R. 5 E., SBBM, 80 ft. N. of electric pole and 15 ft. W. of right- of-way fence.	Alluvium from acid, igneous rocks.	3639	6-60	129	8	---	100	98
Rositas loamy coarse sand: 180 ft. E. and 50 ft. S. of NW. corner sec. 18, T. 14 S., R. 6 E., SBBM.	Alluvium from acid, igneous rocks.	3630	5-60	134	9	100	95	89
Sheephead rocky fine sandy loam: 200 ft. W. of State Highway 78 and 4.1 miles E. of Julian, in SW $\frac{1}{4}$ sec. 33, T. 12 S., R. 4 E., SBBM.	Deeply weathered, micaceous schist.	3640	9-18	127	11	100	83	69

See footnotes at end of table.

Mechanical analysis 2/--Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve--Continued				Percentage smaller than--						AASHO 3/	Unified 4/
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
99	97	94	72	65	42	18	8	<u>Pct.</u> --	NP	A-4(0)	ML
80	41	31	14	12	9	5	4	--	NP	A-1-b(0)	SM
96	81	67	21	17	12	9	6	--	NP	A-2-4(0)	SM
84	50	41	24	21	13	7	4	--	3	A-1-b(0)	SM
71	41	33	14	12	7	4	2	--	NP	A-1-b(0)	SM
58	41	34	15	12	3	1	1	--	NP	A-1-b(0)	SM

Soil and location	Parent material	California Division of Highways sample number	Depth	Moisture-density data <u>1/</u>		Mechanical analysis <u>2/</u>		
				Maximum dry density	Optimum moisture	Percentage passing sieve--		
						3/4 in.	3/8 in.	No. 4 (4.7 mm.)
			In.	Lb./cu. ft.	Pct.			
Visalia sandy loam: 80 ft. S. of Rincon Rd., NW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 16, T. 11 S., R. 1 W., SBEM.	Mixed alluvium; dominantly granitic material.	65-104	12-40	133	9	---	---	100
Vista coarse sandy loam: 2 $\frac{1}{4}$ miles S. and 3/4 mile E. of Fallbrook, NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 31, T. 9 S., R. 3 W., SBEM.	Deeply weathered, coarse- textured granodiorite or tonalite.	3641	19-28	135	8	---	100	98

1/ Basic test data for the San Diego Area, Calif., from the California Division of Highways.

2/ Data for sieve sizes 10, 40, and 60 were obtained by the Soil Conservation Service (SCS) using graphic interpolation of sieve data from the California Division of Highways. Results by this procedure may differ somewhat from results obtained by the soil survey procedure of SCS. In the California procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS procedure the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

TEST DATA--Continued

Mechanical analysis 2/--Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve--Continued				Percentage smaller than--						AASHO 3/	Unified 4/
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
97	75	62	34	---	--	15	14	<u>Pet.</u> 25	6	A-2-4(0)	SC-SM
81	45	36	23	22	14	10	7	24	8	A-2-4(0)	SC

3/ Based on AASHO Designation: M-145 (1). The classifications include the interpolations by SCS of grain-size data for sieves Nos. 10 and 40.

4/ Based on the Unified Soil Classification System (10). The classifications include interpolated data by SCS for sieves Nos. 10 and 40. The Bureau of Public Roads (BPR) and SCS have agreed to consider that all soils having plasticity indexes within two points of A-line are to be given a borderline classification. Examples of borderline classifications are SW-SM and SC-SM.

5/ Nonplastic.

TABLE 14.--ESTIMATES OF SOIL PROPERTIES

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or this reason it is necessary to follow carefully the instructions for referring to other series that appear of which are highly variable and require on-site investigation. Dashes indicate no determination or data

Soil series and map symbols	Depth to hard rock or hardpan	Depth from surface (typical profile)	Classification			Percent greater than 3 inches
			Dominant USDA texture	Unified	AASHO	
	<u>Ft.</u>	<u>In.</u>				
Altamont: AtC, AtD, AtD2, AtE, AtE2, AtF.	1½-4	0-36 36	Clay and clay loam--- Calcareous soft shale.	CH	A-7	0
Anderson: AuC, AuF-----	>5	0-60	Very gravelly sandy loam.	GM	A-1	0-5
Arlington: AvC-----	2-3½	0-33 33-48 48-60	Coarse sandy loam--- Weakly cemented coarse sandy loam. Coarse sandy loam---	SM SM SM	A-2 A-2 A-2	0 0 0
Auld: AwC, AwD----- Same estimates for AyE, but depth to hard rock is 1½ to 2½ feet, USDA tex- ture is stony clay, and percent greater than 3 inches is 25 to 40.	3-5	0-54 54	Clay----- Gabbro.	CH	A-7	0
Bancas: BbE, BbE2, BbG, BbG2.	1½-3	0-5 5-27 27	Stony loam----- Clay loam----- Decomposed quartz diomite.	ML CL	A-4 A-6	5-15 0
Blasingame: BgE, BgF----- Same estimates for BeE, but USDA texture is loam and percent greater than 3 inches is 0.	1½-3	0-26 26	Stony loam and stony clay loam. Metaandesite.	CL	A-6	25-40
*Bonsall: B1C, B1C2, B1D2, BmC, BnB. For Fallbrook part of BnB, see Fallbrook series.	4-5	0-10 10-38 38-60	Sandy loam----- Heavy clay loam----- Sandy loam-----	SM CL SC	A-2 or A-4 A-7 A-2 or A-4	0 0 0
Boomer: BrE, BrG----- Same estimates for BoC and BoE, but USDA texture is loam and percent greater than 3 inches is 0.	3-4½	0-16 16-46 46	Stony loam----- Stony clay loam----- Gabbro.	ML or CL CL	A-4 or A-6 A-6	25-40 25-40

See footnote at end of table.

SIGNIFICANT IN ENGINEERING

more kinds of soil. The soils in such mapping units may have different properties and limitations, and for in the first column of this table. No reliable estimates can be made for Urban land and other land types, all not applicable. Symbol > means greater than; < means less than]

Percentage passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plasticity index			
				<u>Pct.</u>	<u>Pct.</u>	<u>In./hr.</u>	<u>In./in. of soil</u>	<u>pH</u>
100	90-100	90-100	75-85	55-70	35-45	0.06-0.2	0.14-0.16	6.6-8.4
30-55	25-50	15-35	10-20	-----	1/ NP	2.0-6.3	0.06-0.08	5.6-6.5
95-100	85-95	60-70	25-35	-----	NP	2.0-6.3	0.10-0.12	6.1-7.3
95-100	85-95	60-70	25-35	-----	NP	0.06-0.20	-----	6.1-6.5
95-100	85-95	60-70	25-35	-----	NP	2.0-6.3	0.10-0.12	6.1-6.5
90-100	90-100	85-95	70-80	50-65	35-45	0.06-0.2	0.14-0.16	6.6-8.4
100	95-100	90-100	50-60	20-30	5-15	0.63-2.0	0.12-0.14	6.6-7.3
100	95-100	90-100	50-70	30-40	10-20	0.63-2.0	0.19-0.21	6.1-6.5
90-100	90-100	90-100	60-70	30-40	15-25	0.2-0.63	0.15-0.17	6.6-7.3
100	90-100	60-70	30-40	-----	NP	2.0-6.3	0.10-0.12	6.1-6.5
100	95-100	85-95	60-70	40-50	20-30	<0.06	0.04-0.06	6.1-8.4
100	95-100	70-80	25-40	25-35	10-20	0.2-0.63	0.11-0.13	7.4-7.8
100	100	85-95	60-75	20-30	5-15	0.63-2.0	0.12-0.18	5.6-6.5
100	95-100	90-100	70-80	30-40	15-25	0.2-0.63	0.14-0.19	5.6-6.0

TABLE 14.--ESTIMATES OF SOIL PROPERTIES

Soil series and map symbols	Depth to hard rock or hardpan	Depth from surface (typical profile)	Classification			Percent greater than 3 inches
			Dominant USDA texture	Unified	AASHO	
	<u>Ft.</u>	<u>In.</u>				
Bosanko: BsC, BsD, BsE, BtC--	1½-3	0-30	Clay and sandy clay loam. Decomposed granite.	CL	A-7	0
Bull Trail: BuB, BuC, BuD2, BuE2.	>5	0-10	Sandy loam-----	SM	A-2 or A-4	0
		10-32 32-60	Sandy clay loam----- Loamy sand and sand--	SC SM	A-4 A-2	0 0
Calpine: CaB, CaC, CaC2, CaD2.	>5	0-34	Coarse sandy loam----	SM	A-2	0
		34-64	Fine gravelly loamy sand.	SM	A-1	0
Carlsbad: CbB, CbC, CbD, CbE.	1½-3½	0-21	Gravelly loamy sand--	SM	A-1	0
		21-39	Loamy sand-----	SM	A-2	0
		39-50	Weakly cemented hardpan.	---	---	---
Carrizo: CeC-----	>5	0-60	Very gravelly sand---	GP or GW	A-1	0
Chesterton: CfB, CfC, CfD2----	2-3	0-19	Fine sandy loam-----	SM	A-4	0
		19-34	Sandy clay-----	CL	A-6	0
		34	Cemented hardpan-----	---	---	---
Chino: ChA, ChB-----	>5	0-7	Fine sandy loam-----	SM	A-4	0
		7-60	Clay loam-----	CL	A-6	0
CkA-----	>5	0-60	Silt loam and loam---	ML or CL	A-4 or A-6	0
*Cieneba: ClD2, ClE2, ClG2, CmE2, CmrG, CnE2, CnG2. For Fallbrook part of CnE2 and CnG2, see Fall- brook series.	½-1½	0-10	Coarse sandy loam----	SM	A-2	0
		10	Weathered granodiorite.			
Corralitos: CsB, CsC, CsD-----	>5	0-43	Loamy sand-----	SM	A-2	0
		43-60	Sand-----	SP or SP-SM	A-3	0

See footnote at end of table.

SIGNIFICANT IN ENGINEERING--Continued

Percentage passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plasticity index			
				<u>Pct.</u>	<u>Pct.</u>	<u>In./hr.</u>	<u>In./in. of soil</u>	<u>pH</u>
100	100	85-95	65-75	40-50	15-35	0.06-0.2	0.14-0.16	6.1-8.4
90-100	85-95	55-65	30-40	-----	NP	2.0-6.3	0.11-0.13	5.6-6.0
90-100	85-100	50-60	40-50	15-30	5-10	0.2-0.63	0.14-0.16	5.6-6.0
90-100	90-100	50-70	15-30	-----	NP	6.3-20.0	0.06-0.08	5.6-6.0
90-100	85-95	50-60	25-35	-----	NP	2.0-6.3	0.10-0.12	5.6-7.3
80-95	75-85	35-50	10-20	-----	NP	2.0-6.3	0.05-0.07	6.6-7.3
80-90	70-80	35-50	10-20	-----	NP	2.0-6.3	0.05-0.07	5.6-6.5
100	100	50-65	15-25	-----	NP	2.0-6.3	0.07-0.09	5.1-6.5
-----	-----	-----	-----	-----	-----	<0.06	-----	-----
35-45	30-40	15-30	0-5	-----	NP	>20.0	0.03-0.05	7.9-8.4
100	95-100	65-80	35-50	-----	NP	2.0-6.3	0.13-0.15	5.6-6.0
100	100	80-95	50-60	25-35	15-30	<0.06	0.04-0.06	5.1-6.0
-----	-----	-----	-----	-----	-----	<0.06	-----	-----
100	95-100	65-80	35-50	-----	NP	2.0-6.3	0.13-0.15	6.1-6.5
100	95-100	90-100	85-95	30-40	20-30	0.63-2.0	0.19-0.21	7.4-8.4
100	100	90-100	70-90	25-40	5-15	0.63-2.0	0.13-0.17	7.9-8.4
95-100	90-100	60-70	25-35	-----	NP	6.3-20.0	0.10-0.12	5.6-6.0
100	100	50-75	15-30	-----	NP	6.3-20.0	0.06-0.08	6.1-7.3
100	100	50-70	0-10	-----	NP	6.3-20.0	0.05-0.07	6.6-7.3

TABLE 14.--ESTIMATES OF SOIL PROPERTIES

Soil series and map symbols	Depth to hard rock or hardpan	Depth from surface (typical profile)	Classification			Percent greater than 3 inches
			Dominant USDA texture	Unified	AASHO	
	<u>Ft.</u>	<u>In.</u>				
Crouch: CtE, CtF----- Same estimates for CuE, CuG, and CvG, but percent greater than 3 inches is 25 to 40.	3-5	0-56 56	Sandy loam----- Weathered grandio- rite.	SM	A-2	0
*Diablo: DaC, DaD, DaE, DaE2, DaF, DoE. For Olivenhain part of DoE, see Olivenhain series.	1½-3	0-32 32	Clay----- Soft sandstone.	CH	A-7	0
Elder: EdC-----	>5	0-70	Shaly fine sandy loam.	SM	A-2 or A-4	0
Escondido: EsC, EsD2, EsE2----- Same estimates for EvC, but depth to hard rock is 3 to 5 feet.	1½-3	0-29 29	Very fine sandy loam. Hard metasedimentary rock.	ML	A-4	0
Exchequer: ExE, ExG-----	½-1	0-10 10	Silt loam----- Hard metavolcanic rock.	ML or CL	A-4 or A-6	0
*Fallbrook: FaB, FaC, FaC2, FaD2, FaE2, FaE3, FeC, FeE, FeE2, FvD, FvE For Vista part of FvD and FvE, see Vista series.	1½->5	0-12 12-47 47	Sandy loam----- Sandy clay loam and loam. Weathered granite.	SM CL	A-2 or A-4 A-6	0 0
Friant: FwF, FxE, FxG-----	¼-1½	0-12 12	Fine sandy loam----- Metasedimentary rock.	SM	A-4	0
Gaviota: GaE, GaF-----	1-1½	0-16 16	Fine sandy loam or sandy loam. Soft sandstone.	SM	A-2 or A-4	0
Grangeville: GoA-----	>5	0-60	Fine sandy loam and very fine sandy loam.	SM	A-4	0

See footnote at end of table.

SIGNIFICANT IN ENGINEERING--Continued

Percentage passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plasticity index			
				<u>Pct.</u>	<u>Pct.</u>	<u>In./hr.</u>	<u>In./in. of soil</u>	<u>pH</u>
85-95	80-90	50-65	20-35	20-30	0-10	2.0-6.3	0.08-0.13	6.1-6.5
100	100	90-100	60-80	50-65	30-40	0.06-0.2	0.14-0.16	6.6-7.8
65-80	60-75	40-60	25-40	-----	NP	2.0-6.3	0.09-0.11	6.1-7.3
100	95-100	80-90	50-65	-----	NP	0.63-2.0	0.15-0.17	6.1-7.3
100	100	90-100	70-90	25-40	5-20	0.63-2.0	0.18-0.20	6.1-6.5
95-100	85-95	60-70	30-40	-----	NP	2.0-6.3	0.11-0.13	6.1-6.5
95-100	90-100	70-85	50-60	25-35	10-20	0.63-2.0	0.14-0.16	6.1-7.3
95-100	85-95	70-80	35-50	-----	NP	2.0-6.3	0.13-0.15	6.1-6.5
100	90-100	65-80	30-50	-----	NP	2.0-6.3	0.11-0.15	7.4-7.8
100	95-100	70-85	35-50	-----	NP	2.0-6.3	0.13-0.15	7.9-8.4

TABLE 14.--ESTIMATES OF SOIL PROPERTIES

Soil series and map symbols	Depth to hard rock or hardpan	Depth from surface (typical profile)	Classification			Percent greater than 3 inches
			Dominant USDA texture	Unified	AASHO	
	<u>Ft.</u>	<u>In.</u>				
Greenfield: GrA, GrB, GrC, GrD.	>5	0-34	Sandy loam-----	SM	A-2 or A-4	0
		34-66	Loamy coarse sand----	SM	A-1	0
Hambricht: HaG-----	1-1½	0-17	Gravelly clay loam---	GC or CL	A-6	0
		17	Shaly breccia.			
Holland: HmD, HmE, HoC----- Same estimates for HnE, HnG, but percent greater than 3 inches is 30 to 40.	1½->5	0-20	Fine sandy loam-----	SM	A-2 or A-4	0
		20-35 35	Sandy clay loam----- Weathered schist.	SC or CL	A-6	0
Huerhuero: Hrc, Hrc2, Hrd, Hrd2, Hre2.	>5	0-12	Loam-----	ML	A-4	0
		12-55	Clay and clay loam---	CL	A-6	0
		55-68	Sandy loam-----	SM or SC	A-2 or A-4	0
Indio: InA, InB, IoA, Isa---	>5	0-45	Silt loam-----	ML	A-4	0
		45-60	Fine sandy loam-----	SM	A-4	0
Kitchen Creek: KcC, Kcd2----	3-5	0-21	Loamy coarse sand----	SM	A-2	0
		21-54	Coarse sandy loam----	SM	A-2	0
		54	Decomposed granite.			
*La Posta: LaE2, LaE3, LcE, LcE2, LcF2, LdE, LdG. For Sheephead part of LdE and LdG, see Sheephead series.	1½-3	0-29	Loamy coarse sand----	SM	A-1	0
		29	Decomposed grano- diorite.			
Las Flores: LeC, LeC2, LeD, LeD2, LeE, LeE2, LeE3.	3½-4½	0-14	Loamy fine sand-----	SM	A-2	0
		14-38	Sandy clay-----	CH or CL	A-7	0
		38-48	Loamy coarse sand----	SM	A-1	0
		48	Soft sandstone.			
Las Posas: LpB, LpC, LpC2, LpD2, LpE2. Same estimates for LrE, LrE2, and LrG, but in surface layer, percent greater than 3 inches is 30 to 40.	2-3½	0-33	Clay and clay loam---	CH	A-7	0
		33	Decomposed gabbro.			

See footnote at end of table.

SIGNIFICANT IN ENGINEERING--Continued

Percentage passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plasticity index			
				<u>Pct.</u>	<u>Pct.</u>	<u>In./hr.</u>	<u>In./in. of soil</u>	<u>pH</u>
100	90-100	80-90	30-40	-----	NP	2.0-6.3	0.11-0.13	6.1-6.5
100	90-100	40-50	15-25	-----	NP	6.3-20.0	0.06-0.08	6.6-7.3
60-75	55-70	50-65	40-55	25-40	15-30	0.2-0.63	0.13-0.15	6.1-6.5
90-100	85-100	65-80	30-45	-----	NP	2.0-6.3	0.13-0.15	5.6-6.0
95-100	90-100	80-95	45-60	30-40	10-20	0.2-0.63	0.14-0.16	5.6-6.0
100	95-100	85-90	60-70	20-30	5-10	0.63-2.0	0.16-0.18	5.1-6.0
100	95-100	85-95	65-75	35-45	15-30	<0.06	0.04-0.06	7.4-8.4
100	100	65-80	30-40	15-30	5-10	0.63-2.0	0.11-0.13	6.6-7.8
100	95-100	90-100	70-80	-----	NP	0.63-2.0	0.19-0.21	7.9-8.4
100	100	70-85	40-50	-----	NP	2.0-6.3	0.13-0.15	7.9-8.4
90-100	85-95	55-65	20-30	-----	NP	6.3-20.0	0.06-0.08	6.1-6.5
90-100	85-95	55-65	25-35	-----	NP	2.0-6.3	0.10-0.12	5.6-6.5
80-100	75-85	40-50	10-20	-----	NP	6.3-20.0	0.06-0.08	6.1-7.3
100	100	60-80	20-35	-----	NP	2.0-6.3	0.09-0.11	5.6-6.5
100	100	85-95	50-60	45-60	20-35	<0.06	0.04-0.06	6.1-7.3
100	80-95	40-50	10-20	-----	NP	6.3-20.0	0.06-0.08	6.6-7.3
100	95-100	90-100	70-80	50-60	20-30	0.2-0.63	0.14-0.16	6.6-7.3

TABLE 14.--ESTIMATES OF SOIL PROPERTIES

Soil series and map symbols	Depth to hard rock or hardpan	Depth from surface (typical profile)	Classification			Percent greater than 3 inches
			Dominant USDA texture	Unified	AASHO	
	<u>Ft.</u>	<u>In.</u>				
Linne: LsE, LsF-----	2-3½	0-37 37	Clay loam----- Calcareous sandy shale.	CL	A-6	0
*Loamy alluvial land: Lu, LvF3. For Huerhuero part of LvF3, see Huerhuero series.						
Marina: MLC, MIE-----	>5	0-57 57-60	Loamy coarse sand---- Sand-----	SM SW	A-2 A-1	0 0
Mecca: MnA, MnB, MoA, MpA2---	>5	0-60	Coarse sandy loam---	SM	A-2	0
Mottsville: MvA, MvC, MvD, MxA.	>5	0-60	Loamy coarse sand----	SM	A-1 or A-2	0
Olivenhain: OhC, OhE, OhF----	>5	0-10 10-42 42-60	Cobbly loam----- Very cobbly clay loam and clay. Cobbly loam-----	ML or CL CL ML or CL	A-4 A-6 or A-7 A-4	30-40 50-60 30-40
Placentia: PeA, PeC, PeC2, PeD2, PfA, PFC.	>5	0-13 13-34 34-63	Sandy loam----- Sandy clay----- Sandy clay loam----	SM CL CL or SC	A-4 A-6 A-6	0 0 0
Playas: Py. No reliable estimates can be made.						
Ramona: RaA, RaB, RaC, RaC2, RaD2---	>5	0-17 17-72	Sandy loam----- Sandy clay loam----	SM SC or CL	A-4 A-6	0 0
RcD, RcE-----	>5	0-17 17-60	Gravelly sandy loam- Gravelly sandy clay loam.	SM SC	A-2 A-6 or A-2	0 0

See footnote at end of table.

SIGNIFICANT IN ENGINEERING--Continued

Percentage passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plasticity index			
				<u>Pct.</u>	<u>Pct.</u>	<u>In./hr.</u>	<u>In./in. of soil</u>	<u>pH</u>
100	100	90-100	70-80	25-40	15-30	0.2-0.63	0.16-0.19	7.9-8.4
100	100	60-70	15-25	-----	NP	6.3-20.0	0.07-0.09	5.6-7.8
100	95-100	35-50	0-5	-----	NP	>20.0	0.04-0.06	7.9-8.4
95-100	90-100	75-85	20-35	-----	NP	2.0-6.3	0.09-0.11	7.4-8.4
85-100	80-95	45-55	15-25	-----	NP	>20.0	0.06-0.08	6.1-6.5
95-100	85-95	75-85	50-60	15-30	5-10	0.63-2.0	0.12-0.14	5.6-6.0
70-85	65-80	60-75	50-65	35-50	15-30	<0.06	0.04-0.06	5.1-5.5
80-95	75-85	70-80	50-60	15-30	5-10	0.63-2.0	0.12-0.14	5.1-5.5
100	95-100	85-95	35-50	-----	NP	2.0-6.3	0.11-0.13	5.6-6.5
100	95-100	90-100	60-70	30-40	20-30	<0.06	0.04-0.06	7.9-8.4
100	90-100	90-100	40-60	25-35	15-25	0.2-0.63	0.14-0.16	7.9-8.4
95-100	90-100	70-85	35-45	-----	NP	2.0-6.3	0.11-0.13	5.6-6.5
95-100	90-100	75-95	45-55	25-35	10-20	0.2-0.63	0.14-0.16	6.1-7.3
75-85	70-80	50-60	20-30	-----	NP	2.0-6.3	0.09-0.11	5.6-6.5
75-85	70-80	55-70	25-45	25-35	10-20	0.2-0.63	0.12-0.14	6.1-7.3

TABLE 14.--ESTIMATES OF SOIL PROPERTIES

Soil series and map symbols	Depth to hard rock or hardpan	Depth from surface (typical profile)	Classification			Percent greater than 3 inches
			Dominant USDA texture	Unified	AASHO	
	<u>Ft.</u>	<u>In.</u>				
*Redding: RdC----- Same estimates for ReE and RfF, but percent greater than 3 inches is 30 to 45 for the 0- to 15-inch layer and 40 to 50 for the 15- to 30-inch layer.	1-3½	0-15	Gravelly loam-----	SM or SC	A-4	0
		15-30	Gravelly clay-----	CL	A-7	0
		30-45	Indurated hardpan-----	-----	-----	-----
Reiff: RkA, RkB, RkC-----	>5	0-60	Fine sandy loam and sandy loam.	SM	A-4	0
Rositas: RoA, RrC, RsA, RSC, RsD.	>5	0-60	Fine gravelly loamy coarse sand.	SM	A-1 or A-2	0
Salinas: SbA, SbC-----	>5	0-64	Clay loam-----	CL or ML	A-6 or A-7	0
		0-46 46-60	Clay----- Clay loam-----	CH CL or ML	A-7 A-6 or A-7	0 0
*San Miguel: SmE, SnG----- For Exchequer part of SnG, see Exchequer series.	1-3	0-8	Silt loam-----	ML	A-4	0
		8-23	Clay-----	CH	A-7	0
		23	Metabasic rock.			
Sheephead: SpE2, SpG2-----	1½-4½	0-8	Cobbly fine sandy loam.	SM	A-4	15-25
		8-51	Very stony fine sandy loam.	SM	A-1	40-70
		51	Weathered mica schist.			
Soboba: SsE-----	>5	0-60	Stony and very stony loamy sand.	GM or SM	A-1	20-45
Stockpen: SuA, SuB-----	>5	0-21	Gravelly clay-----	CH	A-7	0
		21-60	Clay-----	CH	A-7	0
Tollhouse: ToE2, ToG-----	½-1½	0-16 16	Coarse sandy loam---- Granodiorite.	SM	A-2	0

See footnote at end of table.

SIGNIFICANT IN ENGINEERING--Continued

Percentage passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plasticity index			
				<u>Pct.</u>	<u>Pct.</u>	<u>In./hr.</u>	<u>In./in. of soil</u>	<u>pH</u>
75-90	70-85	55-70	35-50	15-30	5-10	0.63-2.0	0.09-0.11	5.1-6.0
75-95	75-90	75-85	60-75	40-50	15-30	<0.06	0.04-0.06	4.5-5.0
-----	-----	-----	-----	-----	-----	<0.06	-----	-----
100	100	70-85	40-50	-----	NP	2.0-6.3	0.13-0.15	6.1-8.4
65-100	60-100	35-60	10-30	-----	NP	6.3-20.0	0.05-0.08	7.4-8.4
100	100	90-100	75-85	30-45	10-25	0.2-0.63	0.19-0.21	6.6-8.4
100	100	90-100	75-85	50-70	25-40	0.06-0.2	0.14-0.16	6.6-8.4
100	100	90-100	75-85	30-45	10-25	0.2-0.63	0.19-0.21	7.9-8.4
100	100	90-100	70-80	20-30	0-10	0.63-2.0	0.13-0.16	5.1-6.0
85-100	80-95	70-90	60-85	50-60	25-35	0.06-0.2	0.13-0.15	4.5-5.5
85-95	80-90	65-75	35-45	-----	NP	2.0-6.3	0.11-0.13	6.1-6.5
60-70	55-65	40-50	10-20	-----	NP	2.0-6.3	0.05-0.07	5.6-6.0
45-65	40-60	20-40	10-20	-----	NP	>20.0	0.03-0.05	6.6-7.3
70-80	65-75	60-70	50-65	50-65	30-40	0.06-0.2	0.12-0.14	6.1-8.4
70-95	65-90	60-85	55-80	50-65	30-40	<0.06	0.03-0.05	7.9-8.4
90-100	85-95	50-60	20-30	-----	NP	6.3-20.0	0.10-0.12	6.1-7.3

TABLE 14.--ESTIMATES OF SOIL PROPERTIES

Soil series and map symbols	Depth to hard rock or hardpan	Depth from surface (typical profile)	Classification			Percent greater than 3 inches
			Dominant USDA texture	Unified	AASHO	
	<u>Ft.</u>	<u>In.</u>				
Tujunga: TuB-----	>5	0-60	Sand-----	SP	A-1	0
Visalia: VaA, VaB, VaC, VaD-----	>5	0-40	Sandy loam-----	SM or SC	A-2 or A-4	0
		40-60	Loam-----	ML	A-4	0
VbB, VbC-----	>5	0-40	Gravelly sandy loam--	SM or SC	A-2	0
		40-60	Gravelly loam-----	ML	A-4	0
Vista: VsC, VsD, VsD2, VsE, VsE2, VsG, VvD, VvE, VvG.	1½-4	0-35	Coarse sandy loam and sandy loam.	SM or SC	A-2	0
		35	Decomposed grandio- rite.			
Wyman: WmB, WmC, WmD-----	>5	0-13	Loam-----	ML	A-4	0
		13-67	Clay loam-----	CL	A-6	0

1/
Nonplastic.

SIGNIFICANT IN ENGINEERING--Continued

Percentage passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plasticity index			
				<u>Pct.</u>	<u>Pct.</u>	<u>In./hr.</u>	<u>In./in. of soil</u>	<u>pH</u>
90-100	85-95	40-50	0-5	-----	NP	>20.0	0.05-0.07	6.6-7.3
95-100	90-100	70-80	30-40	10-30	5-10	2.0-6.3	0.11-0.13	6.1-6.5
100	100	85-95	65-75	20-35	5-10	0.63-2.0	0.16-0.18	6.1-6.5
75-85	70-80	50-60	20-30	10-30	5-10	2.0-6.3	0.09-0.11	6.1-6.5
75-85	70-80	60-70	50-60	20-35	5-10	0.63-2.0	0.13-0.15	6.1-6.5
80-100	75-95	45-60	20-35	20-30	0-10	2.0-6.3	0.10-0.13	6.1-7.3
100	95-100	80-90	50-65	20-35	5-10	0.63-2.0	0.16-0.18	6.1-7.3
100	95-100	80-95	60-75	30-40	10-20	0.2-0.63	0.19-0.21	6.6-7.3

moisture content. Soil in earthwork is most stable if it is compacted to about maximum dry density when it is at the optimum moisture content.

Liquid Limit and Plasticity Index (Atterberg Limits).--Tests for plastic limit and liquid limit measure the effect of water on the consistence of the soil. As the moisture content of a plastic, or clayey soil increases from a dry state, the soil changes from a semisolid state to a plastic state. As the moisture content is further increased, the material changes from a plastic state to a liquid state. The plastic limit is the moisture content at which the material passes from a semisolid state to a plastic state. The liquid limit is the moisture content at which the soil passes from a plastic state to a liquid state. The plasticity index is the numerical difference between the liquid limit and plastic limit. It indicates the range in moisture content within which the soil is in a plastic condition. Moisture content, liquid limit, and plasticity index are expressed as a percentage of dry weight of the soil. Atterberg limits do not apply to predominately gravelly or sandy soils.

Estimates of Soil Properties Significant in Engineering

Estimated properties of the soils are shown in table 14. The estimates are based on test results given in table 13, on field examination, and on experience with soils within the Area and with similar soils elsewhere. Because these estimates are for typical soils, some variation from the estimated values should be expected.

Permeability refers only to movement of water downward through undisturbed and uncompacted soil.

It does not include lateral seepage. The estimates are based on soil characteristics that influence the porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available water capacity is 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. In table 14, it is commonly expressed as inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Engineering Interpretations

Table 16 rates the suitability of soils for topsoil and road fill and their limitations for road location and water-retention structures. Terms used in the table are explained in the following paragraphs.

