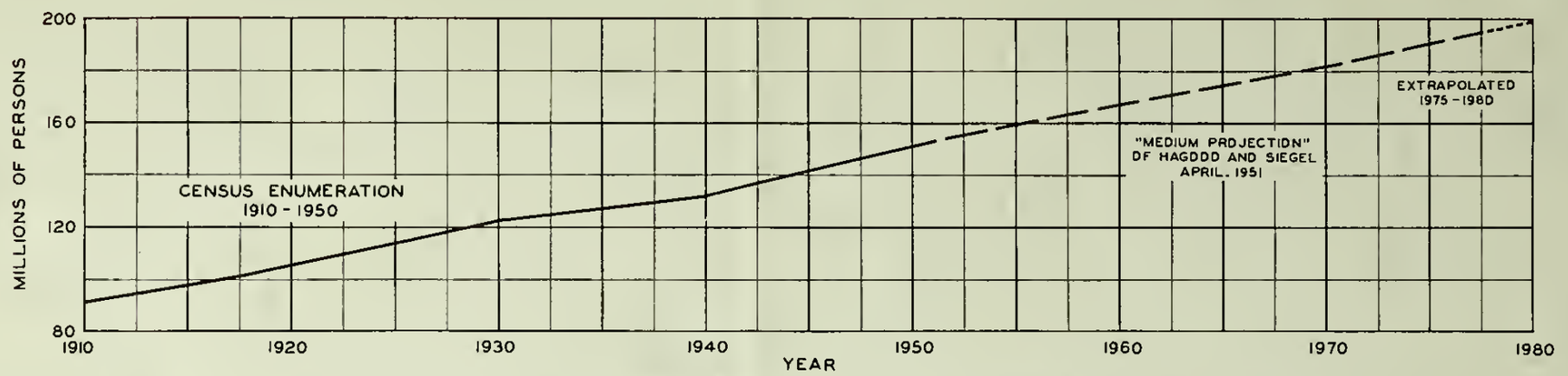

FIG. IA. POPULATION OF THE UNITED STATES (INCLUDING MILITARY FORCES OVERSEAS)

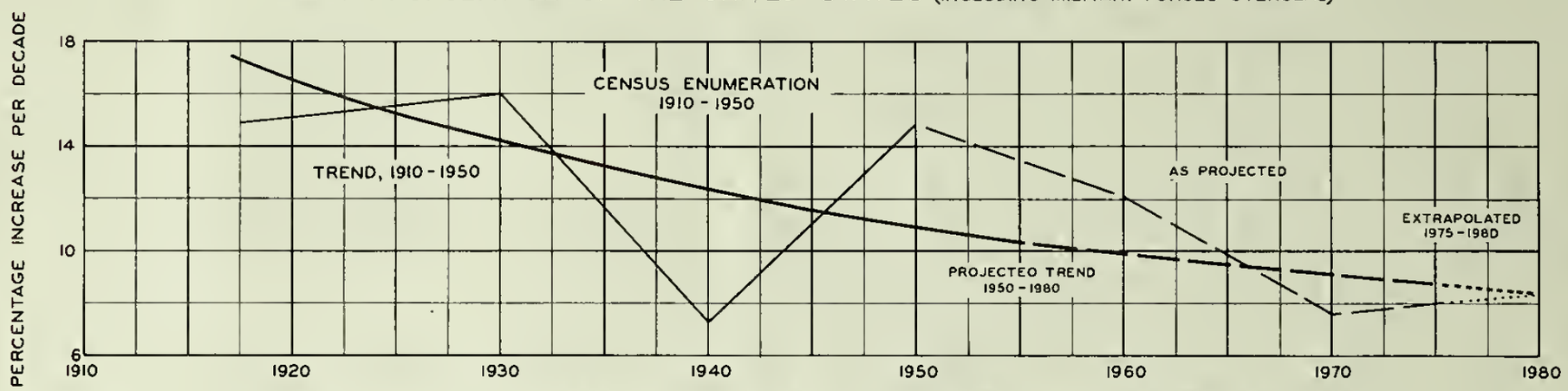

FIG. IB. PERCENTAGE INCREASE PER DECADE OF UNITED STATES POPULATION

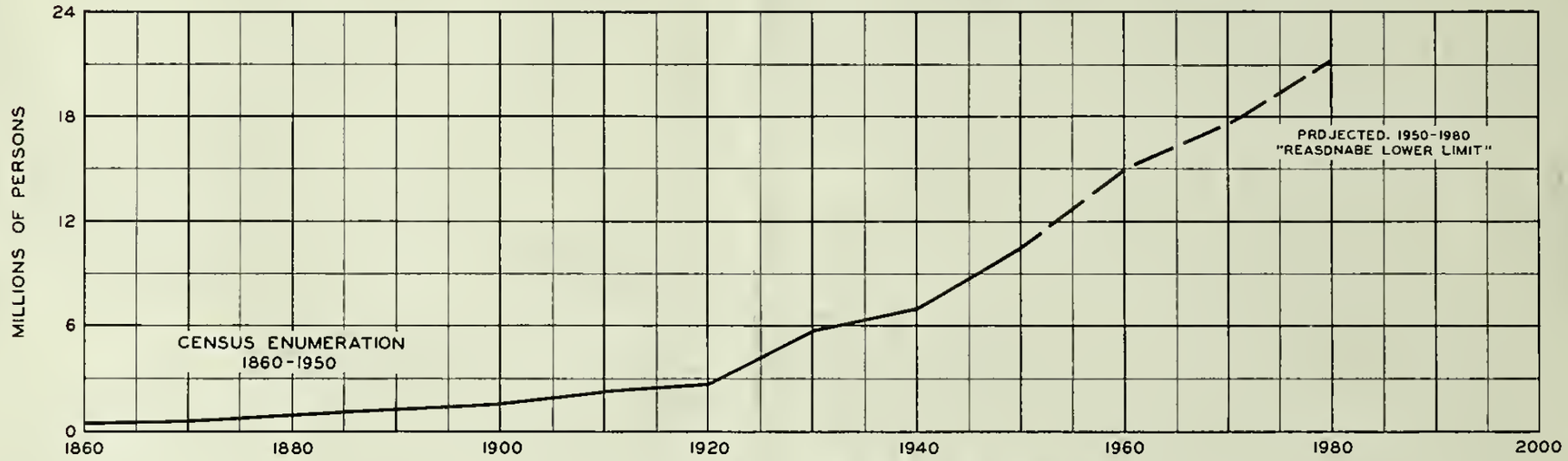

FIG. IC. POPULATION OF CALIFORNIA

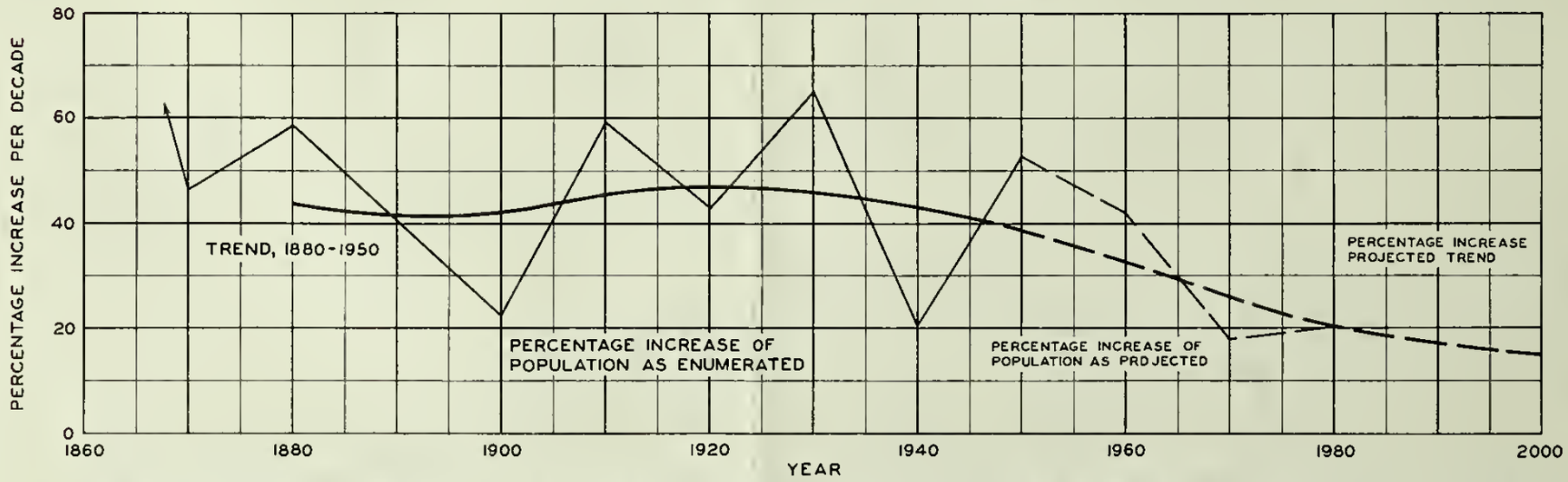

FIG. ID. PERCENTAGE INCREASE OF CALIFORNIA POPULATION OVER THE POPULATION TEN YEARS EARLIER

PROJECTED POPULATION OF UNITED STATES AND CALIFORNIA

DIVISION OF WATER RESOURCES

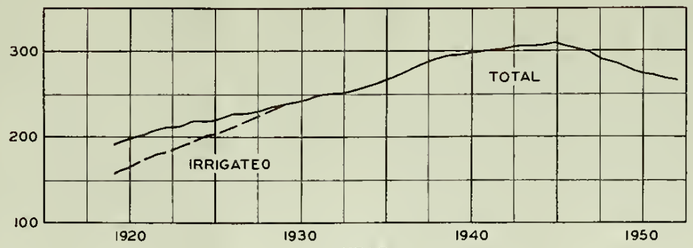

FIG. 2A. CITRUS FRUITS

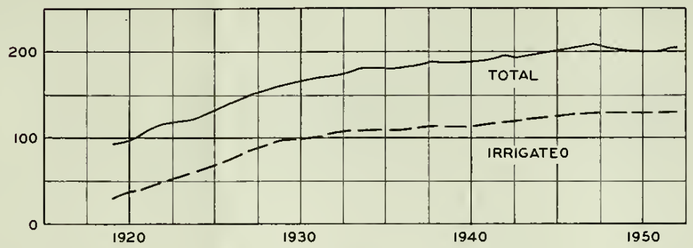

FIG. 2B. NUT CROPS

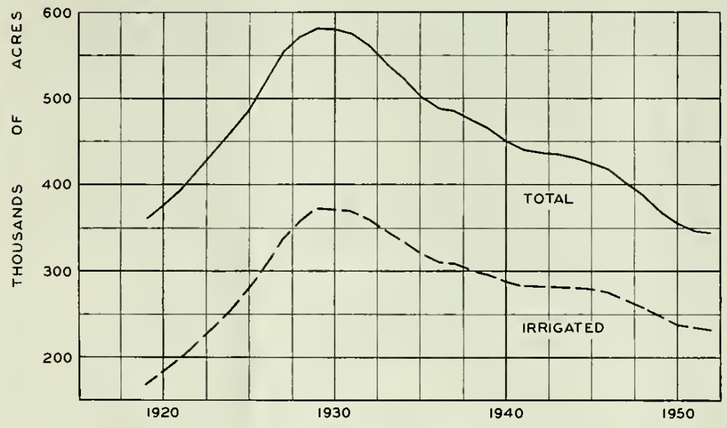

FIG. 2C. DECIDUOUS TREE FRUITS

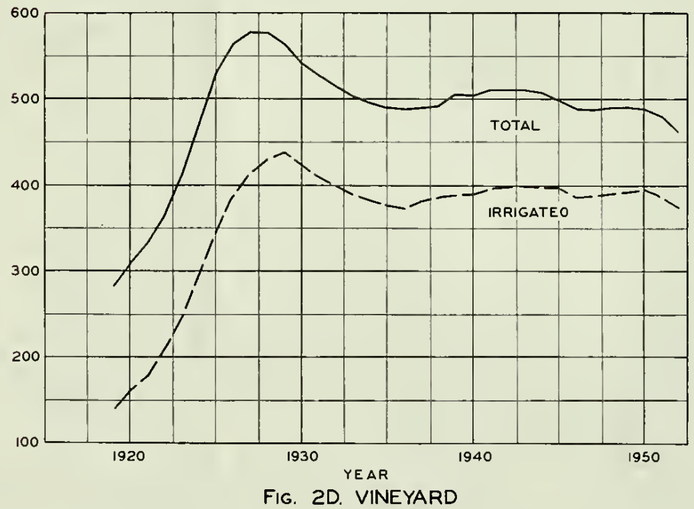

FIG. 2D. VINEYARD

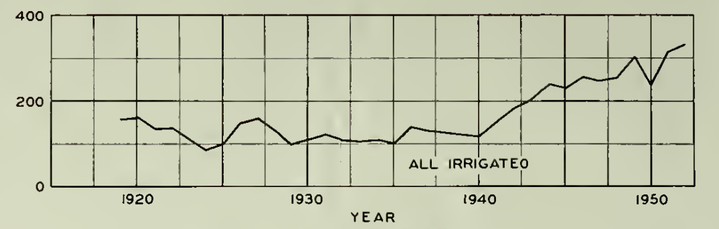

FIG. 2E. RICE

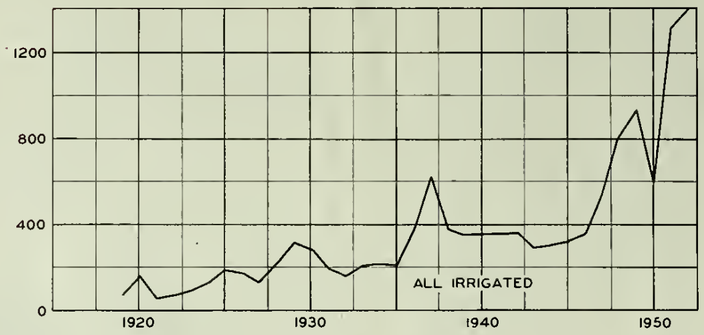

FIG. 2F. COTTON

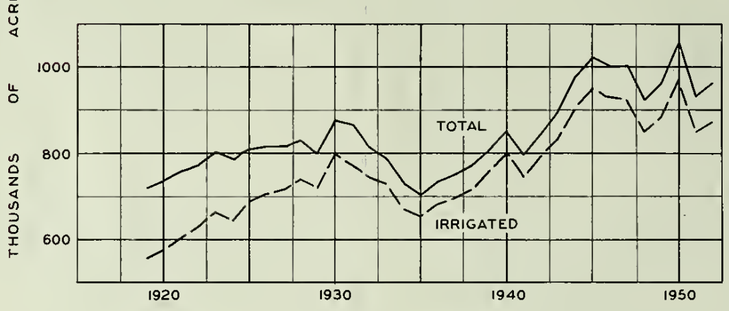

FIG. 2G. ALFALFA

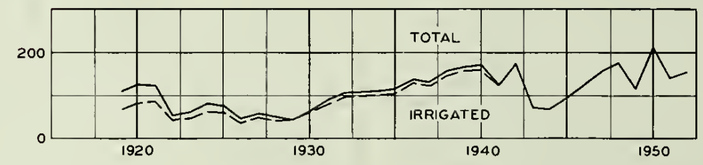

FIG. 2H. SUGAR BEETS

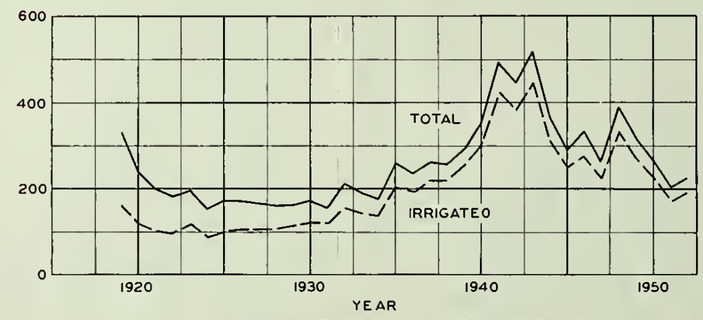

FIG. 2I. CORN, SORGHUMS, HOPS AND FLAX

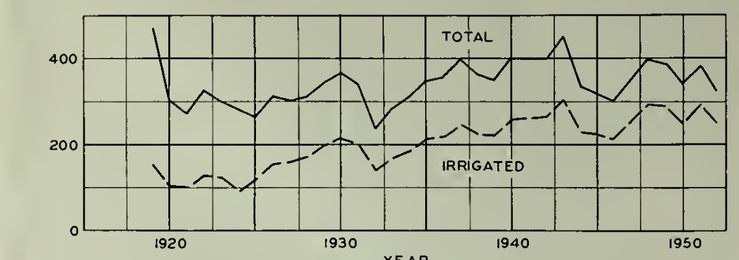

FIG. 2J. BEANS, GREEN AND DRY

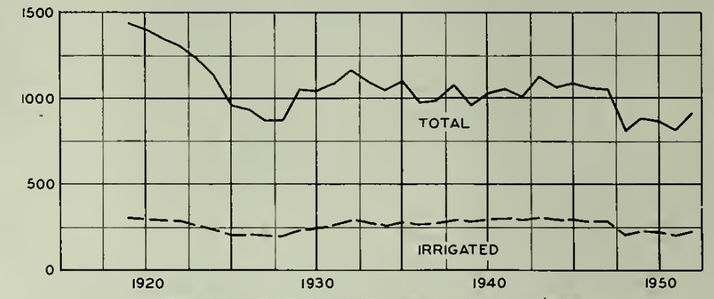

FIG. 2K. EXTENSIVE HAY CROPS (WILD GRAIN AND OTHER TAME HAY EXCLUDING ALFALFA)

