SOILS

Big Basin Redwoods State Park

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by

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This section was prepared under contract and has not received full technical review by the Resource Protection Division, Department of Parks and Recreation

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INTRODUCTION

Soils information for this report was taken primarily from the countywide survey done by the USDA Soil Conservation Service (1980).

Twenty different soil types have been identified within Big Basin Redwoods State Park. A soils map was prepared from the original map in the USDA report at 1:24,000 (Map S-1).

In addition, data was gathered from the USDA Soil Conservation Service National Soils Handbook and the Santa Cruz County Office of Watershed Management.

Soil is a very important resource of any park unit. In part, the soils determine the type of vegetation found at a site. The vegetation directly affects the wildlife species that can inhabit the area. In additon, vegetation also influences soil development. A continuous, inter-dependent cycle occurs between all of these resources.

The soil of an area is also an important element to consider when developing campgrounds, trails, roads, etc. as some soils are unstable and highly erodable. The many factors involved in the assessment of this resource are discussed in the following sections.

SOILS DESCRIPTIONS AND INTERPRETATIONS -

General Description

The soils of Big Basin Redwoods State Park have developed under subhumid to humid climatic conditions with an annual rainfall of 51 - 152 centimeters (20 - 40 inches). All the soils show an acid reaction by field test. Soils of the uplands and terraces are acid with a pH value of 5.3 - 5.8 in surface soils and 4.6 - 5.0 in the subsoils.

Differences in soil development, rainfall, temperature, drainage, and parent material have had their effect in producing a number of different soil types in the park.

In general, the surface soils are fairly dark under virgin conditions although many of the sandy soils soon change to a lighter color after they have been cultivated for some time and the organic matter has been oxidized and deleted. The soils of this area usually have a higher organic-matter content than those of the Great Valley of California, where the rainfall and humidity are lower. Under the high rainfall climate of this area, many of the sandy soils are leached of plant nutrients.

The soils differ considerably in their surface texture, depending chiefly on the type of parent material. Those soils that have their origin in coarse-textured igneous rocks produce sandy soils. The same

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103–Aquents, flooded

109–Beaches

110–Ben Lomond sandy loam, 5 to 15 percent slopes

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168–Santa Lucia Shaly clay loam, 30 to 50 percent

169–Santa Lucia shaly clay loam, 50 to 75 percent

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173–Sur-Catelli complex, 50 to 75 percent slopes

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181–Xerorthents-Rock outcrop complex, 50 to 100 percent slopes

SCALE IN FEET 2000 0 2000 4000 6000

BIG BASIN REDWOODS STATE PARK

SOIL MAP

INVENTORY OF FEATURES

RESOURCES AGENCY OF CALIFORNIA

DEPARTMENT OF PARKS AND RECREATION

APPROVED _____ DATE _____

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CHECKED

SHEET No. S-1

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TABLE S-1
PHYSICAL AND CHEMICAL PROPERTIES OF SOILS
(Soil Survey of Santa Cruz County, 1980)

Soil name and map symbol	Depth	Permea-	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors*	
						K	T
103 Aquents							
109 Beaches							
110,111,112 Ben Lomond	0-19 19-46 46	2.0-6.0 2.0-6.0 ----	0.10-0.12 0.09-0.15 ------	5.6-7.3 5.1-6.0 ---	Low------- Low------- ----------	0.17 0.17 ----	3
113--------- Ben Lomond	0-19 19-46 46	2.0-6.0 2.0-6.0 ----	0.10-0.12 0.09-0.15 ------	5.6-7.3 5.6-6.5 ---	Low------- Low------- ----------	0.17 0.17 ----	
114,115----- Ben Lomond	0-19 19-46 46	2.0-6.0 2.0-6.0 ----	0.10-0.12 0.09-0.15 ------	5.6-7.3 5.1-6.0 ---	Low------- Low------- ----------	0.17 0.17 ----	3
142,143,144- Lompico	0-5 5-37 37	2.0-6.0 0.6-2.0 ----	0.13-0.16 0.15-0.18 ------	6.1-7.3 4.5-6.0 ---	Low------- Moderate-- ----------	0.28 0.17 ----	
153--------- Maymen	0-6 6-14 14	0.6-2.0 0.6-2.0 ----	0.08-0.12 0.11-0.13 ------	5.1-6.5 4.5-6.4 ---	Low------- Moderate-- ----------	0.20 0.24 ----	1
167,168,169- Santa Lucia	0-5 5-38 38	0.6-2.0 0.6-2.0 ----	0.10-0.14 0.08-0.11 ------	5.1-7.3 5.1-6.5 ---	Low------- Low------- ----------	0.15 0.10 ----	2
170,171,172 Soquel	0-21 21-37 37-51 51-62	0.6-2.0 0.2-0.6 0.2-0.6 0.2-0.6	0.14-0.18 0.14-0.17 0.17-0.19 0.13-0.17	5.6-6.5 5.6-7.3 5.6-7.3 5.6-7.3	Moderate-- Moderate-- Moderate-- Moderate--	0.43 0.43 0.28 0.37	5
173--------- Sur	0-18 18-35 35	2.0-6.0 2.0-6.0 ----	0.05-0.10 0.05-0.08 ------	6.1-7.3 5.1-7.3 ---	Low------- Low------- ----------	0.10 0.10 ----	1
176,177----- Watsonville	0-18 18-39 39-63	0.6-2.0 0.06 0.06-0.2	0.14-0.17 0.02-0.04 0.04-0.06	5.6-7.3 5.6-8.4 5.6-8.4	Low------- High------ Moderate--	0.28 0.28 0.24	3
181--------- Xerorthents							

*Erosion Factors:
(K) Soil erodibility is a measure of the susceptibility of the soil to erosion by water.
(T) Soil - loss tolerance factor is the maximum rate of soil erosion.

TABLE S-2
SOIL AND WATER FEATURES
(Soil survey of Santa Cruz County, 1980)

Soil name and map symbol	Hydrologic group	High water table			Bedrock		Risk of corrosion	
		Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
103---------- Aquents								
109---------- Beaches								
110,111,112----- Ben Lomond	B	>6.0	----	-----	40-60	Rippable	Moderate---	Low
113---------- Ben Lomond	B	>6.0	----	-----	40-60	Rippable	Moderate---	Low
114,115--------- Ben Lomond	B	>6.0	----	-----	40-60	Rippable	Moderate---	Low
142,143,144----- Lompico	B	>6.0	----	-----	20-40	Rippable	High-------	High
153---------- Maymen	D	>6.0	----	-----	10-20	Hard	Moderate---	Moderate
167,168,169----- Santa Lucia	C	>6.0	----	-----	20-40	Hard	High-------	High
170,171,172----- Soquel	B	>6.0	----	-----	>60	--------		
173---------- Sur	B	>6.0	----	-----	20-40	Hard	Moderate---	Moderate
176,177,178,179, 180---------- Watsonville	D	1.5-3.0	Perch-ed	Nov-Mar	>60	--------	High-------	High
181---------- Xerorthents								

is true of those soils derived from the sandy coastal-plain deposits. The sandstone rocks produce sandy soils, and the shale rocks produce heavy-textured soils. The texture of the alluvial soils is governed by the character of the parent rocks and also by the velocity of the running water, by means of which the materials were transported and deposited. Again, the alluvial soils developed from materials eroded from igneous rocks are coarse-textured, whereas those developed from the finer grained sedimentary rocks are finer-textured or more clayey.

Soils developed over bedrock in the hilly and mountainous upland areas occur at elevations of 122 - 762 meters (400 - 2,500 feet) above sea level. These soils have been formed directly on the decomposed and disintegrated materials of the underlying parent rocks.

Just below the higher hilly and mountainous areas are the soils that are developed on upland coastal-plain materials, representing 6% of the total Santa Cruz Mountains area.

Stream depositions form smooth, gently sloping alluvial fans on the flood plains along the streams that rise in the mountains to the east. These soils apparently have been slightly modified since deposition, and very little difference is evident between the surface soils and the subsoils.