Topsoil.--The suitability of each soil for topsoil is rated good, fair, or poor in table 16. Topsoil is borrow material used in establishing vegetation on road shoulders, waterways, eroded slopes, construction sites, golf fairways, and other disturbed areas. The soils are rated on their ability to support an erosion-resistant cover of common species of plants. The requirements of special plants, such as those used for golf greens, are not considered. The accessibility of suitable material and the presence of weeds, soilborne diseases, and insects also are not considered in the ratings. Criteria for rating soils as a source of topsoil are given in table 15.

TABLE 15.--CRITERIA FOR RATING SOILS AS A SOURCE OF TOPSOIL

Soil properties or qualities affecting suitability	Suitability		
	Good	Fair	Poor
Texture (USDA)-----	Sandy loam, fine sandy loam, very fine sandy loam, or loam.	Clay loam, sandy clay loam, or silt loam.	Sands, loamy sands, silty clay loam, silty clay, or clay.
Gravel content-----	Less than 15 percent--	15 to 35 percent-----	More than 35 percent.
Cobblestones and stones---	None-----	Less than 3 percent-----	More than 3 percent.
Reaction (pH)-----	6.1 through 7.8-----	5.1 to 6.0 or 7.9 to 8.4-	Less than 5.0 or more than 8.4.
Salinity EC saturation extract (mmhos./cm.)	Less than 4-----	4 to 8-----	More than 8.
Thickness of soil material in place.	More than 40 inches---	40 to 20 inches-----	Less than 20 inches.

TABLE 16.--ENGINEERING INTERPRETATIONS

[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 mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table. Only the most limiting feature or soil horizon is listed for each specific interpretation. No attempt was made to allow for a range in interpretative ratings. No interpretations are given for Urban land and other land types, all of which are highly variable and require onsite investigation]

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Altamont: AtC-----	Poor: clay---	Poor: A-7----	Severe: CH, A-7.	Moderate: 3 to 5 feet to rock; slope.	Moderate: CH.
AtD, AtD2, AtE, AtE2, AtF----	Poor: clay---	Poor: A-7----	Severe: CH, A-7; slope.	Severe: slope-	Moderate: CH.
Anderson: AuC-----	Poor: very gravelly sandy loam.	Good-----	Slight-----	Severe: moderately rapid permeability.	Severe: GM.
AuF-----	Poor: very gravelly sandy loam.	Good-----	Severe: slope.	Severe: moderately rapid permeability; slope.	Severe: GM.
Arlington: AvC-----	Fair: 2 to 3 1/2 feet to weak hardpan.	Good-----	Slight-----	Moderate: slope.	Severe: SM, less than 35 percent fines.
Auld: AwC-----	Poor: clay---	Poor: A-7----	Severe: CH, A-7.	Moderate: 3 to 5 feet to rock.	Moderate: CH.
AwD-----	Poor: clay---	Poor: A-7----	Severe: CH, A-7; slope.	Severe: slope-	Moderate: CH.
AyE-----	Poor: stony clay.	Poor: A-7----	Severe: CH, A-7; slope; 15 to 25 percent stones.	Severe: slope; 15 to 25 percent stones.	Moderate: CH.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Bancas: BbE-----	Poor: stony loam and clay loam.	Fair to poor: A-4 or A-6.	Severe: slope.	Severe: slope.	Moderate: ML or CL; clay loam.
BbE2, BbG-----	Poor: stony loam and clay loam.	Fair to poor: A-4 or A-6.	Severe: slope.	Severe: slope.	Moderate: ML or CL.
BbG2-----	Poor: stony loam and clay loam.	Poor: A-6----	Severe: slope.	Severe: slope.	Moderate: ML or CL.
Blasingame: BeE, BgE, BgF-----	Fair: 1 1/2 to 3 feet to rock.	Poor: A-6----	Severe: slope.	Severe: slope.	Slight.
*Bonsall: B1C, B1C2-----	Fair: sandy loam over clay loam.	Good to poor: A-2, A-4, or A-7.	Severe: CL, A-7.	Moderate: 4 to 5 feet to rock; slope.	Slight.
B1D2-----	Fair: sandy loam over clay loam.	Good to poor: A-2, A-4, or A-7.	Severe: CL, A-7.	Severe: slope.	Slight.
BmC-----	Fair: sandy loam over clay loam.	Good to poor: A-2, A-4, or A-7.	Severe: CL, A-7.	Moderate: slope.	Slight.
BnB----- For Fallbrook part of BnB, see Fallbrook FaB, FaC, FaC2.	Fair: sandy loam over clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: CL, A-7.	Moderate: 4 to 5 feet to rock; slope.	Slight.
Boomer: BoC-----	Fair: loam over clay loam.	Fair to poor: A-4 or A-6.	Severe: ML or CL, A-4 or A-6.	Moderate: 3 to 4 1/2 feet to rock; slope.	Moderate: ML or CL.
BoE-----	Fair: loam over clay loam.	Fair to poor: A-4 or A-6.	Severe: ML or CL, A-4 or A-6; slope.	Severe: slope.	Moderate: ML or CL.
BrE, BrG-----	Poor: stony loam over stony clay loam.	Fair to poor: A-4 or A-6.	Severe: ML or CL, A-4 or A-6; slope.	Severe: slope.	Moderate: ML or CL.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Bosanko: BsC, BsD, BsE-----	Poor: clay---	Poor: A-7----	Severe: CL, A-7.	Severe: 1 1/2 to 3 feet to rock.	Slight.
BtC-----	Poor: stony clay.	Poor: A-7----	Severe: CL, A-7.	Severe: 1 1/2 to 3 feet to rock; 15 to 25 percent stones.	Slight.
Bull Trail: BuB, BuC-----	Fair: sandy loam over sandy clay loam.	Good to fair: A-2 or A-4.	Moderate: SM or SC, A-2 or A-4.	Moderate: slope.	Severe: SM, less than 35 percent fines.
BuD2-----	Fair: sandy loam over sandy clay loam.	Good to fair: A-2 or A-4.	Moderate: SM or SC, A-2 or A-4; slope.	Severe: slope.	Severe: SM, less than 35 percent fines.
BuE2-----	Fair: sandy loam over sandy clay loam.	Good to fair: A-2 or A-4.	Severe: slope.	Severe: slope.	Severe: SM, less than 35 percent fines.
Calpine: CaB, CaC, CaC2-----	Fair: coarse sandy loam over gravel- ly loamy sand.	Good-----	Slight-----	Severe: moderately rapid per- meability.	Severe: SM, less than 35 percent fines.
CaD2-----	Fair: coarse sandy loam over gravel- ly loamy sand.	Good-----	Moderate: slope.	Severe: moderately rapid per- meability; slope.	Severe: SM, less than 35 percent fines.
Carlsbad: CbB, CbC-----	Poor: gravelly loamy sand.	Good-----	Slight-----	Moderate: slope.	Severe: SM, less than 35 percent fines.
CbD-----	Poor: gravelly loamy sand.	Good-----	Moderate: slope.	Severe: slope.	Severe: SM, less than 35 percent fines.
CbE-----	Poor: gravelly loamy sand.	Good-----	Severe: slope.	Severe: slope.	Severe: SM, less than 35 percent fines.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Carrizo: CeC-----	Poor: very gravelly sand.	Good-----	Slight-----	Severe: very rapid permeability.	Severe: GP or GW.
Chesterton: CfB, CfC-----	Poor: 2 to 3 feet to hardpan.	Fair to poor: A-4 or A-6.	Severe: CL, A-6.	Moderate: slope.	Moderate: SM, more than 35 percent fines.
CfD2-----	Poor: 2 to 3 feet to hardpan.	Fair to poor: A-4 or A-6.	Severe: CL, A-6.	Severe: slope.	Moderate: SM, more than 35 percent fines.
Chino: ChA, ChB-----	Fair: fine sandy loam over clay loam.	Fair to poor: A-4 or A-6.	Severe: mostly CL, A-6.	Moderate: moderate permeability.	Slight.
CkA-----	Poor: saline--	Fair to poor: A-4 or A-6.	Severe: CL or ML, A-4 or A-6.	Moderate: moderate permeability.	Moderate: ML or CL.
*Cieneba: C1D2, C1E2, C1G2, CmE2, CmrG, CnE2, CnG2. For Fallbrook part of CnE2 and CnG2, see Fallbrook FeE, FeE2.	Poor: 1/2 to 1 1/2 feet to rock; rocky.	Good-----	Severe: 1/2 to 1 1/2 feet to rock; rocky.	Severe: rapid permeability.	Severe: SM, less than 35 percent fines.
Corralitos: CsB, CsC-----	Poor: loamy sand over sand.	Good-----	Slight-----	Severe: rapid permeability.	Severe: SM, less than 35 percent fines; SP, SW.
CsD-----	Poor: loamy sand over sand.	Good-----	Moderate: slope.	Severe: rapid permeability; slope.	Severe: SM, less than 35 percent fines; SP, SW.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Crouch:					
CtE-----	Fair: coarse sandy loam; 3 1/2 to 5 feet to rock.	Good-----	Severe: slope.	Severe: moderately rapid permeability; slope.	Severe: SM, less than 35 percent fines.
CtF-----	Fair: coarse sandy loam; 3 to 5 feet to rock.	Good-----	Severe: slope.	Severe: moderately rapid permeability; slope.	Severe: SM, less than 35 percent fines.
CuE, CuG-----	Fair: coarse sandy loam; 3 to 5 feet to rock; rocky.	Good-----	Severe: slope.	Severe: moderately rapid permeability; slope.	Severe: SM, less than 35 percent fines.
CvG-----	Fair: fine sandy loam; 3 to 5 feet to rock; 15 to 25 percent stones.	Good-----	Severe: slope.	Severe: moderately rapid permeability; slope.	Severe: SM, less than 35 percent fines.
*Diablo:					
DaC, DaD, DaE, DaE2-----	Poor: clay; 1 1/2 to 3 feet to rock.	Poor: A-7----	Severe: CH, A-7.	Severe: 1 1/2 to 3 feet to rock.	Moderate: CH.
DaF-----	Poor: clay; 1 1/2 to 3 feet to rock.	Poor: A-7----	Severe: CH, slope.	Severe: 1 1/2 to 3 feet to rock; slope.	Moderate: CH.
DoE----- For Olivenhain part of DoE, see Olivenhain OhE, OhF.	Poor: clay; 1 1/2 to 3 feet to rock.	Poor: A-7----	Severe: CH, A-7; slope.	Severe: 1 1/2 to 3 feet to rock; slope.	Moderate: CH.
Elder: EdC-----	Fair: shaly fine sandy loam.	Good to fair: A-2 or A-4.	Moderate: SM, A-2 or A-4.	Severe: moderately rapid permeability.	Moderate: SM, more than 35 percent fines.
Escondido:					
EsC-----	Fair: 1 1/2 to 3 feet to rock.	Fair: A-4---	Moderate: ML, A-4.	Moderate: moderate permeability; slope.	Moderate: ML.
EsD2-----	Fair: 1 1/2 to 3 feet to rock.	Fair: A-4---	Moderate: ML, A-4; slope.	Severe: slope.	Moderate: ML.
EsE2-----	Fair: 1 1/2 to 3 feet to rock.	Fair: A-4---	Severe: slope.	Severe: slope.	Moderate: ML.
EvC-----	Good-----	Fair: A-4---	Moderate: ML, A-4.	Moderate: moderate permeability; slope.	Moderate: ML.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Exchequer: ExE, ExG-----	Poor: 1/2 to 1 foot to rock; rocky.	Fair to poor: A-4 or A-6.	Severe: 1/2 to 1 foot to rock; slope.	Severe: 1/2 to 1 foot to rock; slope.	Moderate: ML or CL.
* Fallbrook: FaB, FaC, FaC2-----	Fair: sandy loam over sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: CL, A-6.	Moderate: moderate permeability; slope.	Moderate: SM, more than 35 percent fines.
FaD2, FaE2, FaE3-----	Fair: sandy loam over sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: CL, A-6.	Severe: slope.	Moderate: SM, more than 35 percent fines.
FeC-----	Fair: sandy loam over sandy clay loam; rocky.	Good to poor: A-2, A-4, or A-6.	Severe: CL, A-6; slope.	Moderate: moderate permeability; slope.	Moderate: SM, more than 35 percent fines.
FeE, FeE2-----	Fair: sandy loam over sandy clay loam; rocky.	Good to poor: A-2, A-4, or A-6.	Severe: CL, A-6; slope.	Severe: slope.	Moderate: SM, more than 35 percent fines.
FvD, FvE----- For Vista part of FvD, see Vista VsD2. For Vista part of FvE, see Vista VsE, VsE2, VsG.	Fair: sandy loam over sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: CL, A-6; slope.	Severe: slope.	Moderate: SM, more than 35 percent fines.
Friant: FwF-----	Poor: 1/4 to 1 1/2 feet to rock.	Fair: A-4---	Severe: 1/4 to 1 1/2 feet to rock; slope.	Severe: 1/4 to 1 1/2 feet to rock; slope.	Moderate: SM, more than 35 percent fines.
FxE, FxG-----	Poor: 1/4 to 1 1/2 feet to rock; rocky.	Fair: A-4---	Severe: 1/4 to 1 1/2 feet to rock; slope.	Severe: 1/4 to 1 1/2 feet to rock; slope.	Moderate: SM, more than 35 percent fines.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Gaviota: GaE, GaF-----	Poor: 1 to 1 1/2 feet to rock.	Good to fair: A-2 or A-4.	Severe: 1 to 1 1/2 feet to rock; slope.	Severe: 1 to 1 1/2 feet to rock; slope.	Moderate: SM, more than 35 percent fines.
Grangeville: GoA-----	Fair: pH 7.9 to 8.4; calcareous.	Fair: A-4---	Moderate: SM, A-4.	Severe: moderately rapid permeability.	Moderate: SM, more than 35 percent fines.
Greenfield: GrA, GrB-----	Fair: sandy loam over loamy coarse sand.	Good to fair: A-1, A-2, or A-4.	Moderate: SM, A-2 or A-4.	Severe: moderately rapid over rapid permeability.	Severe: SM, 15 to 40 percent fines.
GrC-----	Fair: sandy loam over loamy coarse sand.	Good to fair: A-1, A-2, or A-4.	Moderate: SM, A-2 or A-4.	Severe: moderately rapid permeability.	Severe: SM, 15 to 40 percent fines.
GrD-----	Fair: sandy loam over loamy coarse sand.	Good to fair: A-1, A-2, or A-4.	Moderate: SM, A-2 or A-4.	Severe: moderately rapid permeability; slope.	Severe: SM, 15 to 40 percent fines.
Hambright: HaG-----	Poor: 1 to 1 1/2 feet to rock.	Poor: A-6---	Severe: GC or CL, A-6; slope.	Severe: 1 to 1 1/2 feet to rock; slope.	Slight.
Holland: HmD-----	Fair: fine sandy loam over sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: SC or CL, A-6.	Severe: slope.	Moderate: SM, mostly more than 35 percent fines.
HmE-----	Fair: fine sandy loam over sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: SC or CL, A-6; slope.	Severe: slope.	Moderate: SM, mostly more than 35 percent fines.
HnE, HnG-----	Poor: stony fine sandy loam over stony sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: SC or CL, A-6; slope.	Severe: slope.	Moderate: SM, mostly more than 35 percent fines.
HoC-----	Fair: fine sandy loam over sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: SC or CL, A-6.	Moderate: slope.	Moderate: SM, mostly more than 35 percent fines.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Huerhuero:					
HrC, HrC2-----	Poor: loam over clay.	Fair to poor: A-4 or A-6.	Severe: CL, A-6.	Moderate: slope.	Moderate: ML over SM.
HrD, HrD2-----	Poor: loam over clay.	Fair to poor: A-4 or A-6.	Severe: CL, A-6.	Severe: slope.	Moderate: ML over SM.
HrE2-----	Poor: loam over clay.	Fair to poor: A-4 or A-6.	Severe: CL, A-6; slope.	Severe: slope.	Moderate: ML over SM.
Indio:					
InA, InB-----	Fair: silt loam.	Fair: A-4--	Moderate: ML, A-4.	Moderate: moderate permeability; ML, silt loam.	Moderate: ML.
IoA-----	Poor: saline.	Fair: A-4--	Moderate: ML, A-4.	Moderate: moderate permeability; ML, silt loam.	Moderate: ML.
IsA-----	Fair: silt loam.	Fair: A-4--	Moderate: ML, A-4.	Moderate: moderate permeability; ML, silt loam.	Moderate: ML.
Kitchen Creek:					
KcC-----	Poor: loamy coarse sand over coarse sandy loam.	Good-----	Slight-----	Severe: moderately rapid permeability.	Severe: SM, less than 35 percent fines.
KcD2-----	Poor: loamy coarse sand over coarse sandy loam.	Good-----	Moderate: slope.	Severe: moderately rapid permeability; slope.	Severe: SM, less than 35 percent fines.
* La Posta:					
LaE2, LaE3-----	Poor: loamy coarse sand.	Good-----	Severe: slope.	Severe: rapid permeability; slope.	Severe: SM, less than 35 percent fines.
LcE, LcE2, LcF2-----	Poor: loamy coarse sand; rocky.	Good-----	Severe: slope.	Severe: rapid permeability; slope.	Severe: SM, less than 35 percent fines.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
La Posta (continued)					
LdE-----	Poor: loamy coarse sand; rocky.	Good-----	Severe: slope.	Severe: rapid permeability; slope.	Severe: SM; loamy coarse sand.
LdG----- For Sheephead part of LdE and LdG, see Sheephead SpE2, SpG2.	Poor: loamy coarse sand; rocky.	Good-----	Severe: slope.	Severe: rapid permeability; slope.	Severe: SM, less than 35 percent fines.
Las Flores:					
LeC, LeC2-----	Poor: loamy fine sand over sandy clay.	Good to poor: A-1, A-2, or A-7.	Severe: CL or CH, A-7.	Moderate: slope.	Severe: SM, less than 35 percent fines.
LeD, LeD2, LeE, LeE2, LeE3---	Poor: loamy fine sand over sandy clay.	Good to poor: A-1, A-2, or A-7.	Severe: CL or CH, A-7.	Severe: slope.	Severe: SM, less than 35 percent fines.
Las Posas:					
LpB, LpC, LpC2, LpD2, LpE2---	Poor: mostly clay.	Poor: A-7---	Severe: CH, A-7.	Severe: 2 to 3 1/2 feet to rock.	Moderate: CH.
LrE, LrE2, LrG-----	Poor: mostly clay; stony surface.	Poor: A-7---	Severe: CH, A-7; slope.	Severe: 2 to 3 1/2 feet to rock; slope.	Moderate: CH.
Linne: LsE, LsF-----	Fair: clay loam.	Poor: A-6---	Severe: CL, A-6; slope.	Severe: 2 to 3 1/2 feet to rock; slope.	Slight.
Marina:					
M1C-----	Poor: loamy coarse sand over sand.	Good-----	Slight-----	Severe: very rapid permeability.	Severe: SM, less than 35 percent fines, or SW.
M1E-----	Poor: loamy coarse sand over sand.	Good-----	Severe: slope.	Severe: very rapid permeability; slope.	Severe: SM, less than 35 percent fines, or SW.
Mecca:					
MnA, MnB, MpA2-----	Good-----	Good-----	Slight-----	Severe: moderately rapid permeability.	Severe: SM, less than 35 percent fines.
MoA-----	Fair: saline.	Good-----	Slight-----	Severe: moderately rapid permeability.	Severe: SM, less than 35 percent fines.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Mottsville: MvA, MvC-----	Poor: loamy coarse sand.	Good-----	Slight-----	Severe: very rapid permeability.	Severe: SM, less than 35 percent fines.
MvD-----	Poor: loamy coarse sand.	Good-----	Moderate: slope.	Severe: very rapid permeability; slope.	Severe: SM, less than 35 percent fines.
MxA-----	Poor: loamy coarse sand.	Good-----	Severe: seasonal high water table.	Severe: very rapid permeability.	Severe: SM, less than 35 percent fines.
Olivenhain: OhC-----	Poor: cobbly loam over very cobbly clay.	Fair to poor: A-4, A-6, or A-7.	Severe: CL, A-6 or A-7.	Severe: 30 to 60 percent cobbles.	Moderate: ML or CL.
OhE, OhF-----	Poor: cobbly loam over very cobbly clay.	Fair to poor: A-4, A-6, or A-7.	Severe: CL, A-6 or A-7; slope.	Severe: slope.	Moderate: ML or CL.
Placentia: PeA-----	Poor: sandy loam over sandy clay.	Fair to poor: A-4 or A-6.	Severe: CL or SC, A-6.	Slight-----	Slight: mostly CL or SC.
PeC, PeC2-----	Poor: sandy loam over sandy clay.	Fair to poor: A-4 or A-6.	Severe: CL or SC, A-6.	Moderate: slope.	Slight: mostly CL or SC.
PeD2-----	Poor: sandy loam over sandy clay.	Fair to poor: A-4 or A-6.	Severe: CL or SC, A-6.	Severe: slope.	Slight: mostly CL or SC.
PfA-----	Fair: sandy loam over sandy clay.	Fair to poor: A-4 or A-6.	Severe: CL or SC, A-6.	Slight-----	Moderate: SM, more than 35 percent fines.
PfC-----	Fair: sandy loam over sandy clay.	Fair to poor: A-4 or A-6.	Severe: CL or SC, A-6.	Moderate: slope.	Moderate: SM, more than 35 percent fines.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Ramona:					
RaA-----	Fair: sandy loam over sandy clay loam.	Fair to poor: A-4 or A-6.	Severe: CL or SC, A-6.	Slight-----	Moderate: SM, more than 35 percent fines.
RaB, RaC, RaC2-----	Fair: sandy loam over sandy clay loam.	Fair to poor: A-4 or A-6.	Severe: CL or SC, A-6.	Moderate: slope.	Moderate: SM, more than 35 percent fines.
RaD2-----	Fair: sandy loam over sandy clay loam.	Fair to poor: A-4 or A-6.	Severe: CL or SC, A-6.	Severe: slope.	Moderate: SM, more than 35 percent fines.
RcD-----	Fair: gravelly sandy loam over gravelly sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: CL or SC, A-6.	Severe: slope.	Moderate: SM, more than 35 percent fines.
RcE-----	Fair: gravelly sandy loam over gravelly sandy clay loam.	Good to poor: A-2, A-4, or A-6.	Severe: CL or SC, A-6; slope.	Severe: slope.	Moderate: SM, more than 35 percent fines.
Redding:					
RdC-----	Poor: gravelly loam over gravelly clay.	Fair to poor: A-4 or A-7.	Severe: ML or CL, A-7.	Moderate: slope.	Moderate: SC or SM, more than 35 percent fines.
ReE, RfF-----	Poor: cobbly loam over cobbly clay.	Fair to poor: A-4 or A-7.	Severe: ML or CL, A-7; slope.	Severe: slope.	Moderate: SC or SM, more than 35 percent fines.
Reiff: RkA, RkB, RkC-----	Good-----	Fair: A-4---	Moderate: SM, A-4.	Severe: moderately rapid permeability.	Moderate: SM, more than 35 percent fines.
Rositas:					
RoA, RrC, RsA, RsC-----	Poor: mostly gravelly loamy coarse sand.	Good-----	Slight-----	Severe: rapid permeability.	Severe: SM, less than 35 percent fines.
RSD-----	Poor: mostly gravelly loamy coarse sand.	Good-----	Moderate: slope.	Severe: rapid permeability.	Severe: SM, less than 35 percent fines.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Salinas:					
SbA-----	Fair: clay loam.	Poor: A-6 or A-7.	Severe: ML or CL, A-6 or A-7.	Slight-----	Moderate: ML or CL.
SbC-----	Fair: clay loam.	Poor: A-6 or A-7.	Severe: ML or CL, A-6 or A-7.	Moderate: slope.	Moderate: ML or CL.
ScA-----	Poor: clay--	Poor: A-7---	Severe: CH, A-7.	Slight-----	Moderate: CH.
ScB-----	Poor: clay--	Poor: A-7---	Severe: CH, A-7.	Moderate: slope.	Moderate: CH.
* San Miguel: SmE, SnG----- For Exchequer part of SnG, see Exchequer ExE, ExG.	Poor: silt loam over clay; rocky.	Fair to poor: A-4 or A-7.	Severe: CH, A-7; slope.	Severe: 1 to 3 feet to rock; slope.	Moderate: CH.
Sheephead: SpE2, SpG2-----	Poor: mostly very stony fine sandy loam.	Fair to good: A-4 or A-1.	Severe: slope.	Severe: 15 to 55 percent stones; slope.	Severe: SM, mostly less than 35 percent fines.
Soboba: SsE-----	Poor: very stony loamy sand.	Good-----	Severe: 15 to 30 percent stones.	Severe: very rapid permeability; slope.	Severe: GM or SM, less than 35 percent fines.
Stockpen:					
SuA-----	Poor: gravelly clay and clay.	Poor: A-7---	Severe: CH, A-7.	Slight-----	Moderate: CH.
SuB-----	Poor: gravelly clay and clay.	Poor: A-7---	Severe: CH, A-7.	Moderate: slope.	Moderate: CH.
Tollhouse: ToE2, ToG-----	Poor: 1/2 to 1 1/2 feet to rock; rocky.	Good-----	Severe: 1/2 to 1 1/2 feet to rock; slope.	Severe: 1/2 to 1 1/2 feet to rock; slope.	Severe: SM, less than 35 percent fines.
Tujunga: TuB-----	Poor: sand---	Good-----	Slight-----	Severe: very rapid permeability.	Severe: SP.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Visalia:					
VaA-----	Good-----	Good to fair: A-2 or A-4.	Moderate: SM or SC, A-2 or A-4.	Moderate: moderate per- meability.	Severe: SC or SM, 30 to 40 percent fines.
VaB, VaC-----	Good-----	Good to fair: A-2 or A-4.	Moderate: SM or SC, A-2 or A-4.	Moderate: moderate per- meability; slope.	Severe: SC or SM, 30 to 40 percent fines.
VaD-----	Good-----	Good to fair: A-2 or A-4.	Moderate: SM or SC, A-2 or A-4.	Severe: slope.	Severe: SC or SM, 30 to 40 percent fines.
VbB, VbC-----	Fair: grav- elly sandy loam over gravelly loam.	Good to fair: A-2 or A-4.	Slight-----	Moderate: moderate per- meability; slope.	Severe: SC or SM, less than 35 percent fines.
Vista:					
VsC, VsD-----	Fair: 2 to 4 feet to rock.	Good-----	Moderate: 2 to 4 feet to rock.	Severe: moderately rapid per- meability.	Severe: SM, less than 35 percent fines.
VsD2-----	Fair: 1 1/2 to 3 1/2 feet to rock.	Good-----	Moderate: 1 1/2 to 3 1/2 feet to rock.	Severe: moderately rapid per- meability.	Severe: SM, less than 35 percent fines.
VsE, VsE2, VsG-----	Fair: 1 1/2 to 3 1/2 feet to rock.	Good-----	Severe: slope.	Severe: moderately rapid per- meability; slope.	Severe: SM, less than 35 percent fines.
VvD-----	Fair: 1 1/2 to 3 feet to rock; rocky.	Good-----	Moderate: 1 1/2 to 3 feet to rock.	Severe: moderately rapid per- meability; slope.	Severe: SM, less than 35 percent fines.
VvE-----	Fair: 1 1/2 to 3 feet to rock.	Good-----	Severe: slope.	Severe: moderately rapid per- meability; slope.	Severe: SM, less than 35 percent fines.
VvG-----	Fair: 1 1/2 to 2 1/2 feet to rock.	Good-----	Severe: slope.	Severe: moderately rapid per- meability; slope.	Severe: SM, less than 35 percent fines.

TABLE 16.--ENGINEERING INTERPRETATIONS--Continued

Soil series and map symbols	Suitability for--		Degree and kind of limitation for--		
	Topsoil	Road fill	Road location	Water retention structures	
				Floor	Embankment
Wyman: WmB, WmC-----	Fair: loam over clay loam.	Fair to poor: A-4 or A-6.	Severe: CL, A-6.	Moderate: slope.	Moderate: ML or CL.
WmD-----	Fair: loam over clay loam.	Fair to poor: A-4 or A-6.	Severe: CL, A-6.	Severe: slope.	Moderate: ML or CL.



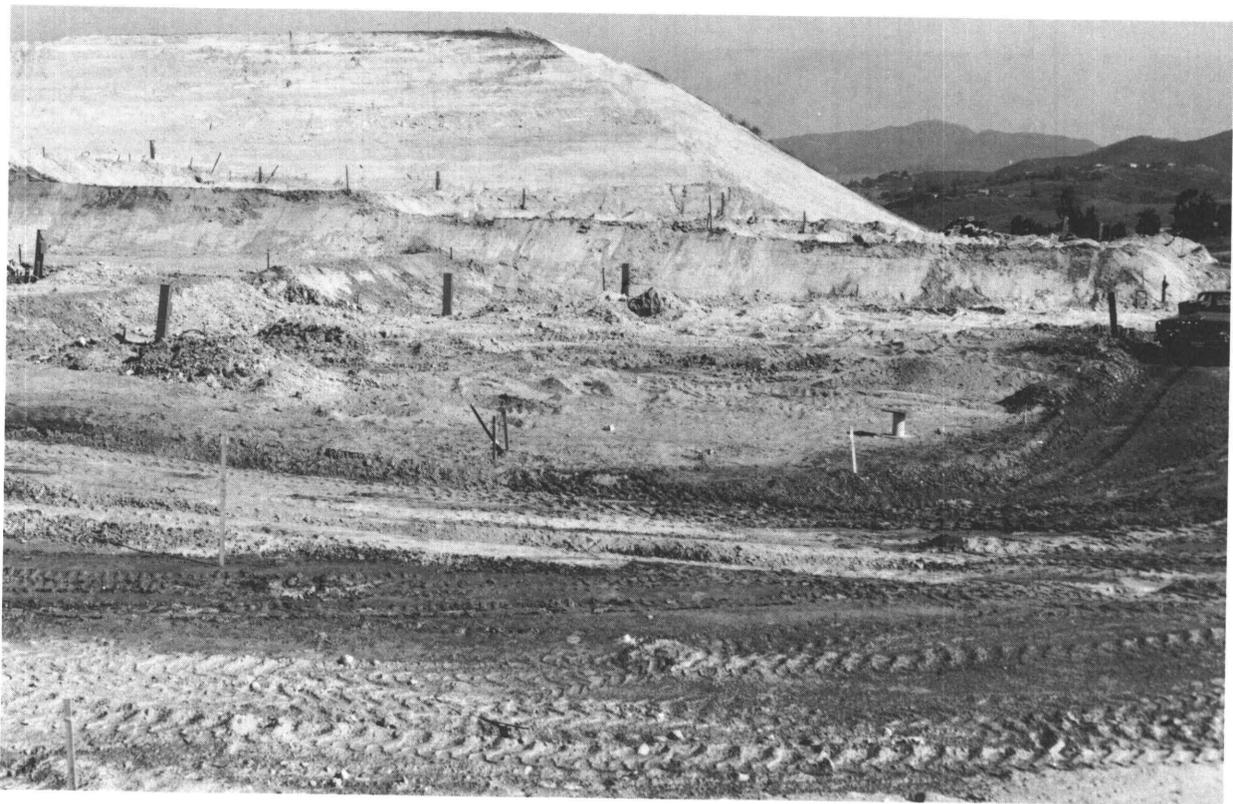
Damaged driveway, buckling curb and street. The soil is a Diablo clay.



House and garage, built on a Diablo clay, badly damaged as a result of soil shrinking and swelling.



Runoff from surrounding soils floods area near Escondido.