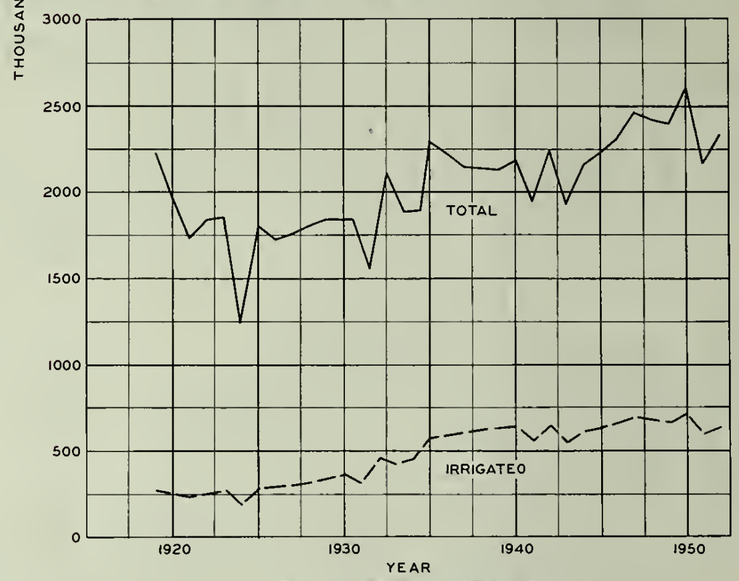

FIG. 2L SMALL GRAINS

TOTAL AND IRRIGATED ACREAGE OF CALIFORNIA CROPS

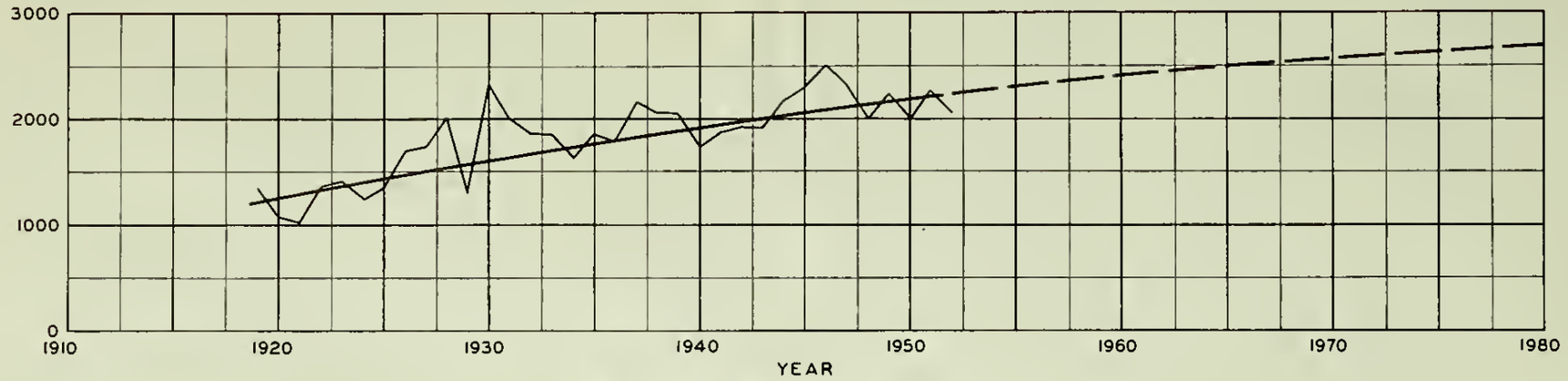

FIG. 3A. DECIDUOUS FRUIT TREE

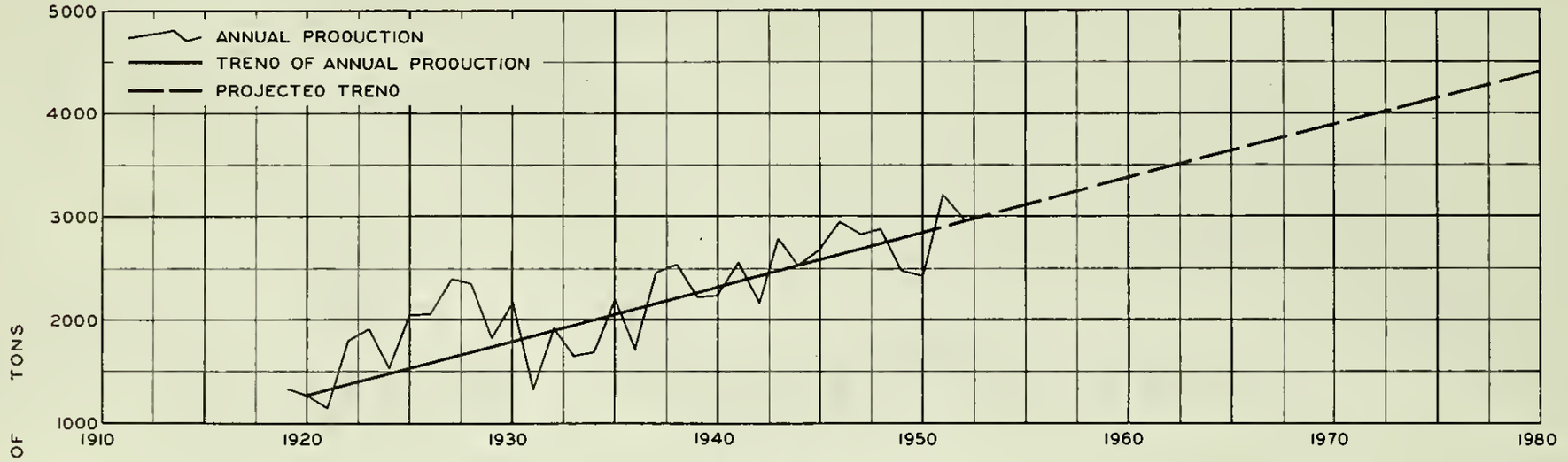

FIG. 3B. GRAPE

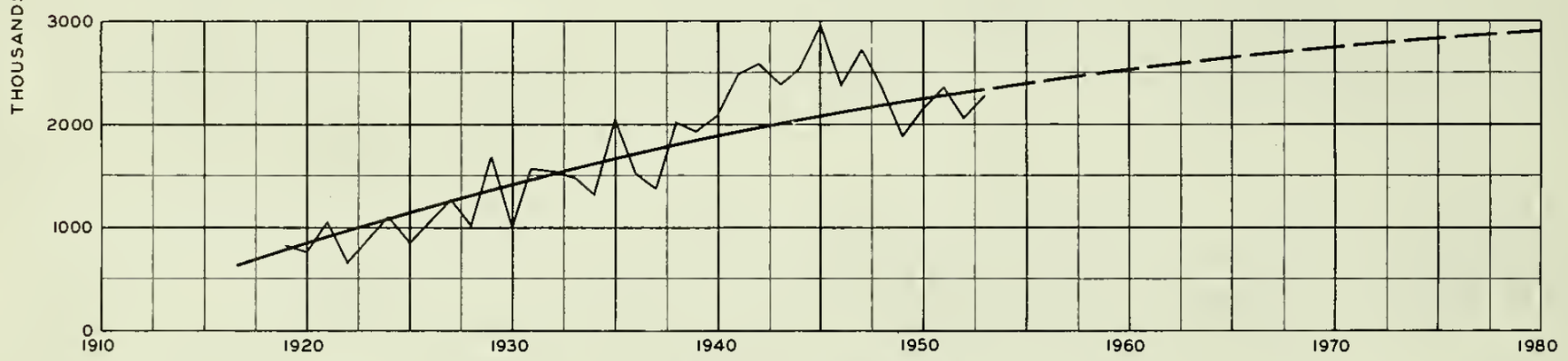

FIG. 3C. CITRUS FRUIT

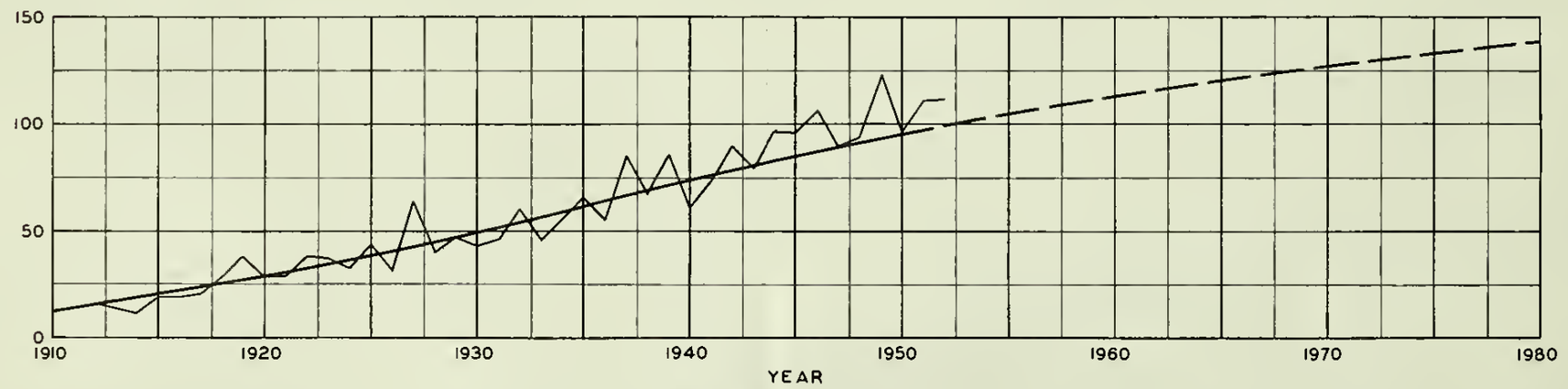

FIG. 3D. NUT CROP

CALIFORNIA FRUIT, GRAPE AND NUT PRODUCTION

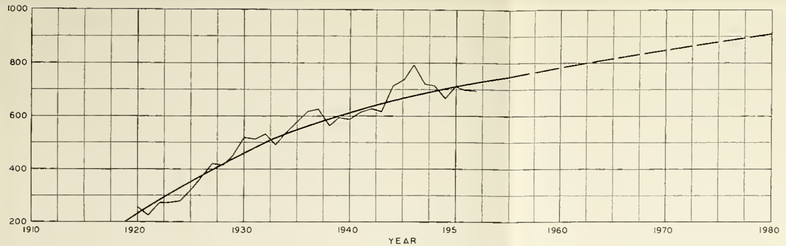

FIG. 4A. TRUCK CROPS

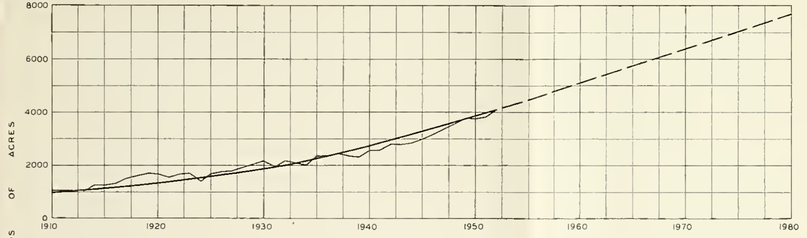

FIG. 4B. FIELD CROPS

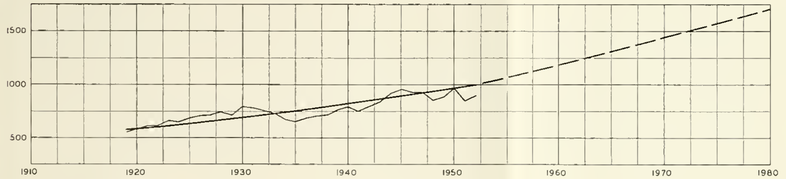

FIG. 4C. ALFALFA

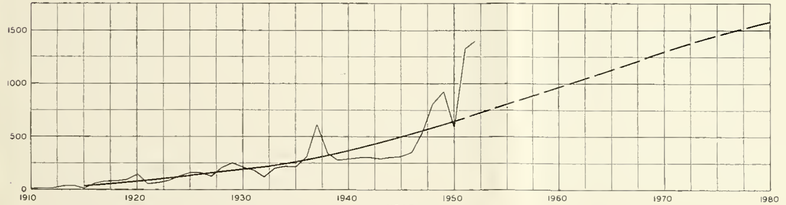

FIG. 4D. COTTON

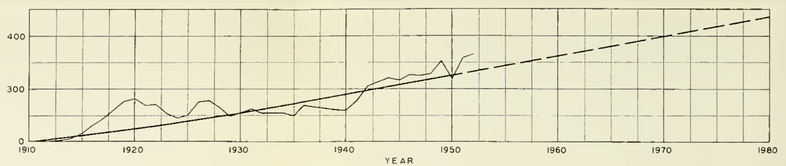

FIG. 4E. RICE

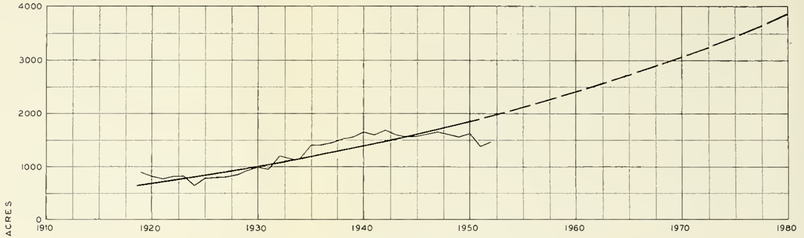

FIG. 4F. MISCELLANEOUS FIELD CROPS

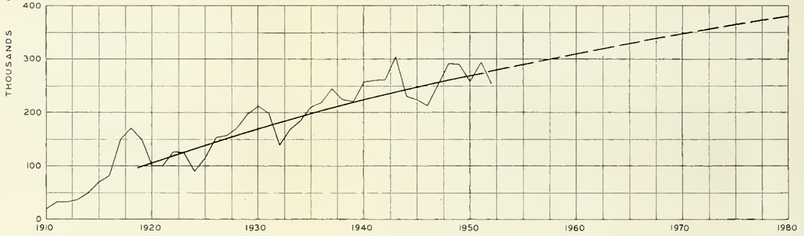

FIG. 4G. BEANS

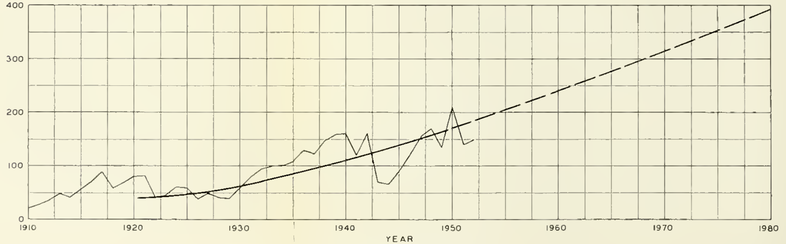

FIG. 4H. SUGAR BEETS

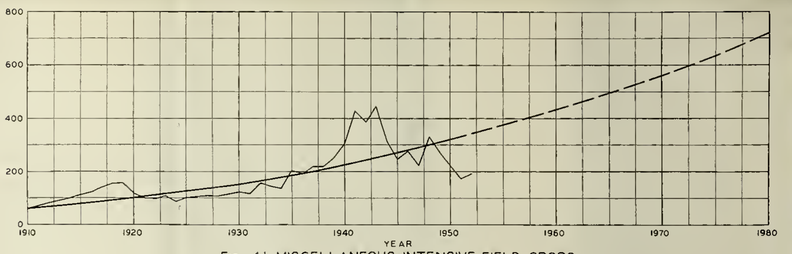

FIG. 4I. MISCELLANEOUS, INTENSIVE FIELD CROPS

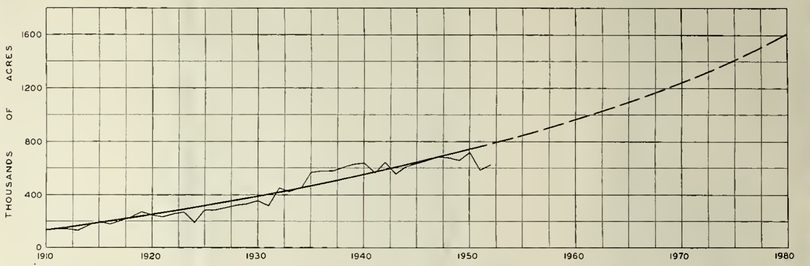

FIG. 4J. SMALL GRAIN CROPS

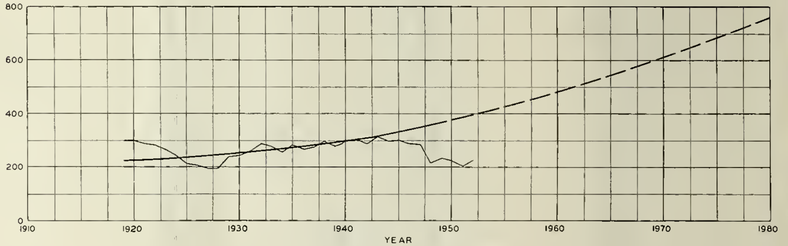

FIG. 4K. EXTENSIVE HAY CROPS

IRRGATED HARVESTED ACREAGE
TRENO OF IRRIGATED HARVESTED ACREAGE
PROJECTED TRENO

IRRIGATED HARVESTED ACREAGE OF CALIFORNIA CROPS

APPENDIX B

DIRECTORY OF WATER SERVICE AGENCIES IN CALIFORNIA

TABLE OF CONTENTS

DIRECTORY OF WATER SERVICE AGENCIES IN CALIFORNIA

DIRECTORY OF WATER SERVICE AGENCIES IN CALIFORNIA

INTRODUCTION

One of the major factors contributing to the phenomenal growth of California has been the favorable political elimate for loeal community water development. This environment, expressed through laws and policies of the State Government, has permitted the formation of local organizations to cope with and resolve water problems, and to meet as they occurred the many municipal, industrial, and agricultural water demands. Presently there are more than 2,500 sueh organizatons in the State.

As a part of the investigation of present water utilization in California, a list was compiled of the ageneies which serve, distribute, or sell water for domestic, irrigation, or other uses. This directory is presented hereinafter in tabular form.

Introductory to the directory, there follows a brief description of the principal classes and types of loeal community water service agencies in California. There are two prineipal types of such agencies, privately owned and public. The privately owned agencies may, in turn, be divided into two general classes, commercial water companies and mutual water eompanies. The principal classes of publicly owned agencies are public water districts and municipal waterworks.

Commercial Water Companies

Commercial water companies are organized for the purpose of building and operating waterworks for the profit of persons who will provide the capital for and own the systems. They differ from mutual water companies and public agencies in that both of the latter are nonprofit cooperative enterprises under local ownership and control. Ownership of the assets of a commercial water eompany may be held by persons who live outside of the water service area. Such eompanies are usually incorporated, although an individual may engage in public utility serviee of water. Most commercial water companies in California operate under the jurisdiction of the State Public Utilities Commission, and must serve water to all applieants within their service areas, as specified in eertificates of convenience issued by the Public Utilities Commission.

Mutual Water Companies

Mutual water companies, sometimes ealled "eooperatives," are private associations of people, organized for the purpose of providing water at cost, primarily for the use of their members. Such companies are voluntary, nonprofit enterprises, and are controlled by their members or stockholders. They have no obligation to serve water to any but their members and stockholders. This contrasts with the obligations of water districts and commercial companies, under whieh service must be extended to all consumers within sueh agency's service area if water is available. Mutual water companies may or may not be ineorporated, and do not come within the jurisdiction of the Public Utilities Commission.

Public Water Districts

Early in the statehood of California the people reeognized that privately owned and operated water serviee organizations could not cope with all the water problems that were developing. Through their Legislature, therefore, they enacted the first of many laws providing for publie districts to accomplish eertain desirable purposes. It is notable that nearly all public water districts, unlike mutually owned enterprises, have the power of assessment of the lands of the districts and of eminent domain. The first of the water district laws was the Reclamation District Act of 1867. The first law authorizing formation of irrigation districts was enacted by the Legislature in 1872. However, the Wright Act of 1877 has formed the basis for virtually all irrigation distriet legislation subsequently enacted in California. Since that time, as new or more pressing water problems arose requiring public action, the Legislature has passed many acts authorizing formation of different types of districts to meet different circumstanees.

There are at present two principal methods in this State of forming water districts. One is the enactment by the Legislature of a general act, under which any number of districts may be formed in aeeordance with a procedure set forth in the act. The other method is by a special act of the Legislature ereating a particular distriet and preseribing its powers. Under the general water district acts, there are specifie provisions requiring notice and hearing of petitions for formation, which for the most part are conducted by county boards of supervisors. Under the second method, notice and hearing are afforded by the legislative process, whereby the authorizing bills are heard in committee and on the floor of the Legislature.

California statutes presently authorize the formation of more than 30 types of districts relating to the development, conservation, use, disposal, and avoidance of water, and most of these districts may provide water serviee. There follows a list of general water district acts, together with the year of the original authorizing legislation.

Community Services Districts (1951)
County Reereation Districts (1931)

County Water Authorities (1943)
County Water Districts (1913)
County Waterworks Districts (1913)
Drainage Districts (1885)
Drainage Districts (1903)
Drainage Districts (1919)
Flood Control and Flood Water Conservation Districts (1931)
Irrigation Districts (1897)
Levee Districts (1905)
Metropolitan Water Districts (1927)
Municipal Utility Districts (1921)
Municipal Water Districts (1911)
Municipal Water Districts (1935)
Protection Districts (1880)
Protection Districts (1895)
Protection Districts (1907)
Public Utility Districts (1921)
Reclamation Districts (1867)
Resort Districts (1931)
Storm Drain Maintenance Districts (1937)
Storm Water Districts (1909)
Water Districts (1913)
Water Conservation Districts (1927)
Water Conservation Districts (1931)
Water Replenishment Districts (1955)
Water Storage Districts (1921)
Water Storage and Conservation Districts (1941)

Most but not all of the foregoing listed acts have been used by interested groups to form water districts. The purposes, powers, restrictions, and privileges, which vary with each act, are briefly described and compared in a periodic publication of the Division of Water Resources entitled "General Comparison of California Water District Acts."

In addition to the water districts formed pursuant to the foregoing general district acts, more than 30 districts have been formed under special acts of the Legislature. The Legislature has constitutional authority to organize taxation districts with boundaries defined in the legislative act, without submitting the question to a vote of property owners within the area. Most of such special water districts are county-wide in area, and may be regarded as a natural outgrowth of the local district organization movement as the water problems became more and more complex. Inasmuch as most of these districts have been created of recent years, only a few to date have actively entered into water development activities. The following list is indicative of the districts formed under special acts, whose powers include the development, disposal, and/or sale of water. The year shown for each district is that in which it was created by the Legislature. These likewise are briefly described and compared in the publication cited in the preceding paragraph.

Alameda County Flood Control and Water Conservation District (1949)
American River Flood Control District (1927)
Avenal Community Services District (1955)
Brisbane County Water District (1950)
Contra Costa County Flood Control and Water Conservation District (1951)
Contra Costa County Storm Drainage District (1953)
Del Norte County Flood Control District (1955)
Donner Summit Public Utility District (1950)
Humboldt County Flood Control District (1945)
Kings River Conservation District (1951)
Lake County Flood Control and Water Conservation District (1951)
Los Angeles County Flood Control District (1915)
Marin County Flood Control and Water Conservation District (1953)
Mendocino County Flood Control and Water Conservation District (1949)
Montalvo Municipal Improvement District (1955)
Monterey County Flood Control and Water Conservation District (1947)
Morrison Creek Flood Control District (1953)
Napa County Flood Control and Water Conservation District (1951)
Olivehurst Public Utility District (1950)
Orange County Flood Control District (1927)
Orange County Water District (1933)
Riverside County Flood Control and Water Conservation District (1945)
Sacramento County Water Agency (1952)
San Benito County Water Conservation and Flood Control District (1953)
San Bernardino County Flood Control District (1939)
San Diego County Flood Control District (1945)
San Luis Obispo County Flood Control and Water Conservation District (1945)
Santa Barbara County Flood Control and Water Conservation District (1955)
Santa Barbara County Water Agency (1945)
Santa Clara County Flood Control and Water Conservation District (1951)
Santa Cruz County Flood Control and Water Conservation District (1955)
Solano County Flood Control and Water Conservation District (1951)
Sonoma County Flood Control and Water Conservation District (1949)
Vallejo Sanitation and Flood Control District (1952)
Ventura County Flood Control District (1944)
Yolo County Flood Control and Water Conservation District (1951)

Municipal Waterworks

One of the major classes of publicly owned water service agencies in California consists of municipally owned waterworks, which, in general, serve water within the municipal boundaries. Approximately 200 cities in California now own and operate their own waterworks.

DIRECTORY OF WATER SERVICE AGENCIES IN CALIFORNIA

The following tabulation of water service agencies in California presents the data by counties in each hydrographic area. Information on the number of domestic consumers and on the number of irrigated acres, as well as the approximate location of the service area of each agency, is included in the tabulation. The period during which this information was collected was from 1950 through 1954.

Inasmuch as there is a continuing process of formation of private and public water service agencies, and also a process of dissolution or annexation of such agencies, the directory, although the most complete and comprehensive known to have been made to date, is not warranted to include all such agencies that may exist in California.

10—99801

WATER SERVICE AGENCIES, NORTH COASTAL AREA

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Del Norte County			
Commercial Water Companies			
Crescent City Water Company	Crescent City		1,154
Hunter Water Company	Crescent City		10
Klamath Glen Subdivision Water Service	Klamath		125
Klamath Water Company	Klamath		125
McBeth Acres Water System	Klamath		39
Smith River Water Service	Smith River		105
Mutual Water Companies			
Gasquet Mutual Water Company	Crescent City		28
Humboldt County			
Municipal Waterworks			
Arcata	Arcata		1,585
Blue Lake	Blue Lake		255
Eureka	Eureka		7,615
Fortuna	Fortuna		930
Trinidad	Trinidad		100
Commercial Water Companies			
Benbow Water Company	Benbow		30
Campton Heights Water Service	Rohnerville	30	175
Fields Landing Water Works	Fields Landing		134
Francis Land and Water Company	Ferndale		480
Garberville Water Company, Inc.	Garberville		233
Humboldt Hill Water Service	Bucksport		3
Loleta Water Works	Loleta		142
Myers Water Works	Myers Flat		70
Phillipsville Water Company	Phillipsville		34
Redway Water Company	Redway		180
Rio Dell Water System	Rio Dell		359
Riverside Water Works	Ferndale		67
Rohnerville Water Works	Rohnerville		139
Weott Water Company	Weott		120
Willow Creek Water Works	Willow Creek	25	50
Mutual Water Companies			
Arcata Airport Water Supply	Arcata		30
Big Lagoon County Water Supply	Trinidad		79
Carlotta Water Supply	Carlotta		14
East Highway Water Company	Eureka		4
Fickle Hill Water Supply	Fickle Hill		30
Fort Seward Water Supply	Fort Seward		2
Hagwood's Orick Water Supply	Orick		14
King Salmon Mutual Water Company	Fields Landing		20
Korbel Water Supply	Korbel		104
Orick Water Company	Orick		17
Port Kenyon Water Supply	Ferndale		71
Samoa Water Supply	Eureka		135
Scotia Water Supply	Scotia	150	354
Marin County			
Commercial Water Companies			
Coast Springs Water Company	Dillon Beach		117
Mendocino County			
Municipal Waterworks			
Fort Bragg	Fort Bragg		1,291
Ukiah	Ukiah		2,375
Commercial Water Companies			
Brown's Water Works	Albion		12
Dos Rios Water Works	Dos Rios		10
Pacific Gas and Electric Company	Willits		914
Point Arena Water Works	Point Arena		111
Rogina Water Company	Talmage	28	145
Mutual Water Companies			
Caspar Lumber Company	Caspar		50
Laytonville Mutual Water Company	Laytonville		15
Oak Knolls Mutual Water Company	Ukiah		15
County Water Districts			
Willow County Water District	Ukiah		126
Round Valley County Water District	Covelo		

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Mendocino County—Continued			
Irrigation Districts			
Potter Valley Irrigation District	Potter Valley	3,900	
Public Utility Districts			
Hopland Public Utility District	Hopland		75
Modoc County			
Irrigation Districts			
Tule Lake Irrigation District	Tulelake	30,000	
United States Bureau of Reclamation Projects			
Klamath Project	Tulelake	(See Siskiyou County)	
Siskiyou County			
Municipal Waterworks			
Dorris	Dorris		277
Etna	Etna		225
Montague	Montague		179
Tulelake	Tulelake		490
Yreka	Yreka		1,136
Commercial Water Companies			
Ball Water Company	Weed		56
Cottonwood Irrigation and Mining Company	Hornbrook		200
Dunsmuir Water Corporation	Fort Jones		198
Hornbrook Water Company	Hornbrook		56
Macdoel Water Works	Macdoel		9
Shastina Water Service	Shastina		375
Mutual Water Companies			
Champion Park Water Agency	Dunsmuir		24
Farmers Ditch Company	Etna	5,000	
Forks of Salmon Water Supply	Etna	50	2
Hilt Water System	Hilt		150
Klamath River Cooperative Ditch	Klamath River	325	4
Shasta River Water Association	Montague	3,895	
Tennant Water Supply	Weed		128
Van Fossen and Mason Water System	Dunsmuir		46
Irrigation Districts			
Big Springs Irrigation District	Grenada	2,100	
Butte Valley Irrigation District	Mt. Hebron	3,647	
Grenada Irrigation District	Grenada	1,394	
Montague Water Conservation District	Montague	3,450	
Scott Valley Irrigation District	Fort Jones	3,650	
Tule Lake Irrigation District	Tulelake	(See Modoc County)	
United States Bureau of Reclamation Projects			
Klamath Project	Tulelake	79,352	
Sonoma County			
Municipal Waterworks			
Cloverdale	Cloverdale		600
Healdsburg	Healdsburg		1,424
Santa Rosa	Santa Rosa		8,894
Sebastopol	Sebastopol		1,238
Commercial Water Companies			
Armstrong Valley Water Company	Guerneville		73
Bressie, V. L.	Bodega Bay		52
Camp Meeker Water System	Camp Meeker		302
Camp Rose Company	Camp Rose		93
Cazadero Water Company	Cazadero		121
Citizens Utilities Company of California	El Bonito, Monte Rio, Guerneville, Rio Nido, Guernewood Park		2,279
Del Rio Water Company	Del Rio		152
Geyserville Water Works	Geyserville		136

WATER SERVICE AGENCIES, NORTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Sonoma County—Continued			
Commercial Water Companies—continued			
Hacienda Water Company	Hilton		126
Horgan Water Company, C. J.	Hilton		7
Jenner Water Works	Jenner		66
Mountain Avenue Water Company	Fetters Springs		191
Occidental Water Works	Occidental		56
Rio Dell Water Company	Rio Dell		131
Russian River Terrace Water Company	Russian River Terrace		310
Summer Home Park Water Company	Sebastopol		138
Vacation Beach Water Company	Guerneville		128
Windsor Utility Corporation	Windsor		54
Mutual Water Companies			
Branger Mutual Water Company	Santa Rosa		7
Broadmoor Acres Water Supply	Santa Rosa		19
Carmet by the Sea Water Company	Bodega Bay		14
East Austin Mutual Water Company	Cazadero		40
Fircrest Mutual Water Company	Sebastopol		38
Forest Home Park Water Supply	Forestville		135
Graton Waterworks Company	Graton		32
Holland Heights Mutual Water Company	Santa Rosa		100
Kelly Mutual Water Company	Sebastopol		40
Lancaster Water Supply	Santa Rosa		8
McChristian Water Supply	Bodega Bay		35
Sonoma County—Continued			
Mutual Water Companies—continued			
Mission Highlands Mutual Water Company	Sonoma		10
Morton Water Service	Glen Ellen		11
Preston Heights Water Company	Cloverdale		1
Russian River Mutual Water Company	Healdsburg	2	10
Salmon Creek Water Company	Bodega Bay		54
West Beach Mutual Water Company	West Beach		11
Willis Mutual Water Company	Santa Rosa		5
Public Utility Districts			
Bodega Bay Public Utility District	Bodega Bay		
Camp Rose Public Utility District	Healdsburg		89
Cotati Public Utility District	Cotati		110
Special Water Service Districts			
Sonoma County Flood Control and Water Conservation District		(Sells at wholesale)	
Trinity County			
Commercial Water Companies			
Weaverville Water Works	Weaverville		358
County Waterworks Districts			
Hayfork Water Works District No. 1	Hayfork		300

WATER SERVICE AGENCIES, SAN FRANCISCO BAY AREA

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Alameda County			
Municipal Waterworks			
Hayward	Hayward		7,671
Pleasanton	Pleasanton		754
Commercial Water Companies			
California Water Service Company	Livermore		1,889
Citizens Utilities Company of California	Decoto Niles	40	1,401
Gallegos Waterworks	Mission San Jose		10
Mutual Water Companies			
Baumberg Well Water System	Hayward	30	40
Cerros Estrellados Water Company	Oakland	2	5
Highland Mutual Water Company	Hayward		242
Mohrland Mutual Water Association, Inc.	Hayward		80
Norris Canyon Mutual Water Company	Hayward		14
County Water Districts			
Alameda County Water District	Washington Township		2,500
Pleasanton Township County Water District	Pleasanton	500	77
Municipal Utility Districts			
East Bay Municipal Utility District	Oakland		187,000
Contra Costa County			
Municipal Waterworks			
Martinez	Martinez		3,310
Pittsburg	Pittsburg		3,500
Walnut Creek	Walnut Creek		939
Commercial Water Companies			
Bay Water Company	Pittsburg		1,555
California Water Service Company	Bay Point Concord Crockett Danville Martinez Oleum Port Costa Valona		15,658
Clyde Company	Clyde		115
Hercules Water Company	Pinole		645
Sobrante Water Company	Richmond		91
Webb Waterworks	Pittsburg		98
Mutual Water Companies			
Concord Boulevard Irrigation Group	Concord		60
Diablo Estates Water Corporation	Concord	10	
El Monte Water Association, Inc.	Concord	130	
Fifty-six Water Group	Concord	7	27
Oak Hill Irrigation Association	Martinez	18	15
County Water Districts			
Anderson Grove County Water District	Pacheco	6	
Contra Costa County Water District	Pittsburg	5,501	
Lafayette County Water District*	Lafayette		2,743
Orinda County Water District*	Orinda		2,134
Pleasant Hill County Water District*	Lafayette		1,063
San Miguel County Water District	Walnut Creek	240	40
Saranap County Water District*	Lafayette		1,340
Public Utility Districts			
Diablo Public Utility District	Danville	400	
Municipal Utility Districts			
East Bay Municipal Utility District	Oakland	(See Alameda County)	
United States Bureau of Reclamation Projects			
Central Valley Project		(Sells at wholesale)	
Marin County			
Commercial Water Companies			
Inverness Park Water Company	Inverness Park		66
Inverness Water Works	Inverness		276
Muir Beach Company	Muir Beach		22
Olema Water System	Olema		31
Point Reyes Water Company	Point Reyes Station		130
Seahaven Water System	Inverness		7
Stinson Beach Water Company	Stinson Beach		237
Mutual Water Companies			
Hamilton Air Force Base	Ignacio	350	
County Water Districts			
North Marin County Water District	Novato		1,712
Public Utility Districts			
Bolinas Public Utility District	Bolinas		175
Bolinas Beach Public Utility District	Bolinas Beach		120
Municipal Water Districts			
Marin Municipal Water District	Fairfax Mill Valley San Anselmo San Rafael Sausalito, etc.		23,872
Napa County			
Municipal Waterworks			
Calistoga	Calistoga		580
Napa	Napa		5,435
St. Helena	St. Helena		923
Commercial Water Companies			
Hacienda Water Company	Napa		350
Lucchesi, F., Water System	Napa		47
Mutual Water Companies			
Bar 49 Ranch Water Supply	St. Helena	10	10
Bentley Home Sites Water Company	Calistoga		7
Pacific Union College Association	Angwin	90	100
Tucker Acres Water Company	Calistoga		7
County Water Districts			
Congress Valley Napa County Water District	Napa		19
Yountville Napa County Water District	Yountville		120
Special Water Service Districts			
Napa County Flood Control and Water Conservation District		(Sells surplus water outside district)	
San Francisco County			
Municipal Waterworks			
San Francisco	San Francisco		146,326
San Mateo County			
Municipal Waterworks			
Burlingame	Burlingame		
Daly City	Daly City		5,540
Hillsborough	Hillsborough		1,186
Millbrae	Millbrae		1,320
Redwood City	Redwood City		9,614
San Bruno	San Bruno	15	3,980
Commercial Water Companies			
Butano Land and Development Company	Butano Falls Tract		49
California Water Service Company	Atherton Broadmoor Menlo Park San Carlos San Mateo South San Francisco Woodside		30,288
Citizens Utilities Company of California	Montara Moss Beach		282

WATER SERVICE AGENCIES, SAN FRANCISCO BAY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
San Mateo County—Continued			
Commercial Water Companies—Continued			
Friendly Acres Water Company	Redwood City		1,015
San Carlos Manor Water System	San Carlos		120
Troutmere Utilities	La Honda		24
Visitacion City Water Company	Brisbane		427
Mutual Water Companies			
Bay View Mutual Water Company	Palo Alto	20	5
Brookside Water Company	Redwood City		37
Butano Canyon Mutual Water Company	Pescadero		49
Cuesta La Honda Guild	Redwood City		275
East Almond Cooperative Water Company	Palo Alto	12	10
Kings Mountain Park Water Company	Woodside		22
Ladera Water Company	Menlo Park		50
La Honda Vista Water Company No. 1	Redwood City		7
Loma Mar Mutual Water and Improvement Company	Loma Mar		12
Los Trancos Water Company	Menlo Park		91
Martins Beach Water Supply	Half Moon Bay		50
Marwel Water Company	Woodside	2	4
Millbrae Hills Mutual Water Company	Millbrae		14
O'Connor Tract Cooperative Water Company	Palo Alto	36	200
Olds Water Company	Redwood City		4
Palo Alto Park Mutual Water Company	Palo Alto		410
Rancho Canada Mutual Water Company	Redwood City		24
Searview Water Company, Inc.	Redwood City		3
Sky L'Onda Mutual Water Company, Inc.	Redwood City	70	124
Ware Acres Mutual Water Company	Woodside		13
Woodside Mutual Water Company	Woodside		30
County Water Districts			
Belmont County Water District	Belmont		1,774
Brisbane County Water District	Brisbane		650
Coastside County Water District	El Granada Half Moon Bay		675
North Coast County Water District	Sharp Park		1,800
County Waterworks Districts			
San Mateo County Waterworks District No. 1 (Ravenswood)	Palo Alto	50	528
San Mateo County Waterworks District No. 2 (East Palo Alto)	Palo Alto	50	913
San Mateo County Waterworks District No. 3 (Palomar Park)	Palo Alto		60
Municipal Improvement Districts and County Maintenance Districts			
Willow Road Water Maintenance District	Palo Alto		3,700
Public Utility Districts			
Diamond Public Utility District	San Francisco		625
Millbrae Public Utility District	Millbrae		267
Santa Clara County			
Municipal Waterworks			
Palo Alto	Palo Alto		11,575
Mountain View	Mountain View		2,832
Santa Clara	Santa Clara		3,157
Sunnyvale	Sunnyvale		3,250
Commercial Water Companies			
Agnew Water Works	Agnew		92
Aldercroft Heights Company, Inc.	Los Gatos		110
Almaden Water Company	Los Gatos	400	
Blacks Almaden Water System	Almaden		100
California Water Service Company	Los Altos		11,026
Campbell Water Company	Campbell	140	1,611
Criswell Water System	Los Gatos		10
Peninsula Service Corporation	Mountain View		31
Puccetti Water System	Mountain View	2	5
Putnam, Tarrant, Estate of	Cupertino	579	
Ryan, Water System, H.	Alma		11
Santa Clara County—Continued			
Commercial Water Companies—Continued			
San Jose Water Works	San Jose Campbell Los Gatos Saratoga		49,791
Santa Teresa Water Service	San Jose		30
Water Works of Monte Vista, Ltd.	Sunnyvale	130	718
Mutual Water Companies			
Berryessa Water Company	San Jose		7
Blanco Rancho Water Company	Los Altos		42
Briscoe-Emery Water Company	San Jose		27
Chemeketa Park Mutual Water Company	Los Gatos		151
Hamilton Water Company	Sunnyvale	138	
Holy City Brotherhood	Holy City	20	12
Kirk Ditch	Campbell	1,210	
Laco Mutual Water Company	Los Altos		15
Lake Canyon Mutual Water Company	Los Gatos		60
Lyndale Knolls Mutual Water Company	Los Altos		9
Melody Woods Water Company	Holy City		19
Oak Hill Mutual Water Company	Palo Alto		12
Oaknoll Water System	Mountain View		10
Rancho Water Trust	San Jose		20
Redwood Mutual Water Company, Inc.	Redwood Estates		290
Robleda Water Association	Los Altos		28
Rolling Hills Mutual Water Company	Cupertino		2
Saratoga Heights Mutual Water Company	Saratoga		5
Spinsk Water System	Los Altos	100	900
University Park Improvement Association	Mountain View		78
County Water Districts			
Milpitas County Water District	Milpitas		
Special Water Service Districts			
Santa Clara County Flood Control and Water Conservation District		(Sells surplus water outside district)	
Solano County			
Municipal Waterworks			
Fairfield	Fairfield		1,031
Suisun	Suisun		775
Vallejo	Vallejo		13,000
Commercial Water Companies			
California-Pacific Utilities Company	Benicia		1,600
Irrigation Districts			
Solano Irrigation District	Fairfield	(See Table 5)	
Reclamation Districts			
Reclamation District 1607	Collinsville	2,461	
Special Water Service Districts			
Solano County Flood Control and Water Conservation District		(Sells at wholesale)	
United States Bureau of Reclamation Projects			
Solano Project		(Sells at wholesale)	
Sonoma County			
City Waterworks Municipally Owned			
Sonoma	Sonoma		840
Privately Owned Water Companies			
California Water Service Company	Petaluma		4,300
Donaghy, Water Company	Glen Ellen		64
Glen Ellen Waterworks	Glen Ellen		210
Penngrove Water Company	Penngrove		70
Sonoma Water and Irrigation Company	Sonoma Vista Boyes Springs		1,071
Special Water Service Districts			
Sonoma County Flood Control and Water Conservation District		(Sells at wholesale)	

* Operated as part of the East Bay Municipal Utility District.