Soils of the wind-modified coastal plain areas occupy sloping to gently undulating terraces at an elevation of approximately 15 - 61 meters (50 - 200 feet) above sea level. These border the coastline and have been developed on old sand dunes and sandy beach material moved inland to a distance of about 0.8 - 1.6 kilometers (1/2 - 1 mile).

The physical and chemical properties, and the soil and water features of the soils found in Big Basin Redwoods State Park are summarized in Tables S-1 and S-2.

Formation and Morphology

Soil consists of organic and mineral matter and the characteristics of a soil at any given place are determined by the interaction of five factors of soil formation: 1) The climate under which the soil material has accumulated or weathered; 2) the influence of plants and animals; 3) the relief, or topography; 4) physical and chemical properties of the parent material; and 5) the length of time these factors have been active.

Climate, plants and animals are the "active" factors of soil formation. Relief modifies the effects of climate and vegetation mainly by its influence on runoff and temperature. The nature of the parent material also affects the kind of soil that is formed.

Climate

Climate has a marked influence on the formation of a particular soil type. Heat and moisture strongly influence the amount and kind of vegetation, the rate at which organic matter decomposes, the rate at which minerals weather and the removal or accumulation of material in the different soil horizons.

Along the immediate coast, fog occurs in the summer, humidity is higher, and the transpiration rate and temperature are lower. This mild climate influences the decomposition of the surface litter and results in soils that have a gray, dark gray or grayish brown surface layer.

In the hills and mountains, the effects of higher precipitation and lower temperature are reflected in the kinds of vegetation and soil; woody and herbaceous vegetation is more abundant and the organic matter content of the soils increases. Laboratory analyses indicate that the surface layer of the soils in these areas contains 3% - 5% organic carbon. The soils are commonly dark colored and have a granular surface layer overlain by a layer of leaves, twigs and decomposed organic matter.

Rainfall is sufficient in the mountainous areas to leach the soils of bases, which results in a lower soil reaction; soils are commonly medium acid to very strong acid.

Warm temperatures in the spring when soils are moist, accelerate the soil forming process.

Plants and Animals

Plants and animals affect organic matter, nitrogen content and soil reaction, and help improve structure and porosity. Seventy percent of Santa Cruz County is dominated by coniferous and broadleaf trees that occur mainly on north and northeast facing slopes. This type of plant cover reduces runoff, erosion and evaporation. Soils that formed under the coniferous forest commonly have a mat of fresh and decomposed bark, twigs, leaves and needles, 2.5 - 15.2 centimeters (1-6 inches) thick. Such material is acid and it contributes to the acid reaction of soils. When decomposing, this mat of organic matter gives a dark color to surface which extends deeply into soil profile. Soil analyses indicate 1-6% organic carbon in the surface layer.

The roots of coniferous and broadleaf trees follow cracks and fracture planes in parent rock and contribute to the physical and chemical weathering process. Sometimes roots make up more than 20% of the upper 5.1 -7.6 centimeters (2-3 inches) of the soil. In most places, the carbon to nitrogen ratio of these soils is more than twenty to one. Soils with dark color, porosity and structure associated with wooded areas are those of Ben Lomond, Nisene, Felton,Catelli, Lompico, and Sur series. Dominant tree species on these soils are redwood, Douglas-fir, tanbark oak, madrone, California live oak, black oak, and

bay laurel.

On south and southwest facing slopes and in areas higher than the persistent summer fog belt, the steep and very steep slopes are most often covered with brush and chaparral. The vegetation in these areas does not adequately protect the soils from erosion. Because of continual erosion, the soils in most of these areas are less than 50.8 centimeters (20 inches) deep. Examples are Maymen and Maymen variant soils. Dominant plants on these areas are manzanita, ceanothus and coyote brush.

Relief

Steepness, shape, and length of slope affect runoff, erosion and the amount of moisture available for soil development. For example, Maymen soils that have steep to very steep slopes have features that have been largely determined by the degree of slope. Because of rapid runoff and erosion, these soils are less than 51 centimeters (20 inches) deep. The surface layer is very thin, and little or no clay has accumulated in the subsoil.

Aspect is especially important in hills and mountains, and also has an effect on the microclimate of soils. For example, soils that have north facing slopes have cooler temperatues and retain moisture longer than soils on south facing slopes. Consequently, the soils on north facing slopes or soils that have north facing aspects have a denser plant cover, are deeper, have a thicker, darker colored surface layer, and have a greater clay content in the subsoil than do soils that have south facing slopes. Differences in soil characteristics as a result of aspect are readily evident in Ben Lomond or Felton soils that have north and northeast facing slopes and Bonnydoon and Maymen soils that have southwestern slopes.

Elevation also influences soil formation, mainly through affect on the soil climate.

On alluvial plains, when the soil profile is saturated with water, many physical and chemical reactions are inhibited. Anaerobic reactions become dominant because there is inadequate oxygen. These soils tend to be colder than soils that have aerobic conditions. Soils on alluvial plains, because of their low lying position, commonly receive additional sediment from flooding. This generally retards soil development, because each episode of flooding and deposition provides new soil parent material before existing soil development cycles are complete.

Parent Material

Parent material is the consolidated material from which the soil forms and within Big Basin Redwoods State Park there is a large variety of this parent material.

The Sur Formation, which consists of metamorphosed rock, is the oldest formation in Santa Cruz County. Soils in the northeastern part of Ben Lomond Mountains are commonly moderately steep to very steep. Schist is the most common rock in the formation. Soils formed in material derived from schists have a loamy texture. Examples of such soils are: Aptos, Nisene, Felton and Lompico.

Most of the northeast facing landscapes of Ben Lomond Mountain consist of intrusions of granitic rock formed from quartz diorite, or granodiorite. These soils have a loamy texture. The dominant soils are Ben Lomond, Catelli, and Sur. Sur soils have a higher content of rock fragments.

Rocks of the Paleocene Epoch occupy relatively small areas in the county, consisting mostly of micaceous sandy siltstone and sandstone of the Locatelli Formation. Some of the soils formed in material derived from siltstone are Felton and Lompico. Soils derived from sandstone are Ben Lomond and Sur.

The sedimentary rock of the Eocene, Oligocene and Miocene epochs is the most extensive rock of Santa Cruz County. Several formations of sedimentary rock have been recognized, including the Vaquero (Oligocene), Butano (Eocene) and Purisma (Pliocene) formations.

The Vaqueros Formation consists largely of arkosic sandstone with distinct interbeds of mudstone and shale. This rock is exposed in large areas, mainly along the summit and on ridgetops in Santa Cruz mountains. Where the rock is coarse-grained sandstone, the soils commonly formed are Sur, Catelli and Ben Lomond. Felton and Lompico soils formed in weathered mudstone and shale. The stoney, shallow Maymen soils occur along the summit and are underlain by consolidated shale and mudstone. Large areas of exposed rock outcrop are common on the Maymen and Sur soils.

Butano formation consists largely of arkosic sandstone and interbeds of mudstone, shale and siltstone. Where these rocks are on northeast and north-facing slopes, they commonly are deeply weathered. On ridgetops and southwest and south-facing slopes, the soils that formed in these are commonly sandy loam and fine sandy loam. Maymen and Sur soils generally are stoney and formed in hard sandstone, shale, and mudstone. Catelli, Ben Lomond and Pfeiffer soils formed in weathered coarse-grained sandstone.

The rock of the Purisma Formation consists mostly of fine-grained sandstone, mudstone and siltstone. This rock is commonly deeply weathered, especially on north and northeast-facing slopes, where greater moisture contributes to deep weathering. The soils that formed in these areas commonly are loam, fine sandy loam and sandy loam. In some places where the slopes face southwest, the mudstone or siltstone is hard and firm and the soils commonly are 25 - 50 centimeters (10-20 inches) deep. Soils commonly derived are Bonnydoon, Pfeiffer, Ben Lomond, Felton, Aptos, Nisene and Lompico.

Soil Descriptions

The map units shown on the detailed soil map following this section represent the kinds of soils within Big Basin Redwoods State Park. Each type within the Park is described and together with the soil map (Map M-1) can be useful for determining the potential of a soil and its management according to use, and in enhancing, protecting, and preserving the environment.