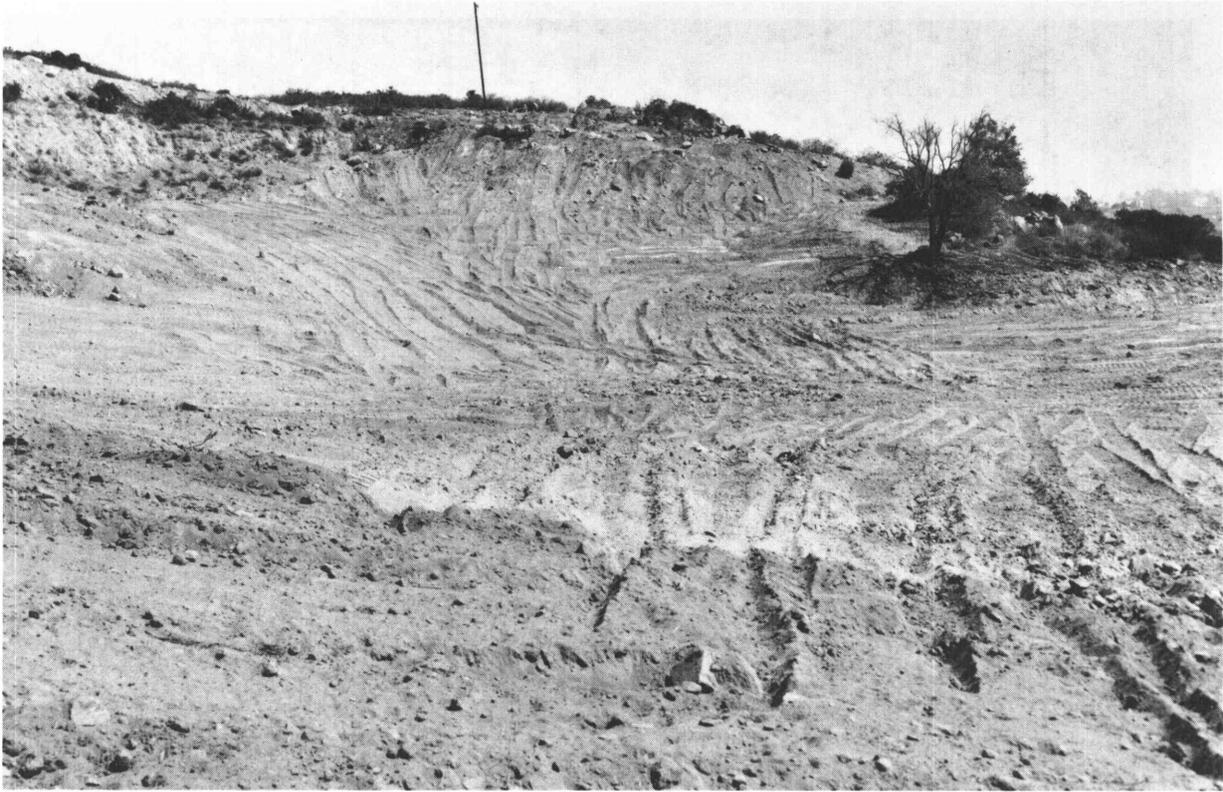
Trailer pad construction showing depth of cut and fill on Diablo-Urban land complex,
15 to 50 percent slopes.



Contour orchard on Vista coarse sandy loam, 30 to 65 percent slopes. This soil is in capability unit VIIe-1 (19).



Stubble mulch tillage on a Diablo clay.



Steep banks, scarred landscape, and an increasing erosion hazard. Borrow pit for decomposed granite in a Vista rocky coarse sandy loam.



Contour farming of tomatoes on Diablo clay, 9 to 15 percent slopes. Tomatoes are furrow irrigated. This soil is in capability unit IIIe-5 (19).

Road Fill.--The suitability of each soil as a source of excavated material for road subgrade is rated good, fair, or poor in table 16. The extent and accessibility of deposits and the

susceptibility to frost action are not considered in the ratings. Criteria for rating soils as a source of road fill are given in table 17.

TABLE 17.--CRITERIA FOR RATING SOILS AS A SOURCE OF ROAD FILL

[Frost action is not considered in determining criteria]

Factors affecting suitability	Suitability		
	Good	Fair	Poor
AASHO classification--	A-1, A-2, A-3-----	A-4, A-5-----	A-6, A-7, A-8.

Road Location.--The limitations of each soil for roads and streets that support light traffic are rated slight, moderate, or severe in table 16. The ratings apply to undisturbed soil, but it is assumed that the surface layer, because

of its higher organic-matter content, will be removed. The susceptibility to frost action is not considered in the ratings. Criteria for rating soils for road location are given in table 18.

TABLE 18.--CRITERIA FOR RATING SOILS FOR ROAD LOCATION

Factors affecting limitation	Limitation		
	Slight	Moderate	Severe
Unified classification-	SW, SP, GW, GP; SM or GM (less than 35 percent fines). <u>1/</u>	ML, SC, GC; SM or GM (more than 35 percent fines). <u>1/</u>	MH, CH, CL, OL, OH, Pt.
AASHO classification. <u>2/</u>	A-1, A-2, A-3-----	A-4, A-5-----	A-6, A-7, A-8.
Soil depth-----	More than 40 inches----	20 to 40 inches-----	Less than 20 inches.
Slope-----	0 to 9 percent-----	9 to 15 percent-----	More than 15 percent.
Seasonal high water table.	More than 5 feet-----	3 to 5 feet-----	Less than 3 feet.
Stones and cobblestones.	Less than 3 percent-----	3 to 15 percent-----	More than 15 percent.
Rocks-----	0 to 2 percent-----	2 to 10 percent-----	More than 10 percent.

1/ Fines less than 0.074 millimeter (200 mesh sieve).

2/ No frost action considered in determining criteria.

Water-Retention Structures.--Soil features affecting the construction of small water-retention structures, such as overnight irrigation storage reservoirs, fish ponds, stock-water ponds, recreation lakes, and sewage lagoons, are considered in establishing limitation ratings for this use. Ratings are given for use of the soil as (1) a floor for water impoundments and (2) a source of embankment material.

Limitations are rated slight, moderate, and severe. Ratings are based on those soil properties that relate to the water tightness of both the impoundment area, or floor, and the embankment

stability; the effect of slope on the capacity of the site for storage; and the stability and safety of the embankment.

In making these interpretations, it is assumed that (1) ratings are based upon undisturbed soil, (2) the site location is otherwise suitable for its intended use, and (3) the permeability rating for the floor is based upon the most restrictive layer in the soil profile in an undisturbed state.

Criteria for rating soils for use as a floor for water impoundments are given in table 19. Criteria for rating soils for use as embankment material are given in table 20.

TABLE 19.--CRITERIA FOR RATING SOILS FOR USE AS A FLOOR FOR WATER IMPOUNDMENT

Factors affecting limitation	Limitation		
	Slight	Moderate	Severe
Permeability (in./hr.)--	Less than 0.63 inch---	0.63 inch to 2.0 inches--	More than 2.0 inches.
Depth to hard rock-----	More than 5 feet-----	5 to 3 feet-----	Less than 3 feet.
Slope-----	Less than 2 percent---	2 to 9 percent-----	More than 9 percent.
Organic matter-----	Less than 2 percent---	2 to 15 percent-----	More than 15 percent.
Coarse fragments less than 6 inches in diameter.	Less than 20 percent--	20 to 50 percent-----	More than 50 percent.
Coarse fragments on surface, more than 6 inches in diameter.	Less than 3 percent---	3 to 15 percent-----	More than 15 percent.
Unified classification--	CH, CL, SC, GC-----	ML or MH; GM or SM (more than 35 percent fines). <u>1/</u>	SW, SP, GW, GP; GM or SM (less than 35 percent fines); <u>1/</u> OL, OH, Pt.

1/ Fines less than 0.074 millimeter (200 mesh sieve).

TABLE 20.--CRITERIA FOR RATING SOILS AS A SOURCE OF MATERIAL FOR EMBANKMENTS

Factors affecting limitation	Limitation		
	Slight	Moderate	Severe
Unified classification-	GC, SC, CL-----	CH, MH, ML; GM or SM (more than 35 percent fines). <u>1/</u>	GP, GW, SP, SW; GM or SM (less than 35 percent fines); <u>1/</u> OL, OH, Pt.

1/ Fines less than 0.074 millimeter (200 mesh sieve).

INTERPRETATIONS FOR FARMING AND RANCHING

Agriculture is one of the major enterprises in the San Diego Area (5). Truck crops, flowers, and livestock are the major products. Prime soils ^{5/} are required to maintain the agricultural economy at its present level. However, demands for urban or nonfarm use of the soils, rising land values, and increasing taxes make it increasingly difficult for the farmer to stay in business. Intensive farming practices, specialized production, and high capital requirements have changed many agricultural units from the small family-size farm to a factorylike operation. In addition, the rapid expansion of urban development is forcing agriculture into new areas.

In locating new farm sites, farmers are faced with many decisions. The suitability of the soils is the major factor to be considered. Equipped with soil information and proper interpretations, farmers and those who work with farmers can locate and determine what crop is best suited to a particular area. Detailed onsite investigations are needed at specific locations. Also essential in effective long-range planning is locating areas where not only the soils but also the climate and topography are suited to agricultural development.

Information provided by the interpretations in this part of the survey will aid in locating the best agricultural lands.

The suitability of the soils for five major crops and criteria considered in determining the suitability ratings shown in table 21 are explained in the pages that follow. Also explained are the Storie index ratings, which are shown in the Guide to Mapping Units. In addition, this part of the survey defines the capability classification used by the Soil Conservation Service, in which the soils are grouped according to their suitability for crops. It describes land resource areas and suggests use and management of the soils of the San Diego Area by capability unit. It also describes the management needed for specified crops, shows estimates of yields of these crops, table 22, and describes range management by range sites.

Land Resource Areas

Land resource units are broad geographic areas, generally several thousand acres in extent, that are characterized by particular patterns of soil, including slope and erosion, and by climate, water resources, land use, and type of farming (3). The 48 conterminous States in the nation have been divided into 156 land resource areas. The San Diego Area lies within resource areas 19, 20, and 30. Area 19 is on the Coastal Plains and in the Foot-hills and interior valleys, area 20 is in the Mountains, and area 30 is in the Desert. These physiographic areas are shown on the general soil map.

Land Resource Area 19.--This area includes the Coastal Plains and the interior valleys in the Foot-hills. The dominant topographic features are gently sloping to undulating marine terraces, rolling up-lands, smooth to rocky hills, canyons, and relatively narrow, winding valleys. All rivers and streams flow into the Pacific Ocean. The vegetation consists of coastal chaparral and grasses. Oaks grow in the valleys. Elevations range from sea level to 2,000 feet. Rainfall ranges from 10 inches along the coast to 18 inches inland. The only precipitation is gentle rain in winter and early in spring. The frost-free period ranges from 230 to 360 days. Frosts are light and infrequent.

The major limiting factors are steep slopes, shallow soils, claypans, stones, and rock outcrops.

In establishing the capability classification for land resource area 19, it is assumed that--

Irrigation water is available for all irrigable soils. In some places the water supply is salty enough so that drainage and leaching are required for crops that are highly sensitive to salts. Rainfall is adequate for leaching so that most crops are not damaged by accumulation of salts.

The major crops are grown commercially. Frost-tolerant flowers and truck crops are grown in winter; frost-sensitive perennial crops, citrus, and avocados are grown in locations that have good air drainage.

Land Resource Area 20.--This area is the Southern California Mountains, known as the peninsular range. The topography is dominantly steep and very steep, but there are small drainage meadows and narrow and broad mountain valleys. Most of the very steep slopes are on the sides of young, V-shaped river valleys. The vegetation consists of chaparral, trees, and grasses. Elevations range from 2,000 to about 6,000 feet. The precipitation is more than 20 inches; at the highest elevations it is more than 40 inches. Rain falls mostly in winter and spring; summer thunderstorms occur infrequently at higher elevations. The frost-free period ranges from 140 to 260 days.

The major limiting factors are steep slopes, shallow soils, low temperatures, stones, and cobblestones.

In establishing the capability classification for land resource area 20, it is assumed that--

Irrigation water generally is not available; the water supply within this area is limited. Some water is used locally for irrigating orchards. The principal source of moisture for crops is rainfall and snowfall in winter and early in spring.

Pears and apples are the major crops. Most of the acreage is rangeland and woodland.

Land Resource Area 30.--This area is the Sonoran Basin and Range. It includes most of the eastern and northeastern third of the San Diego Area. It

^{5/} Prime soils, as defined in the Land Conservation Act of 1965 of the California State Legislature, are soils that are in capability classes I and II or produce \$200 or more gross annual income 3 years out of 5.

TABLE 21.--CROP SUITABILITY

[Only arable soils are listed. Dashes indicate that the soil is poorly suited or not suited to the specified crop. Numerals indicate soil properties or qualities that adversely affect suitability for a specified crop. Numeral 1 refers to slope; 2 to surface layer texture; 7 to permeability rate; and 9 to depth to hard rock, or a hardpan, or any layer that restricts permeability. A soil rated as good or fair for any one crop is classified as agricultural land]

Map symbol	Soil	Avocados	Citrus	Truck crops	Tomatoes	Flowers
AtC	Altamont clay, 5 to 9 percent slopes-----	-----	-----	-----	Good-----	-----
AtD	Altamont clay, 9 to 15 percent slopes-----	-----	-----	-----	Fair 1---	-----
AtD2	Altamont clay, 9 to 15 percent slopes, eroded.	-----	-----	-----	Fair 1---	-----
AtE	Altamont clay, 15 to 30 percent slopes-----	-----	-----	-----	Fair 1---	-----
AtE2	Altamont clay, 15 to 30 percent slopes, eroded.	-----	-----	-----	Fair 1---	-----
AuC	Anderson very gravelly sandy loam, 5 to 9 percent slopes.	Good----	Good----	-----	-----	-----
AuF	Anderson very gravelly sandy loam, 9 to 45 percent slopes.	Good----	-----	-----	-----	-----
AvC	Arlington coarse sandy loam, 2 to 9 percent slopes.	-----	-----	Fair 7----	Fair 2---	Good.
AwC	Auld clay, 5 to 9 percent slopes-----	-----	-----	-----	Good-----	-----
AwD	Auld clay, 9 to 15 percent slopes-----	-----	-----	-----	Fair 1---	-----
BeE	Blasingame loam, 9 to 30 percent slopes-----	-----	Fair 1--	-----	-----	-----
BgE	Blasingame stony loam, 9 to 30 percent slopes.	-----	Fair 1--	-----	-----	-----
B1C	Bonsall sandy loam, 2 to 9 percent slopes-----	-----	-----	-----	-----	Fair 9.
B1C2	Bonsall sandy loam, 2 to 9 percent slopes, eroded.	-----	-----	-----	-----	Fair 9.
B1D2	Bonsall sandy loam, 9 to 15 percent slopes, eroded.	-----	-----	-----	-----	Fair 9.
BmC	Bonsall sandy loam, thick surface, 2 to 9 percent slopes.	-----	Fair 7--	-----	Fair 2---	Good.
BnB	Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes.	-----	Fair 7--	-----	Fair 2---	Fair 9.
BsC	Bosanko clay, 2 to 9 percent slopes-----	-----	Fair 7--	-----	Good-----	-----
BsD	Bosanko clay, 9 to 15 percent slopes-----	-----	-----	-----	Fair 1---	-----
BsE	Bosanko clay, 15 to 30 percent slopes-----	-----	-----	-----	Fair 1---	-----
BtC	Bosanko stony clay, 5 to 9 percent slopes----	-----	Fair 7--	-----	-----	-----
CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes.	-----	Fair 9--	Good-----	-----	Good.
CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes.	-----	Fair 9--	Fair 1----	-----	Good.
CbD	Carlsbad gravelly loamy sand, 9 to 15 percent slopes.	-----	Fair 9--	-----	-----	Fair 1.
CbE	Carlsbad gravelly loamy sand, 15 to 30 percent slopes.	-----	Fair 1--	-----	-----	-----
CfB	Chesterton fine sandy loam, 2 to 5 percent slopes.	-----	-----	Fair 7----	Fair 2--	Good.
CfC	Chesterton fine sandy loam, 5 to 9 percent slopes.	-----	-----	Fair 7----	Fair 2--	Good.
CfD2	Chesterton fine sandy loam, 9 to 15 percent slopes, eroded.	-----	-----	-----	Fair 1--	Fair 1.
ChA	Chino fine sandy loam, 0 to 2 percent slopes.	-----	Good----	Fair 7----	Fair 2--	Good.
ChB	Chino fine sandy loam, 2 to 5 percent slopes.	-----	Good----	Fair 7----	Fair 2--	Good.
C1D2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded.	Fair 9--	-----	-----	-----	Fair 9.
C1E2	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.	Fair 9--	-----	-----	-----	-----

See footnotes at end of table.

TABLE 21.--CROP SUITABILITY--Continued

Map symbol	Soil	Avocados	Citrus	Truck crops	Tomatoes	Flowers
C1G2	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded.	Fair 9--	-----	-----	-----	-----
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded.	Fair 9--	-----	-----	-----	-----
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded.	Fair 9--	-----	-----	-----	-----
Co	Clayey alluvial land-----	-----	-----	-----	Good----	-----
CsB	Corralitos loamy sand, 0 to 5 percent slopes.	Good----	Good----	Good----	-----	Good.
CsC	Corralitos loamy sand, 5 to 9 percent slopes.	Good----	Good----	Fair 1---	-----	Good.
CsD	Corralitos loamy sand, 9 to 15 percent slopes.	Good----	Good----	-----	-----	Fair 1.
DaC	Diablo clay, 2 to 9 percent slopes-----	-----	-----	-----	Good----	-----
DaD	Diablo clay, 9 to 15 percent slopes-----	-----	-----	-----	Fair 2--	-----
DaE	Diablo clay, 15 to 30 percent slopes-----	-----	-----	-----	Fair 1--	-----
DaE2	Diablo clay, 15 to 30 percent slopes, eroded.	-----	-----	-----	Fair 1--	-----
EdC	Elder shaly fine sandy loam, 2 to 9 percent slopes.	Good----	Good----	Fair 1---	Fair 2--	Good.
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes.	-----	Fair 9--	Fair 7---	Fair 2--	Good.
EsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.	-----	Fair 9--	-----	Fair 2--	Fair 1.
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes, eroded.	-----	Fair 9--	-----	-----	-----
EvC	Escondido very fine sandy loam, deep, 5 to 9 percent slopes.	Fair 1/-	Good----	Fair 7---	Fair 2--	Good.
FaB	Fallbrook sandy loam, 2 to 5 percent slopes--	Fair 2/-	Fair 7--	Fair 7---	Fair 2--	Good.
FaC	Fallbrook sandy loam, 5 to 9 percent slopes--	Fair 2/-	Fair 7--	Fair 7---	Fair 2--	Good.
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded.	Fair 2/-	Fair 7--	Fair 7---	Fair 2--	Good.
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded.	Fair 2/-	Fair 7--	-----	Fair 2--	Fair 1.
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded.	Fair 2/-	Fair 7--	-----	-----	-----
FaE3	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded.	Fair 2/-	Fair 7--	-----	-----	-----
FeC	Fallbrook rocky sandy loam, 5 to 9 percent slopes.	Fair 2/-	Fair 7--	Fair 7---	-----	-----
FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes.	Fair 2/-	Fair 7--	-----	-----	-----
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded.	Fair 2/-	Fair 7--	-----	-----	-----
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes.	Fair 2/-	Fair 9--	-----	Fair 1--	Fair 1.
FvE	Fallbrook-Vista sandy loams, 15 to 30 percent slopes.	Fair 2/-	Fair 1--	-----	-----	-----
GoA	Grangeville fine sandy loam, 0 to 2 percent slopes.	-----	-----	Good----	Fair 2--	Good.
GrA	Greenfield sandy loam, 0 to 2 percent slopes.	Good----	Good----	Good----	Fair 2--	Good.
GrB	Greenfield sandy loam, 2 to 5 percent slopes.	Good----	Good----	Good----	Fair 2--	Good.
GrC	Greenfield sandy loam, 5 to 9 percent slopes.	Good----	Good----	Fair 1---	Fair 2--	Good.
GrD	Greenfield sandy loam, 9 to 15 percent slopes.	Good----	Good----	-----	Fair 2--	Fair 1.
HrC	Huerhuero loam, 2 to 9 percent slopes-----	-----	-----	Fair 7---	Good----	Fair 2.

See footnotes at end of table.

TABLE 21.--CROP SUITABILITY--Continued

Map symbol	Soil	Avocados	Citrus	Truck crops	Tomatoes	Flowers
HrC2	Huerhuero loam, 5 to 9 percent slopes, eroded.	-----	-----	Fair 7----	Good-----	Fair 2.
HrD	Huerhuero loam, 9 to 15 percent slopes-----	-----	-----	-----	Fair 1---	Fair 2.
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded.	-----	-----	-----	Fair 1---	Fair 2.
LeC	Las Flores loamy fine sand, 2 to 9 percent slopes.	-----	-----	Fair 7----	-----	Good.
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded.	-----	-----	Fair 7----	-----	Good.
LeD	Las Flores loamy fine sand, 9 to 15 percent slopes.	-----	-----	-----	-----	Fair 1.
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.	-----	-----	-----	-----	Fair 1.
LpB	Las Posas fine sandy loam, 2 to 5 percent slopes.	-----	Fair 7--	Fair 7----	Fair 2---	Good.
LpC	Las Posas fine sandy loam, 5 to 9 percent slopes.	-----	Fair 7--	Fair 7----	Fair 2---	Good.
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, eroded.	-----	Fair 7--	Fair 7----	Fair 2---	Good.
LpD2	Las Posas fine sandy loam, 9 to 15 percent slopes, eroded.	-----	Fair 7--	-----	Fair 2---	Fair 1.
LpE2	Las Posas fine sandy loam, 15 to 30 percent slopes, eroded.	-----	Fair 7--	-----	-----	-----
M1C	Marina loamy coarse sand, 2 to 9 percent slopes.	Good---	Good----	Fair 1----	-----	Good.
M1E	Marina loamy coarse sand, 9 to 30 percent slopes.	Good---	Fair 1--	-----	-----	-----
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes.	-----	Fair 7--	-----	-----	-----
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes.	-----	Fair 7--	-----	-----	-----
PeA	Placentia sandy loam, 0 to 2 percent slopes.	-----	-----	-----	Fair 9---	Good.
PeC	Placentia sandy loam, 2 to 9 percent slopes.	-----	-----	-----	Fair 9---	Good.
PeC2	Placentia sandy loam, 5 to 9 percent slopes, eroded.	-----	-----	-----	Fair 9---	Good.
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded.	-----	-----	-----	Fair 9---	Fair 1.
PfA	Placentia sandy loam, thick surface, 0 to 2 percent slopes.	-----	-----	-----	Fair 9---	Good.
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes.	-----	-----	-----	Fair 9---	Good.
RaA	Ramona sandy loam, 0 to 2 percent slopes-----	-----	Fair 7--	Fair 7----	Fair 2---	Good.
RaB	Ramona sandy loam, 2 to 5 percent slopes-----	-----	Fair 7--	Fair 7----	Fair 2---	Good.
RaC	Ramona sandy loam, 5 to 9 percent slopes-----	-----	Fair 7--	Fair 7----	Fair 2---	Good.
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded.	-----	Fair 7--	Fair 7----	Fair 2---	Good.
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded.	-----	Fair 7--	-----	Fair 2---	Fair 1.
RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes.	-----	Fair 7--	-----	Fair 2---	Fair 1.
RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes.	-----	Fair 7--	-----	-----	-----
RkA	Reiff fine sandy loam, 0 to 2 percent slopes.	Good---	Good----	Good-----	Fair 2---	Good.
RkB	Reiff fine sandy loam, 2 to 5 percent slopes.	Good---	Good----	Good-----	Fair 2---	Good.

See footnotes at end of table.

TABLE 21.--CROP SUITABILITY--Continued

Map symbol	Soil	Avocados	Citrus	Truck crops	Tomatoes	Flowers
RkC	Reiff fine sandy loam, 5 to 9 percent slopes.	Good-----	Good----	Fair 1--	Fair 2--	Good.
SbA	Salinas clay loam, 0 to 2 percent slopes-----	-----	Fair 7--	Fair 2--	Good----	Fair 2.
SbC	Salinas clay loam, 2 to 9 percent slopes-----	-----	Fair 7--	Fair 2--	Good----	Fair 2.
ScA	Salinas clay, 0 to 2 percent slopes-----	-----	-----	-----	Good----	-----
ScB	Salinas clay, 2 to 5 percent slopes-----	-----	-----	-----	Good----	-----
SsE	Soboba stony loamy sand, 9 to 30 percent slopes.	Good-----	-----	-----	-----	-----
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes.	-----	-----	Fair 7--	Good----	Fair 2.
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes.	-----	-----	Fair 7--	Good----	Fair 2.
TuB	Tujunga sand, 0 to 5 percent slopes-----	Good-----	-----	Fair 2--	-----	Good.
VaA	Visalia sandy loam, 0 to 2 percent slopes----	Good-----	Good----	Good----	Fair 2--	Good.
VaB	Visalia sandy loam, 2 to 5 percent slopes----	Good-----	Good----	Good----	Fair 2--	Good.
VaC	Visalia sandy loam, 5 to 9 percent slopes----	Good-----	Good----	Fair 1--	Fair 2--	Good.
VaD	Visalia sandy loam, 9 to 15 percent slopes----	Good-----	Good----	-----	Fair 2--	Fair 1.
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes.	Good-----	Good----	Good----	Fair 2--	Good.
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes.	Good-----	Good----	Fair 1--	Fair 2--	Good.
VsC	Vista coarse sandy loam, 5 to 9 percent slopes.	Good-----	Fair 9--	Fair 1--	Fair 2--	Good.
VsD	Vista coarse sandy loam, 9 to 15 percent slopes.	Good-----	Fair 9--	-----	Fair 2--	Fair 1.
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded.	Good-----	Fair 9--	-----	Fair 2--	Fair 1.
VsE	Vista coarse sandy loam, 15 to 30 percent slopes.	Good-----	Fair 9--	-----	-----	-----
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded.	Good-----	Fair 9--	-----	-----	-----
VsG	Vista coarse sandy loam, 30 to 65 percent slopes.	Good-----	-----	-----	-----	-----
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes.	Good-----	Fair 9--	-----	-----	-----
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes.	Good-----	Fair 9--	-----	-----	-----
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes.	Good-----	-----	-----	-----	-----
WmB	Wyman loam, 2 to 5 percent slopes-----	-----	Fair 7--	Fair 7--	Fair 2--	Fair 2.
WmC	Wyman loam, 5 to 9 percent slopes-----	-----	Fair 7--	Fair 7--	Fair 2--	Fair 2.
WmD	Wyman loam, 9 to 15 percent slopes-----	-----	Fair 7--	-----	Fair 2--	Fair 2.

1/ Soil is deep enough to justify a rating of fair.

2/ Permeability can be improved by ripping the subsoil, thus justifying a rating of fair.

TABLE 22.--AVERAGE YIELDS PER ACRE OF PRINCIPAL CROPS

[Dashes indicate the crop is not suited to or is not commonly grown on the soil specified. Underscored figures are collected yields. All other figures are estimated yields]

Soil	Irrigated crops						
	Tomatoes	Avocados	Oranges	Lemons	Celery	Gladioli	Barley (dryfarmed)
	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Dozen spikes</u>	<u>Tons</u>
Altamont clay, 5 to 9 percent slopes-----	19.0	----	----	----	24.3	----	<u>1.2</u>
Altamont clay, 9 to 15 percent slopes-----	15.0	----	----	----	----	----	<u>1.0</u>
Altamont clay, 9 to 15 percent slopes, eroded-----	15.0	----	----	----	----	----	1.1
Altamont clay, 15 to 30 percent slopes-----	15.0	----	----	----	----	----	<u>1.0</u>
Altamont clay, 15 to 30 percent slopes, eroded-----	14.5	----	----	----	----	----	<u>1.0</u>
Anderson very gravelly sandy loam, 5 to 9 percent slopes-----	----	3.5	15.0	14.5	----	----	----
Anderson very gravelly sandy loam, 9 to 45 percent slopes-----	----	3.5	----	----	----	----	----
Arlington coarse sandy loam, 2 to 9 percent slopes-----	11.1	----	----	----	21.6	3,656	<u>.5</u>
Auld clay, 5 to 9 percent slopes---	15.0	----	----	----	24.3	----	<u>.5</u>
Auld clay, 9 to 15 percent slopes--	15.0	----	----	----	----	----	<u>.6</u>
Blasingame loam, 9 to 30 percent slopes-----	----	----	12.0	11.6	----	----	----
Blasingame stony loam, 9 to 30 percent slopes-----	----	----	12.0	11.6	----	----	----
Bonsall sandy loam, 2 to 9 percent slopes-----	----	----	----	----	----	2,925	<u>.5</u>
Bonsall sandy loam, 2 to 9 percent slopes, eroded-----	----	----	----	----	----	2,925	.9
Bonsall sandy loam, 9 to 15 percent slopes, eroded-----	----	----	----	----	----	2,925	.9
Bonsall sandy loam, thick surface, 2 to 9 percent slopes-----	12.7	----	12.0	11.6	----	3,656	1.0
Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes-----	12.7	----	15.0	14.5	----	2,925	.9
Bosanko clay, 2 to 9 percent slopes-----	15.8	----	11.2	10.9	24.3	----	1.1
Bosanko clay, 9 to 15 percent slopes-----	15.0	----	----	----	24.3	----	<u>.8</u>
Bosanko clay, 15 to 30 percent slopes-----	14.2	----	----	----	----	----	1.0
Bosanko stony clay, 5 to 9 percent slopes-----	----	----	11.2	10.9	----	----	----
Carlsbad gravelly loamy sand, 2 to 5 percent slopes-----	----	----	10.5	10.1	24.3	3,656	----
Carlsbad gravelly loamy sand, 5 to 9 percent slopes-----	----	----	10.5	10.1	21.6	3,656	----
Carlsbad gravelly loamy sand, 9 to 15 percent slopes-----	----	----	10.5	10.1	----	3,290	----
Carlsbad gravelly loamy sand, 15 to 30 percent slopes-----	----	----	10.5	10.1	----	----	----
Chesterton fine sandy loam, 2 to 5 percent slopes-----	12.7	----	----	----	24.3	3,656	.8
Chesterton fine sandy loam, 5 to 9 percent slopes-----	12.7	----	----	----	24.3	3,656	.8

See footnote at end of table.