WATER SERVICE AGENCIES, CENTRAL COASTAL AREA

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Monterey County			
Municipal Waterworks			
Gonzales	Gonzales		357
Greenfield	Greenfield		375
Soledad	Soledad		482
Commercial Water Companies			
Alco Water Service	Alisal		2,134
Alisal Heights Water Company	Salinas	60	256
Ambler Park Water Utility	Ambler Park		70
Arroyo Seco Water Company	Soledad		53
Baird Water Company	Salinas	60	290
Bolsa Knolls Water Company	Salinas		114
California Water and Telephone Company	Carmel Carmel Highlands Monterey Pacific Grove		15,615
Chualar Water Works	Chualar		66
East Monterey Water Service	Monterey		1,675
Fruitland Water Company	Watsonville	5	16
Los Lomas Water Company	Watsonville	110	145
Pacific Gas and Electric Company	King City Salinas		762
Rancho Del Monte Water Company	Carmel		49
Mutual Water Companies			
Acacia Park Water and Improvement Association	Salinas		165
Aneste Water Supply	Salinas		10
Cassenelli Water Supply	Soledad	120	
Castroville Subdivision Water Supply	Castroville		19
Chetmore Acres Water Association	Watsonville	50	6
Clark Colony Water Company	Greenfield	3,600	
Coastlands Mutual Water Company	Carmel		20
Del Monte Ice Company	Castroville		5
Del Monte Water Company	Salinas		19
Fort Romie Water Company	Soledad	220	
Gabilan Water Company	Salinas		55
Laguna Seca Water Company, Inc.	Salinas		9
Larson Water Supply	San Lucas		15
McKanna Water Supply	Bradley		2
Mountain Springs Water Company			9
Orchard Lane Water Association	Salinas		16
Partington Mutual Water Company	Monterey		8
Phillips Water Supply	Castroville		13
Pierri Water Supply	Castroville		6
Reliz Water Company	Greenfield		
Rizzo Mutual Water Company	Castroville		5
Roberti Water Supply	Castroville		15
Rolling Hills Ranchos Water Association	Salinas		60
Snyder and Biddle Water Supply	Castroville		10
Spreckels Sugar Company	Spreckels	8,020	200
Springfield Mutual Water Company	Castroville		3
Tierra Verde Mutual Water Company	Salinas	30	17
Union Water Company of Greenfield	Greenfield	530	
Virginia Acres Water Company, Inc.	Salinas	12	
West Side Water Company of Greenfield	Greenfield	427	
White Tract Water Company	Salinas		14
Wildwood Water Company	Salinas		8
San Benito County			
Municipal Waterworks			
Hollister	Hollister		1,900
San Juan Bautista	San Juan Bautista		322
Commercial Water Companies			
Tres Pinos Water System	Tres Pinos		40
Mutual Water Companies			
Hepsedam Mutual Water Company	Hollister		35
San Justo Mutual Water Company	Hollister		11
Irrigation Districts			
Hollister Irrigation District	Hollister	17,500	
San Luis Obispo County			
Municipal Waterworks			
Arroyo Grande	Arroyo Grande		1,004
Paso Robles	Paso Robles		1,671
Pismo Beach	Pismo Beach		945
San Luis Obispo	San Luis Obispo		5,000
Commercial Water Companies			
Avila Water Company	Avila		150
Oceano Water Company	Oceano		78
Mutual Water Companies			
Atascadero Mutual Water Company	Atascadero		1,280
Branch's Mill Water Company	Arroyo Grande	200	
Cambria Pines Service Corporation	Cambria		410
Garden Farms Mutual Water Company	Atascadero		54
Green River Mutual Water Company	Paso Robles		47
Grieb-Taylor Ditch Company	Arroyo Grande	110	
McNeill Pump Company	Arroyo Grande	38	
Morro Rock Mutual Water Company	Cayucos		138
Paso Robles Beach Water Association	Cayucos		280
County Water Districts			
Grover City County Water District	Grover		750
County Waterworks Districts			
San Luis Obispo County Waterworks District No. 1 (San Miguel)	San Miguel		475
San Luis Obispo County Waterworks District No. 2 (Morro Bay)	Morro Bay		1,075
San Luis Obispo County Waterworks District No. 4 (Morro Bay)	Morro Bay		480
San Luis Obispo County Waterworks District No. 5 (Templeton)	Templeton		189
San Luis Obispo County Waterworks District No. 6 (Santa Margarita)	Santa Margarita		157
San Luis Obispo County Waterworks District No. 9 (Baywood)	Morro Bay		145
Santa Barbara County			
Municipal Waterworks			
Lompoc	Lompoc		1,406
Santa Barbara	Santa Barbara		13,270
Santa Maria	Santa Maria		3,924
Commercial Water Companies			
Campodonico Water Works	Guadalupe		574
Carpinteria Water Company, Inc.	Carpinteria	10	1,060
Casitas Road Water Company	Carpinteria	225	
Evergreen Service Company	Santa Maria		4
Mayer Tract Waterworks	Santa Maria		143
Ocean Oaks Water Company	Carpinteria		10
Orcutt Town Water Company	Orcutt		348
Solvang Water Works	Solvang		306
Toro Canyon Company, Inc.	Summerland		168
Mutual Water Companies			
Anderson Water Supply	Santa Ynez		16
Betteravia Water Supply	Betteravia	7,000	66
Carneros Water Company	Goleta	564	16
Cathedral Oaks Mutual Water Company	Santa Barbara	90	3
Dow Tract No. 1	Goleta	5	56
Dow Subdivision Water Company	Goleta		40
Erickson Subdivision Association	Santa Barbara		15
Gobernador Land and Water Company	Carpinteria	500	
Hyland Mutual Water Company	Santa Barbara		75
Ivydene Mutual Water Company	Montecito		18
La Cumbre Mutual Water Company	Santa Barbara	550	369
Las Positas Mutual Water Company	Santa Barbara		44
Mesa Associates Mutual Water Company	Carpinteria	72	7
Miramar Addition Improvement Company	Santa Barbara		15

WATER SERVICE AGENCIES, CENTRAL COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Santa Barbara County—Continued			
Mutual Water Companies—continued			
Montecito Creek Water Company	Santa Barbara		55
More Mesa Mutual Water Company	Santa Barbara	109	6
Newlove Water Company	Santa Maria	60	75
Painted Cave Mutual Water Company	Santa Barbara		33
Paradise Improvement Association	Santa Barbara		50
Patterson Road Mutual Water Company	Orcutt		16
Ranchoil Mutual Water Company	Cuyama	14	8
Rancho Sneno Mutual Water Company	Santa Barbara	56	93
Rincon Del Mar Mutual Water Company	Carpinteria		19
Rosario Park Water District	Santa Barbara		18
Riven Rock Mutual Water Company	Santa Barbara		6
Santa Maria Air Base Water Supply	Santa Maria		110
Serena Mutual Water Company	Santa Barbara	3	17
San Marcos Trout Club	Santa Barbara		33
Shepard Mesa Mutual Water Company	Carpinteria	155	15
Sunset Road Mutual Water Company	Santa Barbara	3	31
Sykes Water Supply	Santa Barbara		50
Terrace Mutual Water Company	Santa Barbara		50
Todmorden Mutual Water Company	Goleta	23	11
County Water Districts			
Carpinteria County Water District	Carpinteria	4,700	
Goleta County Water District	Goleta	16,000	1,000
Montecito County Water District	Santa Barbara	2,325	1,422
Summerland County Water District	Summerland		145
County Waterworks Districts			
Santa Barbara County Waterworks District No. 1	Buellton		105
Municipal Improvement Districts and County Maintenance Districts			
Solvang Municipal Improvement District	Solvang		371
Special Water Service Districts			
Santa Barbara County Water Agency		(Sells at wholesale)	
United States Bureau of Reclamation Projects			
Cachuma Project		(Sells at wholesale)	
Santa Clara County			
Municipal Waterworks			
Gilroy	Gilroy		1,442
Morgan Hill	Morgan Hill		705
Commercial Water Companies			
Mecchi Water Company	Morgan Hill		25
San Martin Water Works	San Martin		96
Mutual Water Companies			
Carpignano, James	San Martin		45
Cox, Agnes, Water Supply	Los Gatos	(See Santa Cruz County)	
Special Water Service Districts			
Santa Clara County Flood Control and Water Conservation District		(Sells surplus water outside district)	
Santa Cruz County			
Municipal Waterworks			
Santa Cruz	Santa Cruz	1,200	11,100
Watsonville	Watsonville		5,861
Commercial Water Companies			
Beltz Water System	Twin Lakes		757
Ben Lomond Redwood Park Water Company	Ben Lomond		115
Big Basin Water Company	Boulder Creek		45

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Santa Cruz County—Continued			
Commercial Water Companies continued			
Citizens Utilities Company of California	Ben Lomond, Boulder Creek, Brookdale		2,138
Felton Water Company	Felton		711
Forest Glen Water Company	Aptos		35
La Selva Beach Water Company	La Selva Beach		193
Monterey Bay Water Company	Aptos, Capitola, Rio del Mar, Seacliff, Soquel		3,076
Riverside Grove Water Company, Inc.	Riverside Grove	5	98
Zayante Water Company	Zayante		167
Mutual Water Companies			
Assemblies of God	Santa Cruz		15
Bauer Water Company	Felton		30
Beulah Park Mutual Water Company	Santa Cruz		14
Big Redwood Park Mutual Water Company	Felton		24
Bracken Brae Corporation	Boulder Creek		25
California Conference of the Free Methodist Church			6
Camp Evers Store Water Supply	Santa Cruz	1	12
Cathedral Woods Mutual Water Company	Soquel	25	7
Cox, Agnes, Water Supply	Los Gatos		11
Davenport Water Supply	Davenport		80
Duffield Acres Water Supply	Watsonville	35	27
Forest Lakes Mutual Water Company	Felton		132
Forest Springs Mutual Water Company	Boulder Creek		108
Gold Gulch Mutual Water Company			27
Highland Park Water Service	Watsonville		12
Larita Woods Mutual Water Company, Inc.	Felton		30
Laurel Community League, Inc.	Laurel		27
Lompico Cooperative Water Association	Felton	640	238
Love Creek Heights Mutual Water Association	Ben Lomond		2
Manana Woods Mutual Water Company	Santa Cruz		20
Mountain Springs Water Service	Ben Lomond		11
Mount Hermon Association	Mount Hermon		432
New Freedom Mutual Water System	Watsonville		95
Olympia Mutual Water Company	Olympia		30
Paradise Park Masonic Club	Santa Cruz		375
Ramona Woods Mutual Water Company	Boulder Creek		23
San Lorenzo River Park Mutual Water Company	Boulder Creek		79
San Lorenzo Woods Mutual Water Company	Boulder Creek		47
Santa Hacienda Mutual Water Company	Santa Cruz	20	30
Sunset Beach Mutual Water Company	Watsonville		30
Terrace View Water Company	Santa Cruz		5
Vine Hill Mutual Water and Improvement Company	Santa Cruz		5
County Water Districts			
Central Santa Cruz County Water District	Aptos		24
San Lorenzo Valley County Water District	Boulder Creek, etc.		
County Waterworks Districts			
Santa Cruz County Waterworks District No. 1	Davenport		75
Special Water Service Districts			
Santa Cruz County Flood Control and Water Conservation District		(Sells at wholesale)	

WATER SERVICE AGENCIES, SOUTH COASTAL AREA

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Los Angeles County			
Municipal Waterworks			
Alhambra	Alhambra		15,042
Arcadia	Arcadia		8,964
Avalon	Avalon		1,000
Azusa	Azusa		3,236
Beverly Hills	Beverly Hills		9,577
Burbank	Burbank		21,991
Compton	Compton		9,846
Covina	Covina		2,010
El Monte	El Monte		2,364
El Segundo	El Segundo		2,522
Glendale	Glendale		25,448
Glendora	Glendora		1,610
Hawthorne	Hawthorne		5,663
Huntington Park	Huntington Park		6,026
Inglewood	Inglewood		12,850
La Verne	La Verne		1,230
Long Beach	Long Beach		56,846
Los Angeles	Los Angeles		421,229
Lynwood	Lynwood		8,525
Manhattan Beach	Manhattan Beach		7,194
Monrovia	Monrovia		6,779
Monterey Park	Monterey Park		7,296
Pasadena	Pasadena		36,609
Pomona	Pomona		10,417
San Fernando	San Fernando		3,699
Santa Monica	Santa Monica		15,687
Sierra Madre	Sierra Madre		2,484
Signal Hill	Signal Hill		1,387
South Gate	South Gate		12,721
South Pasadena	South Pasadena		4,839
Torrance	Torrance		5,832
Vernon	Vernon		652
Whittier	Whittier		8,602
Commercial Water Companies			
Azusa Valley Water Company	Covina, West Covina		2,200
Berlu Water Company	Bellflower		384
Bouquet Canyon Water Company	Saugus		55
California Michigan Land and Water Company	Lamanda Park, East Pasadena, East Los Angeles, Eastmont	400	1,433
California Water Service Company	Hermosa Beach, Redondo Beach, Torrance, Azusa, El Monte, Rosemead, San Gabriel, San Marino, South Gate, Lynwood, Pell Gardens, Watts, Redondo Beach, Wilmington, Duarte, Gardena	2,000	38,953
California Water and Telephone Company		56	10,687
Central Gardens Water Company			967
Coast Water Company		23	932
Conservative Water Company			8,667
Dominguez Water Corporation			5,600
Duarte Domestic Water Company		800	4,000
East Gardena Water Company		56	
East Pasadena Water Company, Ltd.	Lamanda Park, East Pasadena		131
Fairacres Water Company	North Long Beach		702
Ideal Petroleum Company	Bellflower		42
Investment Water Corporation, Ltd.	Los Angeles		5,013
Junior Water Company, Inc.	Norwalk		1,145
Lakewood Water and Power Company	Lakewood		19,261
La Mirada Water Company	La Mirada		12
Malibu Water Company	Rancho Topanga Malibu	60	987
Montebello Land and Water Company	Montebello	1,200	2,434
Narbonne Ranch Water Company No. 2	Lomita	360	575
Newhall Water Company	Newhall		818
Orchard Dale Service Company	Luitweiller, Orchard Dale	650	849

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Los Angeles County—Continued			
Municipal Waterworks—Continued			
Pacific Water Company	Burbank Tract, Hawaiian Gardens, Independence Square, Orangewood		1,646
Palos Verdes Water Company	Palos Verdes		2,037
Park Water Company	El Monte		24,326
Peerless Land and Water Company	Bellflower		500
Plunkett Water Company	Long Beach		22
Ranchito Water Company	Pico		198
San Dimas-Charter Oak Domestic Water Company	San Dimas, Charter Oak		1,480
San Gabriel Valley Water Company	Baldwin Park, El Monte, Whittier		27,453
Southern California Water Company	Culver City, Lennox and 25 others	1,070	69,491
Sparling Water Company	Topanga Canyon		545
Suburban Mutual Water Company	Norwalk		941
Suburban Water Systems	Covina, Downey, Glendora, Los Nietos, Puente, South Covina, West Covina, Whittier	1,550	7,587
Sunshine Water Company	Santa Fe Springs		1,150
Uehling Water Company, Inc.	Compton		1,280
Watson, Burl, Domestic Water Company	El Monte		493
Mutual Water Companies			
Adams, J. Q., Mutual Water Company	Puente	77	
Adams Ranch Mutual Water Company	Rosemead		97
Alta Canada Mutual Water Company	La Canada	50	4
Alvin Poore Water Service	El Monte		60
Amarillo Mutual Water Company	Garvey	171	380
Angelus Heights Water Company	La Crescenta	324	126
Annexation for Water, Inc.	La Crescenta, Montrose, Verdugo		6,000
Arroyo Ditch and Water Company	Downey	1,000	
Artesia Garden Water Association	Artesia	20	22
Artesia Ice Service	Artesia		30
Atlantic Boulevard Water Users Association	Long Beach		320
Avenue Line Water Association	Claremont	200	
Azusa Agricultural Water Company	Azusa	1,200	
Azusa Irrigating Company	Azusa	4,000	
Baker Cooperative Company	El Monte	7	20
Baker, I.F., Mutual Water Company	El Monte		18
Baldwin Park Water Company	Baldwin Park	135	
Banta Ditch Association	Whittier		
Base Line Water Company	La Verne	402	
Baughman Water Company	Claremont	1,001	
B-B Water Company	Puente	87	
Beck Tract Mutual Water System	Artesia		35
Bellflower Home Garden Water Company	Bellflower	120	250
Bellflower Water Company	Bellflower	195	1,606
Belvedere Mutual Water Company	Redondo Beach	3	112
Ben Sher Mutual Water Company, Inc.	Mint Canyon	300	43
Berggren-Robinson-Gaghiaro Water Company	Puente	50	1
Beverly Acres Mutual Water Users Association	Whittier		75
B.F.S. Mutual Water Company	Whittier	200	
Bigby Townsite Water Company	Bellflower		178
Big Rock Beach Water Company	Malibu	10	101
Blue Ribbon Community Water Company	El Monte		105
Bonita Water Company	Claremont	160	

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Los Angeles County—Continued			
Mutual Water Companies—Continued			
Bonnie Brae Water Company	Claremont	190	
Botello Water Company	San Dimas	110	
Boulder Water Company	Claremont	300	
Boulevard Water Company No. 2	Baldwin Park	50	
Briggs Terrace Mutual Water Company	La Crescenta		30
California Domestic Water Company	Whittier	4,700	330
Canon Water Company of Pomona	Pomona	3,100	
Cantrill Mutual Water Company	El Monte		58
Canyon View Water Company	Baldwin Park	250	
Cassel Water Company	Covina	180	
Castaic Mutual Water Company	Castaic	200	75
Cate Ditch Company	Pico	300	
C and C Mutual Water Company	Baldwin Park	140	
Cedar Avenue Mutual Water Company, Inc.	El Monte		65
Center City Water Company	Paramount		125
Century Center Mutual Water Association	Clearwater		300
Century City Mutual Water Company	Hollydale		78
Cerritos Park Mutual Water Company	Bellflower		125
Cerro del Oro Water Company	La Verne	80	
Chatsworth Lake Mutual Water Corporation	Chatsworth		100
Cherryvale Water Users Association	Long Beach		28
Chrisco Mutual Water Association	Mint Canyon		48
Christian Acres Mutual Water Company	Hawaiian Gardens		127
Cienega Springs Water Company	Glendora	5	3
Citrus Grove Heights Water Company	Whittier	330	150
City Farms Mutual Water Company	Artesia	21	46
Claremont Basin Mutual Water Company	Claremont	1,000	
Claremont Cooperative Water Company	Claremont	600	60
Claremont Heights Irrigation Company	Claremont	300	66
Colima Tract Water Company	Whittier	500	
College Way Mutual Domestic Company	La Verne		8
Columbia Land and Water Company	San Dimas	510	
Community Water Supply	Norwalk		9
Comstock Water Company	Puente	150	2
Connemara Mutual Water Company	Azusa	55	10
Contract Water Company of Azusa	Azusa	1,200	
Cook Tract Water Company	Paramount		66
Corona Del Malibu	Malibu		2
Corral Canyon Mutual Water Company	Malibu		20
Covina Highlands Water Company	Covina	60	19
Covina Irrigating Company	Covina	3,500	
Crescenta Mutual Water Company	Montrose		2,960
Cross Water Company	Puente	1,000	450
Crystal Mutual Water Company	Whittier		318
Deerpath Mutual Water Company	Santa Monica		84
Del Monte Irrigation Company	Pomona	1,800	
Del Rio Mutual Water Company	El Monte		169
Didier Farms Mutual Water Company	Puente	155	20
Downey Valley Water Company	Downey	25	53
Dreher, E. L., Agent	Claremont	170	
Duarte Mutual Water Company	Duarte		
Durward Well Company	La Verne	74	
East End Irrigation Company	Pomona	175	
East Gardena Water Company	Gardena	250	
Edgemont Water Company	La Verne	40	
El Camino Water Company	Claremont	300	
El Campo Mutual Water Company	San Marino		54
El Monte Community Association	El Monte		130
El Segundo Land and Improvement Company	El Segundo	15	1
Eureka Water Company	Claremont	70	1
Fairview Mutual Water Company	Claremont	188	
Farm Mutual Water Company	El Monte		222
Fickewirth Mutual Water Company, Ltd.	Puente	78	
Flintridge Heights Mutual Water Company	Glendale		4
Francisquito Water Company	Puente	90	
Los Angeles County—Continued			
Mutual Water Companies—Continued			
Franklin Avenue Water Company, Inc.	Pomona	66	
Fruit Street Water Company	La Verne	120	
Gardena Water Supply Company	Gardena	125	
Giano Mutual Water Company	Puente		15
Glendora Independent Water Company	Glendora	1,500	140
Glendora Irrigating Company	Glendora	2,500	250
Golden Poppy Park Water Trust	Compton		100
Grazide Rancho Mutual Water Company	Puente	300	25
Harrison Avenue Water Company	Claremont	375	
Haskin, Claire R., Water Company	Compton		33
Hemlock Mutual Water Company	El Monte		134
Hepner Water Company	Covina	100	
Herbert Mutual Water Company	El Monte	50	72
Hidden Hills Mutual Water Company	Calabasas		44
Highway Highlands Water Company	Glendale		1,002
Hilgartner Mutual Water Company	Vernon		6
H.J.S. Mutual Water Company	Compton		76
Hollenbeck Street Water Company	West Covina	320	19
Home Water Company	Compton		60
Howell Road Mutual Water Company	Puente	100	12
Indian Hill Water Company	Claremont	90	
Irrigation Company of Pomona	Pomona	1,000	
Jenkins Realty Mutual Water Company	Artesia		12
Jones-Yorba Mutual Water Company	La Verne	145	
Kingsley Tract Water Co., Ltd.	Pomona	350	93
Kinneloa Water Company	Pasadena		52
Kwis Mutual Water Company	Puente	183	185
La Grande Source Water Company	Puente	885	
Laguna Maywood Mutual Water Company No. 1	Maywood		56
La Habra Heights Mutual Water Company	La Habra	2,800	570
Lake Hughes Water Supply	Lake Hughes		175
Lambert Mutual Water Company	El Monte	20	60
La Merced Heights Land and Water Company	Montebello	300	
La Puente Cooperative Water Company	Covina	1,800	
Las Flores Mesas Water System	Malibu		19
Las Flores Water Company	Pasadena		1,057
Las Tunas Water Company, Ltd.	Malibu		50
La Verne Heights Water Association	La Verne		46
La Verne Mutual Water Company	La Verne	111	
La Verne Water Association	La Verne	900	62
Leffingwell Rancho Pipe Line Association	Whittier	309	
Lexington Boulevard Mutual Water Company	El Monte	10	28
Lincoln Avenue Water Company, Inc.	Pasadena	10	3,009
Live Oak Water Company	Pomona	100	
Loma Mutual Water Company	El Monte		5
Los Nietos Irrigation Company	Whittier	1,200	
Lowell Avenue Mutual Water Company	Los Angeles	42	26
Lowell Tract Water Company	Whittier	10	13
Lynwood Gardens Mutual Water Company	Lynwood		350
Lynwood Park Mutual Water Company	Compton		354
Maechtlen and Nusbickel	La Verne	200	
Main Avenue Mutual Water Company	Baldwin Park	40	
Malibu Lake Mountain Club, Ltd.	Agoura		100
Malibu Lakeside Mutual Water Company	Agoura		100
Malibu Mar Vista Mutual Water Company	Malibu		1
Maple Mutual Water Company	Bellflower		38
Maple Water Company	Puente		96
Maxson-Neely Water Company	Covina	15	
Maywood Mutual Water Company No. 1	Maywood		1,200
Maywood Mutual Water Company No. 2	Maywood		1,710

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Los Angeles County Continued			
Mutual Water Companies—Continued			
Maywood Mutual Water Company No. 3	Maywood		1,830
McCauley Well Company, Ltd.	Pomona	90	
Meadows Mutual Water Company	Whittier		13
Mesa Mutual Water Company	Pasadena		23
Metcalf Mutual Water Company, Inc.	El Monte		9
Michigan Avenue Farms Mutual Water Company	Paramount		136
Midland Park Water Trust	Compton		104
Midway Gardens Mutual Association	Paramount	28	112
Mills Tract Water Company	La Verne	150	
Mint Canyon Village Water Company	Newhall	46	121
Mira Loma Mutual Water Company	Pasadena	90	89
Mission Gardens Mutual Water Company	Garvey		155
Moneta Water Company	Torrance	1,250	300
Mont Antonio Water Company	Claremont	400	
Monte Mutual Water Company, Inc.	El Monte		40
Monterey Acres Mutual Water Company, Inc.	Artesia		133
Monte Vista Pipe Line Association	Sunland	123	
Monte Vista Water Company	Pomona	400	
Mountain View Gardens Mutual Water Association	Long Beach		30
Mountain Water Company of La Crescenta	Glendale	1,200	2,200
Mount Wilson Hotel Company	Mount Wilson		7
Murphy Ranch Mutual Water Company	Whittier	650	286
Narbonne Ranch Water Company No. 3	Torrance	4	246
Neighbors Water Association	Compton		8
New Mint Water System	Newhall		59
North El Monte Water Company	El Monte	150	
North Gate Gardens Water Company	North Long Beach		150
North Long Beach Extension Water Company	North Long Beach		400
North Palomares Irrigation Company	Claremont	684	
North Side Water Company of Walnut	Walnut	750	
Old Baldy Water Company	La Verne	357	
Olivita Mutual Water Company	Inglewood		283
Omaha Water Company	Covina	230	
Orange Belt Water Company	Covina	25	
Orange Grove Tract Water Company	Pomona	300	320
Orchard Park Water Club, Inc.	Long Beach		125
Packard Mutual Water Company	Pomona		115
Packers Mutual Water Company	Los Angeles		10
Palomares Irrigation Company	Pomona	425	
Park Avenue Well Association	Pomona	104	
Park, Sherman and Taylor	Malibu		8
Pearson's Mutual Water Company	Covina	150	
Piedmont Heights Water Club	Long Beach		20
Pomona Ranch Water Company	Claremont	220	
Potrero Heights Water Company	San Gabriel	30	524
Property Owners Water System	Newhall		40
Puddingstone Water Company	La Verne	101	30
Purity Mutual Water Company	El Monte		99
Ramona Avenue Irrigation Company	Pomona	100	
Rancho Green Valley Water Company	Saugus		155
Rancho Mutual Water Company	Rolling Hills		289
Rancho Santa Gertrudes Mutual Water System	Downey	40	28
Reeves Tract Water Company	Bellflower		45
Richards Irrigation Company	Claremont	400	20
Richland Farms Water Company	Compton	203	315
Richwood Mutual Water Company	El Monte		135
Rincon Ditch Company	Whittier	527	
Riverwood Ranch Mutual Water Company	Los Angeles		25
Rowland and Foster Water Company	Puente	250	75
Rowland Manor Mutual Water Company	Walnut		102
Rubio Canon Land and Water Association	Altadena		2,370
Rurban Homes Mutual Water Company, Inc.	El Monte		132
San Dimas Land and Water Company	La Verne	340	
San Dimas Water Company	Covina	2,800	
Santa Catalina Island Company	Avalon		850
Santa Gertrudes Irrigation Company	Whittier	15	