Preceeding the name of each map unit is the symbol that numerically identifies the soil on the soil map. Each soil description includes general facts about the soil and a brief description of the soil profile. Also, principal hazards and limitations are indicated and the management concerns and practices are discussed.

The map units on the soil map represent an area on the landscape made up mostly of the soil or soils for which the unit is named.

103 Aquents, flooded. Aquents consist of sandy to clayey sediment and mucky and peaty material that are frequently inundated by tides and runoff water. These areas are along the coast and in narrow valleys near the coast. Elevation ranges from sea level to about 15 meters (50 feet). The mean annual air temperature is about 14.4 C (58 F). The frost-free season ranges from 245 to 275 days.

Included with this unit in mapping are areas of Fluventic Hapolxerolls, Aquic Xerofluvents, and organic soils consisting of muck and peat. Small areas of Soquel soils are also included.

Drainage is very poor, and runoff is very slow. There is no hazard of erosion, or the hazard is slight, except when runoff is rapid. Deposition and streambank cutting take place if drainageways are not maintained. Depth to the water table ranges from 25 centimeters (10 inches) in winter to 102 centimeters (40 inches) in summer. Effective rooting depth is as much as 152 centimeters (60 inches) for water-loving plants but is less for water-sensitive plants.

The vegetation is commonly reeds, tules, willows, and in a few places, pickleweed.

This unit is used mainly for wildlife habitat and recreation. A few areas are used for limited grazing. Some areas can be reclaimed, but the economic and environmental impact of reclamation should be considered.

109 Beaches. Beaches consist of narrow strips between the ocean and the dune lands or coastal cliffs, and they include the beaches and the deltas of rivers and creeks. The highest part of this map unit is subject to wave action only during very high tides. Beaches were formed by marine deposits and are made up of sand, pebbles, and some cobbles and stones. The amount of deposits varies with inland management practices and the seasonal runoff that carries sediment to the beaches. Ocean tides, waves, and currents prevent the finer soil particles from settling on the beaches.

Included with this unit in mapping are very narrow, extremely steep coastal cliffs and small areas of dune land.

The hazard of erosion by ocean waves, tides and current is very high. Soil blowing is also a hazard.

This unit is used mainly for recreation and wildife habitat.

110 Ben Lomond sandy loam, 5 to 15 percent slopes. This deep, well drained soil is on ridgetops, on short side slopes, and in rolling areas in the Santa Cruz and Ben Lomond Mountains. It formed in residuum derived from sandstone or granitic rock. Slopes are convex. Elevation ranges from 122 - 914 meters (400 - 3,000 feet) but is dominantly about 610 meters (2,000 feet). The mean annual precipitation is about 127 centimeters (50 inches), and the mean annual air temperature is about 12.8 C (55 F). The frost-free season ranges from 220 to 230 days.

Typically, the soil is covered by a 5 centimeters (2-inch) mat of partially decomposed needles and twigs. The surface layer is dark, grayish brown, slightly acid and neutral sandy loam about 48 centimeters (19 inches) thick. The subsoil is brown, medium acid sandy loam about 28 centimeters (11 inches). The substratum is pale brown, medium acid sandy loam about 41 centimeters (16 inches) thick. Weathered sandstone is at a depth of 17 centimeters (46 inches).

Included with this soil in mapping are areas of Catelli and Nisene soils and small areas of Aptos, Felton, Lompico, Sur, and Zayante soils. Also included are small areas of soils that are similar to this Ben Lomond soil but are somewhat poorly drained; soils that are similar but formed in alluvium and are 1.5 meters (5 feet) to more than 3.0 meters (10 feet) deep to bedrock; and soils that are similar but have slopes of 15 to 30 percent.

Permeability of this Ben Lomond soil is moderately rapid. Effective rooting depth is 102 - 152 centimeters (40 - 60 inches). Available water capacity is 10 - 22 centimeters (4 - 8.5 inches). Runoff is medium, and the hazard or erosion is slight to moderate.

This soil is used mainly for timber production, recreation, wildlife habitat, and watershed. It is also used as homesites and for apple orchards, Christmas tree farms, tree nurseries, and pasture.

111 Ben Lomond sandy loam, 15 to 20 percent slopes. This deep, well drained soil is on long side slopes. About 80 percent of the soil is hilly, and 20 percent has steep, complex slopes. It formed in residuum derived from sandstone or granitic rock. Elevation ranges from 122 - 914 meters (400 - 3,000 feet). The mean annual precipitation is about 127 centimeters (50 inches), and the mean annual air temperature is about 12.8 C (55 F). The frost-free season ranges from 220 to 245 days.

Typically, the soil is covered by a 5 centimeter (2 inch) mat of partially decomposed needles and twigs. The surface layer is dark grayish brown, slightly acid neutral sandy loam about 48 centimeters (19 inches) thick. The subsoil is brown, medium acid sandy laom about 28 centimeters (11 inches) thick. The substratum is pale brown, medium acid sandy loam about 41 centimeters (16 inches) thick. Weathered sandstone is at a depth of 117 centimeters (46 inches).

Included with this soil in mapping are areas of Nisene soils and small areas of Aptos, Felton, Lompico, and Sur soils. Also included are areas of soils that are similar to this Ben Lomond soil but have slopes of less than 15 percent.

Permeability of this Ben Lomond soil is moderately rapid. Effective rooting depth is 102 - 152 centimeters (40 - 60 inches). Available water capacity is 10 - 22 centimeters (4.0 - 8.5 inches). Runoff is rapid, and the hazard of erosion is moderate to high.

This soil is used mainly for timber production, recreation, wildlife habitat, and watershed. It is also used as homesites and for firewood production and apple orchards.

113 Ben Lomond-Catelli Sur complex, 30 to 75 percent slopes. This complex is on mountains. Most areas extend from ridgetops to drainageways, but a few areas occupy only small parts of mountainsides. Slopes are long and complex. Elevation ranges from 122 - 914 meters (400 - 3,000 feet). The mean annual precipitation is about 122 centimeters (48 inches), and the annual air temperature is about 14 degrees C (55 degrees F). The frost-free season ranges from 220 to 245 days.

This complex is about 30 percent Ben Lomond sandy loam, 30 percent Catelli sandy loam, and 20 percent Sur stony sandy loam. The Catelli soil makes up as much as 45 percent of the southwesterly slopes of the Ben Lomond and Santa Cruz Mountains. The Sur soil is found on ridges and on some fingers of rock areas that are parallel to the ridges.

Included with these soils in mapping are small areas of Aptos sandy loam, Felton sandy loam, Lompico loam, Maymen stony loam, Nisene loam, Zayante coarse sand, and a soil that is similar to the Catelli soil but is more than 101 centimeters (40 inches) deep to parent rock. Also included are areas of soils that are similar to the Sur soil but are stony loamy sand and stony sand. Included soils make up about 20 percent of this complex.

The Ben Lomond soil is deep and well drained. It formed in residuum derived from sandstone or quartz diorite. Typically, the soil is covered by a 5 centimeters (2-inch) mat of partially decomposed needles and twigs. The surface layer is dark grayish brown, slightly acid neutral sandy loam about 48 centimeters (19 inches) thick. The subsoil is brown, medium acid sandy loam about 28 centimeters (11 inches) thick. The substratum is pale brown, medium acid sandy loam about 41 centimeters (16 inches) thick. Weathered sandstone is at a depth of 117 centimeters (46 inches).

Permeability of the Ben Lomond soil is moderately rapid. Effective rooting depth is 102 - 152 centimeters (40 - 60 inches). Available water capacity is 10 - 22 centimeters (4.0 - 8.5 inches). Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

The Catelli soil is moderately deep and well drained. It formed in residuum derived from sandstone or granitic rock. Typically, the soil is covered by a 8 centimeter (3-inch) mat of partially decomposed leaves, bark, and twigs. The surface layer is brown, slightly acid sandy loam about 18 centimeters (7 inches) thick. The subsoil is yellowish brown and light yellowish brown, slightly acid and medium acid sandy loam about 41 centimeters (16 inches) thick. The substratum is very pale brown, strongly acid sandy loam about 36 centimeters (14 inches) thick. Weathered sandstone is at a depth of 94 centimeters (37 inches).