TABLE 22.--AVERAGE YIELDS PER ACRE OF PRINCIPAL CROPS--Continued

Soil	Irrigated crops						
	Tomatoes	Avocados	Oranges	Lemons	Celery	Gladioli	Barley (dryfarmed)
	Tons	Tons	Tons	Tons	Tons	Dozen spikes	Tons
Chesterton fine sandy loam, 9 to 15 percent slopes, eroded-----	11.1	----	----	----	18.9	3,473	0.8
Chino fine sandy loam, 0 to 2 percent slopes-----	14.2	----	15.0	14.5	24.3	3,837	1.0
Chino fine sandy loam, 2 to 5 percent slopes-----	14.2	----	15.0	14.5	24.3	3,837	.7
Chino silt loam, saline, 0 to 2 percent slopes-----	----	----	----	----	----	----	.5
Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded-----	----	2.8	----	----	----	3,250	----
Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded-----	----	2.8	----	----	----	----	----
Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded---	----	2.8	10.5	10.1	----	----	----
Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded--	----	2.8	----	----	----	----	----
Clayey alluvial land-----	17.4	----	----	----	27.0	----	1.0
Corralitos loamy sand, 0 to 5 percent slopes-----	----	3.5	15.0	14.5	24.3	3,839	----
Corralitos loamy sand, 5 to 9 percent slopes-----	----	3.5	15.0	14.5	24.3	3,839	----
Corralitos loamy sand, 9 to 15 percent slopes-----	----	3.5	15.0	14.5	----	3,656	----
Diablo clay, 2 to 9 percent slopes--	<u>17.5</u>	----	----	----	<u>27.0</u>	----	<u>1.4</u>
Diablo clay, 9 to 15 percent slopes-----	15.8	----	----	----	----	----	<u>1.4</u>
Diablo clay, 15 to 30 percent slopes-----	14.2	----	----	----	----	----	<u>1.4</u>
Diablo clay, 15 to 30 percent slopes, eroded-----	11.1	----	----	----	----	----	1.0
Elder shaly fine sandy loam, 2 to 9 percent slopes-----	14.2	----	----	----	24.3	3,656	1.0
Escondido very fine sandy loam, 5 to 9 percent slopes-----	14.2	----	<u>8.3</u>	11.6	24.3	3,656	<u>.8</u>
Escondido very fine sandy loam, 9 to 15 percent slopes, eroded-----	14.2	----	12.0	11.6	----	3,290	1.0
Escondido very fine sandy loam, 15 to 30 percent slopes, eroded-----	----	----	12.0	11.6	----	----	----
Escondido very fine sandy loam, deep, 5 to 9 percent slopes-----	14.2	2.8	15.0	14.5	24.3	3,656	1.0
Fallbrook sandy loam, 2 to 5 percent slopes-----	14.2	3.5	15.0	14.5	18.9	3,656	1.0
Fallbrook sandy loam, 5 to 9 percent slopes-----	14.2	3.5	<u>11.0</u>	14.5	18.9	3,656	<u>.6</u>
Fallbrook sandy loam, 5 to 9 percent slopes, eroded-----	----	3.5	15.0	14.5	17.5	3,656	1.0
Fallbrook sandy loam, 9 to 15 percent slopes, eroded-----	----	3.5	15.0	14.5	----	3,290	.9
Fallbrook sandy loam, 15 to 30 percent slopes, eroded-----	----	<u>2.8</u>	13.5	<u>14.3</u>	----	----	----
Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded---	----	2.6	11.2	10.9	----	----	----
Fallbrook rocky sandy loam, 5 to 9 percent slopes-----	----	3.5	13.5	13.0	----	----	----

See footnote at end of table.

TABLE 22.--AVERAGE YIELDS PER ACRE OF PRINCIPAL CROPS--Continued

Soil	Irrigated crops						
	Tomatoes	Avocados	Oranges	Lemons	Celery	Gladioli	Barley (dryfarmed)
	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Dozen spikes</u>	<u>Tons</u>
Fallbrook rocky sandy loam, 9 to 30 percent slopes-----	----	3.5	13.5	13.0	----	----	----
Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded-----	----	3.0	13.5	13.0	----	----	----
Fallbrook-Vista sandy loams, 9 to 15 percent slopes-----	12.7	3.5	15.0	14.5	----	3,290	.9
Fallbrook-Vista sandy loams, 15 to 30 percent slopes-----	----	3.5	15.0	14.5	----	----	----
Grangeville fine sandy loam, 0 to 2 percent slopes-----	14.2	----	----	----	24.3	3,656	.9
Greenfield sandy loam, 0 to 2 percent slopes-----	14.2	<u>1/3.3</u>	<u>1/15.0</u>	<u>1/14.5</u>	24.3	3,656	1.0
Greenfield sandy loam, 2 to 5 percent slopes-----	14.2	<u>1/3.3</u>	<u>1/12.4</u>	<u>1/14.5</u>	24.3	3,656	.4
Greenfield sandy loam, 5 to 9 percent slopes-----	14.2	<u>1/3.3</u>	<u>1/15.0</u>	<u>1/14.5</u>	21.6	3,656	1.0
Greenfield sandy loam, 9 to 15 percent slopes-----	14.2	3.3	15.0	14.5	18.9	3,290	.9
Huerhuero loam, 2 to 9 percent slopes-----	<u>22.5</u>	----	----	----	<u>26.0</u>	3,473	1.0
Huerhuero loam, 5 to 9 percent slopes, eroded-----	<u>20.0</u>	----	----	----	27.0	3,473	1.0
Huerhuero loam, 9 to 15 percent slopes-----	14.2	----	----	----	21.6	3,290	1.0
Huerhuero loam, 9 to 15 percent slopes, eroded-----	14.2	----	----	----	----	3,107	1.0
Kitchen Creek loamy coarse sand, 5 to 9 percent slopes-----	----	----	----	----	----	----	.8
Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded---	----	----	----	----	----	----	.8
Las Flores loamy fine sand, 2 to 9 percent slopes-----	----	----	----	----	<u>27.0</u>	3,656	1.0
Las Flores loamy fine sand, 5 to 9 percent slopes, eroded-----	----	----	----	----	<u>27.0</u>	3,656	1.0
Las Flores loamy fine sand, 9 to 15 percent slopes-----	----	----	----	----	24.3	3,473	1.0
Las Flores loamy fine sand, 9 to 15 percent slopes, eroded-----	----	----	----	----	21.6	3,290	1.0
Las Posas fine sandy loam, 2 to 5 percent slopes-----	14.2	----	15.0	14.5	24.3	3,656	1.0
Las Posas fine sandy loam, 5 to 9 percent slopes-----	14.2	----	<u>8.3</u>	14.5	24.3	3,656	.8
Las Posas fine sandy loam, 5 to 9 percent slopes, eroded-----	14.2	----	15.0	14.5	21.6	3,473	1.0
Las Posas fine sandy loam, 9 to 15 percent slopes, eroded-----	14.2	----	15.0	14.5	18.9	3,290	----
Las Posas fine sandy loam, 15 to 30 percent slopes, eroded-----	----	----	13.5	13.0	----	----	----
Linne clay loam, 9 to 30 percent slopes-----	----	----	----	----	----	----	<u>1.1</u>
Marina loamy coarse sand, 2 to 9 percent slopes-----	----	3.5	13.5	13.0	21.6	3,656	----
Marina loamy coarse sand, 9 to 30 percent slopes-----	----	3.5	12.0	11.6	16.2	----	----

See footnote at end of table.

TABLE 22.--AVERAGE YIELDS PER ACRE OF PRINCIPAL CROPS--Continued

Soil	Irrigated crops						
	Tomatoes	Avocados	Oranges	Lemons	Celery	Gladioli	Barley (dryfarmed)
	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Dozen spikes</u>	<u>Tons</u>
Mottsville loamy coarse sand, 2 to 9 percent slopes-----	----	----	----	----	----	----	<u>0.5</u>
Olivenhain cobbly loam, 2 to 9 percent slopes-----	----	----	12.0	11.6	----	----	----
Olivenhain cobbly loam, 9 to 30 percent slopes-----	----	----	12.0	11.6	----	----	----
Placentia sandy loam, 0 to 2 percent slopes-----	15.8	----	----	----	----	3,656	1.0
Placentia sandy loam, 2 to 9 percent slopes-----	15.8	----	----	----	----	3,656	<u>.4</u>
Placentia sandy loam, 5 to 9 percent slopes, eroded-----	15.8	----	----	----	----	3,656	1.0
Placentia sandy loam, 9 to 15 percent slopes, eroded-----	14.2	----	----	----	----	3,290	1.0
Placentia sandy loam, thick surface, 0 to 2 percent slopes-----	15.8	----	----	----	----	3,656	1.0
Placentia sandy loam, thick surface, 2 to 9 percent slopes-----	15.8	----	----	----	----	3,656	1.0
Ramona sandy loam, 0 to 2 percent slopes-----	15.8	----	<u>1/13.5</u>	<u>1/13.0</u>	----	3,656	<u>.9</u>
Ramona sandy loam, 2 to 5 percent slopes-----	15.8	----	<u>1/11.4</u>	<u>1/13.0</u>	----	3,656	<u>.8</u>
Ramona sandy loam, 5 to 9 percent slopes-----	15.8	----	<u>1/12.6</u>	<u>1/13.0</u>	----	3,656	<u>.5</u>
Ramona sandy loam, 5 to 9 percent slopes, eroded-----	15.8	----	<u>1/15.8</u>	<u>1/13.0</u>	----	3,473	1.0
Ramona sandy loam, 9 to 15 percent slopes, eroded-----	14.2	----	13.5	13.0	----	3,290	.9
Ramona gravelly sandy loam, 9 to 15 percent slopes-----	14.2	----	13.5	13.0	----	3,290	.9
Ramona gravelly sandy loam, 15 to 30 percent slopes-----	----	----	12.0	11.6	----	----	----
Reiff fine sandy loam, 0 to 2 percent slopes-----	15.8	<u>1/3.5</u>	<u>1/15.0</u>	<u>1/14.5</u>	24.3	3,837	1.0
Reiff fine sandy loam, 2 to 5 percent slopes-----	15.8	<u>1/3.5</u>	<u>1/15.0</u>	<u>1/14.5</u>	24.3	3,837	1.0
Reiff fine sandy loam, 5 to 9 percent slopes-----	15.8	<u>1/3.5</u>	<u>1/15.0</u>	<u>1/14.5</u>	21.6	3,837	1.0
Salinas clay loam, 0 to 2 percent slopes-----	17.4	----	13.5	13.0	29.7	3,290	1.0
Salinas clay loam, 2 to 9 percent slopes-----	17.4	----	<u>13.8</u>	<u>19.1</u>	29.7	3,290	1.0
Salinas clay, 0 to 2 percent slopes-----	16.4	----	----	----	----	----	<u>1.5</u>
Salinas clay, 2 to 5 percent slopes-----	16.4	----	----	----	----	----	<u>1.0</u>
Soboba stony loamy sand, 9 to 30 percent slopes-----	----	3.7	----	----	----	----	----
Stockpen gravelly clay loam, 0 to 2 percent slopes-----	<u>15.0</u>	----	----	----	<u>28.5</u>	3,290	----
Stockpen gravelly clay loam, 2 to 5 percent slopes-----	<u>12.0</u>	----	----	----	<u>26.0</u>	3,290	----
Tujunga sand, 0 to 5 percent slopes-----	----	<u>1/3.5</u>	----	----	<u>30.0</u>	3,473	----
Visalia sandy loam, 0 to 2 percent slopes-----	<u>20.0</u>	<u>1/3.5</u>	<u>1/15.0</u>	<u>1/14.5</u>	27.0	3,656	1.0

See footnote at end of table.

TABLE 22.--AVERAGE YIELDS PER ACRE OF PRINCIPAL CROPS--Continued

Soil	Irrigated crops						
	Tomatoes	Avocados	Oranges	Lemons	Celery	Gladioli	Barley (dryfarmed)
	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Dozen spikes</u>	<u>Tons</u>
Visalia sandy loam, 2 to 5 percent slopes-----	15.8	<u>1/3.5</u>	<u>1/13.4</u>	<u>1/14.5</u>	27.0	3,656	<u>0.7</u>
Visalia sandy loam, 5 to 9 percent slopes-----	15.8	<u>1/3.5</u>	<u>1/15.0</u>	<u>1/14.5</u>	27.0	3,656	1.0
Visalia sandy loam, 9 to 15 percent slopes-----	14.2	3.5	13.5	13.0	----	3,473	.9
Visalia gravelly sandy loam, 2 to 5 percent slopes-----	14.2	<u>1/3.5</u>	15.0	14.5	27.0	3,656	.9
Visalia gravelly sandy loam, 5 to 9 percent slopes-----	14.2	<u>1/3.5</u>	15.0	14.5	27.0	3,656	.9
Vista coarse sandy loam, 5 to 9 percent slopes-----	14.2	3.5	13.5	13.0	----	3,656	1.0
Vista coarse sandy loam, 9 to 15 percent slopes-----	14.2	3.5	13.5	13.0	----	3,290	1.0
Vista coarse sandy loam, 9 to 15 percent slopes, eroded-----	14.2	3.5	13.5	13.0	----	3,107	1.0
Vista coarse sandy loam, 15 to 30 percent slopes-----	----	<u>4.3</u>	12.0	11.6	----	----	----
Vista coarse sandy loam, 15 to 30 percent slopes, eroded-----	----	3.5	12.0	11.6	----	----	----
Vista coarse sandy loam, 30 to 65 percent slopes-----	----	3.5	----	----	----	----	----
Vista rocky coarse sandy loam, 5 to 15 percent slopes-----	----	3.5	12.0	11.6	----	----	----
Vista rocky coarse sandy loam, 15 to 30 percent slopes-----	----	3.5	12.0	11.6	----	----	----
Vista rocky coarse sandy loam, 30 to 65 percent slopes-----	----	3.5	----	----	----	----	----
Wyman loam, 2 to 5 percent slopes-----	14.2	----	<u>1/12.0</u>	<u>1/11.6</u>	----	3,290	1.0
Wyman loam, 5 to 9 percent slopes-----	14.2	----	<u>1/12.3</u>	<u>1/11.6</u>	----	3,290	<u>.5</u>
Wyman loam, 9 to 15 percent slopes-----	14.2	----	12.0	11.6	----	3,290	1.0

1/ Frost is likely in winter.

extends from Riverside County to the Mexican border. It is characterized by many short ranges of nearly barren mountains, some older alluvial deposits or terrace remnants, and extensive recent alluvial fans and desert basins, some of which are saline or saline-alkali. Elevations range from 100 to 2,500 feet. The mean annual precipitation is less than 5 inches. Much of the precipitation falls during high intensity storms, which at times produce local floods and little soil moisture. The climate is extremely arid. The vegetation is sparse desert shrubs and cactus. Some areas have a fair cover of mesquite and creosotebush. Temperatures are high in summer, and there is a wide fluctuation between the maximum and the minimum temperatures.

The major limiting factors are lack of irrigation water, stones, cobblestones, low available water holding capacity, low fertility, and the hazard of wind erosion.

In establishing the capability classification in land resource area 30, it is assumed that--

Because of inadequate rainfall, the soils are not suitable for cultivation unless irrigated. In most of the area, rainfall is inadequate for a sustained yield of any native forage. The frost-free season is 210 to 260 days. Potential evapotranspiration is 40 inches or more, and the actual evapotranspiration is less than 5 inches.

Irrigation water is scarce; it is mainly from wells. The Borrego Valley is the only area that has an adequate supply of good-quality irrigation water. Only a few small tracts elsewhere in the resource area are irrigated. Water quality varies in amount and composition of soluble salts. In places the salts content is so high that leaching is required. Wind erosion is a continuing problem in some parts of this resource area, particularly on sandy soils.

Flooding does not significantly affect management and cropping systems. In some areas,

however, measures are needed for reducing the flood hazard.

The choice of crops is somewhat limited because of the climate. Forage crops are the principal crops, but citrus, grapes, cotton, and vegetables are grown also.

Crop Suitability

The western third of the San Diego Area, that is, the Coastal Plains and the Foothills, Land Resource Area 19, is climatically adapted to year-round agricultural production. Elevations are near sea level to about 2,000 feet. Avocados, citrus, truck crops, tomatoes, and flowers are the major crops.

Except for the alluvial plains, the soils on Camp Pendleton are too steep and shallow for agriculture. North and south of San Marcos and southeast of Lemon Grove extending to the Mexican border are areas of steep soils that are shallow over impervious metamorphic rock. None of these areas are used for agriculture. Near Miramar the soils are low in fertility and have too many cobblestones to be suitable for cultivation. Areas in the Mountains lack irrigation water, and winters are too cool for extensive cropping. Areas in the Desert also lack irrigation water.

General requirements for each crop listed in table 21 are given in the paragraphs that follow. Atlas maps that show the suitability of the soils throughout the area for various crops are available from SANCOG.

Avocados.--The climate, soils, and topography in part of the San Diego Area are suited to avocados. Avocados grow well on hillsides. Generally soils on hillsides are moderately to very rapidly permeable and have good air drainage. Avocado root rot is directly related to the permeability of the soil; the slower the permeability, the greater the hazard of root rot. Table 23 shows criteria considered in determining the suitability ratings listed in table 21.

TABLE 23.--CRITERIA FOR RATING SOILS FOR GROWING AVOCADOS

Soil property or quality	No rating	Fair	Good
Depth to hard bedrock or hardpan. ^{1/}	Less than 36 inches-----	36 to 60 inches-----	More than 60 inches.
Subsoil permeability (in./hr.).	Less than 0.63 inch-----	0.63 inch to 20.0 inches.	0.63 inch to 20.0 inches.
Subsoil or substratum material.	Clay or clay loam B horizon, hardpan, or hard rock.	Sandy loam to sandy clay loam B horizon, decomposed granite, or alluvium.	Sandy loam or loam B horizon, decomposed granite, or alluvium.

^{1/}Decomposed granite is not hard bedrock. It is permeable and does not adversely affect growth of avocados.

Citrus.--Citrus is less sensitive to frost and slow permeability than avocados but is more difficult to manage on the steeper slopes. It is commonly grown on nearly level to moderately steep soils. The frost hazard tends to be more severe

on the valley floors, because of cold air drainage, but can be controlled by the use of smudge pots and circulation fans. Table 24 shows criteria considered in determining the suitability ratings listed in table 21.

TABLE 24.--CRITERIA FOR RATING SOILS FOR GROWING CITRUS

Soil property or quality	No rating	Fair	Good
Soil rooting depth. <u>1/</u>	Less than 20 inches-----	20 to 36 inches-----	More than 36 inches.
Subsoil permeability (in./hr.).	0.2 to less than 0.06 inch or more than 20.0 inches.	0.2 to 0.63 inch-----	0.63 to 20.0 inches.
Slope-----	More than 30 percent----	30 to 15 percent-----	Less than 15 percent.

1/ Decomposed granite restricts roots of citrus trees.

Truck Crops.--Truck crop farming is important in the San Diego Area. In the past, most of the truck cropping was along the Coastal Plains. Two crops were grown each year. In recent years, production has been shifting inland in advance of a rapidly expanding metropolitan region. Most production now is along

the eastern edge of the Coastal Plains and within the inland valleys in the Foothills. The soils on these level alluvial fans and plains are deep and sandy and provide the essential requirements for sustained production. Table 25 shows criteria considered in determining the suitability ratings listed in table 21.

TABLE 25.--CRITERIA FOR RATING SOILS FOR GROWING TRUCK CROPS

Soil property or quality	No rating	Fair	Good
Soil depth-----	Less than 20 inches----	20 to 36 inches-----	More than 36 inches.
Surface layer texture. <u>1/</u>	Clayey, rocky, cobbly, stony, very gravelly soils or rock outcrops.	Clay loam, loam, sands, or gravelly loamy coarse sand.	Fine sandy loam, very fine sandy loam, sandy loam, loamy sand, or loamy fine sand.
Subsoil permeability (in./hr.).	Less than 0.6 inch-----	0.06 inch to 2.0 inches or more than 20.0 inches.	2.0 to 20.0 inches.
Slope-----	More than 9 percent----	9 to 5 percent-----	Less than 5 percent.

1/ Clays and clay loams are preferred for celery because sand affects mature heads. Well-managed clays are fair for strawberries.

Tomatoes.--In terms of cash value, tomatoes are by far the most important crop grown in the San Diego Area. Tomatoes are normally considered a truck crop, but because of their economic importance and their unique soil requirements, a separate

rating is provided. Unlike other truck crops, which grow best in sandy soils, tomatoes can be grown in soils that have a high clay content. Table 26 shows criteria considered in the suitability ratings listed in table 21.

TABLE 26.--CRITERIA FOR RATING SOILS FOR GROWING TOMATOES

Soil property	No rating	Fair	Good
Soil depth-----	Less than 20 inches-----	20 to 36 inches-----	More than 36 inches.
Surface layer texture.	Very gravelly, cobbly, or stony soils; loamy sands, sands; rock outcrop.	Sandy loams or gravelly soils. <u>1/</u>	Clay, loam, or clay loam.
Slope-----	More than 30 percent----	30 to 15 percent-----	Less than 15 percent.

1/
No rating for gravelly sands and gravelly loamy sands.

Cut Flowers.--The production of cut flowers in the San Diego Area is a most important enterprise. Because the cash return per acre is high, growers of cut flowers have competed more successfully against urban encroachment than growers of other crops. Cool, overcast days and predominantly sandy

soils are ideal for flowers. Some of the best areas are in and around Leucadia, Encinitas, and Carlsbad. These areas are undergoing rapid urbanization. Table 27 shows criteria considered in determining the suitability ratings listed in table 21.

TABLE 27.--CRITERIA FOR RATING SOILS FOR GROWING CUT FLOWERS

Soil property	No rating	Fair	Good
Soil depth-----	Less than 10 inches-----	10 to 20 inches-----	More than 20 inches.
Surface layer texture.	Clayey soils; very gravelly, cobbly, rocky, or stony soils; rock outcrop.	Loam, clay loam, or gravelly soils. <u>1/</u>	Sandy loams, loamy sands, or sands.
Slope-----	More than 15 percent----	15 to 9 percent-----	Less than 9 percent.

1/
No rating for gravelly clay.

In the Guide to Mapping Units at the back of this survey, the soils of the county are listed in alphabetic order and are rated according to the Storie Index (6). This index expresses numerically the relative degree of suitability, or value, of a soil for general intensive agriculture. The rating is based on soil characteristics only. It does not take into account other factors, such as the availability of water for irrigation, the climate, and the 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 separately in terms of percentage of the ideal, or 100 percent. The factors are:

Factor A, Profile characteristics. Factor A expresses relative suitability of a profile for the growth of plant roots. Soils that have deep permeable profiles are rated 100 percent. Those that have a dense clay layer or a hardpan or are shallow over bedrock are rated less than 100 percent. The rating depends upon the extent to which root penetration is limited.

Factor B, Texture of the surface soil. Factor B is rated according to the texture of the surface soil, which affects the ease of tillage and the capacity of the soil to hold water. The moderately coarse and medium textures--fine sandy loam, loam, and silt loam--are the most desirable and are rated as 100 percent. The coarser and finer textures, such as sand and clay, are rated less than 100 percent.

Factor C, 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 limitation to use of the soil, such as poor drainage or a high water table, erosion, salts or alkali, low fertility, acidity, or unfavorable microrelief. If more than one limitation exists, the values of each are multiplied together to get the X factor.

The index rating of a soil is obtained by multiplying the four factors, A, B, C, and X; thus, any one factor may dominate or control the final rating. For example, a soil may have an excellent profile

justifying a rating of 100 percent for factor A, excellent texture of the surface soil justifying 100 percent for factor B, a smooth, nearly level surface justifying 100 percent for factor C, but a 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 agricultural use as shown by their Storie Index ratings. The six grades and their range in index ratings are:

	<u>Index rating</u>
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 in grade 1 have few or no limitations that restrict their use for crops. Soils in grade 2 are suitable for most crops and have few special management needs, but they have minor limitations that narrow the choice of crops. 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.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of 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 rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, the subclass, and the unit. These levels are described in the following paragraphs.

6/
By Dr. FRANK F. HARRADINE, lecturer in Soil Morphology, University of California, Davis.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, IIe. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used only in some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by w, s, and c, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally

designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-5. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Capability unit numbers generally are assigned locally but are part of a statewide system. All of the units in the system are not represented by the soils of the San Diego Area; therefore the numbers are not consecutive.

Capability units in California are given Arabic numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. Numerals used to designate units within the classes and subclasses indicate the following limitations:

0. Sand and gravel in the substratum.
1. Erosion hazard.
2. Wetness caused by poor drainage or flooding.
3. Slow or very slow permeability of the subsoil or substratum.
4. Coarse texture or excessive gravel.
5. Fine or very fine textured soil.
6. Salts or alkali.
7. Cobblestones, stones, or rocks.
8. Nearly impervious bedrock or a hardpan.
9. Low fertility or toxicity.

Management by Capability Units

The placement of the soils in capability units in the San Diego Area depends partly on land resource areas. Each soil that occurs in two or more resource areas is in two or more capability units.

The use and management of the soils in the San Diego Area by capability units are described in the following pages. The soil series names are mentioned in each capability unit, but this does not mean that all mapping units in the series are in that particular unit. The capability designation for each soil in the survey area is given in the "Guide to Mapping Units." The number of the resource area is added in parentheses to the class, subclass, and unit designation.

Capability Unit I-1(19)

The soils in this unit are very deep and well drained or moderately well drained. They are in the Chino, Ramona, Reiff, Salinas, and Visalia series. They are on alluvial fans and plains. Slopes are 0 to 2 percent. The surface layer is sandy loam to clay loam, and the subsoil or underlying material is loam to heavy clay loam.

These soils have medium to high fertility. They are friable and fairly easy to work. A pan is likely to form in areas where tillage is excessive. The available water holding capacity ranges from 7.5 to 11.5 inches in the 60 inches of rooting depth. Permeability is moderately rapid to moderately slow.

The soils in this unit are suited to walnuts, citrus, flowers, tomatoes, and truck, forage, field, and specialty crops. Reiff and Visalia soils are also suited to avocados. In many locations, winter frost is severe enough to affect production of citrus and avocados and some truck crops. Nearly all crops but legumes respond to nitrogen. All crops but avocados respond to phosphorus. The supply of potassium is apparently adequate for all crops. Deficiencies of zinc and other minor elements occur in places.

There is little or no hazard of erosion because these soils are nearly level. Both sprinklers and furrows are used for irrigating.

Capability Unit I-1(30)

This unit consists of very deep, well-drained soils. Slopes are 0 to 2 percent. These are soils of the Indio and Indio, dark variant, series. Their texture is predominantly silt loam, but thin strata of loam and fine sandy loam occur in the substratum. They are calcareous and mildly to moderately alkaline.

These soils are very friable and easy to work. Excessive tillage disperses the surface soil, reduces the rate of infiltration, and causes a weak tillage pan to form. Fertility is high. The available water holding capacity is 7.5 to 9.5 inches in the 60 inches of rooting depth. Permeability is moderate. Runoff is very slow, and the erosion hazard is none to slight.

The soils in this unit are suited to many kinds of crops, mainly alfalfa, cotton, grain sorghum, barley, dates, melons, and selected truck crops. Deep cuts can be made in land leveling without reducing productivity. Nonlegumes respond to nitrogen and phosphorus, and legumes respond to phosphorus. The supply of potassium is adequate.

Wind erosion is likely in spring if the surface soil is dry and pulverized. The hazard of water erosion caused by improper irrigation methods is slight. Borders and furrows are used for irrigating.

Capability Unit IIe-1(19)

The soils in this unit are moderately deep to very deep and well drained to moderately well drained. They are in the Chino, Elder, Fallbrook, Greenfield, Ramona, Reiff, Salinas, Visalia, and Wyman series. They are on alluvial fans and plains. Slopes are 2 to 9 percent. The surface layer ranges from clay loam to sandy loam, and the subsoil or underlying material ranges from sandy loam to clay loam. In places the soils are gravelly throughout. The rooting depth is more than 60 inches in all but

the Fallbrook soil. This soil is 32 to 60 inches deep and overlies decomposed granodiorite.

These soils have medium to high fertility. They are friable and fairly easy to work. A pan is likely to form in areas where tillage is excessive. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water holding capacity is 5 to 11.5 inches. Permeability is moderately rapid to moderately slow.

These soils are suited to walnuts, citrus, flowers, tomatoes, and pasture, truck, field, and specialty crops. All but Chino, Ramona, Salinas and Wyman soils are suited to avocados. Crops sensitive to frost, particularly citrus and avocados, should be protected. Some locations are too cold for such crops. Most crops respond to nitrogen and phosphorus. Potassium rarely is needed. Deficiencies of minor elements, particularly zinc, occur in places.

Sheet and gully erosion can be controlled by tilling across the slope, by growing cover crops, and by leaving crop residue on the surface during rainy periods. Provision for handling runoff from adjacent areas is needed in places. Generally, sprinklers are used for irrigating. Furrows, along with moderate leveling and land shaping, can be used on Chino, Elder, Ramona, Salinas, Visalia, and Wyman soils.

Capability Unit IIe-1(30)

This unit consists of very deep, well-drained soils. Slopes are 2 to 5 percent. These are soils of the Indio and Mecca series. Their texture is coarse sandy loam or silt loam. Some stratification occurs, but the change in texture is not significant enough to greatly change the permeability or the available water holding capacity. The soils are calcareous and mildly to moderately alkaline.

These soils are very friable and easy to till. Excessive tillage frequently disperses the surface soil, reduces infiltration, and causes a tillage pan to form. Fertility is medium to high. The available water holding capacity is 5 to 9.5 inches in the 60 inches of rooting depth. Permeability is moderately rapid to moderate. Runoff is slow, and the erosion hazard slight.

The soils in this unit are suited to many kinds of crops, mainly alfalfa, cotton, grain sorghum, barley, dates, citrus, melons, and selected truck crops. Deep cuts made in land leveling do not reduce productivity. Nonlegumes respond to nitrogen and phosphorus, and legumes respond to phosphorus. The supply of potassium is adequate.

Controlling erosion is a problem if the irrigation system is not properly installed, for example, irrigating in furrows or borders that run down the slope. Wind erosion is likely in spring if the surface soil becomes dry and pulverized.

Borders or furrows across the slope are suitable for irrigating. Cross-slope farming, returning crop residue to the soil, and growing cover crops help in controlling erosion.

Capability Unit IIe-4(30)

Mecca fine sandy loam, 0 to 2 percent slopes, eroded, is the only soil in this unit. It is calcareous and mildly to moderately alkaline, very deep, and well drained, and is subject to wind erosion. There are low wind hummocks in some areas.

This soil is very friable and easy to till. Excessive cultivation causes a weak tillage pan to form. Fertility is medium. The available water holding capacity is 7.5 to 8 inches in the 60 inches of rooting depth. Permeability is moderately rapid. The soil is moderately eroded, mainly by wind; the hazard of water erosion is slight.

This soil is suited to a variety of cultivated crops, mainly alfalfa, cotton, grain sorghum, barley, dates, and melons. Deep cuts can be made in land leveling without reducing productivity. Non-legumes respond to nitrogen and phosphorus, and legumes respond to phosphorus. The supply of potassium is adequate.

Damage to young seedlings by the abrasive action of windblown sands is common. Establishing windbreaks, growing crops that are not easily damaged by wind, or keeping the soil moist during windy periods helps in controlling wind erosion. Borders and furrows are used for irrigating.

Capability Unit IIe-5(19)

The soils in this unit are moderately deep to very deep, moderately well drained to well drained clays on alluvial fans or uplands. Slopes are 2 to 9 percent. These are soils of the Altamont, Auld, Diablo, and Salinas series. In some places they are 34 to 60 inches deep over soft sandstone, shale, or metavolcanic rock; in others they are more than 60 inches deep in alluvium.

These soils have medium to high fertility. They are difficult to till because of their clay texture. When dry, the surface layer becomes granular and deep cracks form. When wet, the soil swells and the cracks close. No strong tillage pans form. Runoff is slow to medium, and the erosion hazard slight to moderate. The available water holding capacity is 5 to 10 inches. Permeability is slow.

These soils are best suited to tomatoes and field and specialty crops. They are not suited to avocados.

Only a small acreage is grazed. All crops respond to nitrogen and phosphorus. The supply of potassium is generally adequate.

Most of the soils are gently sloping to moderately sloping. Soil particles are not easily dispersed or readily detached during winter storms. Irrigation furrows and all tillage should be across the slope to reduce the hazard of erosion. Cover crops and the return of crop residue help to increase water intake, improve tilth, and control erosion.