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Los Angeles County—Continued			
Mutual Water Companies—Continued			
Santa Gertrudes Water Company	Whittier	80	
Sepulveda, R. D., Estate	San Pedro	7	1
Simons Brick Company	Montebello	1	135
Somerset Mutual Water Company	Bellflower		2,600
Sorenson Mutual Water Association	Whittier		10
Southland Water Company	Norwalk		1,500
Standefer Ditch Company	Pico	400	
Stanton Water Company	Puente	60	
Sterling Mutual Water Company	El Monte		85
Studebaker Mutual Water Company	Norwalk		59
Sunny Slope Water Company	San Gabriel	990	4,569
Sunset Mutual Water Company	Puente	40	
Swan Ranch Water Company	Walnut	155	
Swenson Mutual Water Company	Baldwin Park	100	
Sylvia Park Mutual Water and Service Company	Topanga		35
Temple Avenue Mutual Water Company	Puente	200	1
Templeton Water System	El Monte		14
Topanga Beach Water Association	Santa Monica		172
Topanga Oaks Mutual Water Company	Topanga		50
Topanga Park Mutual Water Company, Inc.	Topanga		75
T P K & B Water Company	Puente	138	
Tract 180 Water Company	Bell		1,000
Tract 349 Mutual Water Company	Huntington Park	10	850
Tract 6192 Water Company	Whittier		72
Twin Lakes Park Company	Chatsworth		62
Upper Kagel Canyon Mutual Water Association	San Fernando		13
Valencia Heights Water Company	Covina	800	150
Valencia Water Company	Puente	310	16
Valencia Water Company	Covina	425	9
Valhalla Water Association	Tujunga		16
Valley View Mutual Water Company	Baldwin Park	40	500
Valley View Water Company	Claremont	175	
Valley Water Company	Pasadena		2,300
Val Verde Park Water Company	Saugus	1,080	214
Veteran Springs Mutual Water Company	Veteran Springs		44
Victoria Mutual Water Company	Puente	300	
Walnut Mutual Water Company	Walnut		21
Walnut Park Mutual Water Company	Huntington Park	640	2,872
Walnut Place Mutual Water Company No. 17	Baldwin Park		51
Walnut Place Mutual Water Company No. 36	Baldwin Park	12	30
Walnut Place Mutual Water Company No. 42	Baldwin Park	28	20
Weldon Canyon Cooperative Water Association No. 1	San Fernando		4
Werner Tract Mutual Water Company	Baldwin Park		200
West Coast Water Company	Rosemead	55	
West Gateway Mutual Water Company	Whittier		195
West Newhall Mutual Water Company	Newhall		45
Whittier Extension Mutual Water Company	Puente	2,200	176
Wood Mutual Water Company	El Monte		61
Woodland Mutual Water Company	El Monte	33	41
County Waterworks Districts			
Los Angeles County Waterworks District No. 1, (Woodcrest)	Los Angeles		2,121
Los Angeles County Waterworks District No. 2, (Norwalk)	Norwalk	5	964
Los Angeles County Waterworks District No. 5, (Belle-Vernon)	Compton		840
Los Angeles County Waterworks District No. 10, (Willowbrook)	Los Angeles	5	1,489
Los Angeles County Waterworks District No. 13, (Lomita)	Lomita	100	2,310
Los Angeles County Waterworks District No. 16, (Miramonte Park)	Los Angeles		1,215
Los Angeles County Waterworks District No. 21, (Kagel Canyon)	San Fernando		219
Los Angeles County Waterworks District No. 22, (Liberty Acres)	Hawthorne		3,159

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Los Angeles County—Continued			
Municipal Water Districts			
Foothill Municipal Water District	La Crescenta, etc.	14,000	20,250
Pomona Valley Municipal Water District	Pomona, etc.	8,500	
Torrance Municipal Water District No. 1	Torrance	125	
Torrance Municipal Water District No. 3	Torrance	2,000	7,800
West Basin Municipal Water District	Inglewood, etc.	(Sells at wholesale)	
County Water Districts			
Baldwin Park County Water District	Baldwin Park		5,100
Crescenta Valley County Water District	Glendale	2,400	3,900
Downey County Water District	Downey		7,500
La Puente Valley County Water District	Puente	440	
Newhall County Water District	Newhall		
Paramount County Water District	Paramount		1,721
Pico County Water District	Pico		4,150
San Gabriel County Water District	San Gabriel	2	7,125
Sativa Los Angeles County Water District	Compton		1,126
Val Verde County Water District	Saugus		186
Irrigation Districts			
La Canada Irrigation District	Pasadena		1,610
South Montebello Irrigation District	Montebello	190	1,525
Walnut Irrigation District	Downey		750
Metropolitan Water Districts			
Metropolitan Water District of Southern California		(Sells at wholesale)	
Orange County			
Municipal Waterworks			
Anaheim	Anaheim		4,764
Brea	Brea		1,350
Fullerton	Fullerton		4,808
La Habra	La Habra		2,000
Newport Beach	Newport Beach		6,800
Orange	Orange		3,541
San Clemente	San Clemente		1,100
Santa Ana	Santa Ana		15,418
Seal Beach	Seal Beach		1,035
Commercial Water Companies			
Clark Pumping Plant	Garden Grove	45	
Dyke Water Company	Garden Grove		
Jones Water Company	El Modena		391
Martinez, J., Water System	Garden Grove		91
Pacific Water Company	Barber City, New Westminster and 7 others		2,713
Park Lane Water Company	Garden Grove		46
San Juan Water Company	Laguna Beach		650
Southern California Water Company	Huntington Beach and 6 others		4,452
Sunset Land and Water Company	Sunset Beach		499
Tustin Water Works	Tustin	14	1,375
Mutual Water Companies			
Anaheim Eucalyptus Water Company	Placentia	740	
Anaheim Union Water Company	Anaheim	8,500	
Arovista Mutual Water Company	Brae	500	5
Atwood Water Company	Atwood	210	
Benedict Water Company	Anaheim	101	
Boulevard Gardens Water Company	Boulevard Gardens	6	107
Brookhurst Water Company	Anaheim	100	3
Capistrano Acres Mutual Water Company	San Juan Capistrano	415	
Capistrano Heights Water Company	San Juan Capistrano	195	
Capistrano Water Company	San Juan Capistrano	432	
Catalina Street Pump Owners	Santa Ana		13
Cerritos Water Company	Anaheim	108	

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Orange County—Continued			
Mutual Water Companies—Continued			
Citrus Water Association	Orange		26
Citrus Water Company	Santa Ana	157	
Colonia Mutual Water Company	Anaheim		110
Dalewood Mutual Water Association	Garden Grove		77
Dawn Water Company	Orange	290	11
Diamond Park Mutual Water Company	Santa Ana		94
Eastside Water Association	Santa Ana		250
El Aguador Irrigation Company	Anaheim	62	8
El Camino Water Company	Fullerton	100	
El Modena Mutual Irrigation Company	Santa Ana	400	50
El Toro Mutual Water Company No. 1	El Toro	300	
Equitable Water Company	Anaheim	103	5
Fairview Farms Water Company	Santa Ana	409	
Fardale Mutual Water Company	Anaheim	70	
Fardale Pump Company	Anaheim	90	3
Frances Mutual Water Company	Tustin	1,227	
Garden Grove Acres Mutual Water Company	Santa Ana	40	44
Garden Grove Irrigation Company No. 1	Garden Grove	160	
Gay Street Water Association	Cypress		22
Goodwin Mutual Water Company	Placentia	52	4
Grandview Mutual Water Company	La Habra	120	
Greenwald Mutual Water Company	Santa Ana	60	
Hall, Hellis, and Bradford, and Holtz	Santa Ana	100	
Hansen Water Company	Stanton	98	12
Harding Water Users	Anaheim	10	26
H and M Water Company	Stanton		9
Homewood Mutual Water Company	North Buena Park		498
Hualde Mutual Water Company	La Habra	350	
Ideal Water Company	Anaheim	143	1
Katella Water Company	Anaheim	107	
Kellogg Water Company	Anaheim	105	
La Habra Water Company	La Habra	3,000	365
La Paz Mutual Water Company	Garden Grove		59
Lemon Heights Mutual Water Company	Tustin	275	
Liberty Park Water Association	Huntington Beach		48
Loma Vista Mutual Water Company	Tustin	35	7
Lomita Land and Water Company	Seal Beach	300	1
Magnolia Mutual Water Company	Anaheim	75	12
Magnolia Pumping Plant	Anaheim	120	
Magnolia Union Water Association	Anaheim	120	
Midway City Mutual Water Company	Midway City		165
Miller Manor Mutual Water Company	Orange		3
Mine Camp Water System	Orange		35
Miraflores Mutual Water Company	Anaheim		4
M.O.B. Mutual Water Company	Fullerton	200	
Modjeska Service Company	Orange		106
Moore Mutual Water Company	Oceanview	36	60
Mutual Water Company of Goode Subdivision	Santa Ana		19
Mutual Water Company of Landsdown	Fullerton	80	220
Newhope Water Company	Santa Ana	20	6
North East Water Company	Anaheim	90	10
North Street Copartnership Pumping Plant	Anaheim	85	
Nutwood Mutual Pumping Plant Association	Anaheim	120	3
Orange Avenue Water Company	Anaheim	71	2
Orange County Water Service Company	Anaheim	10	14
Orange Grove Water Company	Anaheim	119	
Orange Magnolia Water Company	Buena Park		15
Orange Park Acres Mutual Water Company	Orange	800	200
Orangewood Water Company	Anaheim	70	4
P. A. Stanton Water Company	Anaheim	123	3
Palm Mutual Water Company	Anaheim	70	
Panorama Heights Mutual Water Company	Orange	4	18
Parsons Mutual Water Company	Garden Grove	2	9
Paw Paw Mutual Irrigation Company	Fullerton	80	
Peralta Hills Water Company	Olive	354	24
Pilot Water Company	Placentia	300	

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Orange County—Continued			
Mutual Water Companies—Continued			
Placentia Mutual Water Company	Placentia	97	12
Red Hill Water Company	Tustin	1,085	
Richfield Mutual Water Company	Atwood	200	
Rio Vista Water Company	Anaheim	123	7
Romenya Drive Mutual Water Company, Inc.	Anaheim	87	6
Saamae Land and Water Company	Huntington Beach	60	2
San Juan Heights Water Company	San Juan Capistrano	80	4
Santa Ana Heights Water Company	Santa Ana	194	867
Santa Ana Street Water Company	Anaheim	144	8
Santa Ana Valley Irrigation Company	Orange	15,800	
Santiago Mutual Water Company	Orange	30	10
Savanna Mutual Water Corporation	Stanton	15	24
Schneider Water Company	Anaheim	25	7
Section Two Water Company	Anaheim	250	34
Section 13 Water Company	Anaheim	176	8
Seven Hills Mutual Water Company	Tustin	600	8
Shady Brook Water Company	Silverado		150
Silverado Mutual Water Company	Silverado		54
South Main Mutual Water Company, Inc.	Santa Ana		384
Southwestern Mutual Water Company, Inc.	Santa Ana		141
Stanky Pumping Plant	Anaheim	65	4
Sunny Hills Mutual Water Company	Fullerton	2,000	120
Sunset Land and Water Company	Seal Beach		505
Trabuco Oaks Mutual Water Company	Santa Ana		71
Trabuco Water Company	San Juan Capistrano	440	
Tract 868 Mutual Water Company	Stanton	20	48
Tract 1022 Mutual Water Company	Santa Ana	40	5
Tract 1052 Mutual Water Association	Garden Grove		98
Turner Mutual Water Company	Tustin	85	
Tustin Mutual Water Company	Tustin		
Tye Water Company	Anaheim	131	
Valencia Irrigation Company, Inc.	Anaheim	103	
Valencia Water Company	Anaheim	128	
Villa Park Mutual Water Company, Inc.	Orange	266	
Vista Del Rio Rancho Water Group	Anaheim	100	5
Walnut Canyon Mutual Water Company	Anaheim	250	
Webster Tract Water System	Anaheim		20
West Anaheim Water Company	Anaheim	360	4
Wilminedi Water Company	Anaheim	100	2
Yorba Irrigation Company	Yorba Linda	1,150	
Yorba Linda Water Company	Yorba Linda	2,540	530
County Water Districts			
Fairview County Water District	Costa Mesa		809
Laguna Beach County Water District	Laguna Beach		3,850
Orange County Water District No. 2	Buena Park		1,492
Orange County Water District No. 3	Garden Grove		2,906
Orange County Water District No. 4	San Juan Capistrano		220
Orange County Water District No. 5	Westminster		407
Orange County Water District No. 7	Anaheim		193
Orange County Water District No. 8	El Modena		116
South Coast County Water District	South Laguna		970
Irrigation Districts			
Carpenter Irrigation District	Orange	1,200	
Newport Heights Irrigation District	Newport Beach	60	2,397
Newport Mesa Irrigation District	Newport Beach	50	434
Serrano Irrigation District	Orange	1,316	
Municipal Water Districts			
Coastal Municipal Water District	Laguna Beach, etc.	(Sells at wholesale)	
Orange County Municipal Water District	Placentia, etc.	(Sells at wholesale)	
Metropolitan Water Districts			
Metropolitan Water District of Southern California		(Sells at wholesale)	
Riverside County			
Municipal Waterworks			
Elsinore	Elsinore		917
Perris	Perris		620
Riverside	Riverside		14,757
San Jacinto	San Jacinto		770
Commercial Water Companies			
Anza Water Company	Arlington	120	390
Citizens Domestic Water Company	Arlington La Sierra La Sierra Heights		1,950
Corona City Water Company	Corona		2,899
Good Hope Water Company	Perris		14
Idyllwild Water Company	Idyllwild		521
Inter-County Water Company	Crestmore		70
Jurupa Heights Water Company	Sparrland		450
Lake Hemet Water Company	Hemet		2,490
Mission Water Company	West Riverside		651
Romoland Water System	Romoland		150
Rubidoux Vista Water System	West Riverside		183
Sunny Slope Heights Water Company	West Riverside		578
West Riverside Canal Company	Riverside	7,200	
Mutual Water Companies			
Agua Mansa Water Company	Riverside	620	
Alamo Water Company	Riverside	250	
Alta Mesa Mutual Water Company	Arlington	160	
Anza Water Company	Arlington	750	250
Aqua Copia Mutual Water Company	Mira Loma	1,200	3
Arlington Mutual Water Company	Arlington	1,200	
Babtiste Mutual Water Company	Hemet	188	
Billick Mutual Water Company	Hemet	158	
Bonita Vista Mutual Water Company		78	9
Box Springs Mutual Water Company	Edgemont	480	420
Brownlands Mutual Water Company	Lakeview	1,800	
Cajalco Mutual Water Company	Corona	200	50
Cherry Valley Mutual Water Company	Beaumont		6
Clayton Mutual Water Company	Clayton		34
Clearview Mutual Water Company	Riverside	7	40
Clear Water Company, Inc.	Riverside	260	
Corona Heights Water Company	Corona	300	
Corona Mesa Water Company	Corona		4
Coronita Mutual Water Company	Corona		15
Crestmore Heights Mutual Water Company	Riverside		47
East Riverside Water Company	Riverside	3,350	
Edgemont Gardens Mutual Water Company	Sunnymead	430	450
Elsinore Valley Mutual Water Company	Elsinore	110	35
Eryl Water Company	Hemet	165	
Fairview Land and Water Company	Hemet	200	
Fairview Pumping Plant	Hemet	60	
Fairway Mutual Water Corporation	San Jacinto		38
Felspar Gardens Water Company	Riverside		41
Fern Valley Mutual Water Company	Idyllwild		274
Foothill Mutual Water Company	Hemet	240	
Fort Fremont Mutual Water Company	Riverside		212
Fruitvale Mutual Water Company	San Jacinto	5,368	
Gage Canal Company	Riverside	6,394	
Girard Street Mutual Water Company	Hemet	125	
Glass-Gilmore Mutual Water Company	Perris		4
Glen Eyrie Heights Mutual Water Company	Beaumont	310	10
Grand Avenue Mutual Water Company	Elsinore	6	23
Grand View Mutual Water Company	Beaumont	44	39
Hannon Mutual Water Company	Beaumont	60	12
Highline Mutual Water Company	Hemet	175	
Home Gardens Water Company	Corona		437
Idyllmont Mutual Water Company	Idyllwild		3
Jewell and Clemens Pumping Plant	Hemet	145	
Jurupa Ditch Company	Riverside	600	
Jurupa Water Company	Riverside	988	
Kilmeny Lot Owners Water Association	Elsinore	12	75
La Cadena Mutual Water Company	Riverside		27
Laguna Mutual Water Company	Hemet	200	

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Riverside County—Continued			
Mutual Water Companies—Continued			
Lakeview Mutual Water Company	Elsinore		91
Landowners Mutual Water Company	Elsinore		56
La Sierra Water Company	Riverside	1,500	
Lemona Heights Water Company	Riverside	190	
Lincoln Heights Pumping Company	Riverside	255	
Lincoln Heights Water Company	Riverside		
Little Lake Mutual Water Company	Hemet	355	
L.T.J. Water Company	Hemet	300	
Madison Park Pump Association	Riverside	70	
Mayberry Avenue Mutual Water Company	Hemet	65	
Meridian Mutual Water Company	Hemet	200	
Merryman Water Company	Hemet	297	
Midway Mutual Water Company	Hemet	175	
Mockingbird Pumping Company	Riverside		150
Monte Rue Acres Mutual Water Company	Riverside		48
Moreno Mutual Irrigation Company	Moreno	1,000	
Moreno Water Company	Moreno	350	
Mountain Mutual Water Company	Hemet		8
Mutual Water Company of Glen Avon Heights	Riverside	4,000	450
Nuevo Water Company	Perris	2,000	220
Orange Heights Water Company	Norco	2,500	800
Park Hill Mutual Water Company	Hemet	200	
Perris Mutual Water Company	Perris	130	
Perris Valley Irrigation Company	Perris	3,200	56
Pine Cove Mutual Water Company	Idyllwild		149
Plantation Mutual Pumping Company	Corona	750	
Prado Basin Water Company	Corona	120	
Prenda Pumping Company	Riverside		165
Ramona Mutual Water Company	Hemet	90	
Riverside Highlands Water Company	Highgrove	2,000	225
Riverside Water Company	Riverside	8,700	
Rivino Water Company	Riverside	186	
Salazar Water Company	Riverside	200	
Santa Ana River Water Company	Mira Loma	1,351	640
Santa Fe Mutual Water Company	Hemet	160	
Soboba Mutual Water Company	Hemet	120	
Soboba Water Company	Hemet	210	
South Elsinore Mutual Water Company	Elsinore	1,000	265
South Valley Mutual Water Company	Hemet	275	
Sunnymead Mutual Water Company	Sunnymead	168	54
Tahquitz Mutual Water Company	Hemet	255	
Temescal Water Company	Corona	5,000	
Trujillo Water Company	Riverside	200	
Twin Buttes Water Company	Arlington	1,500	
Valencia Mutual Water Company	Riverside	83	7
Walcot Mutual Water Company	Hemet	150	
Welles Mutual Water Company	Hemet	115	
West End Irrigation Company	Elsinore	75	1
West Riverside Mutual Water Company of Belltown	Riverside	40	96
West Riverside 350-Inch Water Company	Riverside	1,400	
Whiffing Pumping Company	Arlington Heights	75	
Wineland Vineyards Mutual Water Company	Mira Loma	40	82
Yale Mutual Water Company	Hemet	200	
Irrigation Districts			
Beaumont Irrigation District	Beaumont	2,101	1,817
Municipal Water Districts			
Eastern Municipal Water District	Hemet, etc.		
Western Municipal Water District	Riverside, etc.		
Metropolitan Water Districts			
Metropolitan Water District of Southern California		(Sells at wholesale)	
San Bernardino County			
Municipal Waterworks			
Chino	Chino		1,671
Colton	Colton		4,181
Ontario	Ontario		7,783
San Bernardino County—Continued			
Municipal Waterworks—Continued			
Redlands	Redlands		6,655
Rialto	Rialto		1,152
San Bernardino	San Bernardino		20,699
Upland	Upland		2,794
Commercial Water Companies			
Big Bear Pines Water Company	Big Bear Lake		248
Crestmore Village Water Company	Crestmore		165
Delmann Water Company	San Bernardino		17
East Highlands Domestic Water Company	East Highlands		110
East San Bernardino Water Company	East San Bernardino		178
Estates Water Company, Ltd.	Upland	25	248
Fontana Ranchos Water Company	Fontana		83
Godfrey Heights Water Company	Highgrove		12
Inter-County Water Company	Crestmore	(See Riverside County)	
Meadowbrook Water Association	Lake Arrowhead	(See Table 6)	
Mentone Domestic Water Company	Mentone	10	170
North Cucamonga Water Company	Cucamonga		289
Pacific Water Company	Rimforest		36
Park Water Company	Bloomington Chino Crestmore		
Peterson Water Company, Inc.	Loma Linda	18	135
Pioneer Gardens Water Company	San Bernardino		1,512
Pomona Valley Water Company	Chino		191
Running Springs Forest Water Company	San Bernardino		9
San Bernardino Water Utilities Corporation	Verdemont	150	514
Southern California Water Company	Big Bear Lake Bloomington Highland		3,051
Yucaipa Domestic Water Company	Redlands Yucaipa		457
Mutual Water Companies			
Alta Loma Domestic Water Company	Alta Loma		187
Alta Loma Mutual Water Company	Cucamonga	123	
Anderson Mutual Wells Company, Inc.	Highland	90	
Archibald Avenue Water Company	Cucamonga	280	
Arena Mutual Water Association	Ontario	325	
Arrow Route Water Company	Cucamonga	210	
Arroyo Verde Mutual Water Company	San Bernardino		101
Banyan Heights Water Company	Upland	135	
Barnhill Mutual Water Company	Colton	160	
Base Mutual Water Company	Highland	10	62
Bear Valley Extension Water and Pipe Line Company	Bryn Mawr	1,200	
Bear Valley Mutual Water Company	Redlands	7,600	
Beaumont-Yucaipa Water Conservation Assocaition	Yucaipa	200	
Big Bear City Mutual Service Company	Big Bear City	20	707
Big Pine Tract Improvement and Water Association, Inc.	Forest Home		135
Blue Mountain Mutual Water Company	Colton		12
Bon View Mutual Water Association	Ontario	220	
Boulder Water Company	Claremont	150	
Brookings Pipe Line Mutual Water Company	Fredalba		19
Bryn Mawr Mutual Water Company	Redlands	288	
Canyon Ridge Water Company	Upland	180	
Cardiff Farms Mutual Water Company	San Bernardino	48	168
Cedarpines Park Mutual Water Company	Cedarpines		470
Century Water Company	Chino	80	9
Chino District No. 1 Water Company	Chino	68	
Chino Water Company, The	Ontario	1,000	
Church Street Mutual Well Company	Redlands	70	

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
San Bernardino County—Continued			
Mutual Water Companies—Continued			
Citizens Land and Water Company of Bloomington	Bloomington	4,774	
Citrus Water Company	Cucamonga	105	4
City Creek Water Company	Highland	400	
Colton Avenue Water Company	Redlands	50	
Community Water Association of Highland	Highland		41
Conejo Ranchos Mutual Water Company	San Bernardino		71
Corwin Well Company	Highland	150	
Crafton Heights Pipe Line Company	Redlands	390	
Crafton Mesa Mutual Water Company	Redlands	225	
Crafton Water Company	Redlands	1,400	
Crawford Canyon Mutual Water Company	Fontana		35
Cucamonga Water Company	Cucamonga	4,000	600
Cuttle, R. F., Inc.	San Bernardino	84	21
Daley Canyon Mutual Water Company	San Bernardino		30
Del Rosa Mutual Water Company	Del Rosa	256	
Devore Mutual Water Company	San Bernardino		109
Dillson Mutual Water Company	Del Rosa Heights		19
East Barton Water Company	Redlands	100	
East Colton Avenue Water Company	Mentone	130	
East Colton Heights Mutual Water Company	Colton	22	28
East Lugonia Mutual Water Company	Redlands	120	
East Pioneer Mutual Well Company	Redlands	155	
East Redlands Water Company	Redlands	440	
Eastwood Acres Community Water Company	San Bernardino	51	
Etiwanda Domestic Water Association	Etiwanda		165
Etiwanda Water Company	Etiwanda	1,600	
Eucalyptus Street Water Company	Highland	40	20
Euclid Water Company of Upland	Upland		
Fairview Water Company	Redlands	90	
Fallsvale Service Company	Fallsvale		350
Fawnskin Mutual Water Company	Fawnskin		721
Fifth Street Mutual Water Company	Ontario	175	
Fontana Union Water Company	Fontana	12,500	
Foothill Irrigation Company	Alta Loma	600	26
Gaylord Mutual Water Company	Ontario	120	
Gladysta Well and Water Company	Redlands	100	
Grand Avenue Pump Company	Ontario	84	
Grant Company Well	Redlands	100	
Greenspot Mutual Water Company	Greenspot	2,000	
Greenspot Mutual Well Company	Mentone	75	
Haws McKinley Well Company	Highland	90	
Hedges Well, Inc.	Alta Loma	250	
Hellman Water Company	Alta Loma	250	
Hermosa Water Company	Alta Loma	480	1
Highland Avenue Water Company	Fontana	25	40
Highland Haven Mutual Water Company	Fontana		2
Highland Well Company	Highland	100	
Hillside Wells Company	Alta Loma	100	
Holden Mutual Water Company	San Bernardino		42
Home Mutual Water Company	Ontario	240	
Hope Springs Eternal Well, Inc.	Pomona	70	
Inter-City Mutual Water Company	San Bernardino	80	107
Ioamosa Water Company	Alta Loma	580	35
Jewel Water Company	Redlands	130	
Joya Mutual Water Company	Upland	120	1
Judson Mutual Water Company	Redlands	150	
Jumal Water Company	Colton	130	
Kansas Street Water Company	Redlands	75	
King Street Mutual Well Company	Redlands	100	
Ladera Mutual Improvement Company	Loma Linda		123
Lakeside Well Company	Redlands	35	
Lankershim Street Mutual Well Company	Highland	25	118
Las Palmas Water Company	Redlands	20	20
San Bernardino County—Continued			
Mutual Water Companies—Continued			
Lemon Heights Water Company	Upland	300	
Limited Mutual Water Company	Ontario	320	
Linda Vista Water Company	Colton	400	
Loma Linda Home Tract Water Company	San Bernardino	4	75
Loma Linda Mutual Service Company	Loma Linda		180
Longacres Mutual Water Company	Fontana	50	7
Lower Yucaipa Water Company	Redlands	250	
Lugonia Park Water Company	Redlands	100	
Lugonia Water Company	Redlands	1,100	
Lugo Water Company	Redlands	130	
Lytle Creek Water and Improvement Company	Rialto	3,200	
Marabrae Mutual Water Company	Highland		35
Marygold Mutual Water Company	Bloomington	450	225
Mascart Water Company	Redlands	105	
Meeks and Daley Water Company	Colton	200	
Mentone Acres Mutual Well Company	Mentone	240	
Mentone Groves Company	Mentone	122	
Merryfield Water Company	Colton	170	
Mesa Linda Water Company	Alta Loma		60
Mill Creek Mutual Service Company	Mentone		54
Monte Vista Irrigation Company	Ontario	900	
Monte Vista Water Company	Pomona	300	
Moonridge Mutual Water Company	Big Bear Village	30	200
Mountain View Mutual Water Company	Ontario	210	5
Mountain View Park Mutual Water Company	Chino		20
Mountain View Water Company	Upland	850	1
Mount Harrison Mutual Water Company	East Highland	110	
Mount Vernon Water Company	San Bernardino	320	
MuscoyMutualWater Company No. 1	San Bernardino	1,100	1,000
Mutual Well Company	Highland	130	
Myrtle Mutual Water Company	San Bernardino		19
Nickerson Water Company No. 1	Redlands	60	
North Brae Water Company	Redlands	145	
North Fork Water Company	Highland	3,200	
North Shore Mutual Water Company	Fawnskin		29
North Side Water Company	Redlands	110	
Noyes Water Company	Ontario	235	4
Oakglen Domestic Water Company	Oakglen		38
Old Settlers Water Company	Cucamonga	140	
Olive Tree Lane Mutual Water Company	Highland		27
Ontario Water Company	Upland	250	
Orange Park Water Company	Ontario	77	1
Peach Park Water Company	Ontario	135	16
Penn Well Company	Redlands	116	
Pepper Curve Mutual Water Company	Highland	45	20
Perris Hill Mutual Water Company	San Bernardino	90	2
Pharoah and Powell Water Company	Redlands	80	
Pioneer Mutual Water Company	Redlands	90	
Pomona Home Acres Mutual Water Company	Pomona	100	
Pomona Valley Water Company	Chino	110	199
Ramona Avenue Irrigation Company	Pomona	105	
Rancheria Water Company	San Bernardino	310	
Raught Mutual Well Company	Redlands	145	
Redlands Heights Water Company	Redlands	1,000	
Redlands Water Company	Redlands	1,300	
Rex Mutual Water Company	Alta Loma	125	1
Rialto Mutual Land and Water Company	Rialto	500	
Rochester Water Company	Cucamonga		23
Rocky Comfort Mutual Water Company	Redlands	50	23
Rosedale Water Company	Colton	83	
San Antonio Canyon Mutual Service Company	Upland		30
San Antonio Water Company	Upland	4,000	140
San Bernardino Avenue Water Company	Redlands	110	
Sapphire Mutual Water Company	Alta Loma		12
Schowalter Mutual Water Company	Alta Loma	100	11
Section 30 Mutual Water Company	Yucaipa	640	35
Seeley Well Company	Highland	80	