Permeability of the Catelli soil is moderately rapid. Effective rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 5 - 13 centimeters (2 - 5 inches). Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

The Sur soil is moderately deep and somewhat excessively drained. It formed in residuum derived from sandstone, schist, or granitic rock. Typically, the soil is covered by a 1-inch mat of needles, leaves, and twigs. The surface layer is brown, neutral slightly acid stony sandy loam about 46 centimeters (18 inches) thick. The underlying material is reddish yellow, medium acid very stony loam. Unweathered granodiorite is at a depth of 89 centimeters (35 inches).

Permeability of the Sur soil is moderately rapid. Effective rooting depth is 51 - 102 centimeters (20 -40 inches). Available water capacity is 3- 9 centimeters (1.0 - 3.5 inches). Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

These soils are used mainly for timber production, recreation, wildlife habitat, and watershed. They are also used for firewood production and as homesites.

The Ben Lomond soil is well suited to the production of redwood and Douglas-fir, the Catelli soil is somewhat well suited, and the Sur soil is somewhat poorly suited. In a few areas the Sur soil supports ponderosa pine and Coulter pine. The Ben Lomond soil is better suited to timber production than either the Catelli or Sur soil because it is

a deeper soil. This complex is limited for the production of timber mainly by the presence of bedrock at a depth of 51 - 101 centimeters (20 - 40 inches) in the Catelli and Sur soils and by the rock fragment content of 35 percent or more in the Sur soil. The moderate depth and high rock fragment content of these soils limit rooting depth and available water capacity.

These soils are poorly suited to building site development and onsite sewage disposal because of their steep and very steep slopes.

114 Ben Lomond-Felton complex, 30 to 50 percent slopes. This complex consists mainly of soils in concave areas near drainageways. Elevation ranges from 122 - 914 meters (400 - 3,000 feet) but is dominantly less than 610 meters (2,000 feet). The mean annual precipitation is about 114 centimeters (45 inches), and the mean annual air temperature is about 13.3 degrees C (56 F). The frost-free season ranges from 220 to 245 days.

This complex is about 35 percent Ben Lomond sandy loam and 35 percent Felton sandy loam.

Included with these soils in mapping are areas of Nisene loam, Aptos sandy loam, and Lompico loam. Also included are small areas of Catelli sandy loam, Hecker gravelly sandy loam, and soils that are similar to these Ben Lomond and Felton soils but have slopes of less than 30 percent or more than 50 percent.

The Ben Lomond soil is deep and well drained. It formed in residuum derived from sandstone or granitic rock. Typically, the soil has a 5 centimeter (2-inch) mat of partially decomposed needles and twigs. The surface layer is dark grayish brown, slightly acid and neutral sandy loam about 48 centimeters (19 inches) thick. The subsoil is brown, medium acid sandy loam about 28 centimeters (11 inches) thick. The substratum is pale brown, medium acid sandy loam about 41 centimeters (16 inches) thick. Weathered sandstone is at a depth of 117 centimeters (46 inches).

Permeability of the Ben Lomond soil is moderately rapid. Effective rooting depth is 102 - 152 centimeters (40 - 60 inches). Available water capacity is 10 - 19 centimeters (4.0 - 7.5 inches). Runoff is rapid, and the hazard of erosion is high.

The Felton soil is deep and well drained. It formed in residuum derived from sandstone, shale, schist, or siltstone. Typically, the surface layer is dark grayish brown and brown, slightly acid sandy loam about 28 centimeters (11 inches) thick. The subsoil is brown and yellowish red, slightly acid and strongly acid sandy clay loam and clay loam about 81 centimeters (32 inches) thick. The substratum is variegated light brownish gray and light olive brown, strongly acid loam and sandy loam about 51 centimeters (20 inches) thick. Weathered sandstone is at depth of 160 centimeters (63 inches).

Permeability of the Felton soil is moderately slow. Effective rooting

depth is 102 - 183 centimeters (40 - 72 inches). Available water capacity is 14 - 25 centimeters (5.5 - 10.0 inches). Runoff is rapid, and the hazard of erosion is high.

These soils are used mainly for timber, recreation, wildlife habitat, and watershed. They are also used for firewood production and as homesites.

These soils are poorly suited to building site development and onsite sewage disposal because they are found on steep slopes.

115 Ben Lomond-Felton complex, 50 to 75 percent slopes. This complex is dominantly in concave areas near drainageways. Elevation ranges from 122 - 914 meters (400 - 3,000 feet). The mean annual precipitation is about 114 centimeters (45 inches), and the mean annual air temperature is about 13.3 degrees C (56 degrees F). The frost-free season ranges from 220 to 245 days.

This complex is about 35 percent Ben Lomond sandy loam and 35 percent Felton sandy loam.

Included with these soils in mapping are areas of Nisene loam, Aptos sandy loam, and Lompico loam. Also included are small areas of Catelli sandy loam, Hecker gravelly sandy loam, and soils that are similar to the Ben Lomond and Felton soils but have slopes of 75 to 90 percent slopes.

The Ben Lomond soil is deep and well drained. It formed in residuum derived from sandstone or granite rock. Typically, the soil is covered by a 5 (2-inch) mat of partially decomposed needles and twigs. The surface layer is dark grayish brown, slightly acid and neutral sandy loam about 48 centimeters (19 inches) thick. The subsoil is brown, medium acid brown, medium acid sandy loam about 41 centimeters (16 inches) thick. Weathered sandstone is at a depth of 117 centimeters (46 inches).

Permeability of the Ben Lomond soil is moderately rapid. Effective rooting depth is 102 - 152 centimeters (40 - 60 inches). Available water capacity is 10 - 22 centimeters (4.0 - 8.5 inches). Runoff is very rapid, and the hazard of erosion is very high.

The Felton soil is deep and well drained. It formed in residuum derived from sandstone, shale, schist, or siltstone. Typically, the surface layer is dark grayish brown and brown, slightly acid sandy loam about 28 centimeters (11 inches) thick. The subsoil is brown and yellowish red, slightly acid to strongly acid sandy clay loam and clay loam about 81 centimeters (32 inches) thick. The substratum is variegated light brownish gray and light olive brown, strongly acid loam and sandy loam about 51 centimeters (20 inches) thick. Weathered sandstone is at depth of 160 centimeters (63 inches).

Permeability of the Felton soil is moderately slow. Effective rooting depth is 102 - 178 centimeters (40 - 70 inches). Available water

capacity is to 14 - 15 centimeters (5.5 - 10.0 inches). Runoff is very rapid, and the hazard of erosion is very high.

These soils are used mainly for timber, recreation, wildlife habitat, and watershed. They are also used for firewood production.

These soils are poorly suited to building site development and onsite waste disposal because of their very steep slopes.

142 Lompico-Felton complex, 5 to 30 percent slopes. This complex consists of soils on foot slopes and wide ridges. Slopes are dominantly complex. Elevation ranges from 122 - 914 meters (400 - 3,000 feet). The mean annual precipitation is about 122 centimeters (48 inches), and the mean annual air temperature is about 12.8 degrees C (55 degrees F). The frost-free season ranges from 220 to 245 days.

This complex is about 30 percent Lompico loam and 25 percent Felton sandy loam.

Included with these soils in mapping are areas of Aptos fine sandy loam, Nisene loam, Lompico variant loam, and Lompico loam that has a gravelly and cobbly subsoil.

The Lompico soil is moderately deep and well drained. It formed in residuum derived from sandstone, shale, siltstone, or mudstone. Typically the surface layer is brown, slightly acid loam about 13 centimeters (5 inches) thick. The subsoil is brown, strong brown, and yellowish brown, strongly acid and medium acid clay loam and sandy clay loam. Highly weathered sandstone is at a depth of 94 centimeters (37 inches).