Provision for handling runoff from adjacent areas is needed in places. Both sprinklers and furrows are used in irrigating.

Capability Unit IIw-2(19)

The only soil in this unit is Grangeville fine sandy loam, 0 to 2 percent slopes. It is a very deep, somewhat poorly drained soil on alluvial fans and plains. Following rainy periods in winter and spring, the water table is within a depth of 4 feet. During dry periods, it frequently drops to a depth of more than 8 feet. Salinity ranges from none to slight. The texture of the surface layer and the underlying material is fine sandy loam. Occasionally this soil is subject to damaging overflow.

This soil has high fertility. It is easy to till except when wet. Tillage pans do not form readily. In well-drained areas the available water holding capacity is 7.5 to 9 inches in the 60 inches of rooting depth. Runoff is very slow, and the erosion hazard is slight.

This soil is suited to tomatoes, flowers, and field, truck, forage, and specialty crops. In many locations the hazard of winter frost is severe enough to prevent the growth of frost-sensitive crops. Practically all crops respond to nitrogen and phosphorus. The supply of potassium is adequate.

Erosion is no problem except where runoff from diversion terraces is concentrated and a gully forms. Saline soils occur locally. The salts can be leached out readily and the water table kept below the root zone if suitable drainage is installed. Sprinklers are used for irrigating.

Capability Unit IIw-2(20)

This unit consists of Loamy alluvial land, very deep, somewhat poorly drained soil material in former wet meadows. Slopes are 0 to 5 percent. The texture ranges from silt loam to sandy loam. In many places the material is stratified with silt loam to fine sand. Overflow is a hazard in winter.

Loamy alluvial land has medium to high fertility. The available water holding capacity in the 60 inches of rooting depth is 6 to 9 inches. Permeability is moderate. Runoff is very slow to slow, and the erosion hazard is slight.

All areas are used for pasture and range. Average annual precipitation is 30 inches. Pasture and range respond to nitrogen and phosphorus. The supply of potassium is adequate.

Gully erosion is a serious problem in some areas. Head cutting of gullies is typically a hazard. Grass waterways or some kind of mechanical drop is used to control erosion. The gullies act as drainage channels in areas that were wet meadows before they were drained.

Capability Unit IIs-4(19)

Greenfield sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is a very deep, well-drained soil on alluvial fans and plains. The texture is sandy loam in both the surface layer and the subsoil.

This soil has medium fertility. It is friable and easy to work. A pan forms if tillage is excessive. Runoff is very slow, and the erosion hazard is slight. The available water holding capacity is 5.6 to 7.5 inches in the 60 inches or more of rooting depth.

This soil is suited to citrus, avocados, flowers, tomatoes, walnuts, truck crops, and pasture. Protection is needed for frost-sensitive crops, particularly citrus and avocados. Some locations are too cold for such crops. Most crops respond to nitrogen and phosphorus. They rarely respond to potassium. Deficiencies of minor elements, particularly zinc, occur in places.

Sheet and gully erosion can be controlled by growing cover crops and by leaving crop residue on the surface during rainy periods. Provision for handling runoff from adjacent soils is needed in places. Generally, sprinklers are used for irrigating. Furrows can be used along with moderate land shaping.

Capability Unit IIs-4(30)

Mecca coarse sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is very deep, well drained, calcareous, and mildly to moderately alkaline.

This soil is very friable and easy to till. Pans form readily if tillage is excessive. Fertility is medium. The available water holding capacity is 5 or 6 inches in the 60 inches or more of rooting depth. Permeability is moderately rapid. Runoff is very slow, and the erosion hazard slight.

This soil is suited to many kinds of crops, mainly alfalfa, cotton, grain sorghum, barley, dates, melons, and selected truck crops. Deep cuts can be made in land leveling without reducing productivity. Nonlegumes respond to nitrogen and phosphorus, and legumes respond to phosphorus. The supply of potassium is adequate.

The erosion hazard is slight. Abrasion caused by drifting sand is a temporary problem. Young seedlings readily show stress for moisture during periods of high temperatures and dry winds, even though the supply of soil moisture is fairly adequate. Frequent and light irrigations are needed during these periods. Furrows and borders are used for irrigating.

Capability Unit IIs-5(19)

This unit consists of Clayey alluvial land and a very deep, moderately well drained soil in the Salinas series. Both are on alluvial fans and plains and on terraces. Slopes are 0 to 2 percent. The surface layer and the subsoil are dominantly clay but range to clay loam that contains strata of sandy loam.

Fertility is medium to high. The available water holding capacity is 7.5 to 10 inches in the 60

inches of rooting depth. Runoff is very slow, and the erosion hazard is slight. The clay texture makes these soils difficult to till. A pan forms if tillage is excessive.

The soils in this unit are best suited to tomatoes, celery, and pasture crops. All crops respond to nitrogen and phosphorus. The supply of potassium is usually adequate.

Erosion is a minor hazard because the soils are nearly level and the clay is not easily dispersed. Protection from runoff from adjacent soils is needed in places. Flooding is infrequent. Cover crops, crop residue, and other sources of organic matter should be utilized to increase water intake and improve tilth. Both furrows and sprinklers are used for irrigating.

Capability Unit IIs-6(19)

Chino silt loam, saline, 0 to 2 percent slopes, is the only soil in this unit. It is a very deep, moderately well drained soil on alluvial fans. It is silt loam throughout. It contains a small amount of soluble salts.

This soil is easy to till except when wet. Tillage pans do not form readily. Fertility is high. The available water holding capacity is 9 to 11 inches in the 60 inches of rooting depth. Permeability is moderate. Runoff is very slow, and the erosion hazard is slight.

This soil is used for pasture and citrus. It is suited to a variety of salt-tolerant crops. If leached of salts, it can be used for tomatoes and truck and specialty crops. Nitrogen and phosphorus increase forage yields. No potassium is needed.

Sheet and gully erosion can be controlled by growing cover crops and leaving residue on the surface. Provision for handling runoff from adjacent soils is needed in places. Generally, sprinklers are used for irrigating. Furrows can be used, along with moderate leveling and shaping. Irrigation water in excess of crop needs should be applied to leach out salts.

Capability Unit IIIe-1(19)

This unit consists of moderately deep to very deep soils on uplands and deep to very deep soils in valleys. Slopes are dominantly 5 to 9 percent but range from 2 to 15 percent. These soils are in the Escondido, Fallbrook, Greenfield, Las Posas, Ramona, Visalia, Vista, and Wyman series. They are moderately well drained to well drained. They overlie metasedimentary rock, gabbro, or granodiorite. The texture of the surface layer ranges from coarse sandy loam to loam, and that of the subsoil or underlying material from light clay to sandy loam.

These soils have medium to high fertility and in most places are friable and easy to work. A tillage pan is likely to form in areas where the subsoil is clay loam or loam. The soils have a

rooting depth of 26 to more than 60 inches and hold 4 to 11 inches of water available to plants. Runoff is slow to medium, and the erosion hazard slight to moderate.

The soils in this unit are suited to citrus, tomatoes, flowers, and truck crops. All but the Las Posas, Ramona, and Wyman soils are suited to avocados. The Greenfield, Visalia, and Wyman soils, 9 to 15 percent slopes, are not suited to truck crops. Protection from frost is needed for citrus and avocados. Locally small acreages are dryfarmed, mainly to small grain and forage crops. Nitrogen is needed for all crops. Most field and forage crops respond to phosphorus. The supply of potassium is adequate. Deficiencies in minor elements, particularly zinc, occur in places.

Water erosion is a hazard, especially in moderately sloping areas. Growing cover crops or leaving crop residue on the surface during rainy periods helps control erosion. Tillage across the slope or on the contour and diversion ditches are needed locally. Generally, sprinklers are used for irrigation. Contour furrows are used for some specialty crops.

Capability Unit IIIe-1(20)

This unit consists of deep to very deep, well-drained soils on uplands and alluvial fans. Slopes are 2 to 9 percent. These soils are in the Boomer, Holland, and Reiff series. The surface layer ranges from fine sandy loam to loam, and the subsoil from fine sandy loam to clay loam. The root zone is restricted by the underlying weathered bedrock.

These soils have medium to high fertility. They are friable and easy to work. The available water holding capacity ranges from 4.5 to 9 inches in the 36 to more than 60 inches of rooting depth. Permeability ranges from moderately slow to moderately rapid. Runoff is slow to medium, and the erosion hazard slight to moderate.

These soils are used for dryfarmed small grain, forage crops, deciduous orchards, and vineyards. The average annual precipitation is 14 to 38 inches. Supplemental irrigation is seldom needed. Crops respond to nitrogen and phosphorus. The supply of potassium is adequate.

Maintaining a vegetative mulch, cover crops, and crop residue on the surface prevents excessive erosion during the rainy periods. Rough tillage is desirable also. A vegetative waterway or some kind of mechanical drop is often used to control head cutting of gullies in moderately sloping areas. All tillage should be done across the slope.

Capability Unit IIIe-3(19)

This unit consists of moderately deep to deep, moderately well drained soils that have a very slowly permeable subsoil. These are soils of the Bonsall, Fallbrook, Huerhuero, and Placentia series.

They are on foot slopes, marine terraces, terraces, alluvial fans, and uplands. Slopes are 2 to 9 percent. The surface layer is gravelly clay loam to loamy fine sand. The subsoil is heavy clay loam to clay.

Fertility is low to high. Runoff is slow to medium, and the erosion hazard slight to moderate. The available water holding capacity is 3.5 to 6 inches in the 18 to 44 inches of rooting depth. Mixing the clayey subsoil with the coarser textured surface soil and land shaping, other than minor smoothing, should be avoided. Exposed subsoil material is difficult to bring into a reasonably productive state. Tillage pans do not form readily.

The soils in this unit are suited to flowers and tomatoes. Huerhuero soils are also used for truck crops. Some areas are used for range. Tomatoes are grown commercially under intensive management and fertilization. Small acreages of small grain and forage crops are dryfarmed. Nitrogen is needed for all crops. The response to phosphorus varies. The supply of potassium is adequate.

If exposed, the surface soil erodes rapidly in moderately sloping areas during rainy periods in winter. Growing cover crops, leaving crop residue on the surface during rainy periods, and tilling across the slope are necessary measures in erosion control. Provision for handling runoff from adjacent soils is needed in places. Both sprinklers and furrows are used for irrigating.

Capability Unit IIIe-5(19)

This unit consists of moderately deep to deep, well-drained clays on uplands. Soils are in the Altamont, Auld, Bosanko, and Diablo series. Slopes range from 2 percent but are dominantly 9 to 15 percent. These soils are 20 to 60 inches deep over decomposed rock or hard rock. When dry, the surface layer becomes granular and deep cracks form. When wet, the soil swells and the cracks close.

These soils have medium to high fertility. They hold 3.5 to 9 inches of water in the 20 to 60 inches of rooting depth. Permeability is slow when the soil is moist. Runoff is slow to medium, and the erosion hazard slight to moderate. Tillage pans do not form easily because the soil shrinks and swells.

The soils in this unit are suited to field crops and tomatoes (pl. III, bottom). In a few areas they are used for grazing and dryfarmed field crops. Avocados are not suited. Tomatoes are grown commercially. All crops respond favorably to nitrogen and phosphorus. The supply of potassium is adequate. Air drainage is good, and frost-sensitive crops can be grown in nearly all locations.

The erosion hazard is moderate in unprotected areas, some of which are moderately eroded. Contour or cross-slope farming helps in erosion control. Crop residue management, cover crops, and additions of organic matter by mulching and manuring (pl. IV, bottom) increase water intake. Irrigating with

contour furrows is a common practice where tomatoes are grown commercially. Sprinklers are used also. All tillage must be done at the proper moisture content to avoid puddling or the formation of large hard clods.

Capability Unit IIIe-8(19)

The soils in this unit are moderately well drained to well drained and are moderately deep over a very slowly permeable hardpan or bedrock. They are in the Arlington, Carlsbad, and Escondido series. They are on alluvial fans, low ridges, and uplands. Slopes are 2 to 9 percent. The texture of the surface layer and the subsoil is gravelly loamy sand to very fine sandy loam.

These soils have medium fertility. They are friable and fairly easy to work. A weak pan forms in areas where tillage is excessive. Runoff is slow to medium, and the erosion hazard slight to moderate. The available water holding capacity is 3.5 to 5.5 inches in the 24 to 40 inches of rooting depth. Permeability is moderate to moderately rapid, as far down as the hardpan or rock. Leveling is to be avoided because it reduces the soil depth in cut areas and in places exposes the hardpan or bedrock.

The soils in this unit are suited to field and truck crops and flowers. All but the Arlington soils are suited to citrus. Arlington and Escondido soils are suited to tomatoes.

Skillful application of irrigation water prevents waterlogging above the hardpan or bedrock. Protection for frost-sensitive crops is frequently needed in some inland areas. Crops respond to nitrogen and usually respond favorably to phosphorus. The supply of potassium is adequate. Cross-slope farming, crop residue management, and cover crops help in erosion control. Sprinklers are used for irrigating.

Capability Unit IIIec-1(20)

The unit consists of very deep, well-drained soils of the Bull Trail series. These soils are in alluvial basins. Slopes are 2 to 9 percent. The surface layer is sandy loam, and the subsoil is sandy clay loam.

These soils have medium fertility. They are friable and easy to till. The available water holding capacity is 6 to 7.5 inches in the 60 inches of rooting depth. Permeability is moderately slow. Runoff is slow to medium, and the erosion hazard slight to moderate.

These soils are used for dryfarmed small grain, forage crops, deciduous orchards, and vineyards. The average annual precipitation is 16 to 22 inches. Supplemental irrigation is seldom needed. All crops respond to nitrogen and phosphorus. The supply of potassium is adequate.

Maintaining a vegetative mulch, cover crops, or crop residue on the surface prevents excessive erosion during the rainy periods. Rough tillage is desirable also. Vegetative waterways or some kind

of mechanical drop is often used to control head cutting of gullies in moderately sloping areas. All tillage should be done across the slope.

Capability Unit IIIs-3(19)

This unit consists of moderately deep, moderately well drained soils on terraces and marine terraces. Slopes are 0 to 5 percent. These are soils of the Placentia and Stockpen series. The surface layer is sandy loam and gravelly clay loam, and the subsoil is sandy clay and gravelly clay.

These soils have medium fertility. The available water holding capacity is 3.5 to 5 inches in the 20 to 36 inches of rooting depth. Permeability is very slow in the subsoil. Runoff is very slow, and the erosion hazard is slight. In tilling the Placentia soil, precautions should be taken not to mix the sandy clay subsoil with the sandy loam surface layer. Land shaping, other than minor smoothing, should be avoided on both soils. Exposed subsoil material is difficult to bring into a reasonably productive state. Tillage pans do not form readily.

The soils in this unit are suited to tomatoes and flowers. Stockpen soils are also suited to truck crops. Crops respond to nitrogen and phosphorus.

Unless protected during rainy periods, these soils erode. Growing cover crops and leaving crop residue on the surface help in controlling erosion. Provision for handling runoff from adjacent soils is needed in places. Sprinklers and furrows are used for irrigating. Irrigation water must be applied carefully to avoid perching the water table above the very slowly permeable subsoil.

Capability Unit IIIs-4(19)

This unit consists of very deep, somewhat excessively drained soils on alluvial fans and beach ridges. Slopes are 2 to 9 percent. These soils are in the Corralitos and Marina series. They are loamy coarse sands to loamy sands.

These soils have medium fertility. They are very friable and easy to work. The available water holding capacity is 3.7 to 5 inches in the 60 inches of rooting depth. Permeability is rapid. Runoff is slow to medium, and the erosion hazard slight to moderate. The hazard of soil removal or deposition is only slight.

If well managed, the soils in this unit are suited to truck and specialty crops, avocados, citrus, and alfalfa. The specialty crops are mainly flowers and nursery stock. Citrus needs protection from frost, except in areas near the coast. The response to nitrogen is good, and the response to phosphorus is usually favorable. The supply of potassium is usually adequate, but deficiencies in trace elements, particularly zinc, affect some crops.

Wind erosion is very slight but damages young tender plants in exposed locations unless cover is adequate. Cover crops, crop residue management, and

other organic additions help in controlling wind and water erosion. Cross-slope cultivation reduces the erosion hazard. Sprinklers are used for irrigating. Furrows are not suitable because infiltration and permeability are rapid and too much water is lost from the root zone through deep percolation.

Capability Unit IIIs-6(30)

This unit consists of very deep, well drained and moderately well drained, slightly to moderately saline soils in the Indio and Mecca series. Slopes are 0 to 2 percent. Textures are silt loam to sandy loam. The soils have a fluctuating water table, generally at a depth of more than 60 inches. They are calcareous and moderately alkaline.

Fertility is high to medium. The available water holding capacity is 6 to 9.5 inches in the 60 inches of rooting depth. Permeability is moderate to moderately rapid. Runoff is very slow, and the erosion hazard none to slight. The salinity ranges from slight to moderate. If worked when very moist, the soils are easily dispersed and tillage pans form easily.

These soils are suited to range and salt-tolerant crops, such as alfalfa, cotton, barley, and selected grasses.

To bring the soils into a moderately high level of production, the salts have to be leached out of the root zone. If reclamation is successful, the soils can be managed like those in unit I-1(30). Providing adequate drainage for leaching is frequently a problem. Drainage systems must be designed.

Capability Unit IIIC-1(20)

Reiff fine sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is a very deep, well-drained soil on alluvial fans and plains. In many places it is stratified with sandy loam to loam.

This soil has high to medium fertility. It is friable and easy to work. The available water holding capacity is 7.5 to 9 inches in the 60 inches of rooting depth. Permeability is moderately rapid. Runoff is very slow, and the erosion hazard slight.

This soil is suited to dryfarmed small grain, forage crops, deciduous orchards, and vineyards. The average annual precipitation is 14 to 17 inches. Supplemental irrigation is seldom needed. All crops respond to nitrogen and phosphorus. The supply of potassium is apparently adequate.

Controlling gully erosion is a problem in some areas. Head cutting of gullies is typically a hazard. Vegetative waterways or some kind of mechanical drop is used for diverting runoff.

Capability Unit IVE-1(19)

The soils in this unit are moderately well drained to well drained. Included are moderately deep

and deep, upland soils of the Fallbrook, Las Posas, Linne, and Vista series and very deep soils of the Ramona series, on alluvial fans. Slopes are dominantly 9 to 15 percent but range to 30 percent. The surface layer ranges from coarse sandy loam to clay loam. The subsoil or underlying material ranges from sandy loam to light clay.

These soils have medium fertility. They are friable and easy to work. A pan is likely to form in areas where tillage is excessive. The available water holding capacity is 3.5 to 10.5 inches in the 26 to more than 60 inches of rooting depth. Permeability is moderately slow to moderately rapid. Runoff is medium to rapid, and the erosion hazard moderate to high.

All the soils are used for citrus, flowers, tomatoes, and range. Fallbrook and Vista soils are also used for avocados. The Linne soil is used mainly for range. Only a small acreage is dry-farmed small grain. Occasionally, protection against frost damage is needed in areas on alluvial fans. All crops respond to nitrogen. All but avocados respond to phosphorus. The supply of potassium apparently is adequate. Deficiencies of zinc and other minor elements occur in places.

Intensive management is needed to control erosion in clean-tilled areas. Tilling across the slope or on the contour, growing cover crops, leaving crop residue on the surface during rainy periods, and installing diversion terraces help control erosion. Generally, sprinklers are used for irrigating. Contour furrows can be used on tomatoes, but intensive management is needed.

Capability Unit IVE-1(20)

Holland fine sandy loam, 5 to 15 percent slopes, is the only soil in this unit. It is a well-drained soil on uplands. Slopes are 5 to 15 percent. The soil is moderately deep to deep over micaceous schist. The subsoil is sandy clay loam.

This soil has high fertility and is friable and easy to till. The available water holding capacity ranges from 3 to 7 inches in the 23 to 50 inches of rooting depth. Permeability is moderately slow. Runoff is slow to medium, and the erosion hazard slight to moderate.

This soil is moderately or poorly suited to dry-farmed small grain and forage crops. It is fairly well suited to vineyards and deciduous orchards because it is in areas of high precipitation. Supplemental irrigation is seldom needed. The average annual precipitation is 20 to 35 inches. All crops respond to nitrogen and phosphorus.

Growing winter annual crops helps to control soil loss during winter rains. All tillage should be done across the slope or on the contour. Range is the predominant use. Range management is described under the heading "Loamy range site."

Capability Unit IVE-3(19)

The soils in this unit are moderately well drained and shallow to moderately deep. They have a very slowly permeable, dense clay subsoil. These are soils of the Bonsall, Chesterton, Huerhuero, Las Flores, and Placentia series. They formed on uplands, alluvial fans, and terraces. Slopes are 2 to 15 percent. The surface layer is loam to loamy fine sand. The subsoil ranges from heavy clay loam to clay. Few roots penetrate below a depth of 40 inches.

These soils have low to medium fertility. The available water holding capacity is 2.5 to 5.5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate.

All but the Bonsall and Las Flores soils are used for flowers and tomatoes and a few selected crops. They are not generally suited to citrus. Under good management, citrus can be grown in areas where the subsoil is a lighter clay. Truck crops are limited to Chesterton and Las Flores soils. Under intensive management and fertilization, tomatoes can be grown commercially. Small acreages are used for dryfarmed small grain and forage crops. The response to nitrogen and phosphorus is favorable. The supply of potassium is adequate.

Care is needed in cultivated areas to avoid mixing the clay subsoil with the coarser textured surface material. Pans do not form readily. The erosion hazard increases in clean-tilled areas. In most areas the soils are moderately eroded. Tilling on the contour, growing cover crops, and leaving crop residue on the surface during rainy periods keep soil losses at a minimum. Both sprinklers and contour furrows are used for irrigating. Care is needed in irrigating to avoid perching the water table above the very slowly permeable subsoil.

Capability Unit IVE-4(30)

Rositas fine sand, 0 to 2 percent slopes, is the only soil in this unit. It is somewhat excessively drained, very deep, slightly calcareous, and mildly to moderately alkaline.

This soil is soft and easy to till. Fertility is low. The hazard of water erosion is slight. The available water holding capacity is 3 to 4 inches in the 60 inches of rooting depth. Permeability is rapid. Runoff is very slow. Wind erosion is a moderate hazard.

This soil is best suited to grapefruit, vineyards, and alfalfa. It is poorly suited to most row crops, such as cotton or grain sorghum, because of the blowing sand. Deep cuts can be made in leveling without reducing productivity. Nonlegumes respond to nitrogen and phosphorus. Legumes respond only to phosphorus. The supply of potassium is adequate.

Loss of water through deep percolation and damage to young plants by the abrasive action of drifting sand are the main problems. Perennial crops and windbreaks greatly reduce the hazard of erosion. Irrigation should provide for large amounts of

water and short runs to prevent excessive loss of water through deep percolation. Furrows and borders are used for irrigating.

Capability Unit IVE-5(19)

This unit consists of well-drained, shallow to moderately deep clays on uplands. Slopes range from 5 percent but are dominantly 15 to 30 percent. These soils are in the Altamont, Bosanko, and Diablo series. They are 16 to 36 inches deep over decomposed rock. When dry, the surface layer becomes granular and deep cracks form. When wet, the soils swell and the cracks close.

These soils have medium to high fertility. The available water holding capacity is 2.5 to 5.5 inches. Permeability is slow. Runoff is slow to rapid, and the erosion hazard slight to high. Tillage pans do not form easily because the soil shrinks and swells.

All the soils are suited to range. All except Bosanko stony clay are suited to tomatoes. None are suited to avocados. A few specialty crops are sometimes grown in areas under intensive management. Citrus can be grown on the Bonsanko soil but requires efficient irrigation and tillage practices. Only a small acreage is grazed. All crops respond to nitrogen and phosphorus. The supply of potassium is generally adequate. Deficiencies of minor elements affect citrus. Air drainage is very good, and frost-sensitive crops can be grown in all locations.

Sheet and gully erosion are hazards in unprotected areas. Tilling on the contour, growing cover crops, and leaving crop residue on the surface during rainy periods are needed for erosion control. Generally, sprinklers are used for irrigating. Contour furrows are used for intensively managed vegetable crops.

Capability Unit IVE-8(19)

The soils in this unit are moderately well drained or well drained and are moderately deep over bedrock or a very slowly permeable hardpan. They are in the Carlsbad and Escondido series. They are on uplands. Slopes are 9 to 15 percent. The surface layer is gravelly loamy sand or very fine sandy loam, and the subsoil is loamy sand or very fine sandy loam.

These soils have medium fertility. They are friable and fairly easy to work. A weak pan is likely to form in areas where tillage is excessive. Runoff is medium, and the erosion hazard moderate. The available water capacity is 3 to 5.5 inches in the 20 to 39 inches of rooting depth. Permeability is moderate to moderately rapid as far down as the hardpan.

These soils are used for citrus, flowers, specialty crops, and dryfarmed grain. Only the Escondido soil is suited to tomatoes. Protection for frost-sensitive crops is occasionally needed in some inland areas. The response to nitrogen and phosphorus is

usually favorable. The supply of potassium is generally adequate.

The hazard of erosion is moderate in areas under clean tillage. Tilling on the contour, growing winter cover crops, and leaving crop residue on the surface help in erosion control. Generally, sprinklers are used for irrigating. Contour furrows or cross-slope furrows are commonly used for tomatoes or specialty crops in areas under intensive management.

Capability Unit IVec-1(20)

This unit consists of well-drained, very deep soils on alluvial fans and basins. Slopes are 2 to 15 percent. These are soils of the Bull Trail and Calpine series. The texture of the surface layer ranges from coarse sandy loam to sandy loam, and that of the subsoil from coarse sandy loam to sandy clay loam.

The soils in this unit have medium to low fertility and are very friable and easy to till. The available water holding capacity is 4.5 to 7.5 inches in the 60 inches of rooting depth. Permeability is moderately rapid to moderately slow. Runoff is slow to medium, and the erosion hazard slight to moderate.

Soils in this unit are poorly suited to dryfarmed small grain and forage crops. The average annual precipitation is 11 to 22 inches. Supplemental irrigation is seldom needed. All crops respond to nitrogen and phosphorus. The supply of potassium is adequate.

Growing winter annual crops helps to control soil loss during winter rains. All tillage should be done across the slope or on the contour. Range is the predominant use. Range management is described under the heading "Loamy range site."

Capability Unit IVec-4(20)

This unit consists of deep, somewhat excessively drained soils on uplands. Slopes are 5 to 15 percent. These are soils of the Kitchen Creek series. The surface layer is loamy coarse sand, and the subsoil is coarse sandy loam. These soils are underlain by weathered granitic bedrock.

These soils are very friable and easy to till. Fertility is low. The available water holding capacity ranges from 3 to 5.5 inches but averages more than 4 inches in the 36 to 60 inches of rooting depth. Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard slight to moderate.

The soils in this unit are poorly suited to dryfarmed small grain or forage crops, except when winter precipitation is above normal. The average annual precipitation is 12 to 18 inches. Supplemental irrigation is seldom needed. All crops respond to nitrogen and phosphorus. The supply of potassium is adequate.

Growing winter annual crops controls most soil loss during winter rains. Range management is described under the heading "Sandy range site."

Capability Unit IVs-3(19)

Placentia sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is shallow over a very slowly permeable sandy clay subsoil and is moderately well drained. It is on terraces. The surface layer is sandy loam, and the subsoil is sandy clay.

This soil is low to medium in fertility. The available water holding capacity is 3 to 4 inches in the 10 to 20 inches of rooting depth. Permeability is very slow. Runoff is very slow, and the erosion hazard is slight. Care is needed in tilled areas to avoid exposing the sandy clay subsoil or mixing it with the coarser textured surface material.

If well managed, this soil is suited to tomatoes, flowers, and dryfarmed grain. It is not suited to avocados because the subsoil is very slowly permeable. All commonly grown crops respond to nitrogen, and some respond to phosphorus.

Leaving crop residue on the surface reduces the hazard of erosion. Flooding is infrequent. Provisions for handling runoff from adjacent soils are needed. Both sprinklers and furrows are used for irrigating. Care is needed in irrigating to avoid a perched water table.

Capability Unit IVs-4(19)

The soils in this unit are very deep, somewhat excessively to excessively drained and moderately rapidly to very rapidly permeable. They are in the Anderson, Corralitos, Marina, and Tujunga series. They are soils on alluvial fans and plains adjacent to steep mountains and beach ridges. Slopes are 0 to 30 percent. The texture ranges from very gravelly sandy loam to sand.

These soils have low to medium fertility. Runoff is very slow to medium, and the erosion hazard is slight to moderate. The available water holding capacity is 3 to 5 inches in the 60 inches of rooting depth. Flooding is an infrequent hazard on the Tujunga soil. Tillage is difficult in some areas because of the large amount of gravel.

All the soils are suited to avocados and range. All except the Tujunga soil are suited to citrus. All except the Anderson soil are suited to flowers. The Tujunga soil is suited to truck crops. Protection against frost is needed for avocados, citrus, and other frost-sensitive crops in nearly level to gently sloping areas. All crops respond to nitrogen. All but avocados respond to phosphorus. The supply of potassium is adequate. Deficiencies in trace elements, especially zinc, occur in some locations.

The rapid infiltration reduces the rate of runoff during rainy periods. A perennial cover crop of

moderate density generally gives adequate protection against erosion in the steeper areas. Generally sprinklers are used in irrigating. A well-managed, adequately designed irrigation system is required if furrows are used. Light, frequent irrigation is needed to avoid leaching out nutrients and losing too much water through deep percolation.

Capability Unit IVs-4(30)

This unit consists of very deep soils in the Rositas series. Slopes are 0 to 9 percent. These soils are predominantly loamy coarse sands. They are somewhat excessively drained, slightly calcareous, and mildly to moderately alkaline.

These soils are very friable and easy to till. Tillage pans are seldom a problem. Fertility is low. The available water holding capacity is 3 to 4 inches in the 60 inches of rooting depth. Permeability is rapid. Runoff is very slow to medium, and the erosion hazard is slight to moderate.

These soils are best suited to grapefruit, vineyards, and alfalfa. Deep cuts can easily be made in leveling without reducing productivity. Non-legumes respond to nitrogen and phosphorus, but legumes respond only to phosphorus. The supply of potassium is adequate.

Wind erosion is a problem occasionally, and the soils are slightly damaged by drifting sand. The loss of water through deep percolation is a major hazard. Irrigations need to be light and frequent to prevent excessive loss of water. Furrows and borders are used for irrigating.

Capability Unit IVsc-4(20)

This unit consists of very deep, excessively drained soils on flood plains and alluvial fans. Slopes are 0 to 15 percent. These are soils in the Mottsville series. Their texture is loamy coarse sand.

These soils are very friable and easy to till. Fertility is low to medium. The available water holding capacity is 4 or 5 inches in the 60 inches of rooting depth. Permeability is rapid. Runoff is very slow to medium, and the erosion hazard slight to moderate.

The soils in this unit are poorly suited to dry-farmed small grain and forage crops, except when winter precipitation is above normal. The average annual precipitation is 14 to 20 inches. Supplemental irrigation water is seldom needed. All crops respond to nitrogen and phosphorus. The supply of potassium is adequate.

Growing winter annual crops controls most soil loss during winter rains. Management for range is described under the heading "Sandy range site."

Capability Unit Vw-1(20)

Mottsville loamy coarse sand, wet, 0 to 2 percent slopes, is the only soil in this unit. It is

a very deep soil in mountain meadows. The texture is loamy coarse sand to coarse sandy loam. The water table is frequently high late in winter and early in spring. The soil is dry in summer and fall.