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
San Bernardino County—Continued			
Mutual Water Companies—Continued			
Slover Mutual Water Company	Rialto		19
Smith Tract Water Company	Redlands	90	
South Mesa Water Company	Calimesa	2,000	725
South Mountain Water Company	Redlands	500	
Southside Mutual Water Company	Ontario	210	
Stowe Water Company	Redlands	105	
Strawberry Lodge Mutual Water Company	San Bernardino		93
Sunset Water Company of Cucamonga	Cucamonga	185	
Tennessee Water Company	Redlands	145	
Terrace Water Company	Colton	150	275
Tioga Mutual Water Company	Upland	300	130
Treasure Island Mutual Water Company	Pine Knot		12
Tri-City Mutual Water Company	San Bernardino		40
Trible Falls Water Company	Yucaipa		
Upland Foothill Water Company	Upland	300	
Upland Water Company	Upland	300	
Valencia Drive Mutual Water Company	San Bernardino	20	
Valley Farms Mutual Water Company	San Bernardino	75	171
Valley View Park Mutual Water Company	Crestline		148
Victoria Farms Mutual Water Company	San Bernardino	100	105
Vista Grande Mutual Water Company	Colton		12
Walnut Street Pumping Plant	Chino	50	
Webster Mutual Water Company	San Bernardino		18
West End Consolidated Water Company	Upland	1,700	
Western Heights Water Company	Redlands	1,350	625
West Fourth Street Water Company	Ontario	210	
West Highlands Water Company	Patton	800	
West Highland Well Company	Del Rosa	150	
West Ontario Mutual Water Company	Ontario	160	
West Redlands Water Company	Redlands	800	
West Twin Creek Water Company	San Bernardino	290	
Williams Well Corporation, Ltd.	Redlands	120	
Woehr Mutual Water Company	Redlands	75	
Wrach Water Company	Chino	62	
Yucaipa Little Farms	Yucaipa	90	
Yucaipa Valley Mutual Water Company	Yucaipa	4	2
Yucaipa Water Company No. 1	Yucaipa	1,000	1,600
County Water Districts			
Bloomington County Water District	Bloomington		160
Crest Forest County Water District	Crestline		2
Monte Vista County Water District	Ontario		
County Waterworks Districts			
San Bernardino County Waterworks District No. 8	Chino		109
Municipal Water Districts			
Chino Basin Municipal Water District	Ontario, etc.	(Sells at wholesale)	
San Bernardino Municipal Water District	San Bernardino, Redlands, etc.	(Sells at wholesale)	
Metropolitan Water Districts			
Metropolitan Water District of Southern California		(Sells at wholesale)	
San Diego County			
Municipal Waterworks			
Escondido	Escondido		2,012
Oceanside	Oceanside		3,100
San Diego	San Diego		76,662
San Diego County—Continued			
Commercial Water Companies			
California Water and Telephone Company	Chula Vista, Coronado, National City and 8 others	3,100	12,016
Del Mar Utilities	Del Mar		506
Descanso Park Water Company	Descanso		60
Felicita Water Service	Escondido		12
Jesmond Dene Water System	Escondido		24
Moro Water Company	Fallbrook	26	4
Rock Springs Utility District	Escondido		2
Valley Center Water Company	Valley Center		4
Whispering Pines Water Company	Julian		96
Mutual Water Companies			
Bailey Mutual Water Company	Escondido		21
Bennett Mutual Water Company	Escondido	700	11
Bernita Mutual Water Company	El Cajon	23	10
Campo Water System	Campo	20	75
Canyon Ranch Mutual Water Company	Fallbrook	45	2
Carlsbad Mutual Water Company	Carlsbad	2,000	1,490
Chase Heirs Mutual Water Company	El Cajon	12	10
Del Dios Mutual Water Company	Escondido		150
Do-It Mutual Water Company	Bonsall	110	6
East San Pasqual Water Company	Escondido	237	
Escondido Mutual Water Company	Escondido	7,806	727
Green Mutual Water Company of San Diego	Escondido	300	75
Harbison Canyon Mutual Water Company	El Cajon		225
Harmony Grove Spiritualist Association	Escondido		26
High Valley Mutual Water Company	Poway	184	6
Julian Mutual Water Company	Julian		250
Lake Henshaw Resort Water System	Santa Ysabel		29
Lake Morena's Oak Shores Mutual Water Company, Inc.	Campo		75
Lake Morena Views Mutual Water Company	Lake Morena Village		34
Lakeside Farms Mutual Water Company	Lakeside	700	110
La Mesa Mutual Water Company	La Mesa	3	
Long View Mutual Water Company	Escondido	30	11
Los Tulas Mutual Water Company	Warner Hot Springs		18
Monserate Water Company	Fallbrook	89	7
Pala Indian Reservation	Pala	600	72
Palomar Mountain Mutual Water Company	Escondido		100
Pauma Valley Water Company	Pala	460	37
Pine Hills Mutual Water Company	Julian		51
Pine Valley Mutual Water Company	Pine Valley		155
Pratt Mutual Water Company	Fallbrook	4	1
Riverview Farms Mutual Water Company	San Diego	1,000	465
San Luis Rey Heights Mutual Water Company	Bonsall	600	35
San Marcos Water Developers	San Marcos		40
Santa Margarita Mutual Water Company			
S.E.R.J. Mutual Water Company	El Cajon	30	6
Tavern Water System	Alpine		6
Terramar Water Company	Carlsbad	250	25
Vista Manor Mutual Water Company	Vista		6
Willows Water System	Alpine		17
Willowside Terrace Water Association	El Cajon		18
Winterwarm Mutual Water Company	Fallbrook	240	40
County Water Districts			
San Marcos County Water District	San Marcos		

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
San Diego County—Continued			
Irrigation Districts			
Lakeside Irrigation District	Lakeside		500
La Mesa, Lemon Grove and Spring Valley Irrigation District	La Mesa	12,008	18,000
Ramona Irrigation District	Ramona	14	359
San Dieguito Irrigation District	Encinitas	1,670	2,023
Santa Fe Irrigation District	Encinitas	2,470	923
San Ysidro Irrigation District	San Ysidro	400	823
South Bay Irrigation District		3,782	
Vista Irrigation District	Vista	9,000	
Water Districts			
Belfort Village Water District			
Bonsall Heights Water District	Bonsall		
Las Posas Water District			
Moosa Water District	Bonsall		
Orchard Water District			
Public Utility Districts			
Fallbrook Public Utility District	Fallbrook	8,192	1,250
Municipal Water Districts			
Bueno Colorado Municipal Water District	Vista, etc.		
Carlsbad Municipal Water District	Carlsbad		
Poway Municipal Water District	Poway		
Rainbow Municipal Water District	Rainbow, etc.		
Ramona Municipal Water District	Ramona		
Rincon del Diablo Municipal Water District	Escondido		
Valley Center Municipal Water District	Valley Center		
County Water Authorities			
San Diego County Water Authority		(Sells at wholesale)	
Metropolitan Water Districts			
Metropolitan Water District of Southern California		(Sells at wholesale)	
Ventura County			
Municipal Waterworks			
Fillmore	Fillmore		1,093
Oxnard	Oxnard		4,165
Port Hueneme	Port Hueneme		750
Ventura	Ventura		6,124
Commercial Water Companies			
Farmers Irrigation Company	Santa Paula		
Gardens Water Corporation	Oak View		424
Santa Clara Water and Irrigating Company	Saticoy	600	
Santa Paula Water Works, Ltd.	Santa Paula	760	3,367
Saticoy Water Company	Saticoy-Montalvo		906
Southern California Water Company	Ojai		1,091
Warring Brothers Domestic Service	Piru		256
Warring Brothers Irrigating Service	Piru	400	
Yerba Buena Water Company	Solromar		15
Mutual Water Companies			
Agee's Farms Mutual Water Company	Oxnard	40	
Aliso Mutual Water Company	Saticoy	110	6
Alta Mutual Water Company	Saticoy	1,800	59
Arnaz Mutual Water Company	Oak View	33	49
Bardsdale Water Supply	Fillmore		35
Berylwood Heights Mutual Water Company	Somis	700	
Brownstone Mutual Water Company	Fillmore	125	2
Casitas Mutual Water Company	Casitas	15	80
Cienega Water Company	Fillmore	290	10
Citrus Mutual Water Company	Santa Paula	250	
Cloverdale Mutual Water Company	El Rio	101	90
Community Mutual Water Company	Santa Paula	432	14
Conejo Mutual Water Company	Camarillo	212	16
Cozy Dell Eucalyptus Company	Ojai		5
Crestview Mutual Water Company	Camarillo	48	9

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Ventura County—Continued			
Mutual Water Companies—Continued			
Cyprus Mutual Water Company	Port Hueneme		62
Del Norte Water Company	Saticoy	1,200	24
Dempsey Road Mutual Water Company	Oxnard		287
Elmobo Mutual Water Company	Fillmore	150	3
El Rio Mutual Water Company	El Rio		105
Epworth Mutual Water Company	Moorpark	70	5
Fillmore Irrigation Company	Fillmore	875	100
Garden Acres Mutual Water Company	Camarillo		90
Hardscrabble Water Company	Santa Paula	252	
Hollywood Beach Mutual Water Company	Oxnard		158
Hollywood by the Sea Mutual Water Corporation	Oxnard		95
Kadota Mutual Water Company	Santa Susana	319	138
Lake Sherwood Mutual Water Company	Camarillo		80
La Placentia Mutual Water Company	Simi	60	
Las Posas Water Company	Somis		167
Los Encinos Mutual Water Company	Ojai		15
Lucky Seven Mutual Water Company	Oak View	6	7
Mesita Mutual Water Company	Oak View	40	14
Mira Monte Mutual Water Company	Ojai	250	160
Montalvo Mutual Water Company	Montalvo	900	
Montgomery Mutual Water Company	Simi	400	17
Moorpark Home Acres Mutual Water Company	Moorpark	180	62
Moorpark Mutual Water Company	Moorpark	600	
Mound Mutual Water Company	Ventura	853	264
Mutual Water Company of Vineyard Avenue Estates	Oxnard		85
North Oxnard Mutual Water Company	Oxnard	3	3
Ocean View Mutual Water Company			
O'Conner-Camarillo Ranches Mutual Water Company	Camarillo	435	
Olive Mutual Water Company	Ojai	50	
Oxnard Mutual Water Company	Oxnard	2,800	
Pleasant Valley Mutual Water Company	Camarillo		347
Ranchitos Mutual Water Company	Ojai	40	90
Rancho Santa Ana Vista Water Company	Oak View		6
Rissman Mutual Water Company	Piru	83	10
San Cayetano Mutual Water Company	Santa Paula	350	14
San Miguel Mutual Water Company	Ventura	210	
Santa Clara Mutual Water Company	Saticoy	200	6
Santa Rosa Mutual Water Company	Camarillo	557	20
Senior Canyon Mutual Water Company	Ojai	115	100
Sherwin Acres Mutual Water Company	Ventura	27	44
Siete Robles Mutual Water Company	Ojai	5	65
Silver Strand Mutual Water Company	Oxnard		225
Simi Hills Development Association	Canoga Park		125
Simi Mutual Water Company	Simi	90	67
Simi Valley Mutual Water Company	Simi		53
Sinaloa Mutual Water Company	Simi	500	20
Sisar Mutual Water Company	Ojai		32
Skyline Mutual Water Company	Ojai	100	5
Southside Improvement Company	Fillmore	1,478	16
South Slope Mutual Water Company	Simi	257	
Stork Mutual Water Company	Santa Paula	15	1
Susana Water Company	Ventura		255
Tapo Mutual Water Company	Santa Susana	1,113	83
Teal Club Mutual Water Company	Oxnard	4	8
Thermal Belt Water Company	Santa Paula	1,380	50
Thermic Mutual Water Company	Moorpark	500	14
Tico Mutual Water Company	Ojai	52	9
Timber Canyon Mutual Water Company	Santa Paula	60	3
Turner Ditch Company	Santa Paula	259	
Ventura River Mutual Water Company	Ojai		70
Vineyard Avenue Acres Mutual Water Company	Oxnard	122	116
Vineyard Mutual Water Company	Oxnard	200	
Zone Mutual Water Company No. 1 and No. 2	Somis	3,351	

WATER SERVICE AGENCIES, SOUTH COASTAL AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Ventura County—Continued			
County Water Districts			
Meiners Oaks County Water District	Meiners Oaks	200	574
County Waterworks Districts			
County Waterworks District No. 1, Moorpark	Moorpark		375
County Waterworks District No. 3, Simi	Simi	60	100
County Waterworks District No. 4, Casitas Springs	Casitas Springs		90
County Waterworks District No. 5, Camarillo	Camarillo		420
County Waterworks District No. 6, Thousand Oaks	Thousand Oaks		330
Ventura County—Continued			
County Waterworks Districts —Continued			
County Waterworks District No. 7, Live Oak Acres	Live Oak Acres		85
Water Conservation Districts			
Simi Valley Water Conservation District	Simi Valley	10,000	
United Water Conservation District	Santa Paula	68,000	13,500
Special Water Service Districts			
Montalvo Municipal Improvement District	Montalvo		
Ventura County Flood Control District			

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Alameda County			
Irrigation Districts			
Byron-Bethany Irrigation District	Byron	(See Contra Costa County)	
Amador County			
Municipal Waterworks			
Plymouth	Plymouth		222
Commercial Water Companies			
Arroyo Ditch Company	Plymouth	100	16
Jackson Gate Water Works	Jackson Gate		45
Jackson Water Works	Jackson		727
Outingdale Water Company	Placerville		32
Pacific Gas and Electric Company	Amador City, Ione, Sutter Creek		844
River Pines Water Service	River Pines	5	151
Mutual Water Companies			
Volcano Water System	Volcano		30
Butte County			
Municipal Waterworks			
Biggs	Biggs		297
Chico Municipal Airport Water Supply	Chico		45
Gridley	Gridley		1,170
Commercial Water Companies			
California Water Service Company	Chico, Oroville		9,181
Diamond Match Company, The	Sterling City		367
Mulberry Water Works	Chico		112
Pacific Gas and Electric Company	Nelson	17,586	
Sutter Butte Canal Company	Gridley-Biggs	16,997	
Mutual Water Companies			
Ayers Mutual Water Company	Gridley	5	21
Biggs Ditch Company	Biggs	450	
Dayton Mutual Water Company	Chico	1,868	
De Sabla Water Supply	Paradise		22
Durham Mutual Water Company, Ltd.	Durham	5,800	
Las Plumas Water Supply	Oroville		19
Water Users Association Gridley Colony, Ditch No. 1	Gridley	1,200	
Irrigation Districts			
Durham Irrigation District	Durham		166
Oroville-Wyandotte Irrigation District	Oroville	4,450	1,015
Paradise Irrigation District	Paradise	450	2,814
Richvale Irrigation District	Richvale	13,475	
Table Mountain Irrigation District	Oroville	450	
Thermalito Irrigation District	Oroville	1,670	1,000
Reclamation Districts			
Reclamation District 833	Gridley	10,000	
Water Districts			
Biggs West Gridley Water District	Biggs	11,837	
Butte Water Company	Gridley	17,000	
Calaveras County			
Commercial Water Companies			
Pacific Gas and Electric Company	Altaville, Angels Camp		534
Mutual Water Companies			
Angels Water Users Associations	Angels Camp	160	
West Point Ditch Company	West Point	20	40
County Water Districts			
Calaveras County Water District No. 1	Angels Camp		45
Water Districts			
Rock Creek Water District	Farmington	700	4
Calaveras County—Continued			
Public Utility Districts			
Calaveras Public Utility District	Mokelumne Hill, San Andreas		600
Union Public Utility District	Murphys	401	530
Valley Springs Public Utility District	Valley Springs		120
Colusa County			
Municipal Waterworks			
Colusa	Colusa		974
Williams	Williams		420
Mutual Water Companies			
Beduhn Water Supply	Colusa		8
Colusa Irrigation Company	Colusa	1,200	25
Roberts Ditch Irrigation Company	Colusa	1,400	
Swinford Tract Irrigation Company	Colusa	136	
Irrigation Districts			
Compton-Delevan Irrigation District	Maxwell	3,022	
Glenn-Colusa Irrigation District	Delevan	73,687	
Maxwell Irrigation District	Maxwell	1,730	
Princeton-Codora-Glenn Irrigation District	Princeton	(See Glenn County)	
Provident Irrigation District	Princeton	(See Glenn County)	
County Waterworks Districts			
Princeton County Waterworks District	Princeton		85
Reclamation Districts			
Reclamation District 108	Grimes	12,661	
Reclamation District 1004	Colusa	11,460	
Water Districts			
Compton Water District	Maxwell	3,500	
Public Utility Districts			
Arbuckle Public Utility District	Arbuckle		285
Maxwell Public Utility District	Maxwell		238
Contra Costa County			
Municipal Waterworks			
Antioch	Antioch		3,490
Commercial Water Companies			
Pleasantimes Water System	Bethel Island		97
Mutual Water Companies			
Bethel Island Mutual Water Company	Bethel Island		50
Farrar Park Property Owners Water Company	Oakley		50
Loreto Megna Water Company	Antioch	30	50
River View Water Association	Oakley		9
Sandmound Mutual Water Company	Oakley		72
County Water Districts			
Contra Costa County Water District	Pittsburg	(See Table 2)	
Irrigation Districts			
Byron-Bethany Irrigation District	Byron	9,030	
East Contra Costa Irrigation District	Brentwood	16,125	
County Waterworks Districts			
Contra Costa County Waterworks District No. 1	Brentwood		325
Reclamation Districts			
Reclamation District 830	Oakley	3,500	
Reclamation District 1619	Brentwood	2,200	750
Reclamation District 2024	Brentwood	2,369	
Reclamation District 2059		2,000	
United States Bureau of Reclamation Projects			
Central Valley Project		(Sells at wholesale)	

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
El Dorado County			
Municipal Waterworks			
Placerville	Placerville		1,374
Commercial Water Companies			
Farmers Ditch Company	Coloma	90	
Georgetown Divide Water Company, Ltd.	Georgetown		47
Juckes, J. W., Water and Ditch System	Pleasant Valley		1
Randall Ditch Company	Folsom		
Mutual Water Companies			
Caldor Lumber Company	Diamond Spring		34
Mosquito District Mutual Water Company	Placerville	400	4
West Spring Mutual Water Company	Pollock Pines		5
Irrigation Districts			
El Dorado Irrigation District	Placerville	5,700	585
Public Utility Districts			
Georgetown Divide Public Utility District	Georgetown	1,600	102
Pollock Pines-Fresh Pond Public Utility District	Pollock Pines		112
United States Bureau of Reclamation Projects			
Central Valley Project-Sly Park Unit		(Sells at wholesale)	
Fresno County			
Municipal Waterworks			
Clovis	Clovis		850
Coalinga	Coalinga		1,810
Firebaugh	Firebaugh		293
Fowler	Fowler		527
Fresno	Fresno		39,177
Kerman	Kerman		400
Kingsburg	Kingsburg		872
Mendota	Mendota		250
Orange Cove	Orange Cove		547
Parlier	Parlier		368
Reedley	Reedley		1,490
San Joaquin	San Joaquin		122
Sanger	Sanger		1,789
Commercial Water Companies			
Bakman Homesites Water Utility	Fresno		140
Biola Water Company	Biola		143
Bowen Land Company Water System	Fresno		72
Calwa City Water Company	Calwa		871
Caruthers Water Company	Caruthers		161
Cedar Heights Water System	Fresno		35
Del Rey Water Works	Del Rey		174
East Mendota Water Company	Mendota		90
Fresno Suburban Water Service Company	Fresno		62
Gardenview Water System	Fresno		140
Highway City Water System	Highway City		349
Huron Utility Company	Huron		108
Kavanagh Vista Water Company	Fresno		61
Laton Water Company	Laton		182
Mendocino Heights Water Company	Kingsburg	20	2
Mouren Water Service	Huron		73
Northeast Gardens Water System	Fresno	30	61
Pacific Gas and Electric Company	Selma		1,773
Pinedale Water Company	Pinedale		504
Spangler Water System	Fresno		31
Walker Water Company	Parlier		30
Whitener Heights Water Company	Parlier		37
Yosemite Garden Water Company	Pinedale		60
Mutual Water Companies			
California Cotton Compress and Warehouse	Pinedale		57
Columbia Canal Company	Firebaugh	(See Madera County)	
Fresno County—Continued			
Mutual Water Companies—Continued			
Crescent Canal Company	Lanare	12,500	
Dennis-Byrd Ditches	Reedley	1,200	
Eagle Field Water Association	So. Dos Palos	(See Merced County)	
Firebaugh Canal Company	Firebaugh	23,675	4
Hanke Ditch Association	Sanger	1,390	14
Kilpatrick Water Supply	Orange Cove		8
Kings River Bottoms Water Users Association	Sanger	9,000	
Kings River Mutual Water Company	Reedley	130	2
Las Deltas Mutual Water Company	Firebaugh		31
Liberty Canal Company	Burrel	4,000	
Liberty Mill Race Company	Riverdale	21,120	
Music Meadows Mutual Water Company	Fresno		12
New Auberry Water Association	New Auberry		37
North Elderwood Water Company	Fresno	70	
Ora Loma Water Association	Dos Palos	431	
Orange Vale Water Company	Reedley	96	
Reed Ditch Company	Burrel	6,000	
Round Mountain Water Association	Clovis	135	
South Reedley Mutual Water Company	Reedley	10	20
Widren Water Users' Association	Firebaugh	850	
Irrigation Districts			
Alta Irrigation District	Reedley	(See Tulare County)	
Central California Irrigation District		(See Merced County)	
Consolidated Irrigation District	Selma	140,000	
Fresno Irrigation District	Fresno	169,800	
Hills Valley Irrigation District	Orange Cove	0	
James Irrigation District	San Joaquin	16,917	
Laguna Irrigation District	Laton	30,000	
Mendota Irrigation District	Tranquillity	(Inactive)	
Orange Cove Irrigation District	Orange Cove	15,532	
Riverdale Irrigation District	Riverdale	13,380	
Stinson Irrigation District	Burrel	6,000	
Tranquillity Irrigation District	Tranquillity	8,112	175
County Waterworks Districts			
Fresno County Waterworks District No. 1	Fresno		570
Fresno County Waterworks District No. 2	Fresno		254
Fresno County Waterworks District No 3	Fresno		170
Fresno County Waterworks District No. 4	Fresno		1,400
Fresno County Waterworks District No. 5	Fresno		14
Fresno County Waterworks District No. 6	Fresno		32
Fresno County Waterworks District No. 7	Fresno		80
Fresno County Waterworks District No. 8	Fresno		100
Reclamation Districts			
Reclamation District 779	Fresno	25,309	
Reclamation District No. 1003	Laton	1,500	43
Water Districts			
Borland Water District	Mendota	3,499	
Farmers Water District	Mendota	2,300	
International Water District	Clovis	160	
Oro Loma Water District	South Dos Palos	622	
Panoche Water District	Dos Palos	41,000	
Westlands Water District	Helm		
Water Conservation Districts			
Kings River Water Conservation District	Fresno	900,000	
Community Services Districts			
Wahtoke Community Services District	Orange Cove	4,468	

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Fresno County—Continued			
United States Bureau of Reclamation Projects			
Central Valley Project		(Sells at wholesale)	
Glenn County			
Municipal Waterworks			
Orland	Orland		708
Commercial Water Companies			
California Water Service Company	Willows		1,339
Pacific Gas and Electric Company	Butte City	(See Butte County)	
Sacramento River Farms, Ltd.	Hamilton City		150
Mutual Water Companies			
Butte City Water Works	Butte City		35
Davis Water Service	Willows		20
Loam Ridge Mutual Water Company	Orland	1,000	
Orland Unit Water Users' Association	Orland	22,430	
Willow Creek Mutual Water Company	Willows	750	
Irrigation Districts			
Glenn-Colusa Irrigation District	Delevan	(See Colusa County)	
Jacinto Irrigation District	Willows	9,095	
Princeton-Codora-Glenn Irrigation District	Willows	6,848	
Provident Irrigation District	Glenn	10,579	
Reclamation Districts			
Reclamation District 1004		(See Colusa County)	
Kern County			
Municipal Waterworks			
Delano	Delano		2,100
Maricopa	Maricopa		
Tehachapi	Tehachapi		450
Commercial Water Companies			
Arden Water Company	Kernville		43
Arvin Water Company	Arvin		1,055
Buena Vista Canal, Inc.	Bakersfield	17,300	
California Water Service Company	Bakersfield		23,905
Calimar Water Company	Bakersfield		200
Central Canal Company (Calloway)	Bakersfield	63,115	
Commercial Land Company	Tupman		62
East Side Canal Company	Bakersfield	6,293	
Farmers Canal Company	Bakersfield	10,210	
Garden Acres Water Company	Bakersfield		350
Hicks, E. B., Water Company	Bakersfield		100
Kern Island Canal Company	Bakersfield	53,720	
Kern River Canal and Irrigating Company	Bakersfield	9,190	
Kernville Domestic Water System	Kernville		36
Lebec Water Works	Lebec		73
Lost Hills Water Company	Lost Hills		106
McKittrick Water Company	McKittrick		62
Pacific Water Company	Bakersfield Lamont Wasco	170	2,064
Sage Brothers Water Service	South Shafter	3	94
Stine Canal, Inc.	Bakersfield	21,900	
Western Water Company	Fellows Ford City Maricopa Taft		5,406
Mutual Water Companies			
Airport Mutual Water Company	Bakersfield	40	68
Alamont Mutual Water Company	Lamont	19	96
Alta Sierra Mutual Water Company	Bakersfield		92
Anderson Canal, Inc.	Bakersfield	2,420	
Baldwin Diary	Bakersfield	2,300	4
Barnes Water Supply	Bakersfield		24
Bear Mountain Orange Company	Arvin	560	7
Broce Mutual Water Company	McFarland	121	
Casa Loma Water Company	Bakersfield	160	190
Kern County—Continued			
Mutual Water Companies—Continued			
Castro Ditch Company	Bakersfield	250	
Chanslor-Canfield Midway Oil Company	Bakersfield		139
Comanche Point Water Company	Arvin	240	7
DeWitte's Auto Court	Shafter		85
DiGiorgio Fruit Corporation	Bakersfield	10,000	3
Dos Pinos Mutual Water Company	Lamont		66
East Buttonwillow Mutual Water Company	Buttonwillow		8
Edison Mutual Water Company	Bakersfield		61
Edmondson Acres Mutual Water Company	Arvin	15	28
First Edison Well Company	Bakersfield	412	
Foothill Citrus Farms Company	Arvin	225	
Fox Trailer Court	Bakersfield		30
Garfield Community Water Supply Company	Bodfish		16
Green Acres Mutual Water Users	Delano	74	12
James and Dixon Canal Company, Inc.	Bakersfield	2,240	
Jellison, F. D.	Bakersfield	100	
Johnson Canal Company	Bakersfield	1,200	
Joyce Canal Company, Inc.	Bakersfield	1,920	
Kern Mutual Water Company	Buttonwillow		275
Lamont Mutual Water Company	Lamont	40	20
Lerdo Canal Company, Inc.	Lerdo	20,835	
Lerdo Mutual Water Company No. 9	Lerdo	300	
Loma Park Water Company	Bakersfield	140	60
Los Patos Land and Water Company	Bakersfield	60	1
McFarland Mutual Water Company	McFarland		685
Mettler Mutual Water Company	Mettler Station		12
Mexican Colony Water Association	Shafter		84
Miracle Hot Springs Resort	Bakersfield		20
Montal Mutual Water Company	Lamont	20	112
Monte Vista Mutual Water Company	Bakersfield		15
Nightingale, C. E.	Shafter	1	6
Norris Terrace Mutual Water Company	Bakersfield		44
Oildale Mutual Water Company	Oildale		4,000
Old South Fork Company	Bakersfield	1,700	
Pioneer Canal Company	Bakersfield	12,190	
Plunket Canal, Inc.	Bakersfield	1,420	
Richards, Pauly and Tupman	Arvin	320	6
Rag Gulch Mutual Water Company	Delano	732	
Riverkern Mutual Water Company	Kernville		8
San Marino Mutual Water Company			13
Second Edison Well Company	Bakersfield	300	
Shady Acres Auto Camp	Bakersfield		23
Stockdale Mutual Water Company	Bakersfield		55
Sunny Street Mutual Water Company	Shafter		15
Vaughn Water Company, Inc.	Bakersfield		110
Wildwood Farms	Bakersfield	500	1
Williams, Peter M.	Bakersfield	30	90
Willowood Mutual Water Company	Bakersfield	18	
Wilson Ditch	Bakersfield	250	
Wise, H. H.	Bakersfield	10	8
Irrigation Districts			
Delano-Earlimart Irrigation District	Earlimart	(See Tulare County)	
Shafter-Wasco Irrigation District	Shafter	30,407	
Water Storage Districts			
Arvin-Edison Water Storage District	Arvin	95,011	
Buena Vista Water Storage District	Bakersfield	40,291	
North Kern Water Storage District	Famoso	50,000	
Public Utility Districts			
Frazier Park Public Utility District	Bakersfield		391
Highland Park Public Utility District	Bakersfield		903
Lamont Public Utility District	Lamont		470
Plainview Public Utility District	Bakersfield		150
Wasco Public Utility District	Wasco		1,400
United States Bureau of Reclamation Projects			
Central Valley Project		(Sells at wholesale)	