Permeability of the Lompico soil is moderate. Effective rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 8 - 18 centimeters (3 - 7 inches). Runoff is medium or rapid, and the hazard of erosion is moderate or high.

The Felton soil is deep and well drained. It formed in residuum derived from sandstone, shale, siltstone, or schist. Typically, the surface layer is dark grayish brown and brown, slightly acid sandy clay loam and clay loam about 81 centimeters (32 inches) thick. The substratum is variegated light brownish gray and light olive brown, strongly acid loam and sandy loam about 51 centimeters (20 inches) thick. Weathered sandstone is at a depth of 160 centimeters (63 inches).

Permeability of this Felton soil is moderately slow. Effective rooting depth is 101 - 183 centimeters (40 - 72 inches). Available water capacity is 14 - 25 centimeters (5.5 - 10.0 inches). Runoff is medium or rapid, and the hazard of erosion is moderate to high.

These soils are used mainly for timber, recreation, wildlife habitat, and watershed. They are also used as homesites and for firewood production, apple orchards, and pasture.

The few areas of this complex that are used for apple orchards consist mainly of the deeper Felton soil. Use of minimum tillage and winter cover crops helps to control erosion in these areas. Returning crop residue to the soil or the regular addition of other organic material improves fertility and increases the water infiltration rate.

This complex provides habitat for band-tailed pigeon, jay, hawk, deer, raccoon, coyote, bobcat, rabbit, squirrel, mice, salamander, tree frog, lizard, and snake.

Rapid population growth in the county has resulted in increased construction of homes on these soils. Slope severely limits the use of these soils as house sites and as septic tank absorption fields. Only the part of a site used for construction should be disturbed. Topsoil should be stockpiled and used to reclaim areas disturbed by cutting and filling.

143 Lompico-Felton complex, 30 to 50 percent slopes. This complex consists of soils on foot slopes and wide ridges. Slopes are dominantly complex. Elevation ranges from 122 - 914 meters (400 - 3,000 feet). The mean annual precipitation is about 122 centimeters (48 inches), and the mean annual air temperature is about 12.8 C (55 F). The frost-free season ranges from 220 to 245 days.

This complex is about 35 percent Lompico loam and 30 percent Felton sandy loam.

Included with this complex in mapping are areas of Nisene loam and of Aptos fine sandy loam. Also included are small areas of Ben Lomond sandy loam, Catelli sandy loam, Lompico variant loam, Maymen stony loam, and soils that are similar to those in the complex but have slopes of less than 30 percent or more than 50 percent.

The Lompico soil is moderately deep and well drained. It formed in residuum derived from sandstone, shale siltstone or mudstone. Typically, the surface layer is brown, slightly acid loam about 13 centimeters (5 inches) thick. The subsoil is brown, strong brown, and yellowish brown, strongly acid and medium acid clay loam and sandy clay loam. Highly weathered sandstone is at a depth of 94 centimeters (37 inches).

Permeability of the Lompico soil is moderate. Effective rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 7 - 18 centimeters (3 - 7 inches). Runoff is rapid, and the hazard of erosion is high.

The Felton soil is deep and well drained. It formed in residuum derived from sandstone, shale, siltstone, or schist. Typically, the surface layer is dark grayish brown and brown, slightly acid sandy loam about 28 centimeters (11 inches) thick. The subsoil is brown and yellowish red, slightly acid and strongly acid sandy clay loam and clay loam about 81 centimeters (32 inches) thick. The substratum is variegated light brownish gray and light olive brown, strongly acid

loam and sandy loam about 51 centimeters (20 inches) thick. Weathered sandstone is at a depth of 160 centimeters (63 inches).

Permeability of the Felton soil is moderately slow. Effective rooting depth is 101 - 183 centimeters (40 - 72 inches). Available water capacity is 14 - 25 centimeters (5.5 - 10.0 inches). Runoff is rapid, and the hazard of erosion is high.

These two soils are used mainly for timber, recreation, wildlife habitat, and watershed. They are also used for firewood production, homesites, and pasture.

This complex provides habitat for band-tailed pigeon, jay, hawk, deer, raccoon, coyote, bobcat, rabbit, squirrel, mice, salamander, tree frog, lizard, and snake.

Because of the steep slopes these soils are poorly suited to building site development and onsite sewage disposal.

144 Lompico-Felton complex, 50 to 75 percent slopes. This complex consists of soils that are dominantly on footslopes but are also in areas near ridgetops. Elevation ranges from 122 - 914 meters (400 - 3,000 feet). The mean annual precipitation is about 122 centimeters (48 inches), and the mean annual air temperature is about 12.8 degrees C (55 degrees F). The frost-free season ranges from 220 to 245 days.

This complex is about 35 percent Lompico loam and 30 percent Felton sandy loam.

Included with this complex in mapping are areas of Aptos fine sandy loam, Nisene loam, and Maymen stony loam. Also included are small areas of Ben Lomond sandy loam, Catelli sandy loam, Lompico Variant loam, soils that are similar to those in this complex but have slopes of 30 to 50 percent, and a soil that is similar to this Felton soil but has more than 15 percent shale and mudstone fragments in the subsoil.

The Lompico soil is moderately deep and well drained. It formed in residuum derived from sandstone, shale siltstone, or mudstone. Typically, the surface layer is brown, slightly acid loam about 12.7 centimeters (5 inches) thick. The subsoil is brown, strong brown, and yellowish brown, strongly acid and medium acid clay loam and sandy clay loam. Weathered sandstone is at a depth of 94 centimeters (37 inches).

Permeability of the Lompico soil is moderate. Effective rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 8 - 18 centimeters (3 - 7 inches). Runoff is very rapid, and the hazard of erosion is very high.

The Felton soil is deep and well drained. It formed in residuum derived from sandstone, shale, siltstone, or schist. Typically, the surface layer is dark grayish brown and brown, slightly acid sandy

loam about 28 centimeters (11 inches) thick. The subsoil is brown and yellowish red, slightly acid and strongly acid sandy clay loam and clay loam about 81 centimeters (32 inches) thick. The substratum is variegated light brownish gray and light olive brown, strongly acid loam and sandy loam about 51 centimeters (20 inches) thick. Weathered sandstone is at a depth of 160 centimeters (63 inches).

Permeability of the Felton soil is moderately slow. Effective rooting depth is 101 - 152 centimeters (40 - 60 inches). Available water capacity is 14 - 25 centimeters (5.5 - 10.0 inches). Runoff is very rapid, and the hazard or erosion is very high.

These soils are used mainly for timber, recreation, wildlife habitat, and watershed. They are also used for firewood production.

Lompico soil produces more timber than the Felton soil because the Lompico soil has weathered bedrock at a depth of 51 - 102 centimeters (20 - 40 inches).

This complex provides habitat for band-tailed pigeon, jay, hawk, deer, raccoon, coyote, bobcat, rabbit, squirrel, mice, salamander, tree frog, lizard, and snake.

These soils are poorly suited to building site development and onsite sewage disposal because of their very steep slopes.

153 Maymen-Rock outcrop complex, 50 to 75 percent slopes. This complex is on ridges and the upper part of very steep slopes on mountains. Elevation ranges from 244 - 914 meters (800 - 3,000 feet). The mean annual precipitation is about 122 centimeters (48 inches), and the mean annual air temperature is about 14 degrees C (55 degrees F). The frost-free season ranges from 220 to 245 days.

This complex is about 45 percent Maymen stony loam and 25 percent rock outcrop.

Included within this complex in mapping are areas of soils that are similar to the Maymen soil but have bedrock at a depth of less than 25 centimeters (10 inches). Also included are areas of Ben Lomond sandy loam and Madonna loam and small areas of Catelli sandy loam, Hecker gravelly sandy loam, and Sur stony sandy loam.

The Maymen soil is shallower and somewhat excessively drained. It formed in material weathered from shale, sandstone, or granitic rock. Typically, the surface is sandstone, or granitic rock and is covered by a 2 centimeter (1-inch) mat of undecomposed leaves and twigs. The surface layer is pale brown, slightly acid stony loam about 15 centimeters (6 inches) thick. The subsoil is pale brown, medium acid shaly heavy loam about 20 centimeters (8 inches) thick. Unweathered, fractured shale is at a depth of 36 centimeters (14 inches).