Fertility is medium. The available water holding capacity is 4 or 5 inches in the 60 inches of rooting depth. Permeability is rapid. The average annual precipitation is 14 to 20 inches. Snow falls occasionally late in winter. Runoff is very slow, and the erosion hazard is slight. Overflow is an occasional hazard. The soil is slightly saline in a few small areas.

This soil is used mainly for range. Gullies occasionally form in areas where water concentrates. Grassed waterways or drop structures can be used for gully control. Range management is described under the heading "Wet Meadows range site."

Capability Unit VIe-1(19)

The soils in this unit are moderately well drained to excessively drained and shallow to very deep. They are on alluvial fans, terraces, and uplands. Slopes are dominantly 15 to 30 percent but range from 5 to 50 percent. These are soils of the Blasingame, Cieneba, Fallbrook, Las Posas, Linne, Ramona, and Vista series. The texture of the surface layer ranges from gravelly sandy loam to clay loam, and that of the subsoil from coarse sandy loam to light clay.

These soils have low to medium fertility and are friable and fairly easy to work. Tillage pans form infrequently. Cultivation should be kept to a minimum because of the slope. The available water holding capacity is 1 to 9 inches in the 10 to more than 60 inches of rooting depth. Permeability ranges from rapid to moderately slow. Runoff is slow to rapid, and the erosion hazard slight to high.

Most of the soils in this unit are suited to citrus and range. The Cieneba, Fallbrook, and Vista soils are suited to avocados. The Cieneba soils are too shallow for citrus. Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded, is used for flowers. The Linne soil is used only for range. The frost hazard is usually very slight. The response to nitrogen is favorable. Citrus responds to phosphorus. The supply of potassium is adequate.

Cover crops or a cover of perennial vegetation is the most suitable practice for controlling erosion in avocado or citrus groves. Mature avocado orchards provide adequate cover, but young orchards need protection. Generally, sprinklers are used for irrigating.

The soils in this unit respond to seeding and fertilization of adapted grasses and legumes for range. The range needs to be protected from overgrazing and fire.

Capability Unit VIe-1(20)

This unit consists of well-drained soils that are moderately deep to very deep over weathered bedrock.

They are on uplands. Slopes are 5 to 30 percent. These are soils of the Boomer, Crouch, and Holland series. The surface layer ranges from coarse sandy loam to loam, and the subsoil from sandy loam to clay loam.

Fertility is medium to high. The available water holding capacity ranges from 3 to 7.5 inches in the 23 to 60 inches of rooting depth. Permeability is moderately slow to moderately rapid. Snow falls occasionally late in winter. Runoff is medium to rapid, and the erosion hazard moderate to high.

These soils are suited to range and recreational facilities. All are suited to deciduous orchards and improved pasture. The average annual precipitation is 20 to 38 inches. Supplemental irrigation is seldom needed. Orchards and pasture respond favorably to nitrogen and phosphorus. The supply of potassium is adequate.

Range is the predominant use; management practices are described under the heading "Loamy range site." Clean tillage is not suitable for orchards. Excessive soil losses occur during prolonged rainy periods in winter. A permanent grass cover is the best means of controlling erosion.

Capability Unit VIe-3(19)

In this unit are moderately well drained to well drained, shallow to moderately deep soils that have a very slowly permeable subsoil. These are soils of the Huerhuero, Las Flores, and Redding series. They are on uplands and marine terraces. Slopes range from 2 percent but are dominantly 15 to 30 percent. The surface layer is loam, loamy fine sand, or gravelly loam, and the subsoil is clay, sandy clay, or gravelly clay.

These soils have low to medium fertility. The available water holding capacity is 1.5 to 4.5 inches in the rooting depth of 13 to 36 inches. Runoff is slow to rapid, and the erosion hazard slight to high. The soils are slightly to moderately eroded.

The soils in this unit are best suited to range. The steep slopes, the erosion hazard in tilled areas, and the low available water holding capacity make them unsuitable for cultivated crops.

Maintaining a permanent vegetative cover is the most practical means of erosion control. Range management is described under the headings "Claypan range site" and "Acid Claypan range site."

Capability Unit VIe-5(19)

This unit consists of well-drained and moderately deep soils on uplands. Slopes are 30 to 50 percent. These are clays of the Altamont and Diablo series. They are 20 to 32 inches deep over weakly consolidated sandstone and shale.

These soils have medium to high fertility. They are limy in the subsoil. The available water holding capacity is 3.5 to 5 inches in the 20 to 32 inches of rooting depth. Permeability is slow in

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

The soils in this unit are suited to grazing. Maintaining a permanent vegetative cover is the most practical means of erosion control. Range management is described under the heading "Clayey range site."

Capability Unit VIe-7(19)

This unit consists of shallow to moderately deep, excessively drained to moderately well drained, stony to cobbly soils of the Auld, Cieneba, Redding, Blasingame, Fallbrook, Las Posas, Olivenhain, and Vista series. They are on uplands or marine terraces. Slopes range from 2 percent but are dominantly 9 to 30 percent. The surface layer is stony clay or cobbly loam to coarse sandy loam, and the subsoil is stony or cobbly clay to sandy loam.

Fertility is high to low. The available water holding capacity is 6.5 inches in the 10 to 40 inches of rooting depth. Permeability is very slow to moderately rapid. Runoff is slow to rapid, and the erosion hazard slight to high.

These soils are suited to range. The rockiness of the Fallbrook and Vista soils prevents ordinary tillage but does not prevent the establishment or management of tree crops. The Fallbrook, Cieneba, and Vista soils are suited to avocados. All but the Auld, Cieneba, Las Posas, and Redding soils are suited to citrus. Groves in some of the more gently sloping areas require frost protection. Citrus and avocados respond to nitrogen, and citrus responds to phosphorus. The supply of potassium is adequate, but deficiencies in trace elements, particularly zinc, occur in some areas.

Growing permanent cover crops and leaving crop residue on the surface help in erosion control. Sprinklers are used for irrigating. Range management is suggested in the descriptions of range sites "Clayey," "Shallow Loamy," "Loamy," "Claypan," and "Acid Claypan."

Capability Unit VIe-7(20)

This unit consists of moderately well drained and well drained, rocky, stony, and cobbly soils of the uplands. Slopes range from 5 percent but are dominantly 9 to 30 percent. These are soils of the Bancas, Boomer, Crouch, Holland, La Posta, Las Posas, Sheephead, and Soboba series. They are moderately deep to deep over weathered bedrock. Some are slightly to moderately eroded. The surface layer ranges from coarse sandy loam to stony loam and stony fine sandy loam. The subsoil ranges from sandy loam to stony clay loam to light clay.

Fertility is low to medium. The available water holding capacity is 2 to 6.5 inches in the 20 to 60 inches of rooting depth. Permeability is moderately rapid to moderately slow. Runoff is medium to rapid, and the erosion hazard moderate to high. The average annual precipitation is 12 to 35 inches. Snow falls occasionally late in winter.

The soils in this unit are used mainly for range or recreation. They are too stony or rocky for cultivation. There are small acreages of woodland on Boomer and Holland soils. Range management is described under the headings "Loamy range site" and "Sandy range site."

Capability Unit VIe-8(19)

This unit consists of well-drained, very shallow to moderately deep soils on uplands. Slopes are 9 to 30 percent. These are soils of the Carlsbad, Escondido, and Gaviota series. The surface layer is gravelly loamy sand to very fine sandy loam.

Fertility is low to medium. The available water holding capacity is 1 to 5.5 inches in the 9 to 37 inches of rooting depth. Permeability is moderate to rapid as far down as the hardpan or hard rock. Runoff is medium to rapid, and the erosion hazard moderate to high.

These soils are suited to range. The Carlsbad and Escondido soils are suited to citrus. Citrus responds to nitrogen and phosphorus. The supply of potassium is adequate, but deficiencies in trace elements, particularly zinc, occur in some areas.

A cover crop is the most practical means of preventing excessive erosion in orchards. Sprinklers are used for irrigating. Range management is suggested in the descriptions of range sites "Sandy," "Loamy," and "Shallow Loamy."

Capability Unit VIec-1(20)

Bull Trail sandy loam, 15 to 30 percent slopes, eroded, is the only soil in this unit. It is a well-drained soil in alluvial basins. It is very deep over feldspathic sandy alluvium. The surface layer is sandy loam, and the subsoil is sandy clay loam.

Fertility is medium. The available water holding capacity is 6 to 7.5 inches in the 60 inches of rooting depth. Permeability is moderately slow. The average annual precipitation is 16 to 22 inches. Runoff is medium to rapid, and the erosion hazard moderate to high.

Gullies occasionally form in places where water concentrates. Grassed waterways or drop structures can be used for gully control. The soils are used mainly for range. Range management is described under the heading "Loamy range site."

Capability Unit VIs-7(19,20)

The one soil in this unit, Anderson very gravelly sandy loam, 9 to 45 percent slopes, is very deep and somewhat excessively drained or excessively drained. The texture ranges from stony loamy sand to very gravelly sandy loam.

Fertility is low. The available water holding capacity is only 2.5 to 5 inches in the more than 60 inches of rooting depth. Permeability is moderately rapid to very rapid. Runoff is medium to

rapid, and the erosion hazard moderate to high. The average annual precipitation is 12 to 18 inches.

This soil is not used for cultivated crops because it is gravelly. It is suited to avocados. It is also used for range. Protection from frost is needed in a few places. The response to nitrogen is favorable. Avocados do not respond favorably to phosphorus. The supply of potassium is adequate.

A cover crop or a perennial vegetative cover is the most practical means of preventing excessive erosion in orchards. Sprinklers are used for irrigating. Range management is described under the heading "Loamy range site."

Capability Unit VIsc-4(20)

In this unit are moderately deep, somewhat excessively drained and well-drained, coarse-textured soils on uplands. Slopes are 5 to 30 percent. These are soils of the La Posta series. The texture is loamy coarse sand or fine sandy loam. Decomposed granitic bedrock is at a depth of 10 to 32 inches.

Fertility is low. The available water holding capacity is 2 or 3 inches. Permeability is rapid to moderately rapid. Runoff is medium to rapid, and the erosion hazard moderate to high. The average annual precipitation is 15 to 30 inches. Snow falls occasionally late in winter.

The soils in this unit are used for range and recreational facilities. Range management is described under the heading "Granitic range site."

Capability Unit VIIe-1(19)

The soils in this unit are moderately well drained to excessively drained and are shallow to moderately deep over decomposed granitic rock or weakly consolidated marine sandstone. They are in the Cieneba, Fallbrook, Las Flores, and Vista series. They are in the Foothills. Slopes range from 9 to 65 percent. The surface layer ranges from sandy loam to loamy fine sand, and the subsoil from coarse sandy loam to sandy clay.

These soils have low to medium fertility. The available water holding capacity is 1 to 5 inches in the 10 to 40 inches of rooting depth. Permeability is very slow to moderately rapid. Runoff is medium to very rapid, and the erosion hazard moderate to very high. The Cieneba soil is moderately eroded. Fallbrook and Las Flores soils are severely eroded.

These soils are not suited to cultivation. They are used only for range. Marginal areas of Cieneba, Fallbrook, and Vista soils are used for avocados (pl. IV, top), and soils that have slopes of less than 30 percent are used for citrus. Both avocados and citrus respond to nitrogen. Annual grasses and woody plants produce some forage late in winter and in spring.

A permanent vegetative cover is the most practical means of erosion control. Generally sprinklers are used for irrigating citrus and avocados. Range

management for these soils is suggested in the descriptions of range sites "Shallow Loamy," "Loamy," and "Claypan."

Capability Unit VIIe-1(20)

This unit consists of well-drained to somewhat excessively drained, shallow to deep soils on uplands. Slopes are 5 to 50 percent. These are soils of the Crouch and La Posta series. The texture of the surface layer is coarse sandy loam to loamy coarse sand, and that of the subsoil ranges from sandy loam to loamy coarse sand. Acid igneous bedrock is at a depth of 16 to 27 inches in the La Posta soil and at a depth of 36 to 58 inches in the Crouch soil.

Fertility is low to medium. The available water holding capacity is 1 or 2 inches for the La Posta soil and 4.5 to 7.5 inches for the Crouch soil. Permeability is moderately rapid to rapid. Runoff is medium to rapid, and the erosion hazard moderate to high. The La Posta soil is severely eroded. The average annual precipitation ranges from 15 to 35 inches. Snow falls occasionally late in winter.

The soils in this unit are suited to range and recreational facilities. The slope and the erosion hazard are the main limitations. Severe erosion is common for 1 or 2 years following a brush fire. Forage production is limited to browse and annual grasses. Range management is described under the headings "Loamy range site" and "Granitic range site."

Capability Unit VIIe-4(30)

Rositas fine sand, hummocky, 5 to 9 percent slopes, is the only soil in this unit. It is a very deep, somewhat excessively drained soil. It is slightly calcareous and mildly to moderately alkaline. Sand abrasion and blowing sand are the main hazards.

This soil has low fertility. It takes in moisture during high-intensity summer storms. Runoff is slow to medium. The hazard of water erosion is slight to moderate, and that of wind erosion moderate to high. The available water holding capacity is 3 to 4 inches in the 60 inches of rooting depth. Permeability is rapid.

Rainfall is sufficient to produce some forage for regular grazing. Forage production is good if the range is carefully managed. Range management is described under the heading "Sandy range site."

Capability Unit VIIe-7(19)

This unit consists of well-drained, shallow to moderately deep, rocky, stony, cobbly, and gravelly soils in the Blasingame, Cieneba, Fallbrook, Ham-bright, Las Posas, Olivenhain, Redding, and Vista series. These soils are on marine terraces and uplands. Slopes are dominantly 30 to 75 percent but

in some places are only 9 percent. The surface layer ranges from coarse sandy loam to gravelly clay loam. In most areas the subsoil ranges from sandy loam to clay and in some areas is gravelly, cobbly, very cobbly, or stony.

Fertility is low to medium. The available water holding capacity ranges from less than 1 inch to 6 inches in the 5 to 40 inches of rooting depth. Permeability is very slow to moderately rapid. Runoff is medium to very rapid, and the erosion hazard moderate to very high. The rooting depth in the Redding soil is limited by an indurated hardpan and in the Olivenhain soil by very slow permeability.

These soils are well suited to range. They are not suited to crops because they hold a limited amount of water available to plants. Cobblestones and steep slopes restrict tillage. Marginal areas of Vista, Cieneba, and Fallbrook soils are used for avocados. Cieneba and Fallbrook soils are also used for citrus. Avocados and citrus respond to nitrogen.

A permanent vegetative cover is the most practical means of erosion control. Generally sprinklers are used for irrigated avocados and citrus. Range management is described under the headings "Shallow Loamy range site" and "Loamy range site."

Capability Unit VIIe-7(20)

This unit consists of very shallow to moderately deep, moderately well drained to excessively drained, rocky, stony, or cobbly soils on uplands. Slopes are dominantly 30 to 65 percent but range from 5 to 75 percent. These are soils of the Bancas, Boomer, Crouch, Holland, La Posta, Las Posas, Sheephead, and Tollhouse series. They formed over mica schist and acid igneous bedrock. Their texture ranges from stony loam to loamy coarse sand. Rock outcrop covers 2 to 10 percent of some areas.

Fertility is low to medium. The available water holding capacity is 1 to 6.5 inches in the 5 to 58 inches of rooting depth. Permeability is moderately slow to rapid. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. The average annual precipitation ranges from 12 to 38 inches. Light snow falls occasionally late in winter.

The soils in this unit are suitable for range and watershed. Range management is suggested in the descriptions of range sites "Loamy," "Shallow Loamy," and "Granitic."

Capability Unit VIIe-8(19)

The soils in this unit are in the Exchequer, Gaviota, and San Miguel series. All are well drained. All but the San Miguel soils are very shallow over hard, fractured rock. San Miguel soils range to moderately deep. All are on uplands. Slopes are 9 to 70 percent. Textures range from silt loam to fine sandy loam. Rock outcrop covers 2 to 10 percent of many areas.

These soils have very low to low fertility. The available water holding capacity is 0.5 inch to 3 inches in the 3 to 20 inches of rooting depth. Permeability is moderately rapid to slow. Runoff is medium to very rapid, and the erosion hazard is moderate to very high.

The soils in this unit are suited to range and watershed. Large areas of the very steep, rocky slopes covered with woody vegetation are very poor for grazing. Watershed is the most satisfactory use.

A permanent vegetative cover is the most practical means of erosion control. Range management is described under the headings "Acid Claypan range site" and "Shallow Loamy range site."

Capability Unit VIIs-4(30)

This unit consists of very deep, excessively drained and somewhat excessively drained soils in the Carrizo and Rositas series. Slopes are 0 to 15 percent. In most places the texture is loamy coarse sand or very gravelly sand. The soils are noncalcareous to slightly calcareous and mildly alkaline to moderately alkaline.

These soils have low to very low fertility. They take in moisture during high-intensity summer storms. Runoff is medium to very slow. The erosion hazard is slight to moderate. Permeability is rapid to very rapid. The available water holding capacity is 1.5 to 4 inches in the 60 inches of rooting depth.

Rainfall is sufficient to produce some forage for regular grazing. Range management is described under the heading "Sandy range site."

Capability Unit VIIs-8(19)

The soils in this unit are well drained to excessively drained, very shallow to shallow, rocky to very rocky soils of the Cienega, Exchequer, and Friant series. They are on uplands. Slopes are 9 to 75 percent. The surface layer ranges from coarse sandy loam to silt loam. Depth to bedrock is 3 to 17 inches.

These soils have low to very low fertility. The available water holding capacity ranges from less than 0.5 inch to 2 inches. Permeability is moderate to rapid. Runoff is medium to very rapid, and the erosion hazard moderate to very high.

These soils are used only for range. The large amount of rock outcrop and the steep slopes make them unsuitable for cultivation.

A permanent vegetative cover is the most practical means of erosion control. Range management is described under the heading "Shallow Loamy range site."

Capability Unit VIIIe-1(19,20,30)

This unit consists of Badland, Made land, Rough broken land, Sloping gullied land, Steep gullied

land, and Terrace escarpments. None are of any value for farming. Some are in all three resource areas; others are in only one or two. Runoff is rapid, and the erosion hazard high.

This unit is suitable for watershed and wildlife habitat. Establishing and maintaining permanent vegetation is desirable for erosion control.

Capability Unit VIIIw-4(19,20,30)

Only Coastal beaches and Riverwash are in this unit. Neither is suited to farming because of frequent overflow and very coarse textured soil material. Riverwash is in stream channels. It supports a small amount of woody vegetation. Coastal beaches is in resource area 19. Riverwash is in all three resource areas.

This unit is suited to recreational facilities and wildlife habitat.

Capability Unit VIIIw-6(19,30)

This unit consists of Playas and Tidal flats. Tidal flats is in resource area 19. It is level and subject to tidal overflow. It ranges from clay to very fine sand and is saline. Runoff is very slow, and the erosion hazard is slight. Tidal flats is suited to wildlife habitat.

Playas are old desert lakebeds. They are in resource area 30. The soil material is saline. These areas are used mainly for recreation and wildlife habitat.

Capability Unit VIIIs-1(19,20,30)

This unit consists of Acid igneous rock land, Metamorphic rock land, Stony land, Loamy alluvial land, and the very steep, severely eroded soils of the Huerhuero series. All are dominantly rock outcrop and have no value for farming. The associated soil material is shallow and infertile. Runoff is rapid to very rapid, and the erosion hazard moderate to very high.

This unit is suited to wildlife habitat, recreational facilities, and watershed. Some of these land types are in all three resource areas; others are in only one or two.

Crop Management and Yields

Cultivated crops are grown year round along the coast of the San Diego Area, but to a lesser extent inland because of winter frost. The management practiced is based on the suitability of the soil and the climate and on the needs of the crop. Management suggestions can be obtained from the local farm advisor or from the office of the Soil Conservation Service.

The management needed to obtain the yields shown in table 22 is described in the pages that follow.

The yields and the suggested management are based on current technology and plant varieties, on observations made by personnel of the Soil Conservation Service and the University of California Agricultural Extension Service, and on the agricultural commissioner's annual report for San Diego County (8). New developments in crop breeding, control of insects and diseases, irrigation methods, and other management practices will eventually make obsolete some of the practices suggested and the yields predicted.

The yield figures shown in table 22 are averages that can be expected over a period of years. In any given year, yields may be considerably higher or lower than the average. If little or no information was available on the yield of a given crop on a particular soil, estimates were made by comparing this soil with similar soils for which yield data were available. It is assumed that irrigation water is now available or can be made available for all crops listed in table 22, except for barley.

All requirements for plant nutrients are for the elemental form; for example, pounds per acre of the element phosphorus. The gross irrigation requirement is for the total annual plant need per acre less the average effective precipitation. It is calculated on the assumption that the irrigation system is about 70 percent efficient for citrus and avocados and about 55 percent efficient for celery, tomatoes, and gladioli.

A large variety of truck crops is grown in the San Diego Area. Table 22 shows yields for only celery and tomatoes.

The suitability of the soils for each crop, by mapping unit, is shown in table 21. The general management needed for each crop listed in table 22 follows.

Tomatoes.--Deep loams, clay loams, and clays are the most suitable soils for tomatoes. Sandy soils require more fertilization and irrigation.

Seedbed preparation consists of disking and plowing for furrow irrigation.

About 100 pounds of nitrogen, 75 pounds of phosphorus, and 20 yards of chicken manure are applied during the growing season.

Tomatoes are furrow irrigated. About 4 1/2 acre-feet of water is applied per acre each season. Ace, 428, and F-1 hybrids are the main varieties.

Nursery transplants are set out from January into June or July. Plant density ranges from 4,000 to 6,000 plants per acre.

Light cultivation controls weeds.

Pesticides are used for control of mites, hornworms, and other types of worms.

Fumigation and resistant plant varieties are used for control of fusarium wilt and verticillium wilt.

Harvesting begins in May and extends into January.

The fall crop makes up two-thirds to three-fourths of the annual yield.

Avocados.--Avocado trees require well-drained soils and good air drainage. Avocados are more sensitive to frost than oranges and lemons. Windbreaks should be provided in areas subject to damage from

east winds, and protection against the cool ocean breeze is needed on the coast.

Soils unsuitable for avocados are those that are moderately slowly to slowly permeable, for example, soils that have a clay surface layer or subsoil or that overlie hard, impermeable rock.

Rolling, brush-covered soils are the sites for most new groves. A brush rake and a rotary chopper are desirable for clearing. The debris is left on the soil to control erosion. Contour ripping loosens the subsoil, permits root penetration, and increases water absorption. Barley is seeded between trees after they are planted, unless annual grasses have been established.

Planting is done in March, April, and May, after the danger of frost and before hot weather; trees should be planted only deep enough to cover the ball.

Principal varieties are Fuerte, Hass, and Bacon. Plant density is generally one tree per 20 feet. Light applications of nitrogen are needed early in spring. Nitrogen content can be checked by taking leaf samples 4 to 6 months old from August to October. The content should be 1.6 to 2 percent in young but mature leaves. Heavier applications of nitrogen are generally needed on the Hass variety.

Zinc is sprayed on trees each spring.

Zinc sulfate can be added to the soil in bands at the drip line. These additions are effective for 3 to 6 years. Generally they are 23 to 28 percent metallic zinc.

Sprinklers are used for irrigating. About 3 1/2 acre-feet of water per year is needed. Occasional overirrigation leaches salts from the root zone and encourages the growth of cover crops around new plantings.

For control of snails, brown mites, loopers, rats, ants, and thrips, consult an entomologist or the county agricultural commissioner.

Planting resistant rootstock varieties, covering susceptible parts with fungicides or disinfectants, avoiding conditions that contribute to infection, and keeping down sources of infection are the best ways to prevent and control disease.

Root rot.--Do not plant on moderately slowly to very slowly permeable soils. Prevent the spread of disease by establishing chemical barriers, sterilizing tools, removing diseased trees, and discontinuing irrigations in infected areas.

Skin blotch.--Remove diseased trees and set out new seedlings.

Cankers.--Cut out diseased parts and treat with bordeaux spray.

Verticillium.--Remove trees that do not recover, fumigate before replanting, and remove nearby susceptible plants.

Sunburn.--Maintain soil moisture at a proper level to avoid wilting, shade young trees, whitewash exposed limbs and trunks, and prune

or topwork where needed.
Avoid working wet soils.
Replace diseased trees promptly, and replace low-producing trees.
Prune trees after fruit is harvested. Remove dead wood and lower branches so that water is evenly distributed. Prune low producers and topwork old varieties to standard varieties, with careful followup to shape a good tree.
Oranges and Lemons.--Orange and lemon trees require good air drainage, but they can withstand a slightly colder temperature than avocado trees. Windbreaks should be provided in areas subject to damage from east winds, and protection against the cool ocean breeze is needed on the coast.
Orange and lemon trees grow best on well-drained loams to sands, but they can be grown on well-drained clays if well managed. Mature trees on clay soils are likely to be smaller than those on loams or sands. The soil should be at least 20 to 36 inches deep.
Rolling, brush-covered soils are the sites for most new groves. A brush rake and a rotary chopper are desirable for clearing. The debris is left on the soil to control erosion. Contour ripping loosens the subsoil, permits root penetration, and increases water absorption. After clearing, the site is seeded to annual grasses and irrigated. If water is not available, mulches are desirable.
Planting is done after the danger of frost and before hot weather, generally in March, April, and May. Trees should be planted only deep enough to cover the ball.
The principal varieties are Valencia and navel oranges and Eureka lemons.
Plant density is generally one tree per 15 by 20 feet. It can be closer in areas where rooting depth is limited.
Light applications of nitrogen applied early in spring stimulate growth. For oranges, the nitrogen content should be 2.4 to 2.6 percent in leaf samples taken in August to October, and for lemons, 2.3 to 2.5 percent. Samples should be young mature leaves about 4 to 6 months old.
Deficiencies in minor elements, such as zinc, manganese, copper, and magnesium, occur in places.
Sprinklers are used for irrigating. It is important to keep the root zone from becoming too dry, and on clay soils to avoid wetting the trunk of the tree. Good water distribution is essential. Tipburn, sunburn, and dieback the following season are typical hazards on dry soils. About 3 acre-feet of water is applied each year, plus additional amounts if a cover crop is grown. Enough water should be applied periodically to leach salts from the root zone.
Control of bud mites, silver mites, red spiders, scales, thrips, aphids, orangeworms, and snails is needed. For specific control measures, consult an entomologist or the county

agricultural commissioner. Ant control is important, particularly in spring and summer. Planting resistant rootstock varieties, covering susceptible parts of trees with fungicides or disinfectants, avoiding conditions that contribute to infection, and keeping down the sources of infection are the best ways to prevent and control disease.
Brown rot on lemons.--Use bordeaux spray on the lower part after the first rain.
Internal breakdown and stylar end rot.--Keep level of soil moisture above the wilting point; remove older low-bearing trees.
Brown rot, foot rot, and dry rot.--Plant young, clean trees. Plant high and use bordeaux spray at time of planting. Do not overirrigate, and avoid having water stand around the tree trunk. Cut away infected parts and examine the orchards annually.
Scaly bark.--Prune trees in early stages or remove trees when they become nonproductive.
Replace diseased trees promptly, and replace low producers. Fumigate the soil before replanting to control nematodes and gummosis fungi. All drainage problems should be corrected before trees are replanted.
Remove only the deadwood from orange trees. Mechanical topping and hedging keep lemon trees manageable and maintain vigor and productivity. Hand pruning removes large stubs and weak branches. Remove suckers from trunk of young orange and lemon trees and remove cross branches.
Celery.--Celery grows best on clay loams or clays, but if soil moisture can be effectively controlled by irrigation, it grows well on loams, silt loams, and sandy loams. Sand in mature stalks is a problem on sandy soils. The soil should be at least moderately deep.
Most celery fields are disked, subsoiled, plowed, harrowed, and landplaned. Fields are fumigated to control pink rot, and then the field is fertilized. After fertilization the field is sometimes disked, chiseled, and harrowed again. Furrows are spaced 24 to 40 inches apart, depending on the type of equipment and on the rows, whether they are single or double.
About 200 to 400 pounds of nitrogen per acre is applied; 90 pounds of phosphorus and 166 pounds of potassium per acre are applied before planting. Nutrient sprays, such as magnesium, boron, and calcium, are needed to control blackheart, crown checking, and magnesium yellowing.
Furrows are used for irrigating; about 7 acre-feet of water per acre is applied.
Tall Utah 52-70, Tall Utah 52-701+, and Utah 16-11 are planted between August and November at the rate of 1 to 1 1/2 pounds of seed per acre.
Density ranges from 35,000 to 44,000 plants per acre. In single-row beds, plants are spaced 5 to 8 inches apart and rows are 24 to 40

inches apart. In double-row beds, plants are spaced 7 to 10 inches apart and the beds are placed at 40-inch centers.

Cultivation is needed to control weeds, loosen crusted soils, and reshape beds so that rows are at the top of the beds and not in furrows. Cultivate 3 to 4 weeks after transplanting. Seeded fields are generally cultivated before and after thinning.

Damage from insects is seldom widespread. Seedbed treatment and field sanitation generally prevent major problems.

Many of the common diseases can be prevented or controlled by seed treatment, seedbed and field sanitation, and application of fungicides.

Harvesting begins as early as November 20 and extends to March 31. The largest crop is harvested January to March.

Gladioli.--Gladioli are rotated with other crops to minimize problems caused by disease and pests. Gladioli grow best on sands or sandy loams but do well on loams or clay loams if well managed. The soil should be at least 10 to 20 inches deep; a soil more than 20 inches deep is better suited.

Soil preparation consists of disking and plowing. Bulbs are placed in single rows about 30 inches apart.

Phosphorus and calcium are broadcast and disked into the soil before gladioli are planted. Nitrogen and potassium are added as sidedressings 3 or 4 times during the growing season. About 2 acre-feet of water is applied per acre during the growing season. Sprinklers and furrows are used for irrigating.

Principal varieties are red Valeria, white Snow Cloud, pink Spic'n'Span, and Friendship. Jumbo No. 1 bulbs are planted in winter at a rate of 60,000 bulbs per acre. No. 3 size bulbs are planted in summer at a rate of 100,000 or more bulbs per acre.

Two-thirds of the bulbs are planted in spring and summer; the rest are planted throughout the year.

Bedding down gladioli controls weeds. In winter, hilling up minimizes lodging.

General pesticides and fumigation with bromide-chloropicrin or rotation with another crop controls thrips, aphids, nematodes, and worms. Fusarium, bacterial scab, sclerotinia, and viruses are the main diseases. All but viruses can be controlled by applying water at 135° F. to bulbs for 30 minutes, using fungicides, or rotating with another crop.

Most gladioli are harvested in spring and summer; some are harvested throughout the year.

Dryfarmed Barley.--Sandy loams to clays are the most suitable soils for dryfarmed barley. Growth is good on clays or clay loams because these soils store and hold water for plants. Sandy loams are more droughty and hold less water for shorter periods. The soil should be at least moderately deep.

Seedbed preparation consists of general disking. Generally 20 to 30 pounds of nitrogen per acre is applied at the time the stubble is worked into the soil.

There is no predominant variety. Improvement is continuous.

Barley is planted in December and January at the rate of 75 to 100 or more pounds of seed per acre.

Pest control is of no economic importance. General seed treatment controls smut, the principal disease.

Harvest is generally in June and July.