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Kern County—Continued			
Municipal Utility Districts			
Southern San Joaquin Municipal Utility District	Delano	53,000	
Kings County			
Municipal Waterworks			
Corcoran	Corcoran		920
Lemoore	Lemoore		875
Commercial Water Companies			
California Water Service Company	Hanford		4,020
Kettleman City Water Company	Kettleman City		95
Lone Oaks Canal Company	Hanford	5,000	
Pacific Gas and Electric Company	Avenal		1,309
Mutual Water Companies			
Bayou Vista Ditch Company	Corcoran	8,500	
Burke Ditch Company	Hanford	640	
Gates-Jones Mutual Water Company	Corcoran		
Hamblin Mutual Water Company	Hanford	10	40
Hardwick Water Works	Hanford		35
John Heinlen Mutual Water Company	Lemoore		
Lakeside Ditch Company	Hanford	9,610	
Last Chance Water Ditch Company	Hanford	38,000	
Lemoore Canal and Irrigation Company	Lemoore	50,000	
Liberty Farms Mutual Water Company	Corcoran	16,410	
Melga Canal Company	Corcoran	30,000	
Peoples Ditch Company	Hanford	65,872	
Riverside Ditch Company	Hanford	3,615	
Settlers Ditch Company	Hanford	2,600	
Tulare Lake Canal Company	Stratford	37,000	
York Drop Ditch Company	Lemoore	2,700	30
Irrigation Districts			
Alta Irrigation District	Reedley	(See Tulare County)	
Consolidated Irrigation District	Selma	(See Fresno County)	
Corcoran Irrigation District	Corcoran	32,975	
Empire West Side Irrigation District	Hanford	6,400	
Island No. 3 Irrigation District	Traver		
Kings River Delta Irrigation District	Hanford	2,700	
Laguna Irrigation District	Laton	(See Fresno County)	
Lemoore Irrigation District	Lemoore	(Inactive)	
Lucerne Irrigation District	Hanford	(Inactive)	
Stratford Irrigation District	Hanford	9,846	
Reclamation Districts			
Reclamation District 739 (Lovelace)	Stratford	5,959	
Reclamation District 761 (Cohn Central Consolidated)	Stratford	18,000	
Reclamation District 780 (Homeland)	Alpaugh	24,290	
Reclamation District 2069 (Clark's Fork)	Lemoore	2,300	56
Water Districts			
Nunes Water District	Corcoran	18,900	
Water Storage Districts			
Tulare Lake Basin Water Storage District			
Special Water Service Districts			
Avenal Community Services District	Avenal		
Lake County			
Municipal Waterworks			
Lakeport	Lakeport		856
Commercial Water Companies			
Anderson Springs Water Company	Anderson Springs, Middletown		92
Lake County—Continued			
Commercial Water Companies—Continued			
Clear Lake Park Water Company	Austins, Clearlake Park, Pine Dell		468
Cobb Mountain Water Company	Cobb		1
Lucerne Water Company	Lucerne		177
Mutual Water Companies			
Clearlake Oaks Water Company	Clearlake Oaks		400
Crescent Bay Improvement Company	Lower Lake	2	28
Glenhaven Mutual Water Company	Glenhaven		54
Highlands Water Company	Clearlake Highlands		416
Jago's Resort Water Supply	Lower Lake	10	10
Lakewood Resort Water Supply	Kelseyville		14
Loch Lomond Mutual Water Company	Kelseyville		122
Manakee Mutual Water Company, Inc.	Clearlake Highlands		55
Nice Mutual Water Company	Nice		30
Sulphur Bank Mine	Clearlake Oaks		12
County Waterworks Districts			
Lower Lake County Waterworks District No. 1	Lower Lake		107
Kelseyville County Waterworks District No. 3	Kelseyville		140
Lassen County			
Commercial Water Companies			
Hunt, W. H., Estate Company	Adin	70	5
Northern Counties Utility Company	Westwood		1,087
Irrigation Districts			
Big Valley Irrigation District	Bieber Station	2,100	
Madera County			
Municipal Waterworks			
Chowchilla	Chowchilla		1,050
Madera	Madera		3,200
Commercial Water Companies			
Cunningham, Bessie L.	Central Camp		38
Raymond Water Works	Raymond		44
Mutual Water Companies			
Ashview Mutual Water Company	Chowchilla	8,000	
Bliss Ranch Company	Chowchilla	920	5
Bonita Mutual Water Company	Madera	9,202	
Columbia Canal Company	Firebaugh	16,560	
First Ventura-Madera Water Company	Madera	160	
Gravelly Ford Water Association, Inc.	Madera	2,500	
Heer Camp	Chowchilla	160	6
Justin Mutual Water Company	Chowchilla	4,510	
Kilcrease Camp Water Supply	Madera	320	1
Midvale Addition Water System	Madera		80
Redwood Acres Mutual Water Company	Madera		4
Sierra Linda Mutual Water Company	North Fork		4
Sierra Vista Mutual Water Company	Chowchilla	3,600	
Sugar Pine Properties Water Supply	Sugar Pine	10	40
Weatherly Mutual Water Company	North Fork		18
Irrigation Districts			
Madera Irrigation District	Madera	88,688	
Water Districts			
Chowchilla Water District	Chowchilla	62,574	
United States Bureau of Reclamation Projects			
Central Valley Project		(Sells at wholesale)	

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Mariposa County			
Mutual Water Companies			
Fish Camp Mutual Water Company	Mariposa		53
Wawona Mutual Water Company	Wawona		25
Public Utility Districts			
Mariposa Public Utility District	Mariposa		150
Merced County			
Municipal Waterworks			
Atwater	Atwater		910
Dos Palos	Dos Palos		520
Gustine	Gustine		610
Livingston	Livingston		440
Los Banos	Los Banos		1,300
Commercial Water Companies			
Crocker-Huffman Land and Water Company	Merced		4,723
East Side Canal and Irrigation Company	Stevinson	5,935	
Le Grand Water Company	Le Grand		85
Myrtle Acres Water Service	Winton		24
Snelling Water Works	Snelling		37
South Dos Palos Water Works	Dos Palos		80
Winton Water Works	Winton		125
Mutual Water Companies			
Castle Garden Homes, Inc.	Atwater		501
Eagle Field Water Association	South Dos Palos	6,038	
Hilmar Water Works	Hilmar		86
Occidental Canal Company	Gustine	50	
Planada Water Company	Planada		325
Red Top Camp Ranch	Merced	5,000	20
San Luis Canal Company	Los Banos	42,979	
Santa Nella Water Company	Gustine	73	
Sierra Vista Mutual Water Company	Chowchilla	(See Madera County)	
Irrigation Districts			
Central California Irrigation District	Los Banos	132,436	
El Nido Irrigation District	El Nido	7,295	
Merced Irrigation District	Merced	145,348	14
Turlock Irrigation District	Turlock	(See Stanislaus County)	
West Stanislaus Irrigation District	Westley	(See Stanislaus County)	
Water Districts			
Grass Lands Water District			
Mustang Water District	Gustine	281	
Panoche Water District	Dos Palos	(See Fresno County)	
Quinto Water District	Gustine	538	
Romero Water District	Volta	544	
San Luis Water District	Los Banos	13,152	83
Stevinson Water District	Stevinson	20,000	
United States Bureau of Reclamation Projects			
Central Valley Project		(Sells at wholesale)	
Modoc County			
Municipal Waterworks			
Alturas	Alturas		
Commercial Water Companies			
Hunt, W. H., Estate Company	Adin	(See Lassen County)	
Thomas and Bayne Ditch Company	Alturas	560	
Mutual Water Companies			
Willow Ranch Company	Willow Ranch		52
Irrigation Districts			
Big Valley Irrigation District	Bieber Station	(See Lassen County)	
Hot Springs Valley Irrigation District	Canby	4,000	
South Fork Irrigation District	Alturas	12,404	
Napa County			
Mutual Water Companies			
Haus Water Supply	Pope Valley		5
Nevada County			
Municipal Waterworks			
Grass Valley	Grass Valley		1,800
Nevada City	Nevada City		900
Commercial Water Companies			
Graniteville Water Works	Graniteville		19
Mutual Water Companies			
Washington Water Supply	Washington	20	21
Irrigation Districts			
Nevada Irrigation District	Grass Valley	19,807	2,493
Public Utility Districts			
Donner Summit Public Utility District	Soda Springs		
Placer County			
Municipal Waterworks			
Lincoln	Lincoln		850
Roseville	Roseville		3,339
Commercial Water Companies			
Dutch Flat Water Works	Dutch Flat		92
Frey Water Company	Weimar		24
McGee Irrigation Company	Applegate	40	8
Pacific Gas and Electric Company	Auburn, Colfax, Loomis, Newcastle, Rocklin		2,304
Mutual Water Companies			
Morgan Tract Water Users Association	Auburn		20
Timber Hills Water Users	Weimar	20	10
Irrigation Districts			
Camp Far West Irrigation District	Sheridan	2,085	
Citrus Heights Irrigation District	Citrus Heights	(See Sacramento County)	
Nevada Irrigation District	Grass Valley	(See Nevada County)	
Water Districts			
Meadow Vista Water District	Applegate		125
Public Utility Districts			
Donner Summit Public Utility District	Soda Springs	(See Nevada County)	
Foresthill Public Utility District	Foresthill	300	
Community Services Districts			
San Juan Suburban Water District	Citrus Heights	(See Sacramento County)	
Plumas County			
Commercial Water Companies			
Bidwell Water Company	Greenville		379
Meadow Valley Guest Ranch	Meadow Valley	26	10
Portola Water Company, Inc.	Portola		680
Quincy Water Company	Quincy	207	477
Sorsoli Water Company	Crescent Mills		56
Sacramento County			
Municipal Waterworks			
Sacramento	Sacramento		39,794
Commercial Water Companies			
American River Water Service	Sacramento		70
Ben Ali Water Company	North Sacramento		4,350
Capitol Accommodations, Inc.	North Sacramento		1,050
Citizens Utilities Company of California	North Sacramento		4,932

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Sacramento County—Continued			
Commercial Water Companies—Continued			
Del Paso Water Company	Del Paso Manor		979
El Camino Water Company	North Sacramento		60
Elk Grove Water Works	Elk Grove		398
Freeport Water Company	Freeport		439
Fruitridge Vista Water Company	Sacramento		364
Hannum, Max, Water Service	Walnut Grove		88
Isleton Water Works	Isleton		298
K. P. Tract Water Company	Sacramento		11
Natomas Water Company	Folsom Natomas	6	500
Roland Water Company	Sacramento		16
Southern California Water Company	South Sacramento		3,286
Southland Water Company	Sacramento		30
Tallac Village Water Company	Sacramento		1,200
Mutual Water Companies			
Cosumnes Water and Irrigation Association	Sacramento	1,000	
Dunmovin Heights Mutual Water Company	Sacramento		22
Elkhorn Mutual Water Company	Sacramento	5,300	
Hidden River Vista Water Company	Carmichael		15
Natomas Central Mutual Water Company	Sacramento	7,799	
Natomas Riverside Mutual Water Company	Sacramento	20,174	
Noonans South Land Park Water Supply	Sacramento		25
Orangevale Water Company	Orangevale		650
Riverside Mutual Water Company	Sacramento	1,767	
South Land Park Terrace	Sacramento		35
Tokay Park Water Company, Inc.	Florin		10
County Water Districts			
Galt County Water District	Galt		400
Rio Linda County Water District	Rio Linda		260
Irrigation Districts			
Carmichael Irrigation District	Carmichael		2,027
Citrus Heights Irrigation District	Roseville	1,200	1,565
Elk Grove Irrigation District	Elk Grove	23,200	
Fair Oaks Irrigation District	Fair Oaks		1,535
Galt Irrigation District	Galt		
Reclamation Districts			
Reclamation District 3	Ryde	16,000	
Reclamation District 136	Walnut Grove	437	
Reclamation District 341	Rio Vista	10,348	
Reclamation District 364	Walnut Grove	1,369	
Reclamation District 407	Isleton	1,539	
Reclamation District 532	Isleton	1,969	
Reclamation District 551	Courtland	8,500	
Reclamation District 556	Walnut Grove	2,234	50
Reclamation District 563	Walnut Grove	4,584	
Reclamation District 744	Sacramento	1,500	24
Reclamation District 755	Courtland	384	12
Reclamation District 807	Walnut Grove	199	
Reclamation District 824	Sacramento	464	50
Reclamation District 1601	Rio Vista	3,617	
Reclamation District 2067	Rio Vista	7,049	
Water Districts			
Cosumnes River Water District	Michigan Bar	631	
Municipal Improvement Districts and County Maintenance Districts			
Arcade Oaks Terrace Maintenance District	Sacramento		18
Arden Park Vista Maintenance District	Sacramento		1,500
Land Park Water Maintenance District	Sacramento		220
Planehaven Water Maintenance District	Sacramento		100
Riverside Village Maintenance District	Sacramento		115
Sierra Oaks Unit No. 1 Maintenance District	Sacramento		65
Sierra Oaks Units 2 and 3 Maintenance District	Sacramento		80

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Sacramento County—Continued			
Community Services Districts			
San Juan Suburban Water District	Orangevale, etc.	(Sells at wholesale)	
Special Water Service Districts			
Sacramento County Water Agency		(Sells at wholesale)	
San Joaquin County			
Municipal Waterworks			
Lodi	Lodi		4,479
Manteca	Manteca		1,250
Ripon	Ripon		538
Tracy	Tracy		2,225
Commercial Water Companies			
California Water Service Company	Stockton		27,700
Escalon Water and Light Company	Escalon		490
Mayfair Water Company	Stockton		131
Oak Park Court Water Company	Stockton		63
Stockton Land Association, The	Stockton		263
West Lane Heights Water Company	Stockton		137
Mutual Water Companies			
Fremont Irrigation Association	Tracy	667	
Independent Mutual Water Company	Tracy	1,286	
Munro Orchard Water Company	Stockton	413	
Mutual Water Company No. 1 and No. 3	Banta		44
Paradise Mutual Water Company	Tracy	864	
San Joaquin River Water Users Company	Manteca	1,415	
Silva Gardens Mutual Water Company	Stockton		2
Thornton Water Company	Thornton	1,500	
Union Island Mutual Water Company	Tracy	1,400	
Woodbridge Water Users Association	Woodbridge	7,500	
Woods Irrigation Company	Stockton	6,298	
County Water Districts			
Ripon County Water District	Ripon		550
San Joaquin County Water District No. 1	Lockeford		190
San Joaquin County Water District No. 2	Victor		77
Irrigation Districts			
Banta-Carbona Irrigation District	Vernalis	14,491	
Byron-Bethany Irrigation District	Byron	(See Contra Costa County)	
Naglee-Burke Irrigation District	Tracy	2,455	
Oakdale Irrigation District	Oakdale	(See Stanislaus County)	
South San Joaquin Irrigation District	Manteca	63,842	
Tracy-Clover Irrigation District	Tracy	400	
West Side Irrigation District	Tracy	11,826	
West Stanislaus Irrigation District	Westley	(See Stanislaus County)	
Woodbridge Irrigation District	Lodi	15,177	
Reclamation Districts			
Reclamation District 404	Stockton	860	
Reclamation District 2023	Rio Vista	3,150	
Reclamation District 2027	Stockton	5,400	
Reclamation District 2028	Stockton	5,624	
Reclamation District 2030	Stockton	4,400	100
Reclamation District 2041	Stockton	1,205	
Reclamation District 2042	Stockton	2,200	
Reclamation District 2058	Banta	7,990	14
Reclamation District 2062	Banta	3,939	9
Reclamation District 2064	Manteca	3,000	
Reclamation District 2072	Stockton	1,856	
Reclamation District 2074	Stockton		1
Reclamation District 2075	Ripon	2,773	
Water Districts			
Plain View Water District	Tracy	4,147	

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
San Joaquin County—Continued			
Municipal Improvement Districts and County Maintenance Districts			
Colonial Heights Maintenance District	Stockton		150
Lincoln Village Maintenance District	Stockton		250
Water Conservation Districts			
North San Joaquin Water Conservation District	Lodi	40,000	5,000
Stockton and East San Joaquin Water Conservation District	Stockton	42,700	
Shasta County			
Municipal Waterworks			
Redding	Redding		3,654
Commercial Water Companies			
Anderson Water Company	Anderson		497
Castella Water Works	Castella		41
Cottonwood Water Works	Cottonwood		116
Fall River Mills Water Company	Fall River Mills		185
French Gulch Ditch System	French Gulch		
Happy Valley Water Company	Olinda	5,000	10
Johnson Park Water Works	Burney	5	54
Mutual Water Companies			
Bee Creek Ditch and Water Company	Ono	250	5
Bunker Hill Water System	Burney		8
Burney Subdivision Water Association No. 1	Burney		17
Excelsior Ditch	Oak Run	85	
Grover and Wilcox Ditch	Anderson	150	
Millville Ditch Company, Inc.	Millville	175	
Townsend Flat Water Ditch Company	Redding	340	
Verde Vale Water Company	Anderson	20	50
Wren Water System	Cottonwood		6
County Water Districts			
Buckeye County Water District	Redding		125
Burney County Water District	Burney	40	427
Irrigation Districts			
Anderson-Cottonwood Irrigation District	Anderson	19,320	
Public Utility Districts			
Enterprise Public Utility District	Redding		125
Shasta Dam Area Public Utility District	Project City		950
Summit City Public Utility District	Summit City		116
Sierra County			
Municipal Waterworks			
Loyalton	Loyalton		263
Commercial Water Companies			
Bachels Water Right	Goodyear Bar		10
Mutual Water Companies			
Sierra Valley Water Company	Sierraville	14,500	
Public Utility Districts			
Downieville Public Utility District	Downieville		100
Siskiyou County			
Municipal Waterworks			
Mount Shasta	Mount Shasta		840
Commercial Water Companies			
Dunsmuir Water Corporation	Dunsmuir		1,254
Shasta Retreat Water System	Dunsmuir		58
Mutual Water Companies			
McCloud Water Supply	McCloud		600
Pondosa Water Supply	Pondosa		60

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Solano County			
Municipal Waterworks			
Rio Vista	Rio Vista		591
Commercial Water Companies			
California Water Service Company	Dixon		661
Pacific Gas and Electric Company	Vacaville		794
Mutual Water Companies			
Collinsville Water Supply	Collinsville		16
Davis Ranches	Winters	660	3
Rockville Water Supply	Fairfield		20
Irrigation Districts			
Solano Irrigation District	Vacaville	17,283	
Reclamation Districts			
Reclamation District 501	Rio Vista	11,962	
Reclamation District 999	Walnut Grove	(See Yolo County)	
Reclamation District 2060	Rio Vista	4,301	
Reclamation District 2068	Dixon	9,913	
Special Water Service Districts			
Solano County Flood Control and Water Conservation District		(Sells at wholesale)	
United States Bureau of Reclamation Projects			
Solano Project		(Sells at wholesale)	
Stanislaus County			
Municipal Waterworks			
Modesto	Modesto		7,500
Oakdale	Oakdale		1,600
Turlock	Turlock		2,488
Commercial Water Companies			
Bumgardner, George, Water Company	Modesto		1,467
Ceres Water Works	Ceres		631
College Gardens Water Company	Modesto		163
Crows Landing Water Company	Crows Landing		130
Del Este Water Company	Empire, Modesto, Salida, Turlock, Waterford		6,413
Denair Water Works	Denair		170
El Solyo Water Company	Westley	4,000	
Keyes Water Company	Keyes		192
Knights Ferry Water Company	Knights Ferry	3	21
McQuary Water Company	Ceres		75
Mission Manor Water Company	Modesto-Ceres		35
Moore, Joseph A., Water Company	Modesto		296
Morrow Water Company	Ceres		56
Newman Water Works Company	Newman		603
Osterberg Water Works	Modesto		460
Patterson City Water Company	Patterson		709
Riverbank Water Company	Hughson, Riverbank		1,368
Vincent Water Company	Ceres		135
Mutual Water Companies			
Blewett Mutual Water Company	Vernalis	1,064	
El Terino Mutual Water Company	Modesto		22
Patterson Farm Labor Camp	Patterson		144
Patterson Water Company	Patterson	13,910	
Twin Oaks Irrigation Company	Patterson	2,400	
Westley Farm Labor Camp	Westley		248
White Lake Mutual Water Company	Westley	1,408	
Irrigation Districts			
Central California Irrigation District		(See Merced County)	
Modesto Irrigation District	Modesto	70,038	
Oakdale Irrigation District	Oakdale	56,918	
Turlock Irrigation District	Turlock	163,735	
Waterford Irrigation District	Waterford	6,700	
West Stanislaus Irrigation District	Westley	24,861	

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Stanislaus County—Continued			
Reclamation Districts			
Reclamation District 2031	Modesto	3,000	10
Water Districts			
Davis Water District	Newman	100	
Del Puerto Water District	Patterson	3,408	
Foothill Water District	Newman	1,123	
Hospital Water District	Westley	5,260	
Kern Canon Water District	Westley	1,200	
Orestimba Water District	Crows Landing	4,320	
Rock Creek Water District	Farmington	700	
Salado Water District	Patterson	2,220	
Sunflower Water District	Crows Landing	500	
United States Bureau of Reclamation Projects			
Central Valley Project		(Sells at wholesale)	
Sutter County			
Municipal Waterworks			
Live Oak	Live Oak		211
Yuba City	Yuba City		3,102
Commercial Water Companies			
Sutter Butte Canal Company		(See Butte County)	
Mutual Water Companies			
Butte Slough Irrigation Company	Colusa	4,712	
Garden Highway Mutual Water Company	Yuba City	3,100	
Hillcrest Mutual Water Company	Yuba City		15
Meridian Farms Water Company	Meridian	8,284	
Natomas Central Mutual Water Company		(See Sacramento County)	
Natomas Riverside Mutual Water Company		(See Sacramento County)	
Sutter Mutual Water Company	Robbins	47,785	
Tisdale Irrigation and Drainage Company	Grimes	1,155	
Reclamation Districts			
Reclamation District 817	Wheatland	(See Yuba County)	
Reclamation District 1004		(See Colusa County)	
Water Districts			
Oswald Water District	Yuba City	640	
Sutter Extension Water District		10,683	
Municipal Improvement Districts and County Maintenance Districts			
Hillcrest Tract Improvement District	Yuba City	13	15
Tehama County			
Municipal Waterworks			
Corning	Corning		850
Red Bluff	Red Bluff		1,575
Tehama	Tehama		75
Commercial Water Companies			
Gerber Water Works	Gerber		215
Las Flores Water Works	Las Flores		30
Los Molinos Water Works	Los Molinos		166
Mineral Water System	Mineral		50
Mutual Water Companies			
Bend Water Users	Bend	360	
Coneland Water Company	Los Molinos	350	
Corning Irrigation Company	Corning	1,000	
Los Molinos Mutual Water Company	Los Molinos	18,000	
Stanford Vina Ranch Irrigation Company	Vina	5,412	

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Tehama County—Continued			
Irrigation Districts			
Anderson-Cottonwood Irrigation District	Anderson	(See Shasta County)	
Deer Creek Irrigation District	Corning	1,890	
El Camino Irrigation District	Tehama	4,500	
Tulare County			
Municipal Waterworks			
Dinuba	Dinuba		1,595
Exeter	Exeter		1,264
Lindsay	Lindsay		1,650
Porterville	Porterville		2,163
Tulare	Tulare		3,838
Woodlake	Woodlake	300	700
Commercial Water Companies			
Berrysen Water Company	Visalia		47
California Water Service Company	Visalia		5,514
Cook's Water System	Poplar		171
Ducor Water Company	Ducor		41
Farmersville Water Company	Farmersville	35	90
Foothill Ditch Company	Exeter	2,100	
Ivanhoe Water Company	Ivanhoe		479
Lemon Cove Water Company	Lemon Cove		33
Marshall Water Company	Farmersville		
North Tulare Water Company	Tulare		70
Phillips Water Company	Earlimart		30
Pine Flat Water Company	California Hot Springs		87
Wilson Water System	Earlimart		312
Mutual Water Companies			
Alta Vista Water Company	Porterville	185	
Antelope Heights Water and Irrigating Company	Woodlake	380	
Ball and Harris Ditch Company	Porterville	480	
Bedel Mutual Water Company	Visalia		36
Berrysen Mutual Water Company	Visalia		47
Big Stump Trailer Court	Porterville		12
Blachern Water Company	Porterville	50	
Bliss Ditch Company	Tulare		64
Bonnie Brae Ditch	Exeter	1,375	
Brundage Ditch	Three Rivers	132	
Bynum, Roy	Porterville		5
Campbell Moreland Ditch Company	Porterville	1,205	
Canby Mutual Water Company	Canby		19
Cedar Slope Mutual Water Company	Porterville		14
Central Mutual Water Company	Porterville	20	24
Churchill Camp	Tulare		20
Consolidated Peoples Ditch Company	Exeter	20,000	
Copo De Oro Water Company	Porterville	109	
Cottonwood Ditch Association	Ivanhoe	504	
Covina-Ducor Water Company	Ducor	80	
Deer Creek Water Company	Porterville	100	3
Dennison Ditch Company	Springville		
Douglas Drive and Belleview	Porterville		12
Earlimart Mutual Water Company, Inc.	Earlimart		160
East Orosi Water System	Orosi		40
Elderwood Water Company	Woodlake	167	
Elk Bayou Ditch Company	Tulare	4,000	40
Evans Ditch Company	Visalia	2,670	
Fairways Tract Water Company	Porterville	10	2
Farmers Ditch Company	Tulare	8,500	100
Fleming Ditch Company	Visalia	1,290	
Garden City Irrigation Company	Porterville	177	
Gilliam-McGee Ditch	Porterville	308	
Goshen Ditch Company	Goshen	530	
Graham and Osborne Ditch Company	Springville	500	
Grant, Martin, Cabins	Tulare		30
Hamilton Ditch	Woodlake	170	
Hawkeye Ditch Company	Lemon Cove	300	
Hillside Mutual Water Company	Woodlake	85	
Hilo Water Company	Porterville	90	
Honora Water Company	Lemon Cove	500	
Hubbs and Miner Ditch	Porterville	1,810	
Jack Ranch Summer Resort	Posey	5	16

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Tulare County—Continued			
Mutual Water Companies—Continued			
Jennings Ditch Water Company	Visalia	2,300	
Kaweah Lemon Company	Lemon Cove	650	23
Kaweah River Acres Mutual Water Company	Three Rivers		3
Kelly Ditch Company	Three Rivers	150	
Laspina Mutual Water Company	Tulare	10	35
Lemon Cove Ditch Company	Lemon Cove	1,200	
Lindsay Heights Water Company	Lindsay	183	
Linnell Housing Water Supply	Linnell	25	170
Little Pioneer Ditch Company	Woodville	209	
Lois Water Company	Porterville	20	1
Long's Canal	Woodlake	325	
Lovelace Ditch Company	Three Rivers	100	
Marks-Rice Ditch	Lemon Cove	100	
Matheny Mutual Water Company	Tulare	2	8
Mathews Ditch Company	Visalia	2,000	
Miami Well Company, Inc.	Porterville	120	5
Modoc Ditch Company	Visalia	5,000	
Monache Water Company	Porterville	171	
Mount Whitney Ditch and Water Company	Springville	300	
North Tulare Subdivision	Tulare		72
Oakes Ditch Company	Visalia	920	
Oro Water Company	Porterville	59	
Persian Ditch Company	Tulare	3,350	
Pioneer Water Company	Porterville	1,738	
Pleasant Valley Canal Company	Porterville	700	
Poplar Irrigation Company	Porterville	8,308	
Porter Slough Ditch Company	Porterville	1,038	
Redbanks Mutual Water Company	Woodlake	800	
Rhodes and Fine Ditch Company	Porterville	1,034	
Richgrove Mutual Water Company	Richgrove		150
Riverside Water Company	Porterville	100	
River Way Ranch	Three Rivers	12	
Rosedale Water Company	Porterville	172	
Saint Johns Ditch Company	Visalia	590	
Saint Johns River Mutual Water Company	Woodlake	558	1
South Tule Independent Ditch Company	Porterville	500	
Stivers Water Agency	Woodlake		10
Stockton Ditch Company	Woodville	800	
Sunnyside Water Company	Porterville	145	
Sweeney Ditch	Woodlake	165	
Thermal Water Company	Ducor	182	
Tipton Mutual Water Company	Tipton		225
Tooleville Non-Profit Water System	Tulare		65
Tract 99 Mutual Water Company	Porterville		134
Tulare Irrigation Company	Visalia	3,000	
Tule River Riparianists, Inc.	Porterville	5,909	
Uphill Ditch Company	Visalia	3,000	
Visalia and Kaweah Water Company	Visalia	10,000	
Wallace Ranch Water Company	Lemon Cove	1,000	
Watson Ditch Company	Visalia	3,400	
Williams Mutual Water Company	Porterville	40	24
Woodlake Valley Mutual Water Company	Woodlake	135	
Wutchumna Water Company	Visalia	30,000	
Yettem Seville Water Association	Yettem	3,290	
Irrigation Districts			
Alpaugh Irrigation District	Earlimart	8,131	264
Alta Irrigation District	Reedley	110,103	
Consolidated Irrigation District	Selma	(See Fresno County)	
Delano-Earlimart Irrigation District	Earlimart	8,566	
Exeter Irrigation District	Exeter	11,000	
Hills Valley Irrigation District	Orange Cove	(See Fresno County)	
Ivanhoe Irrigation District	Ivanhoe	9,762	
Lindmore Irrigation District	Strathmore	21,100	
Lindsay-Strathmore Irrigation District	Lindsay	9,465	600
Lower Tule River Irrigation District	Pixley	74,685	
Irrigation Districts—Continued			
Orange Cove Irrigation District	Orange Cove	(See Fresno County)	
Porterville Irrigation District	Porterville	14,351	
Saucelito Irrigation District	Terra Bella	15,965	
Stone Corral Irrigation District	Orosi	4,045	
Terra Bella Irrigation District	Terra Bella	3,018	484
Tulare Irrigation District	Tulare	66,313	
Vandalia Irrigation District	Porterville	1,100	42
Public Utility Districts			
Cutler Public Utility District	Cutler		225
Strathmore Public Utility District	Strathmore		250
Woodlake Public Utility District	Woodlake	300	700
Woodville Public Utility District	Woodville		160
Community Services Districts			
London Community Service District	Dinuba		31
Lovell Community Services District	Visalia	3,500	
United States Bureau of Reclamation Projects			
Central Valley Project		(Sells at wholesale)	
Tuolumne County			
Commercial Water Companies			
Pacific Gas and Electric Company	Jamestown, Sonora, Tuolumne		1,798
Mutual Water Companies			
Lilac Terrace Subdivision	Sonora		12
Long Barn Property Owners Corporation	Long Barn		90
Pinecrest Permittees Association	Pinecrest		387
Schoettgun Water Supply	Columbia	25	9
Slide Inn Mutual Water Association	Long Barn		30
County Water Districts			
Tuolumne County Water District No. 1	Twain Harte		692
Yolo County			
Municipal Waterworks			
Davis	Davis		1,290
Winters	Winters		418
Woodland	Woodland		2,998
Commercial Water Companies			
Clear Lake Water Company	Esparto, etc.	26,090	
Washington Water and Light Company	Broderick, Bryte, West Sacramento		2,129
West Sacramento Water Company	West Sacramento		412
Mutual Water Companies			
Capay Valley Ditch Company	Capay	1,280	
Linden Acres Water Supply	West Sacramento		82
Rumsey Ditch Company	Rumsey	158	
Sweetwater Company	Dixon	2,440	
County Waterworks Districts			
Yolo County Waterworks District No. 1	Esparto		183
Reclamation Districts			
Reclamation District 108	Dunnigan	(See Colusa County)	
Reclamation District 150	Sacramento	5,000	83
Reclamation District 307	Clarksburg	6,000	
Reclamation District 999	Clarksburg	23,335	300
Reclamation District 2035	Woodland	7,418	
Reclamation District 2068	Dixon	(See Solano County)	