Permeability of the Maymen soil is moderate. Effective rooting depth is 25 - 51 centimeters (10 to 20 inches). Available water capacity is

3 - 6 centimeters (1.0 to 2.5 inches). Runoff is very rapid, and the hazard of erosion is very high.

Rock outcrop consists of exposures of sandstone, shale and granitic rock.

This complex is used for watershed and recreaton.

Rapid population growth in the county has resulted in increased pressure for homesites. This soil is poorly suited to use as homesites or for septic tank absorption fields because of the very steep slopes and depth to rock.

167 Santa Lucia shaly clay loam, 5 to 30 percent slopes. This moderately deep, well drained soil is on hills and mountains. It formed in material weathered from siliceous shale. Elevation ranges from 30 - 548 meters (100 - 1,800 feet). The mean annual precipitation is about 76 centimeters (30 inches), and the mean annual air temperature is about 14.4 degrees C (58 degrees F). The frost-free season ranges from 245 to 270 days.

Typically, the surface layer is dark gray and grayish brown, neutral, medium acid and strongly acid shaly clay loam and very shaly clay loam about 96 centimeters (38 inches) thick. Below this is fractured siliceous shale.

Included with this soil in mapping are areas of a soil that is similar to this Santa Lucia soil but is less than 35 percent shale fragments in the profile; areas of Bonnydoon loam, Maymen stony loam, and a soil that is similar to this Santa Lucia soil but has a subsoil; and areas of Los Osos loam. Also included are small areas of Soquel loam and soils that are similar to this Santa Lucia soil but have bedrock at a depth of less than 51 centimeters (20 inches) or more than 101 centimeters (40 inches).

Permeability of this Santa Lucia soil is moderate. Effective rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 4 - 11 centimeters (1.5 - 4.5 inches). Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Nearly all areas of this soil are rangeland. A few areas are used for homesites.

If this soil is used for range, the native vegetation should be managed to increase the production of soft chess, purple needlegrass, and California fescue. If the soil is continuously overgrazed, the condition of the range deteriorates; the proportion of desirable forage plants decreases, and the proportion of undesirable plants increases. Control of chamise, brackenfern, poison-oak, and coyotebrush improves the condition of the range and improves the value of the site for watershed, wildlife habitat, and recreation.

The potential is good habitat for deer, jackrabbit, ground squirrel,

bobcat, coyote, gray fox, quail, dove, and hawk.

Rapid population growth in the county has resulted in increased construction of homes on this soil. Moderate depth to bedrock and the hazard of erosion, especially in the steep areas of this soil, are the main limitations for homesites. Depth to rock causes difficulty in trenching for pipelines and also can cause failure of septic tank filter fields. Erosion is a hazard if the surface is disturbed and left bare. Only the areas necessary for construction should be disturbed. Topsoil should be stockpiled and used to reclaim areas disturbed by cutting and filling. Disturbed areas should be reseeded to suitable grasses as soon after development as possible.

168 Santa Lucia shaly clay loam, 30 to 50 percent slopes. This moderately deep, well drained soil is on hills and mountains. It formed in material weathered from siliceous shale. Elevation ranges from 30 - 549 meters (100 - 1,800 feet). The mean annual precipitation is about 76 centimeters (30 inches), and the mean annual air temperature is about 14.4 degrees C (58 degrees F). The frost-free season ranges from 245 to 270 days.

Typically, the surface layer is dark gray and grayish brown, neutral, medium acid and strongly acid shaly clay loam and very shaly clay loam about 96.5 centimeters (38 inches) thick. Below this is fractured siliceous shale.

Included with this soil in mapping are areas of Maymen stony loam, Bonnydoon loam, Los Osos loam, a soil that is similar to this Santa Lucia soil but is 18 to 35 percent clay, and a soil that is similar but has a subsoil. Also included are small areas of soils that are similar to this Santa Lucia soil but have bedrock at a depth of less than 51 centimeters (20 inches) or more than 102 centimeters (40 inches).

Permeability of this Santa Lucia soil is moderate. The effective rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 4 - 11 centimeters (1.5 - 4.5 inches). Runoff is rapid, and the hazard of erosion is high.

Nearly all areas of this soil are rangeland. A few areas are used as homesites.

If this soil is used as range, the native vegetation should be managed to increase the production of soft chess, purple needlegrass, and California fescue. If the soil is continuously overgrazed, the condition of the range deteriorates; the proportion of desirable forage plants decreases, and the proportion of undesirable plants increases. Control of chamise, brackenfern, poison-oak, and coyotebrush improves the condition of the range and improves the value of the site for watershed, wildlife habitat, and recreation. The moderately steep slope of this soil generally makes it difficult to locate good sites for stock watering ponds. Management of brushy areas by burning or mechanical methods can increase the hazard of

erosion unless precautionary measures are taken.

Rapid growth of population in the county has resulted in increased construction of homes on this soil. Depth to bedrock and slope are the main limitations of this soil for homesites. Depth to bedrock also causes difficulty in trenching for pipelines and can cause failure of septic tank filter fields. Effluent from filter fields can surface in areas downslope and create a hazard to health. Because of the slope, erosion is a hazard if the surface is disturbed and left bare. Only the areas used for construction should be disturbed. Topsoil should be stockpiled and used to reclaim areas disturbed by cutting and filling. Disturbed areas should be reseeded to suitable grasses as soon after development as possible.

169 Santa Lucia shaly clay loam, 50 to 75 percent slopes. This moderately deep, well drained soil is on hills and mountains. It formed in material weathered from siliceous shale or mudstone. Elevation ranges from 30 - 549 meters (100 - 1,800 feet). The mean annual precipitation is about 76 centimeters (30 inches), and the mean annual air temperature is about 14.4 degrees C (58 degrees F). The frost-free season ranges from 245 to 270 days.

Typically, the surface layer is dark gray and grayish brown, neutral, medium acid and strongly acid shaly clay loam and very shaly clay loam about 96.5 centimeters (38 inches) thick. Below this is fractured siliceous shale.

Included with this soil in mapping are areas of a soil that is similar to this Santa Lucia soil but is less than 51 centimeters (20 inches) deep to bedrock; areas of Bonnydoon loam, Maymen stony loam, and a soil that is similar but has a subsoil; and areas of Aptos loam, warm. Also included are small areas of a soil that is similar to this Santa Lucia soil but is more than 102 centimeters (40 inches) deep to bedrock.

Permeability of this Santa Lucia soil is moderate. Effective rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 4 - 11 centimeters (1.5 - 4.5 inches). Runoff is very rapid, and the hazard of erosion is very high.

Nearly all areas of this soil are rangeland.

If this soil is used for range, the native vegetation should be managed to increase the production of soft chess, purple needlegrass, and California fescue. If the soil is continuously overgrazed, the condition of the range deteriorates; the proportion of desirable forage plants decreases, and the proportion of undesirable plants increases. Control of chamise, brackenfern, poison-oak, and coyotebrush improves the range and increases the value of the site for watershed, wildlife habitat, and recreation. Management of brush areas by burning, chemical, or mechanical methods can increase the hazard of erosion unless precautionary measures are taken. Among the suitable management practices are those that improve the distribution

of grazing.

Rapid growth of population in the county has resulted in increased pressure for homesites. The moderate depth over bedrock and excessive slope severely limit the use of this soil for construction of homes.

170 Soquel loam, 0 to 2 percent slopes. This very deep, moderately well drained soil is on plains and in narrow valleys. It formed in alluvium. Elevation ranges from 6 - 305 meters (20 - 1,000 feet). The mean annual precipitation is about 76 centimeters (30 inches), and the mean annual air temperature is about 13.9 degrees C (57 degrees F). The frost-free season ranges from 220 to 250 days.