7/ Range

About 60 percent of the San Diego Area is range. Cienega and Las Posas soils are the principal rangeland soils in the western part, extending eastward to elevations of about 3,000 feet. Tollhouse, Sheephead, La Posta, Crouch, Mottsville, Bancas, and Holland soils are the principal rangeland soils in the Mountains, at elevations of more than 3,000 feet. Carrizo and Rositas soils are the principal rangeland soils in the Desert. The desert soils make up only about 5 percent of the total acreage of rangeland in the survey area.

The range in the western and central parts is mostly annual grasses, with varying proportions of needlegrass and other perennial grasses. Much of the range is chaparral intermingled with open grassland and woodland-grass. At high elevations, woodland-grass and chaparral are intermingled with broadleaf and coniferous trees. Grading into the Desert to the east are semidesert shrubs, annual grasses and broadleaf herbs, and perennial grasses, such as desert stipa. California juniper is common in these semidesert areas. Range in the eastern part of the survey area is desert shrub, characterized by creosotebush, desert stipa, and similar drought-resistant plants.

Many areas suitable for range are being diverted to urban and industrial uses, particularly those on the Coastal Plains and in the Foothills, in the western part.

Range Sites

Range sites are kinds of rangeland that produce significantly different kinds and amounts of vegetation. Each site has a different potential for production of forage and presents different management problems.

Most of the important forage plants in the San Diego Area are introduced annuals. The original vegetation was a mixture of perennials and annuals. The introduced annuals grow during cool weather.

7/
By Irvin L. Sealander, range conservationist,
Soil Conservation Service.

They use the available soil moisture to produce seed and mature before the moisture evaporates. These plants furnish highly nutritious forage in winter and in spring when they are green and growing, but when they are mature their nutritional value is low.

The forage-producing plants of the Area are classified as desirable, less desirable, and undesirable. Livestock graze selectively, seeking out the more palatable and nutritious plants. If grazing is not carefully regulated, the desirable plants are weakened or eliminated because they are not allowed to produce seed. Less desirable plants then increase. If overgrazing continues, even the less desirable plants are thinned out or eliminated and undesirable, unpalatable plants take their place or the soil is left bare.

The soils of the Area that are used for range have been grouped into 18 range sites. The grouping is based partly on the kinds of soil and partly on the climate. Climatic variations are marked and affect the kinds of plants that grow in a particular place and their rate of growth. There are four major climatic zones within the three major land resource areas: (1) the Southern California Coastal Plains, area 19; (2) the western part of the Southern California Mountains, area 20 W.; (3) the eastern part of the Southern California Mountains, area 20 E.; and (4) the Sonoran Basin and range, area 30.

The Southern California Coastal Plains, land resource area 19, consists of the Coastal Plains, the Foothills and interior valleys, and the ocean-facing mountain slopes, all of which are generally at elevations of less than 3,000 feet. Cool air and fog make the climate in these areas more moderate throughout the year than it is inland. Average actual evapotranspiration ranges from 10 to 14 inches annually (2).

The western part of the Southern California Mountains, area 20 W., consists of the Mountains and the valleys and plateaus of the interior where the climate is not modified by the ocean or the Desert. Elevations generally are 3,000 to 5,000 feet but range to 6,000 feet. This zone is characterized by low winter temperatures and frequent snow, although most precipitation falls as rain. It has the highest precipitation in the survey area. The average actual evapotranspiration ranges from 14 to 25 inches annually.

The eastern part of the Southern California Mountains, area 20 E., consists of mountain slopes and valleys facing the Desert. Elevations generally range from 3,500 to 5,000 feet. This zone is characterized by high summer temperatures and desiccating winds. The average actual evapotranspiration ranges from 10 to 14 inches annually.

The Sonoran Basin and Range, area 30, consists of the arid mountains, valleys, and desert plains in the eastern part of the survey area. Elevations generally are 100 to 3,500 feet but range to 5,000 feet. This zone is characterized by very low rainfall and very high summer temperatures. The average actual evapotranspiration ranges from 5 to 10 inches annually.

In the following pages, each range site is described, the forage plants are named, and the total annual yield of herbage and of forage available to livestock is estimated for favorable and unfavorable years. The yields for forage are not to be interpreted as usable forage. The estimates show the total yield in air-dry weight for sites that have not been treated with fertilizer. They are based on a limited number of plot clippings and on general knowledge of the sites. Extreme variations in weather can cause even greater annual fluctuations in yields.

To determine the range site designation for a given soil, refer to the "Guide to Mapping Units" at the back of this survey. Following the name of each range site is a number in parentheses that shows the land resource area in which the site occurs. This number should be carefully noted because several sites have identical names except for the area designation. For example, a Loamy Range Site occurs in all the resource areas.

Acid Claypan Range Site (19)

This site occupies approximately 73,000 acres along the coast and in the Foothills of the western part of the survey area. It is in land resource area 19. Elevations are dominantly 50 to 700 feet but range to 3,300 feet. The topography is nearly level or undulating to steep. Slopes are dominantly 2 to 30 percent but range to 50 percent.

The soils are sandy loams to silt loams, in most places gravelly or cobbly, that are shallow to moderately deep over dense clay or a hardpan. They are on alluvial fans, terraces, and coastal ridges. They are moderately well drained to well drained and have a low to moderate water-holding capacity and slow to very slow permeability. Runoff is slow to rapid. Fertility is low.

The potential plant cover is an open to moderately dense stand of brush, predominately such undesirable plants as chamise and California sagebrush. There are lesser amounts of ceanothus, coffeeberry, sugarbush, and other shrubs. If this site is producing at potential, approximately 70 percent of the herbage is a mixture of soft chess, wild oats, filaree, and other desirable plants, including needlegrass and other remnant perennial grasses. Approximately 20 percent is rigput brome, annual fescues, and other less desirable plants. No more than 10 percent is red brome, nitgrass, or other undesirable plants.

The estimated total annual yield ranges from 600 pounds per acre in favorable years to 100 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze ranges from 300 pounds per acre in favorable years to 30 pounds per acre in unfavorable years. Brush control and range seeding increase yields to their potential on all but the soils in mapping units RfF, SmE, and SnG.

Alkali Flats Range Site (30)

This site occupies approximately 3,500 acres in the Desert. It is in land resource area 30. Elevations range from 100 to 2,600 feet. The topography is nearly level to gently sloping. Slopes range from 0 to 5 percent.

The soils are very deep sandy loams and silt loams on alluvial fans and flood plains and on the margins of desert basins. They have a moderately high to high water-holding capacity and moderate to moderately rapid permeability. They are moderately saline-alkali. Runoff is very slow. These soils receive supplemental moisture from runoff after storms or from subsurface flow.

This site has an open to moderately dense cover of alkali-tolerant plants, among them such desirable shrubs as four-wing saltbush and shadscale and such less desirable grasses as saltgrass and alkali sacaton. No more than 20 percent is pickleweed, alkali heath, and other undesirable plants. Red brome, cheatgrass, filaree, and other annual plants are abundant in occasional years of above average rainfall and furnish grazing early in spring.

This site commonly is adjacent to basin areas that are so severely saline-alkali that only iodine-bush, alkali blite, and other alkali-tolerant plants grow.

The estimated total annual yield on this site ranges from 600 pounds per acre in favorable years to 200 pounds per acre in unfavorable years. The total estimated annual yield that livestock and wildlife can graze ranges from 500 pounds per acre in favorable years to 150 pounds per acre in unfavorable years.

Clayey Range Site (19)

This site occupies approximately 20,000 acres along the coast and in the Foothills of the western part of the survey area. It is in land resource area 19. Elevations range from 100 to 2,500 feet. The topography is gently sloping to steep. Slopes range from 2 to 50 percent.

The soils are clays, clay loams, and stony clays that are moderately deep to deep over shale, sandstone, and igneous rock. Some are calcareous. All are well drained and have a moderate to high water-holding capacity and slow to moderately slow permeability. Runoff is mostly medium to rapid.

This site has an open cover of grass. Some areas have scattered oak trees or shrubs. If this site is producing at potential, about 70 percent of the plant cover is wild oats, soft chess, burclover, filaree, and other desirable plants, including needlegrass and other remnant perennial grasses. Approximately 20 percent is ripgut brome, wild barley, and other less desirable plants, and 10 percent is nitgrass, wild mustard, fiddleneck, and other undesirable plants. When the soils are moist late in spring, annual weeds may make up more than 10 percent of the plant cover.

The estimated total annual yield is 2,400 pounds per acre in favorable years and 1,000 pounds per

acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze is 2,000 pounds per acre in favorable years and 900 pounds per acre in unfavorable years.

Soils of this site are well suited to seeding with adapted annual grasses and legumes. Seeding can increase yields in depleted areas two to four times. Fertilization can double the yields in years of high rainfall, but does not significantly increase yields in years of low rainfall.

Claypan Range Site (19)

This site occupies approximately 34,000 acres along the coast and in the Foothills of the western part of the survey area. It is in land resource area 19. Elevations range from 0 to 2,500 feet. The topography is gently sloping to moderately steep. Slopes range from 2 to 30 percent.

The soils are loams, sandy loams, and loamy fine sands that have a clay, sandy clay, or clay loam subsoil. They are shallow to moderately deep over bedrock. These soils are on alluvial fans or marine terraces. They are moderately well drained and well drained. They have a moderately low to moderate water-holding capacity and moderately slow to very slow permeability. Runoff is slow to rapid.

This site has an open cover of grass and scattered flattop buckwheat and California sagebrush. If it is producing at potential, about 70 percent of the plant cover is a mixture of wild oats, soft chess, filaree, burclover, and other desirable plants, including needlegrass and other remnant perennial grasses. Approximately 20 percent is ripgut brome, annual fescues, and other less desirable plants. No more than 10 percent is red brome, nitgrass, California sagebrush, flattop buckwheat, or other undesirable plants.

The estimated total annual yield ranges from 1,500 pounds per acre in favorable years to 400 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze ranges from 1,300 pounds per acre in favorable years to 350 pounds per acre in unfavorable years.

All but the soils in mapping units LeF3 and OhF are well suited to brush control and to seeding with adapted annual grasses and legumes. These practices can increase yields in depleted areas two to four times. Fertilization can double yields in years of high rainfall, but does not significantly increase yields in years of low rainfall.

Very deep soils that have a high water-holding capacity make up about 5 percent of this site.

Granitic Range Site (20W)

This site occupies approximately 71,000 acres in the western mountainous part of the survey area. It is in the western part of land resource area 20. Elevations range from 3,000 to 5,000 feet. The topography is moderately sloping to very steep. Slopes range from 5 to 65 percent.

The soils are loamy coarse sands and in most places are rocky. They are shallow to moderately deep over weathered granitic bedrock. Rock outcrops are common but are not numerous enough to impede the movement of livestock or decrease forage production. These soils are somewhat excessively drained. They have a low to moderately low water-holding capacity and moderately rapid to rapid permeability. Runoff is medium to rapid.

This site has an open to dense cover of brush and scattered oak trees. The potential plant cover is about 50 percent scrub oak, elmbush, red shank, ceanothus, and other chaparral shrubs, and small amounts of big sagebrush and flattop buckwheat. About 30 percent is needlegrass, wild oats, soft chess, filaree, and other desirable plants. No more than 20 percent is red brome, annual fescue, or other undesirable plants.

The estimated total annual yield ranges from 800 pounds per acre in favorable years to 200 pounds per acre in unfavorable years. The estimated total yield that livestock and wildlife can graze ranges from 500 pounds per acre in favorable years to 150 pounds per acre in unfavorable years.

The soils in mapping units LaE2 and LdE are suited to brush control and to range seeding with adapted annual grasses and legumes. These practices can increase yields in depleted areas two to four times.

Granitic Range Site (20E)

This site occupies approximately 13,000 acres in the eastern mountainous part of the survey area. It is in the eastern part of land resource area 20. Elevations range from 3,500 to 5,000 feet. The topography is moderately sloping to very steep. Slopes range from 5 to 65 percent.

The soils are loamy coarse sands and in most places are rocky. They are shallow to moderately deep over weathered granitic bedrock. Rock outcrops are common but are not numerous enough to impede the movement of livestock or decrease forage production. These soils are somewhat excessively drained. They have a low to moderately low water-holding capacity and moderately rapid to rapid permeability. Runoff is medium to rapid.

This site has an open cover of brush and some California juniper. The potential plant cover is about 50 percent elmbush, desert ceanothus, and other desirable shrubs, and about 30 percent desert stipa and other perennial grasses and filaree. No more than 20 percent is chamise and other undesirable shrubs or red brome, cheatgrass, and other less desirable and undesirable annual plants. In some seasons of favorable rainfall, annual grasses and forbs are dominant.

The estimated total annual yield ranges from 600 pounds per acre in favorable years to 100 pounds per acre in unfavorable years. The estimated total yield that livestock and wildlife can graze ranges from 400 pounds per acre in favorable years to 75 pounds per acre in unfavorable years.

Loamy Range Site (19)

This site occupies approximately 113,000 acres on the Coastal Plains and in the Foothills. It is in land resource area 19. Elevations range from 100 to 3,000 feet. The topography is gently sloping to very steep. Slopes range from 2 to 65 percent, but on 85 percent of the acreage slopes are less than 30 percent.

The soils are coarse sandy loams, sandy loams, very fine sandy loams, and loams that are mostly moderately deep to very deep over bedrock. They are on alluvial fans and plains. Some of the soils are gravelly or stony or have rock outcrops. All are moderately well drained to somewhat excessively drained. All have a moderate to high water-holding capacity and moderately rapid to moderately slow permeability. Runoff is slow to very rapid.

This site has a cover of grass-brush or grass. If it is producing at potential, about 50 percent of the cover is ceanothus, California sagebrush, sumac, chamise, flattop buckwheat, black sage, and other brushy plants, and 40 percent is soft chess, wild oats, filaree, needlegrass, and other desirable plants. No more than 10 percent is rigput brome, red brome, annual fescue, nitgrass, annual weeds, and other less desirable and undesirable plants.

The estimated total annual yield ranges from 1,800 pounds per acre in favorable years to 600 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze is 1,200 pounds per acre in favorable years and 350 pounds per acre in unfavorable years.

On all but the soils in mapping units CnG2, VsG, and VvG, removal of brush can increase yields two to four times. Fertilization can increase yields, but generally not enough to justify the cost.

Shallow soils that have low water-holding capacity make up about 5 percent of this site.

Loamy Range Site (20W)

This site occupies approximately 225,000 acres in the western part of land resource area 20. Elevations range from 3,000 to 5,000 feet. At elevations above 4,000 feet is a broadleaf and coniferous forest. The topography is gently sloping to very steep. Slopes range from 2 to 65 percent, but on 70 percent of the acreage slopes are less than 30 percent.

The soils are coarse sandy loams, fine sandy loams, sandy loams, and loams that are mostly moderately deep to very deep. They are on alluvial fans and plains. Some are gravelly, cobbly, or stony or have rock outcrops. All are well drained to somewhat excessively drained. All have a moderately low to high water-holding capacity and moderately rapid to moderately slow permeability. Runoff is slow to very rapid.

This site has an open grass or woodland-grass cover and scattered to common oaks. At high elevations is a mixture of oaks and Jeffrey pine. If this site is producing at potential, approximately

70 percent of the herbage is a mixture of soft chess, wild oats, filaree, needlegrass, blue wild-rye, and other desirable plants. No more than 20 percent is ripgut brome or other less desirable plants, and no more than 10 percent is red brome, nitgrass, and other undesirable plants. Chamise, ceanothus, flattop buckwheat, and other brushy plants are dominant in areas that have been severely damaged by fire. The brushy cover in these areas is commonly very dense.

The potential total annual yield ranges from 2,000 pounds per acre in favorable years to 1,000 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze ranges from 1,600 pounds per acre in favorable years to 800 pounds per acre in unfavorable years.

All but the soils in mapping units BbG, BbG2, BrG, CtF, CuG, HnG, LdG, and SpG2 are well suited to brush control and range seeding. These practices can increase yields to their potential. Fertilization can increase yields substantially.

Loamy Range Site (20E)

This site occupies approximately 18,000 acres in the eastern part of land resource area 20. Elevations range from 3,500 to 5,000 feet. The topography is gently sloping to very steep. Slopes range from 2 to 65 percent, but on 70 percent of the acreage slopes are less than 30 percent.

The soils are coarse sandy loams, sandy loams, and loams that are moderately deep to very deep over bedrock. They are on alluvial fans and plains. Some are gravelly, cobbly, or stony, or have rock outcrops. All are well drained to somewhat excessively drained. All have a moderately low to high water-holding capacity and moderately rapid to moderately slow permeability. Runoff is slow to very rapid.

This site has an open cover of brush. If it is producing at potential, approximately 50 percent of the plant cover is elbrush and other desirable shrubs, and desert ceanothus and other less desirable shrubs. About 30 percent is desert needlegrass, filaree, and other desirable plants. No more than 20 percent is red brome, cheatgrass, or other undesirable plants.

The total estimated annual yield ranges from 1,200 pounds per acre in favorable years to 200 pounds per acre in unfavorable years. The total estimated annual yield that livestock can graze is 700 pounds per acre in favorable years and 125 pounds per acre in unfavorable years.

In broad valleys where this site receives extra moisture from runoff or subsurface flow, the potential plant cover is open grassland or woodland-grass like that of the Loamy Range Site (20W). The potential yields in these areas also are the same.

Loamy Range Site (30)

This site occupies approximately 4,000 acres in the Desert. It is in land resource area 30.

Elevations range from 100 to 2,500 feet. The topography is nearly level to gently sloping. Slopes are 0 to 5 percent.

The soils are very deep fine sandy loams to coarse sandy loams on alluvial fans and plains. They are well drained. They have a moderately high water-holding capacity and moderately rapid to moderate permeability. Runoff is slow to medium.

The potential plant cover is sparse and consists of such desirable shrubs as bur-sage and catclaw acacia and such undesirable shrubs as creosotebush, cactus, and ocotillo. The understory is scattered big galleta, desert needlegrass, and other desirable plants, along with cheatgrass, filaree, and other annual plants. In occasional winters of above-average rainfall these annuals are abundant.

The estimated total annual yield ranges from 125 pounds per acre in favorable years to 25 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze ranges from 100 pounds per acre in favorable years to 30 pounds per acre in unfavorable years. In occasional years of above-average rainfall, annual grasses and broadleaf herbs furnish additional forage for spring grazing.

Sandy Range Site (19)

This site occupies approximately 6,000 acres along the coast and in the Foothills of the western part of the survey area. It is in land resource area 19. Elevations range from 0 to 3,000 feet. The topography is nearly level to strongly sloping. Slopes range from 0 to 15 percent.

The soils are sands, loamy sands, and gravelly loamy sands on alluvial fans and flood plains and in valleys. They overlie sandstone and granitic bedrock. Some are stony. Most are deep to very deep. All are moderately well drained to somewhat excessively drained. All have a low to moderate water-holding capacity and moderately rapid to very rapid permeability. Runoff is slow to very slow.

Moderately deep soils that are slowly permeable make up about 5 percent of this site.

This site has an open cover of brush and a sparse to moderately dense understory of herbaceous plants. Trees and shrubs are abundant in some areas on valley bottoms and flood plains. The brush cover is dense in some upland areas near the coast. If this site is producing at potential, approximately 50 percent of the plant cover is a mixture of soft chess, wild oats, filaree, and other desirable plants. No more than 20 percent is less desirable ripgut brome or red brome, nitgrass, and other undesirable plants. Approximately 30 percent is California sagebrush, goldenbush, flattop buckwheat, and other shrubs.

The estimated total annual yield ranges from 1,500 pounds per acre in favorable years to 300 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze ranges from 1,000 pounds per acre in favorable years to 225 pounds per acre in unfavorable years.

The soils of this site are suited to brush control and to seeding with adapted annual grasses and legumes. These practices can increase yields two to three times.

Sandy Range Site (20W)

This site occupies approximately 40,000 acres in the western mountainous part of the survey area. It is in the western part of land resource area 20. Elevations range from 3,000 to 4,500 feet. The topography is nearly level to strongly sloping. Slopes are 0 to 15 percent.

The soils are sands and loamy coarse sands on alluvial fans and flood plains and in valleys. They are deep to very deep over granitic rock. These soils are moderately well drained to excessively drained. They have a low to moderate water-holding capacity and moderately rapid to very rapid permeability. Runoff is very slow to medium.

This site has an open to moderately dense cover of brush and some oaks and other trees. If this site is producing at potential, approximately 25 percent of the cover is sagebrush, goldenbush, ceanothus, and other shrubs, including small amounts of scrub oak, elmbush, and other desirable shrubs. About 50 percent is soft chess, wild oats, filaree, and other desirable plants, including traces of needlegrass and other perennial grasses. Normally, no more than 25 percent is red brome, nitgrass, broadleaf weeds, or other undesirable plants.

The estimated total annual yield ranges from 1,500 pounds per acre in favorable years to 300 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze ranges from 1,000 pounds per acre in favorable years to 225 pounds per acre in unfavorable years.

The soils of this site are suited to brush control and to seeding with adapted grasses and legumes. These practices can increase yields two to three times. Fertilization can increase yields two to five times in areas where desirable grasses and legumes are dominant.

Sandy Range Site (20E)

This site occupies approximately 7,000 acres in the eastern mountainous part of the survey area. It is in the eastern part of land resource area 20. Elevations range from 3,500 to 4,500 feet. The topography is nearly level to strongly sloping. Slopes range from 0 to 15 percent.

The soils are sands and loamy coarse sands on alluvial fans and flood plains and in valleys. They are deep to very deep over granitic rock. These soils are moderately well drained to excessively drained. They have a low to moderate water-holding capacity and moderately rapid to very rapid permeability. Runoff is very slow to medium.

This site has a cover like that of the Sandy Range Site (20W), but the potential yield is less.

The estimated total annual yield ranges from 1,000 pounds per acre in favorable years to 200 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze ranges from 750 pounds per acre in favorable years to 150 pounds per acre in unfavorable years.

Sandy Range Site (30)

This site occupies approximately 97,000 acres in the desert part of the survey area. It is in land resource area 30. Elevations range from 100 to 2,500 feet. The topography is nearly level to strongly sloping. Slopes range from 0 to 15 percent.

The soils are sands, fine sands, and very gravelly sands on alluvial fans and plains. They are deep to very deep over granitic alluvium. Some are hummocky. All are moderately well drained to excessively drained. All have a low to moderate water-holding capacity and moderately rapid to very rapid permeability. Runoff is slow to very slow.

This site has an open cover of desert shrubs and some mesquite and other trees. If it is producing at potential, approximately 25 percent of the cover is a mixture of ironweed, palo verde, mesquite, catclaw acacia, and other desirable shrubs. About 50 percent is big galleta, desert stipa, Indian ricegrass, and other desirable plants. About 25 percent is creosotebush, bur-sage, ocotillo, and other undesirable plants. In occasional years of above-average rainfall, cheatgrass, red brome, filaree, and other annual plants are abundant.

The estimated total annual yield ranges from 150 pounds per acre in favorable years to 50 pounds per acre in unfavorable years. The estimated total annual yield that livestock can graze ranges from 100 pounds per acre in favorable years to 30 pounds per acre in unfavorable years. In occasional years of above-average rainfall, annual plants furnish additional forage for spring grazing.

Shallow Loamy Range Site (19)

This site occupies approximately 411,000 acres on the Coastal Plains and in the Foothills. It is in land resource area 19. Elevations range from 100 to 3,000 feet. The topography is moderately sloping to very steep. Slopes range from 5 to 75 percent, but in 70 percent of the acreage slopes are more than 30 percent.

The soils are eroded coarse sandy loams to loams that are shallow and very shallow over igneous rock or sandstone. They are rocky or stony in many places. The soils are well drained to somewhat excessively drained and have a low to moderately low water-holding capacity and slow to moderately rapid permeability. Runoff is medium to rapid.

This site has a brush cover, mostly of chamise or flattop buckwheat and California sagebrush along with small amounts of sumac, ceanothus, and other species of chaparral. The herbaceous ground cover

is generally sparse. If this site is producing at potential, approximately 70 percent of the plant cover is a mixture of soft chess, wild oats, filaree, and other desirable plants. Approximately 20 percent is rigput brome and other less desirable plants. No more than 10 percent is red brome, nitgrass, or other undesirable plants.

The estimated total annual yield ranges from 300 pounds per acre in favorable years to 50 pounds per acre in unfavorable years. The estimated annual yield that livestock and wildlife can graze ranges from 150 pounds per acre in favorable years to 25 pounds per acre in unfavorable years.

The soils in mapping units BeE, BgE, C1D2, C1E2, and GaE respond favorably to brush removal, seeding, and fertilization.

Shallow Loamy Range Site (20W)

This site occupies approximately 130,000 acres in the western mountainous part of the survey area. It is in the western part of land resource area 20. Elevations range from 3,000 to 5,000 feet. The topography is moderately sloping to very steep. Slopes range from 5 to 65 percent, but on 75 percent of the acreage slopes are more than 30 percent.

The soils are severely eroded coarse sandy loams to clay loams that are shallow and very shallow over igneous rock or sandstone. They are rocky or stony in many places. These soils are well drained to excessively drained. They have a low water-holding capacity and moderately rapid permeability. Runoff is rapid to very rapid.

This site has an open cover of brush. In many areas this cover is mostly chamise with a scanty ground cover of annual grasses. In other areas it is a mixture of chamise, red shank, ceanothus, and other species of chaparral and scattered sumac. If this site is producing at potential, approximately 50 percent of the herbage is a mixture of soft chess, ryegrass, filaree, and other desirable plants. Approximately 20 percent is red brome, nitgrass, and other less desirable and undesirable plants, and 30 percent is shrubs.

The estimated total annual yield ranges from 400 pounds per acre in favorable years to 100 pounds per acre in unfavorable years. The estimated total annual yield that livestock can graze ranges from 200 pounds per acre in favorable years to 25 pounds per acre in unfavorable years.

Shallow Loamy Range Site (20E)

This site occupies approximately 23,000 acres in the eastern mountainous part of the survey area. It is in the eastern part of land resource area 20. Elevations range from 3,500 to 5,000 feet. The topography is moderately sloping to very steep. Slopes range from 5 to 65 percent, but on 75 percent of the acreage slopes are more than 30 percent.

The soils are eroded coarse sandy loams that are shallow to very shallow over igneous rock or sandstone. They are rocky or stony in many places. They are excessively drained and have a low water-holding

capacity and moderately rapid permeability. Runoff is rapid to very rapid.

This site has an open cover of brush consisting of chamise, manzanita, desert ceanothus, red shank, flattop buckwheat, and some elmbrush. In areas that have been damaged by repeated wildfires, the cover is mostly chamise.

The plant cover of this site is like that of the Shallow Loamy Range Site (20W), but it is more open and the potential productivity is less. If this site is producing at potential, approximately 70 percent of the herbage is needlegrass, filaree, and other desirable plants, and approximately 20 percent is cheatgrass, red brome, and other less desirable and undesirable plants.

The estimated total annual yield ranges from 300 pounds per acre in favorable years to 50 pounds per acre in unfavorable years. The estimated total annual yield that livestock can graze ranges from 150 pounds per acre in favorable years to 25 pounds per acre in unfavorable years.

Wet Meadow Range Site (20E&W)

This site occupies approximately 14,000 acres of meadowland, or cienaga, in both the western and eastern mountainous parts of land resource area 20. The potential kind of plant cover and potential productivity are the same in both parts. The kind of cover and the productivity depend on high water tables rather than on climatic differences within this land resource area. Elevations range from 3,000 to 5,000 feet. Topography is nearly level to strongly sloping. Slopes range from 0 to 15 percent.

The soils are very deep silt loams to loamy coarse sands on alluvial fans and flood plains and in valleys. They have a seasonal high water table, and excess water is within a few inches of the surface part of the year. They have a high water-holding capacity and moderate to moderately rapid permeability. Runoff is slow.

This site has a cover of water-tolerant grasses and grasslike plants. If it is producing at potential, approximately 50 percent of the herbage is a mixture of desirable creeping wildrye, pine bluegrass, sedges, and native clovers. No more than 50 percent is less desirable wire rush. On the drier meadows, blue wildrye is more abundant than creeping wildrye.

When the water table is lowered through gullying, drought, or pumping from wells, the wet meadow plant cover disappears and is replaced by cover like that of the Loamy Range site (20W).

The estimated total annual yield ranges from 4,000 pounds per acre in favorable years to 1,200 pounds per acre in unfavorable years. The estimated total annual yield that livestock and wildlife can graze ranges from 3,500 pounds per acre in favorable years to 1,000 pounds per acre in unfavorable years.

The soils of this site are suited to seeding with adapted perennial grasses, but the hazard of water erosion is high on newly seeded areas. Seeding can increase yields two to four times. Gully control is frequently needed in areas where the water table has been lowered through gully erosion.

LITERATURE CITED

- (1) American Association of State Highway Officials. 1961. Standard Specifications for Highway Materials and Methods of Sampling and Testing. Ed. 8, 2 v., illus.
- (2) Arkley, Rodney J., and Ulrich, Rudolph. 1961. Balancing Soil Moisture Against Evaporation and Transpiration. Calif. Agr., v. 15, No. 1, pp. 4-6, illus.
- (3) Austin, Morris E. 1965. Land Resource Regions and Major Land Resource Areas of the United States. U.S. Dept. Agr. Handbook No. 296, 82 pp., illus.
- (4) Bentley, Jay R. 1967. Conversion of Chaparral Areas to Grassland: Techniques Used in California. U.S. Dept. Agr. Handbook No. 328, 35 pp., illus.
- (5) San Diego County Department of Agriculture. 1969. Crop Report. 9 pp., illus.
- (6) Storie, R. E. 1953. Revision of the Soil Rating Chart. Calif. Agr. Expt. Sta., 4 pp., illus.
- (7) United States Department of Agriculture. 1951. Soil Survey Manual. U.S. Dept. Agr. Handbook No. 18, 503 pp., illus.
- (8) 1964. National Engineering Handbook. U.S. Dept. Agr. Soil Cons. Serv. As modified by Soil Cons. Serv. Area 7 Supplement, October 6, 1967.
- (9) 1967. Sediment--It's Filling Harbors, Lakes, and Roadside Ditches. U.S. Dept. Agr. Inf. Bul. No. 325, 15 pp., illus.
- (10) United States Department of Defense. 1968. Unified Soil Classification System for Roads, Airfields, Embankments and Foundations. MIL-STD-619B, 30 pp., illus.

GLOSSARY

- Available water holding capacity** (also water-holding capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.
- Bedrock**. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Calcareous soil**. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
- Chaparral**. A dense community of scrub plants, normally permanent, that is dominated by evergreen shrubs or dwarf trees.
- Claypan**. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.
- Consistence, soil**. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are--
- Loose**--Noncoherent when dry or moist; does not hold together in a mass.
- Friable**--When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
- Firm**--When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
- Plastic**--When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
- Sticky**--When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.
- Hard**--When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
- Soft**--When dry, breaks into powder or individual grains under very slight pressure.
- Cemented**--Hard and brittle; little affected by moistening.
- Depth, effective soil**. The depth of soil material that plant roots can penetrate readily to obtain water and plant nutrients. It is the depth to a layer that differs sufficiently from the overlying material in physical or chemical properties to prevent or seriously retard the growth of roots.
- Drainage, class (natural)**. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation

but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Evapotranspiration. The combined loss of water from a given area, and during a specified period of time, by evaporation from the soil surface, and transpiration from plants.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Indurated (soil). Having a hard brittle consistency because the particles are held together by cementing substances such as humus, calcium carbonate, or the oxides of silicon, iron, and aluminium. The hardness and brittleness persist even when wet.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Made land. Areas filled artificially with earth, trash, or both.