WATER SERVICE AGENCIES, CENTRAL VALLEY AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Yuba County			
Municipal Waterworks			
Wheatland	Wheatland		300
Commercial Water Companies			
California Water Service Company			2,651
Camptonville Water Service	Camptonville	20	50
Dententers Water Service	Marysville		180
Linda Center Water System	Marysville		52
Yuba Investment Company	Browns Valley		7
Mutual Water Companies			
Challenge Water Supply	Challenge		65
Hallwood Irrigation Company	Marysville	7,036	
Plumas Mutual Water Company	Marysville	1,244	
Yuba County—Continued			
Irrigation Districts			
Browns Valley Irrigation District	Browns Valley	3,300	
Camp Far West Irrigation District	Sheridan	(See Placer County)	
Cordua Irrigation District	Marysville	5,090	
Reclamation Districts			
Reclamation District No. 10	Marysville	9,800	
Reclamation District 817	Wheatland	4,000	40
Water Districts			
Wheatland Water District	Wheatland	8,000	
Public Utility Districts			
Olivehurst Public Utility District	Marysville		686

WATER SERVICE AGENCIES, LAHONTAN AREA

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
El Dorado County			
Commercial Water Companies			
Globin, Frank	Al Tahoe, Bijou Pines		304
Lakeside Lodge Utility	Stateline		27
Pinewood Water Company	Bijou		14
Tahoe Cedars Water Company	Tahoma		92
Tahoe Sierra Water Company	Bijou	228	68
Mutual Water Companies			
Camp Richardson Water Supply	Camp Richardson		3
Fallen Leaf Mutual Water Company	Fallen Leaf		50
Lakeside Park Association	Placerville		95
Meeks Bay Resort	Meeks Bay		60
Tahoe Fifty Subdivision	Tahoe	18	
Water Districts			
Rubicon Water District	Rubicon Beach		10
Inyo County			
Municipal Waterworks			
Bishop	Bishop		600
Commercial Water Companies			
Independence Water Company	Independence		296
Lone Pine Water Company	Lone Pine		430
Smith, A. T., Water Company	Keeler		37
Mutual Water Companies			
Bishop Creek Ditch Company	Bishop	10	
Bishop Creek Water Association	Bishop	8,000	
Tecopa Water Supply	Tecopa		30
Kern County			
Commercial Water Companies			
Inyokern Water Service	Inyokern		140
Randsburg Water Company	Randsburg, Johannesburg		259
Ridgecrest Water Supply	Ridgecrest		468
Rocket Town Water Company, Inc.	Ridgecrest		2
Rosamond Water Company	Rosamond		134
Mutual Water Companies			
China Lake Mutual Water Company	Ridgecrest		8
Citizens Mutual Water Company	Boron	600	84
Desert Sands Water Cooperative, Inc.	Ridgecrest		9
Ridgecrest Mutual Water Company	Ridgecrest		125
Surplus Water Company	Boron		68
Valley Acres Mutual Water Company	Inyokern	25	9
Community Services Districts			
Boron Community Services District	Boron		62
Lassen County			
Commercial Water Companies			
California-Pacific Utilities Company	Susanville		1,871
Mutual Water Companies			
Lassen Irrigation Company	Standish	5,000	
Irrigation Districts			
Tule Irrigation District	Susanville		
Los Angeles County			
Commercial Water Companies			
B. V. Water Company, Inc.	Lancaster-Palmdale		196
Bagstad, Chester C.	Littlerock		12
Mutual Water Companies			
Altura Tract Association	Palmdale	30	22
Antelope Center Water Association	Palmdale	40	30
Antelope Mutual Water Company	Lancaster	5	25
Antelope Park Mutual Water Company	Lancaster		42
Averydale Mutual Water Company	Lancaster	120	38
Bellview Mutual Water Company	Lancaster		43
Big Rock Mutual Water Company	Llano	60	
Los Angeles County—Continued			
Mutual Water Companies—Continued			
Calivalli Mutual Water Company	Littlerock	1,225	
Deep River Water Company	Palmdale		16
Desacres Water Company	Palmdale		15
El Dorado Mutual Water Company	Palmdale		200
Fifty-eight Mutual Water Company	Littlerock	150	
Lake Elizabeth Mutual Water Company	Lancaster		8
Lancaster Water Company	Lancaster		15
Land Projects Mutual Water Company	Lancaster	50	45
Landale Mutual Water Company	Lancaster		15
Leona Valley Mutual Water Company	Palmdale		78
Mountain View Farms Water Company	Lancaster	300	18
Palmdale Ranchos Mutual Water Company	Palmdale	37	47
Palm Ranch Mutual Water Company	Lancaster	1,040	325
Pearblossom Heights Mutual Water Company, Inc.	Pearblossom	11	95
Rock Creek Water Corporation	Pearblossom	500	
Section 29 Mutual Water Company	Lancaster	180	5
Shadow Mountain Mutual Water Company	Palmdale	50	16
Sierra Mutual Water Company, Inc.	Lancaster		12
Sunnyside Farms Mutual Water Company	Lancaster	180	164
Sunnyvale Mutual Water Company	Littlerock	150	24
West Side Park Mutual Water Company	Palmdale		53
White Fence Farms Mutual Water Company	Lancaster	640	41
White Fence Farms Mutual Water Company No. 2	Lancaster	640	25
Wilsona Gardens Mutual Water Company	Lancaster		11
Irrigation Districts			
Littlerock Creek Irrigation District	Littlerock	1,036	227
Palmdale Irrigation District	Palmdale	180	800
County Waterworks District			
Los Angeles County Waterworks District No. 4 (Lancaster)	Lancaster	200	2,175
Los Angeles County Waterworks District No. 23 (Laneaster Heights)	Lancaster	25	139
Modoc County			
Mutual Water Companies			
Patterson Water Company	Cedarville	1,750	
Mono County			
Mutual Water Companies			
Antelope Valley Mutual Water Company	Coleville	6,129	
Sierra Land and Water Company	Leevining	12,000	
Public Utility Districts			
June Lake Fire District	June Lake		1,000
Nevada County			
Commercial Water Companies			
Sanders and Gebhart Water Company	Truckee		22
Public Utility Districts			
Truckee Public Utility District	Truckee		300
Placer County			
Commercial Water Companies			
Carnelian Bay Water Company	Carnelian Bay		65
Fulton Water Company	Lake Forest		40
Lake Forest Water Company	Lake Forest		60
Linkford Water Company	Tahoe Vista		8
Madden Creek Water Company	Homewood		98
Mountain Springs Water Company	Agate Bay View		18
Tahoe Cedars Water Company	Tahoma		
Tahoe Tavern Heights Water System	Tahoe Tavern		11

WATER SERVICE AGENCIES, LAHONTAN AREA—Continued

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Placer County—Continued			
Commercial Water Companies—Continued			
Tahoe Park Water System	Tahoe City		123
Tahoe Pines Water Company	Tahoe Pines		84
Mutual Water Companies			
Brockway Water Company	Brockway		368
Cedar Flat Improvement Association	Tahoe City		100
Lake Forest Unit No. 3 Property Owners Association	Lake Forest		22
Murray Water Company	Tahoe Vista		13
Ridgewood Water System	Tahoe City		28
Short Water System	Tahoe City		4
Squaw Valley Mutual Water Company	Tahoe City	300	87
Sugar Bowl Mutual Water Company	Truckee		16
Timberland Subdivision Water System	Tahoe City		33
Ward Creek Water Company	Tahoe City		15
Ward Well Water Company	Tahoe City		51
San Bernardino County			
Commercial Water Companies			
Apple Valley Ranchos Water Company	Apple Valley		233
Arrowhead Manor Water Company	Lake Arrowhead		88
Arrowhead Utility Company	Lake Arrowhead		975
Hesperia Water Company	Hesperia		101
Lake Brook Park Water System	Lake Brook Park	160	263
Lake Gregory Water Company	Lake Gregory		387
Meadowbrook Water Association	Lake Arrowhead		77
Pacific Water Company	Arrowhead View, Victorville, Wags Tract		490
Randsburg Water Company	Red Mountain	(See Kern County)	
Running Springs Forest Water Company	Running Springs		9
Searles Domestic Water Company	Argus, Point of Rocks, Trona		792
San Bernardino County—Continued			
Commercial Water Companies—Continued			
Smithson Springs Water Company	Desert Springs		54
Southern California Water Company	Barstow		1,829
Sturnacle Water Company	Barstow		10
Swarthout Valley Water Company	Wrightwood		558
Westside Water Company	Barstow		140
Yermo Water Company	Yermo		60
Mutual Water Companies			
Adelanto Mutual Water Company	Adelanto		400
Agua Fria Mutual Service Company	Agua Fria		70
Alpine Water Users Association	Twin Peaks		300
Arrow Bear Mutual Water Company, Inc.	Arrowbear		150
Arrowhead Highlands Mutual Service Company	Arrowhead Highlands		100
Arrowhead View Water Corporation	Blue Jay		121
Arrowhead Villas Mutual Service Company	Sky Forest		263
Crestline Village Mutual Service Company	Crestline		1,700
Desert Knolls Mutual Water Company	Victorville	190	30
Green Valley Mutual Water Company	Green Valley Lake		325
Mountain Pioneer Mutual Water Company	Rimforest		18
Sheep Creek Water Company	Phelan	150	30
Valley of Enchantment Mutual Water Company	Crestline		400
County Water Districts			
Victorville County Water District	Victorville		806
County Waterworks Districts			
San Bernardino County Waterworks District No. 2	Adelanto		223

WATER SERVICE AGENCIES, COLORADO DESERT AREA

Name of water agency	Location, in or near	Area irrigated, in acres	Number of domestic services
Imperial County			
Municipal Waterworks			
Brawley	Brawley		2,171
Calexico	Calexico		1,275
El Centro	El Centro		2,937
Holtville	Holtville		700
Imperial	Imperial		
Westmorland	Westmorland		360
Commercial Water Companies			
Seeley Water System	Seeley		85
Southern California Water Company	Calipatria, Niland		568
Mutual Water Companies			
Oeotillo Mutual Water Company	El Centro		5
Winterhaven Water Company	Winterhaven		175
Irrigation Districts			
Bard Irrigation District	Bard	5,400	
Imperial Irrigation District	El Centro	391,714	
Palo Verde Irrigation District	Blythe	(See Riverside County)	
Public Utility Districts			
Heber Public Utility District	Heber	2,080	
United States Bureau of Reclamation Projects			
Yuma Project	Yuma	8,559 (Also sells at wholesale)	
Riverside County			
Municipal Waterworks			
Blythe	Blythe		900
Coachella	Coachella		573
Indio	Indio		1,077
Commercial Water Companies			
Bubbling Wells Water System, Inc.	Desert Hot Springs		2
Cabazon Water Company	Cabazon	20	133
Cathedral City Water Company	Cathedral City		374
City Water Company of Banning, California	Banning		2,381
Garnet Gardens Water Company	Garnet		48
Mecca Water and Development Company	North Palm Springs		59
Midway Water Service	Banning		40
Palm Desert Water Company			145
Palm Springs Outpost Water Company	Palm Springs		19
Palm Springs Water Company	Palm Springs		3,018
Rancho Mirage Water Company	Rancho Mirage		160
Thermal Water System	Thermal		88
Thunderbird Water Company	Palm Springs	120	17
Mutual Water Companies			
Acres Mutual Water Company	Indio		69
Auroratowne Mutual Water Company	Auroratowne		100
Banning Heights Mutual Water Company	Banning	635	35
Banning Heights Water Company	Banning	672	
Banning Water Company	Banning	1,000	2,260
Cathedral Canon Mutual Water Company	Cathedral City	50	
Country Club Water Company	Palm Springs		1
Cowgill Mutual Water Company	Thermal	80	2
Date Development Water Company	Coachella	160	1
Dateland Mutual Water Company	Indio	80	2
Date Palm Road Mutual Water Company	Palm Springs		8
Deglet Noor Mutual Water Company	Indio	295	
Del Sol Mutual Water Company	Indio	160	22
Desert Date Gardens Irrigation Company	Indio	33	8
Dos Palmas Mutual Water Company	Desert Hot Springs		12
Flying-H Mutual Water Company	Cathedral City		5
Riverside County—Continued			
Mutual Water Companies—Continued			
Hidden Springs Ranch Mutual Water Company	Thousand Palms	1,400	12
Los Ranchitos Mutual Water Company, Ltd.	Cathedral City	25	5
North Indio Mutual Water Corporation	Indio		98
One Twenty Mutual Water Company	Indio		24
Palm Dell Mutual Water Company	Palm Desert		4
Palm Desert Water Company	Indio		127
Palm Springs Vista Mutual Water Company	Palm Springs	40	1
Panorama Mutual Water Company	Palm Desert	40	15
Rancho Myoma Mutual Water Company	Indio	100	3
Rancho Vista Mutual Water Company	Palm Springs	120	350
San Jacinto Mutual Water Company	Indio	80	7
Santa Carmelita Mutual Water Company	Indio		162
Shangri-la Palms Mutual Water Company	Palm Springs	113	75
Whitewater Mutual Water Company	Palm Springs	725	
Wontam Mutual Water Company	Cathedral City	130	127
County Water Districts			
Coachella Valley County Water District	Indio	27,312	
Desert Hot Springs County Water District	Desert Hot Springs		468
Irrigation Districts			
Palo Verde Irrigation District	Blythe	59,571	
Community Services Districts			
Palm Desert Community Services District	Palm Village	220	159
San Bernardino County			
Municipal Waterworks			
Needles	Needles		1,024
Commercial Water Companies			
Abell Water Company	Twentynine Palms		347
Joshua Tree Service Company	Joshua Tree		207
Pacific Water Company	Morongo-Twentynine Palms		902
Sunfair Water Company	Joshua Tree		50
Vidal Water Company	Vidal		6
Yucca Water Company, Ltd.	Yucca Valley		243
Mutual Water Companies			
Condor Mutual Water Company, Inc.	Twentynine Palms		28
Desert Rancho Mutual Water Company	Joshua Tree		6
Hesperia Water Company	Hesperia	75	109
Lucerne Valley Mutual Water Company	Lucerne Valley		8
Mesa Land and Water Company	Joshua Tree		2
Paradise Valley Mutual Water Company	Paradise Valley	300	5
San Diego County			
Commercial Water Companies			
Borrego Springs Water Company	Borrego Valley		66
Jacumba Water Company	Jacumba		110
Live Oaks Spring Water and Power Company	Pine Valley		86
Mutual Water Companies			
Borrego Village Mutual Water Company	Borrego Springs	40	10
Rancho Borrego Mutual Water Company	Borrego Springs		1
Tub Canyon Mutual Water Company	Borrego Valley		67

APPENDIX C

DESCRIPTION OF HYDROGRAPHIC UNITS

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DESCRIPTION OF HYDROGRAPHIC UNITS

NORTH COASTAL AREA

Hydrographic Unit 1—Tule Lake—This unit consists largely of the California portion of areas tributary to the Klamath River Basin, above the U. S. Geological Survey gaging station near Copco. The portion of the natural watershed of the Klamath River in this unit is not large. A more important segment consists of the California portion of the Lost River drainage basin, which has been artificially connected with the Klamath River by a canal for the purpose of reclaiming the bed of Tule Lake. Furthermore, certain other entirely self-contained basins are included in this unit, since these would drain into the Klamath River under conditions of extremely high runoff. These are Butte Valley, Red Rock Basin, and Oklahoma Basin.

Hydrographic Unit 2—Shasta Valley—This unit consists of the drainage basin of the Shasta River above the U. S. Geological Survey gage near Yreka, 0.5 mile above its mouth.

Hydrographic Unit 3—Scott Valley—This unit consists of that portion of the Scott River Basin above the U. S. Geological Survey gage near Fort Jones.

Hydrographic Unit 4—Upper Klamath—This unit consists of the California portion of the Klamath River Basin between the U. S. Geological Survey gaging stations near Copco and near Seiad Valley, with the exception of the Shasta and Scott River drainage basins above the U. S. G. S. gaging stations on those streams.

Hydrographic Unit 5—Trinity—This unit consists of the entire drainage basin of the Trinity River above its month.

Hydrographic Unit 6—Klamath—This unit consists of the California portion of the Klamath River Basin downstream from Seiad Valley, with the exception of the drainage basin of the Trinity River.

Hydrographic Unit 7—Rogue—This unit consists of those lands in California draining northward into the Rogue and Winchuck Rivers in Oregon, together with the drainage basin of Gilbert Creek flowing directly into the Pacific Ocean north of the Smith River.

Hydrographic Unit 8—Del Norte—This unit includes the California portion of the Smith River Basin, as well as minor drainage basins directly tributary to the Pacific Ocean between the Smith and Klamath River Basins, including Jordan, Elk, Cushing, Nickel, Damnation, and Wilson Creeks.

Hydrographic Unit 9—Redwood Creek—This unit includes the drainage basin of Redwood Creek, as well as the drainage basins of smaller streams between the Klamath River and Redwood Creek Basins, including, Ossagon, Butler, Home, and Squashan Creeks.

Hydrographic Unit 10—Mad River—This unit includes the drainage basin of the Mad River, as well as the drainage basins of smaller streams directly tributary to the Pacific Ocean between the Redwood Creek and Mad River Basins, including Freshwater, Stone, and Big Lagoons (Maple Creek), Luffenholz Creek, Little River, and Strawberry and Widow White Creeks, as well as the City of Arcata.

Hydrographic Unit 11—Upper Eel—This unit consists of that portion of the drainage basin of the Eel River and its tributaries upstream from the U. S. Geological Survey gage at Scotia.

Hydrographic Unit 12—Humboldt—This unit consists of the Eel River drainage basin below Scotia, including that of the Van Duzen River, areas tributary to Humboldt Bay from the drainage basin of James Creek to that of Salmon Creek, and basins of other streams draining directly into the Pacific Ocean between the Mad and Mattole River Basins, from Fleenes Creek on the north to Peter B Gulch on the south, with the exception of the City of Arcata.

Hydrographic Unit 13—Mattole—This unit includes the drainage basin of the Mattole River, as well as the basins of the Fourmile Creek group, consisting of streams directly tributary to the ocean south of the Mattole River from Fourmile Creek to Quail Gulch.

Hydrographic Unit 14—Mendocino Coast—This unit consists of several river and stream group basins, from the basin of Jackass Creek in the Tennile River group on the north to that of Russian Gulch in the Stewart's Point group on the south.

Hydrographic Unit 15—Russian River—This unit consists of the entire drainage basin of the Russian River to its mouth.

Hydrographic Unit 16—Bodega—This unit consists of the watersheds of minor streams entering either the Pacific Ocean or Bodega or Tomales Bays, between the Russian River and the south drainage boundary of Grand Canyon near Point Reyes Station.

SAN FRANCISCO BAY AREA

Hydrographic Unit 1—Marin-Sonoma—This unit consists of those drainage basins in Marin and Sonoma Counties lying within the San Francisco Bay Area from that of Tomasini Canyon, a tributary of

Lagunitas Creek, to and including that of Sonoma Creek.

Hydrographic Unit 2—Napa Valley—This unit consists of the drainage basin of the Napa River.

Hydrographic Unit 3—Solano—This unit consists of that portion of the San Francisco Bay Area east of the Napa River drainage basin and north of Suisun Bay, from the drainage basin of an unnamed stream tributary to Glen Cove on the west to that of Montezuma Slough on the east.

Hydrographic Unit 4—Contra Costa—This unit consists of that portion of Contra Costa County draining directly into San Francisco, San Pablo, and Suisun Bays, from El Cerrito Creek to the basin of Kirker Creek, inclusive.

Hydrographic Unit 5—Livermore Valley—This unit consists of the drainage basin of Alameda Creek above the U. S. Geological Survey gaging station near Niles.

Hydrographic Unit 6 — Alameda-Bayside — This unit includes that portion of Alameda County directly bordering on San Francisco Bay, from El Cerrito Creek on the north to Scott Creek on the south, including that portion of the drainage basin of Alameda Creek below the U. S. Geological Survey gaging station near Niles. The portions of the drainage basins of San Leandro and San Lorenzo Creeks in Contra Costa County are also included in this unit.

Hydrographic Unit 7—Santa Clara Valley—This unit consists of all of Santa Clara County in the San Francisco Bay Area, except the portion tributary to Alameda Creek.

Hydrographic Unit 8—San Mateo-Bayside—This unit consists of that portion of San Mateo County draining into San Francisco Bay.

Hydrographic Unit 9—San Mateo-Coastal—This unit includes that portion of San Mateo County draining into the Pacific Ocean, south to and including the drainage basin of Pescadero Creek. This unit also includes the portion of the Pescadero Creek Basin in Santa Cruz County.

Hydrographic Unit 10—San Francisco—This unit consists of the City and County of San Francisco.

CENTRAL COASTAL AREA

Hydrographic Unit 1—Santa Cruz—This unit consists of the drainage basins of streams tributary to the Pacific Ocean and Monterey Bay from the basin of Arroyo de los Frijoles in San Mateo County on the north to the northerly boundaries of the basins of Watsonville and Harkins Sloughs on the south.

Hydrographic Unit 2—San Benito—This unit consists of the drainage basins tributary to the Pajaro River above the U. S. Geological Survey gage near Chittenden, including those of the San Benito River, and Santa Anita, Pacheco, Llagas, and Uvas Creeks.

Hydrographic Unit 3—Pajaro—This unit consists of those lands draining to the Pajaro River between the gage near Chittenden and the mouth of the river, including the basins of Watsonville and Harkins Sloughs on the north and McClusky Slough on the south.

Hydrographic Unit 4—Upper Salinas—This unit includes the entire drainage basin of the Salinas River above the railroad station of Wunpost, as well as the foothill and mountainous portions downstream from Wunpost, lying above the contact between the erosion surfaces of the hills, and the terrace, bench, and valley fill depositional areas, with the exception of the drainage basin of Toro Creek near Spreckels.

Hydrographic Unit 5—Lower Salinas—This unit includes the floor of the Salinas River Valley downstream from Wunpost, lying below the contact between the erosion surfaces of the hills, and the terrace, bench, and valley fill depositional areas, the drainage basins of Toro Creek, a tributary of Salinas River near Spreckels, and of Elkhorn Slough north of the Salinas River, and lands directly tributary to Monterey Bay from the Salinas River south to the northerly boundary of the Canyon Del Rey group at Fort Ord.

Hydrographic Unit 6—Carmel—This unit consists of the drainage basins of the Carmel River and the Canyon Del Rey stream group. The streams of the latter group enter Monterey Bay and the Pacific Ocean between Fort Ord and the Carmel River.

Hydrographic Unit 7—Monterey Coast—This unit consists of the drainage basins of streams tributary to Carmel Bay and the Pacific Ocean south of the Carmel River Basin, from San Jose Creek on the north to an unnamed creek just north of Estero Point, on the south.

Hydrographic Unit 8—San Luis Obispo—This unit consists of drainage basins tributary to the Pacific Ocean from the basins of Ellysly and Villa Creeks on the north to that of Black Lake Canyon on the south.

Hydrographic Unit 9—Carrizo Plain—This unit consists of drainage basins of streams in southeastern San Luis Obispo County tributary to Soda Lake, usually a dry lake bed, with no outlet to the sea.

Hydrographic Unit 10—Santa Maria—This unit consists of the drainage basin of the Santa Maria River and of its major tributaries, the Cuyama and the Sisquoc Rivers, as well as the basin of Oso Flaco Creek which is tributary to a dune-locked lake somewhat north of the mouth of the Santa Maria River.

Hydrographic Unit 11—Santa Ynez—This unit consists of the drainage basins of the Santa Ynez River and San Antonio Creek, as well as those of certain minor streams directly tributary to the Pacific Ocean between the Santa Maria and Santa Ynez Rivers, from an unnamed creek entering the ocean at Mussel Rock to Canyon Tortuga.

Hydrographic Unit 12—Santa Barbara—This unit consists of the drainage basins of streams directly tributary to the Pacific Ocean and the Santa Barbara Channel from the basin of Bear Creek at Weser Spur to the southeastern boundary of the Rincon Creek Basin.

SOUTH COASTAL AREA

Hydrographic Unit 1—Ventura—This unit consists of the drainage basin of the Ventura River, as well as those of smaller streams directly tributary to the Pacific Ocean between Rincon Point (but not including the basin of Rincon Creek) and the easterly drainage boundary of Hall Canyon. The unit includes all of the City of Ventura.

Hydrographic Unit 2—Santa Clara-Calleguas—This unit consists of the drainage basins of the Santa Clara River and Calleguas Creek and their tributaries, as well as the Oxnard Plain lying between those streams, but draining directly to the Pacific Ocean. The upper part of the Santa Clara River Basin extends into Los Angeles County, and includes the Newhall-Saugus area.

Hydrographic Unit 3—Malibu—This unit consists of the drainage basins of streams in Ventura and Los Angeles Counties directly tributary to the Pacific Ocean, between Point Mugu and Topanga Beach, from La Jolla Canyon to Tuna Canyon.

Hydrographic Unit 4—San Gabriel Mountains—This unit consists of those portions of the drainage basins of the San Gabriel River and its tributaries, and of tributaries of the Los Angeles River, lying within the Angeles National Forest. There is an exception where the City of Los Angeles overlaps the national forest. In this area the city boundary is the southerly limit of the unit.

Hydrographic Unit 5—Upper Santa Ana—This unit includes the drainage basins of the Santa Ana River and its tributaries (including the San Jacinto River) above the Santa Ana Narrows at the Riverside-Orange county line. In addition, certain areas in eastern Los Angeles County are included, whose surface drainage is tributary to the San Gabriel River, but whose ground water basins are more intimately connected with the Santa Ana River Basin. These areas have been identified in the South Coastal Basin Investigation of the Division of Water Resources as the Claremont Heights, Live Oak, Pomona, and Spadra Basins.

Hydrographic Unit 6—Los Angeles—This unit consists essentially of the City of Los Angeles and neighboring cities and county areas from Santa Monica to Newport Beach, inclusive. It includes the portions of the drainage basins of the Los Angeles and San Gabriel Rivers and their tributaries lying south of the Angeles National Forest boundary except where the City of Los Angeles overlaps the national forest. In this area, the limit of the unit is the northerly boundary of the city. In addition, the unit includes the drainage basin of the Santa Ana River downstream from the Santa Ana Narrows, as well as areas directly tributary to the Pacific Ocean from the drainage basin of Topanga Canyon to Pelican Point two miles south of the entrance to Newport Bay. It does not include the Claremont Heights, Live Oak, Pomona, and Spadra Basins.

Hydrographic Unit 7—San Juan Capistrano—This unit consists of areas directly tributary to the Pacific Ocean from Pelican Point to, but not including, the drainage basin of the Santa Margarita River, including basins from Los Trancos Canyon on the north to Cockleburr Canyon on the south.

Hydrographic Unit 8—Santa Margarita-San Luis Rey—This unit consists of the drainage basins of the Santa Margarita and San Luis Rey Rivers and their tributaries, with the exception that the southerly boundary was drawn so as to exclude the Vista Irrigation District and to include the service area of the Carlsbad Mutual Water Company.