Typically, the surface layer is very dark grayish brown and brown, medium acid and slightly acid loam about 54 centimeters (21 inches) thick. The upper part of the underlying material is brown, neutral silt loam about 41 centimeters (16 inches) thick over a buried surface layer of brown, neutral silty clay loam about 36 centimeters (14 inches) thick. The lower part, to a depth of 157 centimeters (62 inches), is yellowish brown, neutral loam.

Included with this soil in mapping are areas of the Fluvaquentic Hapoxerolls-Aquic Xerofluvents complex and a soil that is similar to this Soquel soil but has a very gravelly subsoil at a depth of more than 76 - 122 centimeters (30 - 48 inches). Also included are some small narrow valleys that do not have intrenched streams that are subject to intermittent flooding.

Permeability of this Soquel soil is moderately slow. Available water capacity is 22 - 27 centimeters (8.5 - 10.5 inches). Effective rooting depth is 152 centimeters (60 inches). Surface runoff is slow, and the hazard of erosion is none to slight.

Most areas of this soil are intensively cultivated. The main crops are apples, lettuce, brussels sprouts, strawberries, and bushberries. Most other crops commonly grown in the county are suited to this soil. A few areas have been left in timber.

If this soil is properly managed, it is highly productive. Use of green-manure crops and fertilizer helps to maintain tilth and fertility. Most crops respond to nitrogen, and some respond to phosphorus. Where the soil is irrigated, the usual method of irrigation is by furrow or sprinkler systems. Water should be applied at a slow rate over a long period to assure that the root zone is properly wetted.

Rapid growth of population in the county has resulted in increased construction of homes on this soil. This soil is limited for homesites by moderately slow permeability. Lots larger than normal are needed to provide the additional area needed for septic tank filter fields. Onsite inspection is needed to determine if the site is subject to flooding. Unless protected, areas that are subject to flooding should not be used as homesites.

171 Soquel loam, 2 to 9 percent slopes. This very deep, moderately well drained soil is on plains. It formed in alluvium. Elevation ranges from 6 - 305 meters (20 - 1,000 feet). The mean annual precipitation is about 76 centimeters (30 inches), and the mean annual air temperature is about 13.9 degrees C (57 degrees F). The average frost-free season ranges from 220 to 250 days.

Typically, the surface layer is very dark grayish brown and brown, medium acid and slightly acid loam about 53 centimeters (21 inches) thick. The upper part of the underlying material is brown, neutral silt loam about 41 centimeters (16 inches) thick over a buried surface layer of brown, neutral silty clay loam about 36 centimeters (14 inches) thick. The lower part, to a depth of 157 centimeters (62 inches), is yellowish brown, neutral loam.

Included with this soil in mapping are areas of the Fluvaquentic Haploxerolls-Aquic Xerofluvents complex and soils that are similar to this Soquel soil but have a very gravelly subsoil at a depth of 76 - 122 centimeters (30 - 48 inches). Also included are a few narrow valleys that do not have intrenched streams and are subject to intermittent flooding and soils that have a sandy loam surface layer.

Permeability of this Soquel soil is moderately slow. Available water capacity is 22 - 27 centimeters (8.5 - 10.5 inches). Effective rooting depth is 152 centimeters (60 inches). Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Most areas of this soil are intensively-cultivated. The main crops are apples, lettuce, brussels sprouts, strawberries, and bushberries. Most other crops commonly grown in the county also are suited to this soil. A few areas have been left in timber.

If this soil is properly managed, it is highly productive. Use of green-manure crops and fertilizer helps to maintain tilth and fertility. Most crops respond to nitrogen, and some respond to phosphorus. Most crops require irrigation. Where the soil is irrigated, contour furrow and sprinkler systems generally are used. Because the soil is moderately slowly permeable, water should be applied at a slow rate for a long period to wet the entire root zone.

Erosion can be controlled by minimum tillage, contour or cross-slope farming, proper crop residue management, and use of winter cover crops. Sheet and rill erosion can be substantially reduced on steeper slopes used for row crops by terracing and farming on the contour.

Rapid growth of population in the county has resulted in increased construction of homes on this soil. The main limitations of this soil for homesites are moderately slow permeability and moderate slope. Because of the moderately slow permeability, lots larger than normal are needed to provide the additional area needed for septic tank filer fields. Erosion is a hazard in these moderately sloping areas. To reduce erosion, only the part of the site used for construction should be disturbed. Disturbed areas should be reseeded to suitable grasses

as soon after construction as possible.

172 Soquel loam, 9 to 15 percent slopes. This very deep, moderately well drained soil is on plains and fans. It formed in alluvium. Elevation ranges from 6 - 305 meters (20 - 1,000 feet) but is dominantly more than 152 meters (500 feet). The mean annual precipitation is about 76 centimeters (30 inches), and the mean annual air temperature is about 14 degrees C (57 degrees F). The frost-free season is about 220 to 250 days.

Typically, the surface layer is very dark grayish brown and brown, medium acid and slightly acid loam about 53 centimeters (21 inches) thick. The upper part of the underlying material is brown, neutral silt loam about 41 centimeters (16 inches) thick over a buried surface layer of brown, neutral silty clay loam about 36 centimeters (14 inches) thick. The lower part, to a depth of 157 centimeters (62 inches), is yellowish brown, neutral loam. In places, the surface layer is sandy loam.

Included with this soil in mapping are areas of Elkhorn sandy loam. Also included are small areas of loam and coarse sand along narrow stream channels; a soil that is similar to this Soquel soil but is very gravelly at a depth of 76 - 122 centimeters (30 - 48 inches); narrow alluvial escarpments that have slopes of as much as 30 percent; and soils that are similar to this Soquel soil but have slopes of less than 9 percent.

Permeability of this Soquel soil is moderately slow. Available water capacity is 22 - 27 centimeters (8.5 - 10.5 inches). Effective rooting depth is 152 centimeters (60 inches). Surface runoff is medium, and the hazard of erosion is moderate.

Most areas of this soil are cultivated. The hazard of erosion limits use in most places to apple orchards or pasture. A limited acreage of brussels sprouts and strawberries is grown along the coastal area. A few areas are used for timber.

If this soil is properly managed, it is moderately to highly productive. Use of cover crops, crop residue management, minimum tillage, cross-slope or contour farming, and fertilization help to control erosion and to maintain fertility. Most crops require irrigation. Sprinkler or drip type irrigation systems are most suitable. Because this soil is moderately slowly permeable, water should be applied at a slow rate for a long period to wet the entire root system.

Rapid growth of population in the county has resulted in increased construction of homes on this soil. The main limitations of the soil for homesites are moderately slow permeability and steep slope. Because this soil is moderately slowly permeable, lots that are larger than normal are needed to provide the additional area needed for septic tank filter fields. Effluent can surface in downslope areas and become a hazard to health. Erosion is a hazard if this strongly

sloping soil is disturbed. To control erosion, only the part of the site used for construction should be disturbed. Disturbed areas should be reseeded to suitable grasses as soon after construction as possible.

173 Sur-Catelli complex, 50 to 75 percent slopes. This complex consists of soils on mountainsides. The areas extend from the ridges to the draingeways. Slopes are complex. Elevation ranges from 122 - 914 meters (400 - 3,000 feet). The mean annual precipitation is about 122 centimeters (48 inches), and the mean annual air temperature is about 12.8 degrees C (55 degrees F). The frost-free season ranges from 220 to 240 days.

This complex is 35 percent Sur stony sandy loam and 25 percent Catelli sandy loam. Catelli soils generally have slopes of less than 60 percent.

Included with these soils in mapping are areas of Ben Lomond sandy loam, Lompico loam, Madonna loam, Maymen stony loam, soils that are similar to the Sur soil but are less than 51 centimeters (20 inches) deep to bedrock or have loamy sand and sand texture, and a soil that is similar to the Catelli soil but is underlain by hard sandstone. Also included are small areas of Hecker gravelly sandy loam, Zayante coarse sand, soils that are similar to the soils in this complex but have slopes of 75 to 85 percent, and a soil that is similar to the Sur soil but has a light colored surface layer and is strongly acid.