Mapping unit. Areas of soil of the same kind outlined on the soil map and identified by a symbol.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

	In./hr.
Very slow-----	0.06
Slow-----	0.06-0.2
Moderately slow-----	2.0-0.63
Moderate-----	0.63-2.0
Moderately rapid-----	2.0-6.3
Rapid-----	6.3-20.0
Very rapid-----	20.0

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Playa. A strongly saline old lake basin in the arid regions.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Relief. The elevations or inequalities of a land surface, considered collectively.

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 enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Structure, soil. The arrangement of primary soil particles into compound particles of clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are (1) single grain (each grain by itself, as in dune sand) or (2) massive (the particles adhering together without any regular cleavage, as in many clay-pans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil or layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil.

The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further

divided by specifying "coarse," "fine," or "very fine."

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 complete information about a mapping unit, read the description of the mapping unit and that of the soil series to which the mapping unit belongs. Both are in Part I.

Acres and extent are given in Part I, table 2, page 19. All interpretations are given in Part II, in tables as follows:

Homesites, table 1, page 2.	Engineering, table 13, page 42, table 14, page 48, and table 16, page 63.
Sources of construction material, table 5, page 14.	Crops, table 21, page 80.
Recreation, table 7, page 20.	Average yields, table 22, page 84.
Land management, table 11, page 32.	

Numbers in parentheses designate land resource areas. Dashes indicate soil is not suitable for use indicated.

Storie index ratings are explained in Part II on page 92. The symbol < means less than.

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
AcG	Acid igneous rock land-----	18	VIIIIs-1(19,20,30)	106	-----	-----	<10
AtC	Altamont clay, 5 to 9 percent slopes-----	23	IIe-5(19)	95	-----	-----	41
AtD	Altamont clay, 9 to 15 percent slopes-----	23	IIIe-5(19)	97	Clayey (19)	111	39
AtD2	Altamont clay, 9 to 15 percent slopes, eroded-----	23	IIIe-5(19)	97	Clayey (19)	111	28
AtE	Altamont clay, 15 to 30 percent slopes-----	18	IVe-5(19)	100	Clayey (19)	111	29
AtE2	Altamont clay, 15 to 30 percent slopes, eroded-----	24	IVe-5(19)	100	Clayey (19)	111	25
AtF	Altamont clay, 30 to 50 percent slopes-----	24	VIe-5(19)	103	Clayey (19)	111	10
AuC	Anderson very gravelly sandy loam, 5 to 9 percent slopes-----	24	IVs-4(19)	101	Loamy (19)	112	36
AuF	Anderson very gravelly sandy loam, 9 to 45 percent slopes-----	24	VIIs-7(19,20)	104	Loamy (19)	112	25
AvC	Arlington coarse sandy loam, 2 to 9 percent slopes-----	25	IIIe-8(19)	98	Loamy (19)	112	47
AwC	Auld clay, 5 to 9 percent slopes---	26	IIe-5(19)	95	Clayey (19)	111	47
AwD	Auld clay, 9 to 15 percent slopes--	26	IIIe-5(19)	97	Clayey (19)	111	39
AyE	Auld stony clay, 9 to 30 percent slopes-----	26	VIe-7(19)	103	Clayey (19)	111	29
BaG	Badland-----	26	VIIIe-1(30)	106	-----	-----	<10
BbE	Bancas stony loam, 5 to 30 percent slopes-----	27	VIe-7(20)	103	Loamy (20W)	112	36
BbE2	Bancas stony loam, 5 to 30 percent slopes, eroded-----	27	VIe-7(20)	103	Loamy (20W)	112	28
BbG	Bancas stony loam, 30 to 65 percent slopes-----	27	VIIe-7(20)	105	Loamy (20W)	112	13
BbG2	Bancas stony loam, 30 to 65 percent slopes, eroded-----	27	VIIe-7(20)	105	Loamy (20W)	112	11
BeE	Blasingame loam, 9 to 30 percent slopes-----	28	VIe-1(19)	102	Shallow Loamy (19)	114	43
BgE	Blasingame stony loam, 9 to 30 percent slopes-----	28	VIe-7(19)	103	Shallow Loamy (19)	114	30
BgF	Blasingame stony loam, 30 to 50 percent slopes-----	28	VIIe-7(19)	105	Shallow Loamy (19)	114	15
B1C	Bonsall sandy loam, 2 to 9 percent slopes-----	29	IIIe-3(19)	97	Claypan (19)	111	51
B1C2	Bonsall sandy loam, 2 to 9 percent slopes, eroded-----	29	IVe-3(19)	100	Claypan (19)	111	41
B1D2	Bonsall sandy loam, 9 to 15 percent slopes, eroded-----	29	IVe-3(19)	100	Claypan (19)	111	39
BmC	Bonsall sandy loam, thick surface, 2 to 9 percent slopes-----	29	IIIe-3(19)	97	Claypan (19)	111	51

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
BnB	Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes-----	30	IIIe-3(19)	97	-----	-----	49
BoC	Boomer loam, 2 to 9 percent slopes-----	31	IIIe-1(20)	97	Loamy (20W)	112	57
BoE	Boomer loam, 9 to 30 percent slopes-----	31	VIe-1(20)	102	Loamy (20W)	112	50
BrE	Boomer stony loam, 9 to 30 percent slopes-----	31	VIe-7(20)	103	Loamy (20W)	112	35
BrG	Boomer stony loam, 30 to 65 percent slopes-----	30	VIIe-7(20)	105	Loamy (20W)	112	12
BsC	Bosanko clay, 2 to 9 percent slopes-----	31	IIIe-5(19)	97	Clayey (19)	111	32
BsD	Bosanko clay, 9 to 15 percent slopes-----	32	IIIe-5(19)	97	Clayey (19)	111	27
BsE	Bosanko clay, 15 to 30 percent slopes-----	32	IVe-5(19)	100	Clayey (19)	111	26
BtC	Bosanko stony clay, 5 to 9 percent slopes-----	32	IVe-5(19)	100	Clayey (19)	111	25
BuB	Bull Trail sandy loam, 2 to 5 percent slopes-----	33	IIIec-1(20)	98	Loamy (20W,20E)	112, 113	56
BuC	Bull Trail sandy loam, 5 to 9 percent slopes-----	33	IIIec-1(20)	98	Loamy (20W,20E)	112, 113	53
BuD2	Bull Trail sandy loam, 9 to 15 percent slopes, eroded-----	32	IVec-1(20)	101	Loamy (20W,20E)	112, 113	45
BuE2	Bull Trail sandy loam, 15 to 30 percent slopes, eroded-----	33	VIec-1(20)	104	Loamy (20W,20E)	112, 113	35
CaB	Calpine coarse sandy loam, 2 to 5 percent slopes-----	34	IVec-1(20)	101	Loamy (20W,20E)	112, 113	58
CaC	Calpine coarse sandy loam, 5 to 9 percent slopes-----	34	IVec-1(20)	101	Loamy (20W,20E)	112, 113	55
CaC2	Calpine coarse sandy loam, 5 to 9 percent slopes, eroded-----	34	IVec-1(20)	101	Loamy (20W,20E)	112, 113	49
CaD2	Calpine coarse sandy loam, 9 to 15 percent slopes, eroded-----	34	IVec-1(20)	101	Loamy (20W,20E)	112, 113	41
CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes-----	35	IIIe-8(19)	98	Sandy (19)	113	23
CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes-----	35	IIIe-8(19)	98	Sandy (19)	113	21
CbD	Carlsbad gravelly loamy sand, 9 to 15 percent slopes-----	35	IVe-8(19)	100	Sandy (19)	113	20
CbE	Carlsbad gravelly loamy sand, 15 to 30 percent slopes-----	35	VIe-8(19)	104	Sandy (19)	113	15
CcC	Carlsbad-Urban land complex, 2 to 9 percent slopes-----	35	-----	---	-----	-----	--
CcE	Carlsbad-Urban land complex, 9 to 30 percent slopes-----	36	-----	---	-----	-----	--
CeC	Carrizo very gravelly sand, 0 to 9 percent slopes-----	36	VIIIs-4(30)	106	Sandy (30)	114	12
CfB	Chesterton fine sandy loam, 2 to 5 percent slopes-----	36	IVe-3(19)	100	Acid Claypan (19)	110	34
CfC	Chesterton fine sandy loam, 5 to 9 percent slopes-----	37	IVe-3(19)	100	Acid Claypan (19)	110	32
CfD2	Chesterton fine sandy loam, 9 to 15 percent slopes, eroded-----	37	IVe-3(19)	100	Acid Claypan (19)	110	29
CgC	Chesterton-Urban land complex, 2 to 9 percent slopes-----	37	-----	---	-----	-----	--
ChA	Chino fine sandy loam, 0 to 2 percent slopes-----	38	I-1(19)	93	-----	-----	72
ChB	Chino fine sandy loam, 2 to 5 percent slopes-----	38	IIe-1(19)	94	-----	-----	68
CkA	Chino silt loam, saline, 0 to 2 percent slopes-----	38	IIs-6(19)	96	-----	-----	72

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
C1D2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded-----	39	VIe-1(19)	102	Shallow Loamy (19)	114	16
C1E2	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded-----	38	VIe-1(19)	102	Shallow Loamy (19)	114	15
C1G2	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded-----	39	VIIe-1(19)	104	Shallow Loamy (19)	114	6
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded--	39	VIIIs-8(19)	106	Shallow Loamy (19)	114	10
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes---	39	VIIIs-8(19)	106	Shallow Loamy (19)	114	<5
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded-----	39					
	Cieneba-----	--	VIe-7(19)	103	Shallow Loamy (19)	114	18
	Fallbrook-----	--	VIe-7(19)	103	Loamy (19)	112	18
	Rock outcrop-----	--	VIIIs-1(19)	106	-----	-----	--
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded-----	39					
	Cieneba-----	--	VIIe-7(19)	105	Shallow Loamy (19)	114	7
	Fallbrook-----	--	VIIe-7(19)	105	Loamy (19)	112	7
	Rock outcrop-----	--	VIIIs-1(19)	106	-----	-----	--
Co	Clayey alluvial land-----	40	IIs-5(19)	96	-----	-----	44
Cr	Coastal beaches-----	40	VIIIw-4(19)	106	-----	-----	<10
CsB	Corralitos loamy sand, 0 to 5 percent slopes-----	41	IIIs-4(19)	98	-----	-----	64
CsC	Corralitos loamy sand, 5 to 9 percent slopes-----	41	IIIs-4(19)	98	-----	-----	61
CsD	Corralitos loamy sand, 9 to 15 percent slopes-----	40	IVs-4(19)	101	-----	-----	52
CtE	Crouch coarse sandy loam, 5 to 30 percent slopes-----	41	VIe-1(20)	102	Loamy (20W)	112	46
CtF	Crouch coarse sandy loam, 30 to 50 percent slopes-----	42	VIIe-1(20)	105	Loamy (20W)	112	19
CuE	Crouch rocky coarse sandy loam, 5 to 30 percent slopes-----	42	VIe-7(20)	103	Loamy (20W)	112	25
CuG	Crouch rocky coarse sandy loam, 30 to 70 percent slopes-----	42	VIIe-7(20)	105	Loamy (20W)	112	9
CvG	Crouch stony fine sandy loam, 30 to 75 percent slopes-----	42	VIIe-7(20)	105	Loamy (20W)	112	12
DaC	Diablo clay, 2 to 9 percent slopes-----	43	IIE-5(19)	95	-----	-----	42
DaD	Diablo clay, 9 to 15 percent slopes-----	43	IIIe-5(19)	97	Clayey (19)	111	37
DaE	Diablo clay, 15 to 30 percent slopes-----	43	IVe-5(19)	100	Clayey (19)	111	30
DaE2	Diablo clay, 15 to 30 percent slopes, eroded-----	43	IVe-5(19)	100	Clayey (19)	111	27
DaF	Diablo clay, 30 to 50 percent slopes-----	43	VIe-5(19)	103	Clayey (19)	111	13
DcD	Diablo-Urban land complex, 5 to 15 percent slopes-----	44	-----	---	-----	-----	--
DcF	Diablo-Urban land complex, 15 to 50 percent slopes-----	44	-----	---	-----	-----	--
DoE	Diablo-Olivenhain complex, 9 to 30 percent slopes-----	44					
	Diablo-----	--	IVe-5(19)	100	Clayey (19)	111	23
	Olivenhain-----	--	VIe-7(19)	103	Claypan (19)	111	23
EdC	Elder shaly fine sandy loam, 2 to 9 percent slopes-----	44	IIE-1(19)	94	-----	-----	65
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes-----	45	IIIe-8(19)	98	Loamy (19)	112	51

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
FsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded---	45	IVe-8(19)	100	Loamy (19)	112	43
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes, eroded--	45	VIe-8(19)	104	Loamy (19)	112	32
EvC	Escondido very fine sandy loam, deep, 5 to 9 percent slopes-----	46	IIIe-1(19)	96	Loamy (19)	112	56
ExE	Exchequer rocky silt loam, 9 to 30 percent slopes-----	46	VIIIs-8(19)	106	Shallow Loamy (19)	114	<5
ExG	Exchequer rocky silt loam, 30 to 70 percent slopes-----	46	VIIIs-8(19)	106	Shallow Loamy (19)	114	<5
FaB	Fallbrook sandy loam, 2 to 5 percent slopes-----	47	IIe-1(19)	94	-----	-----	64
FaC	Fallbrook sandy loam, 5 to 9 percent slopes-----	47	IIIe-1(19)	96	Loamy (19)	112	57
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded-----	47	IIIe-1(19)	96	Loamy (19)	112	51
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded-----	48	IVe-1(19)	99	Loamy (19)	112	48
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded-----	48	VIe-1(19)	102	Loamy (19)	112	35
FaE3	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded--	48	VIIe-1(19)	104	Shallow Loamy (19)	114	37
FeC	Fallbrook rocky sandy loam, 5 to 9 percent slopes-----	48	VIe-7(19)	103	Loamy (19)	112	33
FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes-----	48	VIe-7(19)	103	Loamy (19)	112	13
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded-----	48	VIe-7(19)	103	Loamy (19)	112	27
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes-----	48	IVe-1(19)	99	-----	-----	54
FvE	Fallbrook-Vista sandy loams, 15 to 30 percent slopes-----	49	VIe-1(19)	102	-----	-----	45
FwF	Friant fine sandy loam, 30 to 50 percent slopes-----	49	VIIIs-8(19)	106	Shallow Loamy (19)	114	5
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes-----	49	VIIIs-8(19)	106	Shallow Loamy (19)	114	8
FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes-----	49	VIIIs-8(19)	106	Shallow Loamy (19)	114	<5
GaE	Gaviota fine sandy loam, 9 to 30 percent slopes-----	50	VIe-8(19)	104	Shallow Loamy (19)	114	11
GaF	Gaviota fine sandy loam, 30 to 50 percent slopes-----	50	VIIe-8(19)	105	Shallow Loamy (19)	114	<5
GoA	Grangeville fine sandy loam, 0 to 2 percent slopes-----	50	IIw-2(19)	95	-----	-----	81
GrA	Greenfield sandy loam, 0 to 2 percent slopes-----	51	IIs-4(19)	95	-----	-----	90
GrB	Greenfield sandy loam, 2 to 5 percent slopes-----	51	IIe-1(19)	94	-----	-----	81
GrC	Greenfield sandy loam, 5 to 9 percent slopes-----	52	IIe-1(19)	94	-----	-----	77
GrD	Greenfield sandy loam, 9 to 15 percent slopes-----	52	IIIe-1(19)	96	Loamy (19)	112	69
HaG	Hambright gravelly clay loam, 30 to 75 percent slopes-----	52	VIIe-7(19)	105	Shallow Loamy (19)	114	5
HmD	Holland fine sandy loam, 5 to 15 percent slopes-----	53	IVe-1(20)	99	Loamy (20W)	112	65
HmE	Holland fine sandy loam, 15 to 30 percent slopes-----	53	VIe-1(20)	102	Loamy (20W)	112	57
HnE	Holland stony fine sandy loam, 5 to 30 percent slopes-----	53	VIe-7(20)	103	Loamy (20W)	112	32
HnG	Holland stony fine sandy loam, 30 to 60 percent slopes-----	53	VIIe-7(20)	105	Loamy (20W)	112	11

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
HoC	Holland fine sandy loam, deep, 2 to 9 percent slopes-----	54	IIIe-1(20)	97	Loamy (20W)	112	68
HrC	Huerhuero loam, 2 to 9 percent slopes-----	54	IIIe-3(19)	97	Claypan (19)	111	41
HrC2	Huerhuero loam, 5 to 9 percent slopes, eroded-----	55	IVe-3(19)	100	Claypan (19)	111	38
HrD	Huerhuero loam, 9 to 15 percent slopes-----	55	IVe-3(19)	100	Claypan (19)	111	36
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded-----	55	IVe-3(19)	100	Claypan (19)	111	36
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded-----	55	VIe-3(19)	103	Claypan (19)	111	32
HuC	Huerhuero-Urban land complex, 2 to 9 percent slopes-----	55	-----	---	-----	---	--
HuE	Huerhuero-Urban land complex, 9 to 30 percent slopes-----	55	-----	---	-----	---	--
InA	Indio silt loam, 0 to 2 percent slopes-----	56	I-1(30)	94	-----	---	85
InB	Indio silt loam, 2 to 5 percent slopes-----	56	IIe-1(30)	94	-----	---	81
IoA	Indio silt loam, saline, 0 to 2 percent slopes-----	56	IIIs-6(30)	99	Alkali Flats (30)	111	56
IsA	Indio silt loam, dark variant-----	56	I-1(30)	94	-----	---	86
KcC	Kitchen Creek loamy coarse sand, 5 to 9 percent slopes-----	57	IVec-4(20)	101	Sandy (20W,20E)	114	45
KcD2	Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded---	58	IVec-4(20)	101	Sandy (20W,20E)	114	45
LaE2	La Posta loamy coarse sand, 5 to 30 percent slopes, eroded-----	58	VIsc-4(20)	104	Granitic (20W,20E)	111, 112	26
LaE3	La Posta loamy coarse sand, 5 to 30 percent slopes, severely eroded-----	58	VIIe-1(20)	105	Granitic (20W,20E)	111, 112	13
LcE	La Posta rocky loamy coarse sand, 5 to 30 percent slopes-----	58	VIIe-7(20)	105	Granitic (20W,20E)	111, 112	15
LcE2	La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded---	59	VIIe-7(20)	105	Granitic (20W,20E)	111, 112	15
LcF2	La Posta rocky loamy coarse sand, 30 to 50 percent slopes, eroded-----	59	VIIe-7(20)	105	Granitic (20W,20E)	111, 112	6
LdE	La Posta-Sheephead complex, 9 to 30 percent slopes-----	59	-----	---	-----	---	--
	La Posta-----	--	VIsc-4(20)	104	Granitic (20W,20E)	111, 112	13
	Sheephead-----	--	VIe-7(20)	103	Loamy (20W,20E)	112, 113	13
	Rock outcrop-----	--	VIIIIs-1(20)	106	-----	---	--
LdG	La Posta-Sheephead complex, 30 to 65 percent slopes-----	59	-----	---	-----	---	--
	La Posta-----	--	VIIe-7(20)	105	Granitic (20W,20E)	111, 112	5
	Sheephead-----	--	VIIe-7(20)	105	Loamy (20W,20E)	112, 113	5
	Rock outcrop-----	--	VIIIIs-1(20)	106	-----	---	--
LcC	Las Flores loamy fine sand, 2 to 9 percent slopes-----	60	IVe-3(19)	100	Claypan (19)	111	36
LcC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded-----	60	IVe-3(19)	100	Claypan (19)	111	31
LcD	Las Flores loamy fine sand, 9 to 15 percent slopes-----	60	IVe-3(19)	100	Claypan (19)	111	34
LcD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded-----	60	IVe-3(19)	100	Claypan (19)	111	29
LcE	Las Flores loamy fine sand, 15 to 30 percent slopes-----	61	VIe-3(19)	103	Claypan (19)	111	29

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, eroded-----	61	VIe-3(19)	103	Claypan (19)	111	26
LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded-----	61	VIIe-1(19)	104	Claypan (19)	111	24
LfC	Las Flores-Urban land complex, 2 to 9 percent slopes-----	61	-----	---	-----	---	--
LfE	Las Flores-Urban land complex, 9 to 30 percent slopes-----	61	-----	---	-----	---	--
LpB	Las Posas fine sandy loam, 2 to 5 percent slopes-----	62	IIIe-1(19)	96	Loamy (19)	112	41
LpC	Las Posas fine sandy loam, 5 to 9 percent slopes-----	62	IIIe-1(19)	96	Loamy (19)	112	--
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, eroded-----	62	IIIe-1(19)	96	Loamy (19)	112	34
LpD2	Las Posas fine sandy loam, 9 to 15 percent slopes, eroded-----	62	IVe-1(19)	99	Loamy (19)	112	33
LpE2	Las Posas fine sandy loam, 15 to 30 percent slopes, eroded-----	62	VIe-1(19)	102	Loamy (19)	112	26
LrE	Las Posas stony fine sandy loam, 9 to 30 percent slopes-----	62	VIe-7(19,20)	103	Loamy (19,20W)	112	24
LrE2	Las Posas stony fine sandy loam, 9 to 30 percent slopes, eroded---	63	VIe-7(19,20)	103	Loamy (19,20W)	112	21
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slopes-----	61	VIIe-7(19,20)	105	Shallow Loamy (19, 114, 115 20W)	115	8
LsE	Linne clay loam, 9 to 30 percent slopes-----	63	IVe-1(19)	99	Clayey (19)	111	14
LsF	Linne clay loam, 30 to 50 percent slopes-----	63	VIe-1(19)	102	Clayey (19)	111	6
Lu	Loamy alluvial land-----	64	IIw-2(20)	95	Wet Meadow (20E&W)	115	61
LvF3	Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded-----	64	VIIIIs-1(19)	106	-----	---	23
Md	Made land-----	64	VIIIe-1(19)	106	-----	---	--
M1C	Marina loamy coarse sand, 2 to 9 percent slopes-----	64	IIIIs-4(19)	98	-----	---	54
M1E	Marina loamy coarse sand, 9 to 30 percent slopes-----	65	IVs-4(19)	101	-----	---	45
MnA	Mecca coarse sandy loam, 0 to 2 percent slopes-----	65	IIIs-4(30)	96	Loamy (30)	113	72
MnB	Mecca coarse sandy loam, 2 to 5 percent slopes-----	65	IIe-1(30)	94	Loamy (30)	113	69
MoA	Mecca sandy loam, saline, 0 to 2 percent slopes-----	65	IIIIs-6(30)	99	Alkali Flats (30)	111	54
MpA2	Mecca fine sandy loam, 0 to 2 percent slopes, eroded-----	66	IIe-4(30)	95	Loamy (30)	113	77
MrG	Metamorphic rock land-----	66	VIIIIs-1(19,20)	106	-----	---	<10
MvA	Mottsville loamy coarse sand, 0 to 2 percent slopes-----	66	IVsc-4(20)	102	Sandy (20W,20E)	114	50
MvC	Mottsville loamy coarse sand, 2 to 9 percent slopes-----	66	IVsc-4(20)	102	Sandy (20W,20E)	114	45
MvD	Mottsville loamy coarse sand, 9 to 15 percent slopes-----	66	IVsc-4(20)	102	Sandy (20W,20E)	114	43
MxA	Mottsville loamy coarse sand, wet, 0 to 2 percent slopes-----	67	Vw-1(20)	102	Wet Meadow (20E&W)	115	45
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes-----	67	VIe-7(19)	103	Claypan (19)	111	29
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes-----	68	VIe-7(19)	103	Claypan (19)	111	20
OhF	Olivenhain cobbly loam, 30 to 50 percent slopes-----	68	VIIe-7(19)	105	Claypan (19)	111	10

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
OkC	Olivenhain-Urban land complex, 2 to 9 percent slopes-----	68	-----	---	-----	---	--
OkE	Olivenhain-Urban land complex, 9 to 30 percent slopes-----	68	-----	---	-----	---	--
PeA	Placentia sandy loam, 0 to 2 percent slopes-----	69	IVs-3(19)	101	Claypan (19)	111	54
PeC	Placentia sandy loam, 2 to 9 percent slopes-----	68	IVe-3(19)	100	Claypan (19)	111	49
PeC2	Placentia sandy loam, 5 to 9 percent slopes, eroded-----	69	IVe-3(19)	100	Claypan (19)	111	44
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded-----	69	IVe-3(19)	100	Claypan (19)	111	41
PfA	Placentia sandy loam, thick surface, 0 to 2 percent slopes-----	69	IIIs-3(19)	98	Claypan (19)	111	67
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes-----	69	IIIe-3(19)	97	Claypan (19)	111	60
Py	Playas-----	69	VIIIw-6(30)	106	-----	---	<10
RaA	Ramona sandy loam, 0 to 2 percent slopes-----	70	I-1(19)	93	-----	---	81
RaB	Ramona sandy loam, 2 to 5 percent slopes-----	70	IIe-1(19)	94	-----	---	65
RaC	Ramona sandy loam, 5 to 9 percent slopes-----	70	IIIe-1(19)	96	Loamy (19)	112	58
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded-----	71	IIIe-1(19)	96	Loamy (19)	112	51
RaD2	Ramona sandy loam, 9 to 15 percent slopes, eroded-----	71	IVe-1(19)	99	Loamy (19)	112	48
RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes-----	71	IVe-1(19)	99	Loamy (19)	112	28
RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes-----	71	VIe-1(19)	102	Loamy (19)	112	25
RdC	Redding gravelly loam, 2 to 9 percent slopes-----	71	VIe-3(19)	103	Acid Claypan (19)	110	19
ReE	Redding cobbly loam, 9 to 30 percent slopes-----	72	VIe-7(19)	103	Acid Claypan (19)	110	16
RfF	Redding cobbly loam, dissected, 15 to 50 percent slopes-----	72	VIIe-7(19)	105	Acid Claypan (19)	110	10
RhC	Redding-Urban land complex, 2 to 9 percent slopes-----	72	-----	---	-----	---	--
RhE	Redding-Urban land complex, 9 to 30 percent slopes-----	72	-----	---	-----	---	--
RkA	Reiff fine sandy loam, 0 to 2 percent slopes-----	73	I-1(19), IIIc-1(20)	93, 99	-----	---	95
RkB	Reiff fine sandy loam, 2 to 5 percent slopes-----	73	IIe-1(19), IIIe-1(20)	94, 97	-----	---	86
RkC	Reiff fine sandy loam, 5 to 9 percent slopes-----	73	IIe-1(19), IIIe-1(20)	94, 97	-----	---	77
Rm	Riverwash-----	73	VIIIw-4(19,20,30)	106	-----	---	<10
RoA	Rositas fine sand, 0 to 2 percent slopes-----	74	IVe-4(30)	100	Sandy (30)	114	56
RrC	Rositas fine sand, hummocky, 5 to 9 percent slopes-----	74	VIIe-4(30)	105	Sandy (30)	114	35
RsA	Rositas loamy coarse sand, 0 to 2 percent slopes-----	74	IVs-4(30)	102	Sandy (30)	114	44
RsC	Rositas loamy coarse sand, 2 to 9 percent slopes-----	74	IVs-4(30)	102	Sandy (30)	114	39
RsD	Rositas loamy coarse sand, 9 to 15 percent slopes-----	74	VIIIs-4(30)	106	Sandy (30)	114	37

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
RuG	Rough broken land-----	74	VIIIE-1(19,20)	106	-----	---	<10
SbA	Salinas clay loam, 0 to 2 percent slopes-----	75	I-1(19)	93	-----	---	81
SbC	Salinas clay loam, 2 to 9 percent slopes-----	75	IIe-1(19)	94	-----	---	73
ScA	Salinas clay, 0 to 2 percent slopes-----	75	IIs-5(19)	96	-----	---	62
ScB	Salinas clay, 2 to 5 percent slopes-----	75	IIe-5(19)	95	-----	---	59
SmE	San Miguel rocky silt loam, 9 to 30 percent slopes-----	76	VIIe-8(19)	105	Acid Claypan (19)	110	19
SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes-----	76	VIIe-8(19)	105	Acid Claypan (19)	110	8
	San Miguel-----	--	VIIe-8(19)	105	Shallow Loamy (19)	114	8
	Exchequer-----	--					
SpE2	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded---	77	VIe-7(20)	103	Loamy (20W,20E)	112, 113	<10
SpG2	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded--	77	VIIe-7(20)	105	Loamy (20W,20E)	112, 113	< 5
SrD	Sloping gullied land-----	77	VIIIe-1(30)	106	-----	---	<10
SsE	Soboba stony loamy sand, 9 to 30 percent slopes-----	78	VIe-7(20)	103	Sandy (20W)	114	24
StG	Steep gullied land-----	78	VIIIe-1(19,20)	106	-----	---	<10
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes-----	78	IIIs-3(19)	98	-----	---	36
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes-----	79	IIIs-3(19)	98	-----	---	34
SvE	Stony land-----	79	VIIIs-1(19,20)	106	-----	---	<10
TeF	Terrace escarpments-----	79	VIIIe-1(19,20,30)	106	-----	---	<10
Tf	Tidal flats-----	79	VIIIw-6(19)	106	-----	---	<10
ToE2	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded---	79	VIe-7(20)	105	Shallow Loamy (20W, 20E)	115	9
ToG	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes----	80	VIe-7(20)	105	Shallow Loamy (20W, 20E)	115	< 5
TuB	Tujunga sand, 0 to 5 percent slopes-----	80	IVs-4(19)	101	Sandy (19)	113	39
Ur	Urban land-----	81	-----	---	-----	---	--
VaA	Visalia sandy loam, 0 to 2 percent slopes-----	81	I-1(19)	93	-----	---	90
VaB	Visalia sandy loam, 2 to 5 percent slopes-----	81	IIe-1(19)	94	-----	---	81
VaC	Visalia sandy loam, 5 to 9 percent slopes-----	81	IIe-1(19)	94	Loamy (19)	112	73
VaD	Visalia sandy loam, 9 to 15 percent slopes-----	81	IIe-1(19)	94	Loamy (19)	112	69
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes-----	81	IIe-1(19)	94	Loamy (19)	112	49
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes-----	82	IIe-1(19)	94	Loamy (19)	112	44
VsC	Vista coarse sandy loam, 5 to 9 percent slopes-----	83	IIe-1(19)	96	Loamy (19)	112	45
VsD	Vista coarse sandy loam, 9 to 15 percent slopes-----	82	IVe-1(19)	99	Loamy (19)	112	43
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded-----	83	IVe-1(19)	99	Loamy (19)	112	40
VsE	Vista coarse sandy loam, 15 to 30 percent slopes-----	83	VIe-1(19)	102	Loamy (19)	112	35
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded-----	83	VIe-1(19)	102	Loamy (19)	112	33

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
VsG	Vista coarse sandy loam, 30 to 65 percent slopes-----	83	VIIe-1(19)	104	Loamy (19)	112	14
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes-----	83	VIe-7(19)	103	Loamy (19)	112	27
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes-----	83	VIe-7(19)	103	Loamy (19)	112	22
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes-----	83	VIIe-7(19)	105	Loamy (19)	112	9
WmB	Wyman loam, 2 to 5 percent slopes--	84	IIE-1(19)	94	Loamy (19)	112	81
WmC	Wyman loam, 5 to 9 percent slopes--	84	IIE-1(19)	94	Loamy (19)	112	77
WmD	Wyman loam, 9 to 15 percent slopes-----	84	IIIE-1(19)	96	Loamy (19)	112	69