The Sur soil is moderately deep and somewhat excessively drained. It formed in residuum derived from sandstone, schist, or granitic rock. Typically, a 1-inch mat of partially decomposed needles, leaves, and twigs covers the surface. The surface layer is brown, neutral and slightly acid stony sandy loam about 46 centimeters (18 inches) thick. The underlying material is reddish yellow, medium acid very stony sandy loam. Hard quartz diorite is at a depth of 89 centimeters (35 inches).

Permeability of the Sur soil is moderately rapid. Effective rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 2 - 9 centimeters (1.0 - 3.5 inches). Runoff is very rapid, and the hazard of erosion is very high.

The Catelli soil is moderately deep and well drained. It formed in residuum derived from sandstone or granitic rock. Typically, a 7.6 centimeter (3-inch) mat of partially decomposed leaves, bark, and twigs covers the surface. The surface layer is brown, slightly and sandy loam about 18 centimeters (7 inches) thick. The subsoil is yellowish brown and light yellowish brown, slightly acid and medium acid sandy loam about 41 centimeters (16 inches) thick. The substratum is very pale brown, strongly acid sandy loam about 36 centimeters (14 inches) thick. Weathered sandstone is at a depth of 94 centimeters (37 inches).

Permeability of the Catelli soil is moderately rapid. Effective

rooting depth is 51 - 102 centimeters (20 - 40 inches). Available water capacity is 5 - 13 centimeters (2.0 - 5.0 inches). Runoff is very rapid, and the hazard of erosion is very high.

These soils are used mainly for watershed, wildlife habitat, recreation, and timber. They are also used for firewood production.

The Catelli soil is well suited to the production of Douglas-fir, and the Sur soil is poorly suited. Small areas of the Sur soil are in ponderosa pine and Coulter pine. The main limitations of this complex for the production of timber is the presence of weathered bedrock at a depth of 51 - 102 centimeters (20 - 40 inches) in the Catelli soil.

These soils are poorly suited to building site development and onsite sewage disposal because of their very steep slopes.

177 Watsonville loam, 2 to 15 percent slopes). This very deep, somewhat poorly drained soil is on coastal terraces. It formed in alluvium. elevation ranges from 6 - 305 meters (20 - 1,000 feet). The mean annual precipitation is about 71 centimeters (28 inches), and the mean annual air temperature is about 14 degrees C (58 degrees F). The frost-free season ranges from 245 to 275 days.

Typically, the surface layer is very dark grayish brown, slightly acid loam about 30 centimeters (12 inches) thick. The subsurface layer is a light gray, slightly acid sandy loam about 15 centimeters (6 inches) thick. The subsoil is pale brown and mixed light gray and very pale brown, and yellow, slightly acid and medium acid sandy clay loam.

Included with this soil in mapping are areas of Elkhorn sandy loam, Pinto loam, and Watsonville loam. Also included are small areas of Cropley silty clay, Danville loam, Elder sandy loam, a sandy loam that is similar to this Watsonville soil but does not have a subsurface layer, a soil that is similar but has a subsoil that has high concentrations of sodium, and a soil on hilltops that is similar but is underlain at a depth of 61 - 152 centimeters (24 - 60 inches) by a layer of consolidated sandy sediment 0.6 - 1.8 meters (2 - 6 feet) thick.

Permeability of this Watsonville soil is very slow. Available water capacity is 10 - 13 centimeters (4.0 - 5.0 inches). Water is perched above the clay at times. The effective rooting depth is as much as 152 centimeters (60 inches), but roots are restricted to cracks in the clay below a depth of 25 - 51 centimeters (10 - 20 inches). Runoff is slow or medium, and the hazard of erosion is slight to moderate.

About 25 percent of the acreage of this soil is cultivated. Crops are mainly irrigated pasture and brussels sprouts. A few areas are used for apple orchards, but production of apples is generally low.

To minimize erosion, orchards should be maintained without cultivation and with grass strips planted across the slope between rows of trees. All pruning should be shredded in place for mulch. Diversions and

grade stabilization structures may be needed in steeper areas. Careful sprinkler irrigation is required to avoid perching excess water within the crop root zone.

If this soil is used for range, the native vegetation should be managed to increase the production of soft chess, purple needlegrass, burclover, and filaree. If the soil is continuously overgrazed, the condition of the range deteriorates; the proportion of undesirable plants increases. Control of narrowleaf plantain, tarweed, thistle, and coyotebrush improves the range.

The potential of this soil is fair habitat for deer, rabbit, squirrel, bobcat, coyote, quail, dove, meadowlark, hawk, and owl.

Rapid growth of population in the county has resulted in increased construction of homes on this soil. Shrink-swell potential, low strength, and very slow permeability are the main limitations to the use of this soil for homesites. Special design is needed for building pads, roads, and other urban-related structures to compensate for the low strength and the shrink-swell potential of this soil. Because of the very slow permeability, septic tank absorption fields do not function properly. In a few areas, borings to a depth of 6 - 9 meters (20 - 30 feet) have located sand strata. Onsite investigations should be made to confirm the presence of sand strata before construction is started. Community sewage systems are needed in areas where density of the population is medium to high.

181 Xerorthents-Rock outcrop complex, 50 to 100 percent slopes. This complex is on mountains. Elevation ranges from about 122 - 914 meters (400 -3,000 feet). The mean annual precipitation is about 122 centimeters (48 inches), and the mean annual air temperature is about 13 degrees C (55 degrees F). The frost-free season ranges from 220 to 245 days.

This complex is 45 percent Xerorthents and 35 percent Rock outcrop.

Included with this complex in mapping are areas of Maymen stony loam, Bonnydoon loam, and Zayante coarse sand.

Xerorthents are shallow. They formed in material weathered from sandstone or shale. Xerorthents consist of light colored sand, loamy sand, or sandy loam. In places, they consist of very shaly clay loam about 10 to 36 centimeters (4 - 14 inches) thick over sandstone or shale.

Rock outcrop consists of exposures of sandstone and shale. It is mainly on ridges or crests of mountains.

This complex is used mainly for watershed, wildlife habitat, and recreation.

Constraints and Sensitivities

The soils of the park are rated in Table S-3 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are: location and accessiblity of the site, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available and either access to public sewerlines or capacity of the soil to absorb septic tank effluent.

The degree of the limitations of the soils is expressed as slight, moderate, or severe. Slight means that the soil properties are generally favorable and that the limitations are minor and easily overcome. Moderate means that the limitations can be overcome or alleviated by planning, design or special maintenance. Severe means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation special design, intensive maintenance, limited use, or by a combination of these measures.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use; a surface that has few or no stones or boulders, absorbs rainfall rapidly but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are: firm when wet; are not dusty when dry; not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

TABLE S-3
SOIL LIMITATIONS FOR RECREATIONAL DEVELOPMENT
(Soil survey of Santa Cruz County, 1980)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
103---------- Aquents				
109---------- Beaches				
110---------- Ben Lomond	Moderate: slope	Moderate: slope	Severe: slope	Slight.
111,112------ Ben Lomond	Severe: slope	Severe: slope	Severe: slope	Severe: slope
113---------- Ben Lomond	Severe: slope	Severe: slope	Severe: slope	Severe: slope
114,115------ Ben Lomond	Severe: slope	Severe: slope	Severe: slope	Severe: slope
142---------- Lompico	Severe: slope	Severe: slope	Severe: slope	Moderate: slope
143,144------ Lompico	Severe: slope	Severe: slope	Severe: slope	Severe: slope
153---------- Maymen	Severe: slope	Severe: slope	Severe: slope, depth to rock	Severe: slope
167---------- Santa Lucia	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
168, 169----- Santa Lucia	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
170---------- Soquel	Slight	Slight	Moderate: small stones.	Slight
171---------- Soquel	Slight	Slight	Moderate: slope, small stones	Slight
172---------- Soquel	Moderate: slope	Moderate: slope	Severe: slope	Slight
177,179------ Watsonville	Severe: percs slowly	Moderate: slope, wetness.	Severe: slope, percs slowly.	Slight
181---------- Xerorthents				

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