Hydrographic Unit 9—San Dieguito-Cottonwood—This unit consists of the drainage basin of Agua Hedionda Creek and the portions of the drainage basins of all streams in southern San Diego County tributary to the Pacific Ocean, from San Marcos Creek to the Tia Juana River, inclusive, east of the boundary of the San Diego Metropolitan Area. This boundary is delineated on sheets 7 and 8 of Plate 11. The northerly boundary of the unit is extended to include all of the Vista Irrigation District.

Hydrographic Unit 10—San Diego—This unit consists of the City of San Diego and neighboring cities and suburbs, as well as other nearby areas expected to be occupied by future expansion of the urban development centering on San Diego. The boundary of the unit was drawn on a series of rancho, township, section, and connecting lines so as to include the service areas of the San Dieguito and Santa Fe Irrigation Districts; most of El Cajon Valley; all of the gently rolling land east of San Diego, National City, and Chula Vista; and the Otay Mesa, east of San Ysidro. This boundary is delineated on sheets 7 and 8 of Plate 11.

CENTRAL VALLEY AREA

Hydrographic Unit 1—Goose Lake—This unit consists of the lands in California draining to Goose Lake. This drainage basin is tributary to the Pit River only in the case of an extremely wet series of years.

Hydrographic Unit 2—Pit River—This unit consists of the Pit River drainage basin to the junction of the Sacramento River, with the exception of the Goose Lake and McCloud River drainage basins.

Hydrographic Unit 3—McCloud River—This unit consists of the entire McCloud River drainage basin above the mouth of the river.

Hydrographic Unit 4—Sacramento River above Shasta Dam—This unit consists of the drainage basin of the main Sacramento River upstream from Shasta Dam, and exclusive of the Pit and McCloud River drainage basins.

Hydrographic Unit 5—West Side, Shasta Dam to Cottonwood Creek—This unit consists of the drainage basins of the tributaries entering the Sacramento River from the west between Shasta Dam and the U. S. Geological Survey gage near Red Bluff, excluding the City of Redding and the Anderson-Cottonwood Irrigation District.

Hydrographic Unit 6—East Side, Cow Creek to Paynes Creek—This unit consists of the drainage basins of those streams entering the Sacramento River from the east between Shasta Dam and the U. S. Geological Survey gage near Red Bluff, with the exception of a minor area in the Anderson-Cottonwood Irrigation District.

Hydrographic Unit 7—Red Bluff to Thomes Creek—This unit consists of the foothill and mountainous portions of drainage basins of streams from Dibble Creek to Moore Creek, inclusive, the latter a minor stream draining the base of the western foothills and entering the Sacramento River next upstream from Stony Creek. The easterly boundary of this unit is longitude 121° 15′ west.

Hydrographic Unit 8—Antelope Creek to Mud Creek—This unit consists of the mountainous and foothill portions of drainage basins tributary to the Sacramento River from the east, from Salt Creek to Mud Creek. The westerly boundary is approximately at the 300-foot contour.

Hydrographic Unit 9—Stony Creek—This unit includes all of the Stony Creek drainage basin above the Black Butte dam site, as well as the foothill portions of drainage basins south to the drainage boundary between Hunters Creek and Funks Creek. The easterly limit follows the line between Ranges 3 and 4 West to the line between Townships 20 and 21 North, thence along a series of section lines one and two miles west of the foregoing range line to the Glenn-Colusa county line.

Hydrographic Unit 10—Butte and Chico Creeks—This unit includes the mountainous and foothill portions of the drainage basins of Butte and Chico Creeks, as well as those of minor streams from Little Chico Creek to and including Ash Creek in Butte County. The easterly limit of the unit was drawn so as to follow the southern and eastern boundaries of the Paradise Irrigation District, thus placing all of the district in the unit. From north to south, the westerly limit of this unit follows section lines, longitude 121° 45′ west, the Chico-Oroville Road, and a line approximately following the Magalia Road.

Hydrographic Unit 11—Cortina Creek—This unit consists of the upstream portions of stream basins of the western foothills south from Funks Creek to, but not including, Cache Creek. The easterly limit of this unit was drawn to exclude the presently irrigated land on the floor of the Sacramento Valley. This line lies to the west of Highway 99W at a distance varying from less than one to more than six miles.

Hydrographic Unit 12—Feather River—This unit includes the entire drainage basin of the Feather River to and including Oroville (except that portion in the Paradise Irrigation District) as well as portions of the lower foothills directly tributary to the Sacramento Valley floor from the basin of Clear Creek (Butte County) to that of Schirmer Ravine, and an area including the Oroville-Wyandotte Irrigation District. The westerly limit of this unit follows the eastern and southern boundaries of the Paradise Irrigation District, the westerly boundary of the Clear Creek drainage basin, and the Lower Miocene Canal from the Coal Canyon Power House to the vicinity of Oroville. South of Oroville, this limit follows the Feather River and the line of a possible canal diverting from the river at an elevation of 125 feet. The southerly limit through the foothills coincides with the Butte-Yuba county line along Honcut Creek.

Hydrographic Unit 13—Yuba and Bear Rivers—This unit includes the entire drainage basins of the Yuba River above Englebright Dam and the Bear River above the Camp Far West Dam, as well as foothill areas directly tributary to the valley floor. Between the Yuba and Bear Rivers the westerly limit of this unit coincides with a possible canal line diverting from the Yuba River at an approximate elevation of 500 feet. South of the Bear River, the limit of this unit coincides with the westerly boundary of the Nevada Irrigation District. In the foothills, the southerly limit of Hydrographic Unit 13 coincides with the southerly boundary of the Auburn Ravine drainage basin. The northerly limit of the unit through the

foothills follows the Yuba-Butte county line along Honcut Creek.

Hydrographic Unit 14—Cache Creek—This unit includes the Cache Creek drainage basin above the point of diversion of the Capay Valley Ditch near Rumsey, as well as the mountain and foothill portions of minor stream drainage between the Cache and Putah Creek Basins lying above the service area of the Winters Ditch of the Clear Lake Water Company.

Hydrographic Unit 15—American River—This unit includes the drainage basin of the American River above Folsom Dam, as well as the Placer County portion of the foothill area directly tributary to the Sacramento Valley floor, above the service area of a possible Folsom North Canal diverting from the American River at an elevation of approximately 200 feet and extending to the south boundary of the Auburn Ravine drainage basin.

Hydrographic Unit 16—Putah Creek—This unit includes the drainage basin of Putah Creek above the proposed diversion point of the Solano Project main canal, at an elevation of about 175 feet, as well as those portions of foothill and mountain areas lying above the service area of that projected canal, south to the boundary of the San Francisco Bay Area.

Hydrographic Unit 17—Anderson-Cottonwood—This unit consists essentially of the City of Redding and the Anderson-Cottonwood Irrigation District.

Hydrographic Unit 18—Tehama—This unit consists of that portion of the west side Sacramento Valley floor lying between longitude 121° 15′ west and the Sacramento River. The southern limit of the unit coincides with the Tehama-Glenn county line.

Hydrographic Unit 19—Vina—This unit consists of that portion of the east side Sacramento Valley floor lying between the approximate 300-foot contour and the Sacramento River. The southerly limit of this unit lies along the course of Big Chico Creek.

Hydrographic Unit 20—Orland—This unit consists of the service area of the Orland Project constructed by the U. S. Bureau of Reclamation, and the remainder of the Sacramento Valley floor in Glenn County lying west of the Glenn-Colusa Irrigation District. The westerly limit of this unit follows the line between Ranges 3 and 4 West, south to the line between Townships 20 and 21 North, thence along a series of section lines one and two miles west of the range line mentioned, to the Glenn-Colusa county line.

Hydrographic Unit 21—Chico—This unit consists of that portion of the east side Sacramento Valley floor lying between the foothills and the Sacramento River. The easterly limit follows section lines, longitude 121° 45′ west, the Chico-Oroville Road, and a line approximately following the Magalia Road. The southerly limit of the unit lies along the Butte-Glenn county line from the Sacramento River to a point about five miles east of the river, thence along a road running easterly to the community of Nelson, and another running northeasterly to a junction with the Magalia Road.

Hydrographic Unit 22—Arbuckle—This unit consists of portions of the west side Sacramento Valley floor lying between the westerly boundary of the Glenn-Colusa Irrigation District and the Colusa Trough on the east, and the foothills on the west. The westerly limit of this unit follows an irregular line from one and more than six miles west of Highway 99W. The southerly limit of this unit lies along Cache Creek Slough between Yolo and Knights Landing.

Hydrographic Unit 23—Colusa Trough—This unit consists of that portion of the Sacramento Valley floor on both sides of the Sacramento River, from the point of diversion of the Central Irrigation Canal to the confluence of the Sacramento and Feather Rivers, whose main source of irrigation water is the Sacramento River itself. The westerly limit of this hydrographic unit coincides with the westerly boundary of the Glenn-Colusa Irrigation District to a point south of Williams, thence along the west line of lands served by water pumped from the Back Borrow Pit of the Colusa Trough, to Knights Landing, thence along the southwestern levee of the Knights Landing Ridge Cut to a point south of Grays Bend. The easterly limit lies somewhat east of Angel Slough from the Glenn-Butte county line to a point near the intersection of the Mt. Diablo Meridian with the line between Townships 18 and 19 North, thence along the Mt. Diablo Meridian to the channel of Butte Creek, along Butte Creek and Butte Slough to the east levee of the Sutter By-pass, and thence along that levee to Nelson Slough, near Nicolaus, where the line changes to the west levee of the by-pass.

Hydrographic Unit 24—Feather River to Butte Slough—This unit consists of that portion of the east side Sacramento Valley floor which receives the majority of its water supply from the Feather River between Oroville and Live Oak. The Sutter Buttes lie wholly within Unit 24. The northerly limit of this unit lies along the Butte-Glenn county line from the Sacramento River to a point about five miles east of the river, thence along a road running easterly to the community of Nelson, and another running northeasterly to the Magalia Road. The easterly limit follows a line approximately along Magalia Road, the lower Miocene Canal, the Feather River from Oroville to a possible canal diversion to the east at an elevation of 125 feet, thence along this possible canal, the Butte-Yuba county line westerly along Honcut Creek,

and the Sutter-Yuba county line along Feather River. The southerly limit coincides with the base of the foothills to the south of Sutter Buttes, with the west and east intercepting canals north of Sutter City, and with an extension of the line of these canals east to the Feather River. The westerly limit lies along the Mt. Diablo Meridian south to the channel of Butte Creek, and along Butte Creek and Butte Slough to the southerly limit.

Hydrographic Unit 25—Yuba—This unit consists of that portion of the east side Sacramento Valley floor lying between Sutter By-pass and the Feather River. This unit receives its major water supply from ground water. The northerly limit of this unit lies along the base of the foothills south of Sutter Buttes, along the west and east intercepting canals north of Sutter City, and along an extension of the line of these canals to the Feather River. The easterly limit is the Feather River and the westerly limit is the Sutter By-pass.

Hydrographic Unit 26—Marysville-Sheridan—This unit consists of that portion of the east side Sacramento Valley floor lying between the Feather River and the base of the eastern foothills. The northerly limit is Honcut Creek. The southern limit is a line two miles south of the line between Townships 12 and 13 North. The northern part of the easterly limit consists of the southerly part of a possible canal line diverting from the Feather River at an elevation of 125 feet. The central part is the line of a possible canal from the Yuba River diverting at an elevation of approximately 500 feet. The southern part of the easterly limit coincides with the westerly boundary of the Nevada Irrigation District. The westerly limit of this unit is the Feather River.

Hydrographic Unit 27—Woodland—This unit includes that portion of the west side Sacramento Valley floor, as well as the Capay Valley, receiving irrigation water from Cache Creek as well as from ground water. The easterly limit of this unit is the westerly boundary of Reclamation District 2035 and the west levee of Yolo By-pass. The southerly limit coincides with the Yolo-Solano county line along Putah Creek. The westerly limit is the limits of the service areas of the Clear Lake Water Company canals and of the Capay Valley Ditch. The northerly limit of the unit follows the northeasterly boundary of Rancho Cañada de Capay, the foothill line above Hungry Hollow, Cache Creek, and Cache Creek Slough to Knights Landing.

Hydrographic Unit 28—Carmichael—This unit includes that portion of the east side Sacramento Valley floor lying within the probable service area of the possible Folsom North and Folsom South Canals, the City of Sacramento, and that portion of Sacramento County lying above the Folsom North Canal. The northern limit is a line two miles south of the line between Townships 12 and 13 North. The westerly limit follows the easterly boundaries of Reclamation Districts 1001 and 1000 from the northwest corner of the unit to the American River, and along the American and Sacramento Rivers north and west of the City of Sacramento. South of the city it conforms to the easterly limit of the Sacramento-San Joaquin Delta as outlined in the "Report of Sacramento-San Joaquin Water Supervision for 1948," issued by the Division of Water Resources. The eastern part of the southerly limit of this unit is the northerly boundary of the Cosumnes Rancho. West of Highway 99 the limit follows an irregular line to the northeast corner of Reclamation District 1002. In Placer County the easterly limit of the unit follows the line of a possible Folsom North Canal at an elevation of approximately 200 feet. In Sacramento County, it follows the northerly and easterly county boundaries north of the American River, and, south of the river, the line of the proposed Folsom South Canal at an elevation of approximately 100 feet.

Hydrographic Unit 29—Dixon—This unit consists of that portion of the service area of the Solano Project lying in the Sacramento River Basin. The easterly limit of this unit coincides with the west levee of the Yolo By-pass, the westerly boundary of Reclamation District 2068, the westerly limit of the Sacramento-San Joaquin Delta as outlined in the "Report of Sacramento-San Joaquin Water Supervision for 1948," and a line through the northeastern corner of the Montezuma Hills. The southerly limit is the Sacramento River between Rio Vista and Collinsville. The westerly limit consists of the easterly limit of the San Francisco Bay Area and the westerly limit of the service area of the Solano Project main canal at an elevation of approximately 175 feet. The northerly limit consists of Putah Creek from Winters to the northeast corner of the Yolo-Solano county line, thence along a line east to the west levee of the Yolo By-pass.

Hydrographic Unit 30—Yolo—This unit consists of that portion of the Sacramento Valley floor, from Nicolaus to a point 11 miles south of Dixon, which area obtains its water supply from the lower Feather River, from the Sacramento River between Grays Bend and Sacramento, and from return flow in the Yolo By-pass. Reclamation District 2068, which constitutes the southernmost part of this unit, obtains its irrigation supply from Haas Slough, a tributary of Cache Slough.

The northern part of the easterly limit of this unit consists of the easterly boundaries of Reclamation Districts 1001 and 1000. Below the City of Sacramento the easterly limit of Unit 30 conforms to the westerly limit of the Sacramento-San Joaquin Delta as outlined in the "Report of Sacramento-San Joa-

quin Water Supervision for 1948." The westerly limit of this unit follows the westerly limit of the Sutter By-pass, the westerly boundary of Reclamation District 2035, the west levee of the Yolo By-pass, the westerly boundary of Reclamation District 2068, and thence by an irregular line to the southern limit 11 miles south of Dixon.

Hydrographic Unit 31—West Side, Kern County—This unit consists of the mountainous and foothill portions of the San Joaquin Valley slope of the Coast Range in San Luis Obispo, Kern, and Kings Counties. The easterly limit of this unit is, in general, the western edges of the alluvial fills of the Kettleman and Antelope Plains. The northerly limit lies along the Kings-Fresno county line and the northerly drainage boundary of Avenal Creek. The southerly limit is a line between the drainage basins of Sandy and Bitterwater Creeks near Taft.

Hydrographic Unit 32—Kern River and Tehachapi Mountains—This unit includes the mountainous and foothill portions of the named regions, as well as the Greenhorn Mountains and minor portions of the valley floor from the Kern-Tulare county line to a point near Maricopa. In addition to the drainage boundary of the upper Kern River, the northerly limit of the unit lies along the south boundary of the White River drainage basin. From the Tulare-Kern county line to the vicinity of Bakersfield, the westerly limit follows a series of section lines representing a division between lands presently irrigated and those not irrigated, from a point 11 miles east of Delano to a point 2 miles east of Bakersfield. From Bakersfield south the limit coincides with the northerly, easterly, and southerly boundaries of the Arvin-Edison Water Storage District. From the southwest corner of that district, the limit follows a series of section lines roughly corresponding to the southern limit of present irrigation development, from 1 to 2½ miles south of Highway 33 to a point 1½ miles southwest of Maricopa. The westerly limit is a line between the drainage basins of Sandy and Bitterwater Creeks.

Hydrographic Unit 33—Tule River—This unit consists of the mountainous and foothill portions of drainage basins of streams from the Tule River to White River, inclusive. The westerly limit follows a series of section lines from a point four miles east of Strathmore to a point five miles east of Richgrove, excluding all of the presently irrigated area on the San Joaquin Valley floor from this unit. Surprise and Pleasant Valleys, just east of Porterville, in this unit, are irrigated by ditches diverting water from both the north and south forks of the Tule River.

Hydrographic Unit 34—Kaweah River—This unit consists of the mountainous and foothill portions of the Kaweah River drainage basin and of minor stream basins from Lewis Creek to Sand Creek near Orange Cove. The westerly limit of this unit follows the easterly boundaries of the irrigation districts along the eastern edge of the valley floor, from Hills Valley and Orange Cove Irrigation Districts on the north to the Lindmore Irrigation District on the south.

Hydrographic Unit 35—Kings River—This unit includes the mountainous and foothill portions of the Kings River drainage basin above the point of diversion of the Alta Canal, as well as those of minor stream basins from Dry Creek near Clovis on the north to Wahtoke Creek on the south. Between the northwesterly corner of the unit and the Kings River, the westerly limit of this unit follows the Friant-Kern Canal, while south of the river it coincides with the easterly boundary of the Alta Irrigation District and the northerly boundary of the Orange Cove Irrigation District.

Hydrographic Unit 36—Antelope Plain—This unit consists of the western portion of the valley floor tributary to Tulare Lake, which obtains irrigation supplies from ground water basins replenished by the streams of Hydrographic Unit 31, immediately to the west. Contained within this unit are the Kettleman Hills and the Buena Vista Hills. The westerly limit of this unit is, in general, the westerly edges of the alluvial fills of the Kettleman and Antelope Plains. The northerly limit is the Fresno-Kings county line and the line between Townships 20 and 21 South. The northern portion of the easterly limit coincides with the westerly boundary of the Tulare Lake Basin Water Storage District, the central portion with the westerly boundary of the Buena Vista Water Storage District, and the southern portion, in the neighborhood of Taft, with the westerly limit of certain lands irrigated directly from Buena Vista Lake.

Hydrographic Unit 37—Kern—This unit consists of those lands receiving water directly or indirectly from the Kern River. The northerly limit of this unit coincides with, from east to west, the Tulare-Kern county line (except for that portion of the Delano-Earlimart Irrigation District in Kern County), the northerly boundary of the Alpaugh Irrigation District, and the southerly boundary of the main portion of the Tulare Lake Basin Water Storage District. However, a minor detached portion of this water storage district lies within Hydrographic Unit 37. The westerly limit of the unit consists of, from north to south, the westerly boundary of the Buena Vista Water Storage District and the westerly limit of certain lands irrigated directly from the Buena Vista Lake. The southerly limit extends from a point 1½ miles southwest of Maricopa along a series of section lines from 1 to 2½ miles south of Highway 33, and along the southerly boundary of the Arvin-Edison Water Storage District. The easterly limit

coincides with the easterly and northerly boundaries of that district, from a point near Wheeler Ridge to a point two miles east of Bakersfield. North of the latter point, the limit follows a series of section lines to the Kern-Tulare county line at a point 11 miles east of Delano.

Hydrographic Unit 38—Earlimart—This unit consists of those lands receiving water supplies either from Tule River and other streams of Hydrographic Unit 33 to the east, or from ground water. The southerly limit of this unit is the Tulare-Kern county line and the southerly boundary of the Delano-Earlimart Irrigation District in Kern County. The westerly limit is, from south to north, the line between Ranges 23 and 24 East, the eastern and northerly boundaries of the Alpaugh Irrigation District, the southeast corner of the Tulare Lake Basin Water Storage District, and the Tulare-Kings county line. The northerly limit is drawn to place the Lower Tule River and Porterville Irrigation Districts in this unit. The easterly limit follows a series of section lines from a point four miles east of Strathmore to a point five miles east of Richgrove, placing the presently irrigated area on this portion of the San Joaquin Valley floor in this unit.

Hydrographic Unit 39—Visalia—This unit consists of those lands receiving the major portion of their water supply from the Kaweah River, or from ground water replenished by the Kaweah or other streams of Hydrographic Unit 34, directly to the east. The southerly limit of this unit is a line drawn to exclude the Corcoran Irrigation District, and to include the service area of the Elk Bayou Ditch Company, as well as the Tulare, Lindmore, and Lindsay-Strathmore Irrigation Districts, in this unit.

The easterly limit of this unit corresponds to the easterly boundaries of a line of irrigation districts from Lindsay-Strathmore on the south to Hills Valley and Orange Cove on the north. The northerly and westerly limits of the unit consist of the easterly and southerly boundaries of the Alta Irrigation District, and of a line drawn so as to include the service area of the Lakeside Ditch Company in this unit.

Hydrographic Unit 40—Fresno-Hanford—This unit consists of that portion of the valley floor which receives the majority of its water supply from the Kings River, and corresponds generally to the service area of members of the Kings River Water Association, excluding the area immediately surrounding Tulare Lake. Between Friant and the Kings River, the easterly limit of Unit 40 follows the Friant-Kern Canal. South of the Kings River the limit follows the easterly and southerly boundaries of the Alta Irrigation District, and a line drawn to include the Peoples Ditch service area and to exclude the service area of the Lakeside Ditch Company. The northerly limit of Unit 40 coincides with the northerly boundary of the Fresno Irrigation District, the course of the San Joaquin River, and the southerly boundary of the Mowry Ranch lying south of the San Joaquin River near Mendota. The westerly limit of the unit follows Fresno Slough and the westerly limit of the service area of members of the Kings River Water Association. The southern limit is the line between Townships 20 and 21 South.

Hydrographic Unit 41—Tulare Lake—This unit consists of the Tulare Lake bed and areas immediately surrounding the lake. The northerly limit of the unit consists of the line between Townships 20 and 21 South and a line drawn to include the Corcoran Irrigation District. The eastern limit coincides with the Kings-Tulare county line. The southerly and westerly limits coincide with the southerly and westerly boundaries of the main portion of the Tulare Lake Basin Water Storage District.

Hydrographic Unit 42—Mount Diablo—This unit consists of the mountainous and foothill portions of the Coast Range above the San Joaquin Valley floor, from the westerly drainage boundary of Markley Canyon to the northerly boundary of the Mountainhouse Creek drainage basin. The northern limit of the unit is a line one mile north of the line between Townships 1 and 2 North. The easterly limit coincides with the westerly boundaries of the East Contra Costa and Byron-Bethany Irrigation Districts.

Hydrographic Unit 43—Altamont to San Luis Creek—This unit consists of the mountainous and foothill portions of the Coast Range tributary to the San Joaquin Valley, between the northerly drainage boundary of Mountainhouse Creek and the southerly drainage boundary of San Luis Creek. The easterly limit of this unit follows, in general, the edge of the San Joaquin Valley floor, except between Orestimba and Garzas Creeks, where it coincides with part of the westerly boundary of the Orestimba Water District.

Hydrographic Unit 44—West Side, Los Banos Creek to Avenal—This unit consists of the mountainous and foothill portions of the Coast Range tributary to the San Joaquin Valley, from the northerly drainage boundary of Los Banos Creek to the northerly drainage boundary of Avenal Creek. The easterly limit of this unit follows, in general, the edge of the San Joaquin Valley floor. However, the bench land region above the valley floor through which flow Los Banos, Salt, and Ortigalita Creeks, is excluded from the unit.

Hydrographic Unit 45—San Joaquin River—This unit includes the drainage basin of the San Joaquin River above Friant Dam, as well as a minor part of the foothill area tributary to the San Joaquin River just downstream from Friant Dam and lying above

the Friant-Kern and Madera Canals. The most important stream draining this latter area is Little Dry Creek, which enters the San Joaquin River from the east.

Hydrographic Unit 46—Chowchilla-Fresno Rivers—This unit includes the mountainous and foothill portions of the drainage basins of the Fresno and Chowchilla Rivers above the crossings of the Madera Canal, as well as the drainage basins of intermediate minor streams from Little Dry Creek tributary to the valley floor near Madera, on the south, to the unnamed stream next south of Dutchman Creek, on the north. From Friant to the Chowchilla River, the westerly limit of this unit follows the Madera Canal. North of the Chowchilla River, the limit follows the line of a possible canal diverting from the Merced River at an elevation of approximately 400 feet.

Hydrographic Unit 47—Merced River—This unit includes the mountainous and foothill portions of the Merced River drainage basin, basins of minor east side streams from Dutchman Creek to the Mariposa-Tuolumne and Merced-Stanislaus county lines. The westerly limit of this unit south of the Merced River lies along the line of a possible canal diverting from the Merced River at an elevation of approximately 400 feet. North of the Merced River the westerly limit corresponds to a canal line diverting from the Tuolumne River at an elevation of about 300 feet.

Hydrographic Unit 48—Tuolumne River—This unit consists of the mountainous and foothill portions of the drainage basin of the Tuolumne River above La Grange Dam, together with similar portions of minor drainage basins between the Mariposa-Tuolumne and Merced-Stanislaus county lines, and the Tuolumne River. The westerly limit of this unit follows the line of a possible canal diverting from the Tuolumne River at an elevation of approximately 300 feet.

Hydrographic Unit 49—Stanislaus River—This unit includes mountainous and foothill portions of the drainage basin of the Stanislaus River above Goodwin Dam, as well as similar portions of the Dry Creek (Modesto) drainage basin. The westerly limit of this unit follows the line of a possible canal diverting from the Stanislaus River at an elevation of approximately 300 feet.

Hydrographic Unit 50—Mokelumne-Calaveras Rivers—This unit includes the mountainous and foothill portions of the Calaveras River drainage basin above Hogan Dam and the Mokelumne River drainage basin above Pardee Dam, as well as similar portions of the Littlejohns Creek and Bear Creek drainage basins. The westerly limit of this unit follows lines of possible canals diverting from the Calaveras River. The south canal line is at an approximate elevation of 300 feet, while the north canal line is at an elevation of approximately 550 feet.

Hydrographic Unit 51—Cosumnes River—This unit includes the mountainous and higher foothill portions of the Cosumnes River drainage basin, as well as similar portions of drainage basins of lesser streams from Jackson Creek on the south to Deer Creek (Sloughhouse) on the north. The westerly limit follows the lines of possible canals from the Nashville dam site on the Cosumnes River. The south canal line would divert from the Cosumnes River at an elevation of approximately 800 feet, with a secondary diversion from Dry Creek (Ione) at an approximate elevation of 400 feet. The north canal line would divert at an elevation of approximately 800 feet.

Hydrographic Unit 52—Antioch—This unit consists of that portion of the west side of the San Joaquin Valley floor which obtains its major water supply from channels of the Sacramento-San Joaquin Delta, excluding lands in the Delta itself. The westerly limit of this unit consists of the eastern limit of the San Francisco Bay Area, a line one mile north of the line between Townships 1 and 2 North, and the westerly boundaries of the East Contra Costa and Byron-Bethany Irrigation Districts. The northerly limit follows the main channel of the San Joaquin River passing Antioch, and the northerly boundary of the East Contra Costa Irrigation District. The easterly limit of the unit consists of the easterly boundary of this district, the sea level contour as it crosses the Byron Tract, Old River, and Tom Paine Slough. The southerly limit of the unit follows the northerly boundary of the Banta-Carbona Irrigation District, and the southerly boundary of the West Side Irrigation District.

Hydrographic Unit 53—Delta-Mendota—This unit consists of those lands of the west side San Joaquin Valley floor receiving the majority of their water supplies from ground water replenished by the streams of Hydrographic Unit 43, directly to the west, and from the Delta-Mendota Canal of the Central Valley Project. The westerly limit of this unit is, in general, the edge of the San Joaquin Valley floor, except between Orestimba and Garzas Creeks where it coincides with part of the westerly boundary of the Orestimba Water District. The northerly limit of the unit consists of the southerly boundary of the West Side Irrigation District. The easterly limit follows the westerly boundaries of the Banta-Carbona and the West Stanislaus Irrigation Districts, the easterly boundary of the Salado Water District and, in general, the westerly limit of the service area of the former San Joaquin Canal Company.

Hydrographic Unit 54—West Side, San Joaquin Valley—This unit consists of that portion of the west side San Joaquin Valley floor between Los Banos

and Avenal, which obtains the majority of its water supply from streams of Hydrographic Unit 44, directly to the west, or from underground waters fed by percolation from these streams and by underflow from the east. The westerly limit of this unit is, in general, the edge of the San Joaquin Valley floor, except for a section through the bench-land region above the valley floor, through which flow Los Banos, Salt, and Ortigalita Creeks. The southerly limit consists of the Fresno-Kings county line and the line between Townships 20 and 21 south. The easterly limit follows the westerly limit of the service area of members of the Kings River Water Association, and Fresno Slough to its junction with the San Joaquin River at Mendota. The northerly limit of Unit 54 consists of the Delta-Mendota Canal and the southwesterly limit of the Firebaugh Canal Company service area.

Hydrographic Unit 55—Madera—This unit consists of that portion of the east side San Joaquin Valley floor whose major sources of water supply are the Madera Canal, the Fresno and Chowchilla Rivers and other streams of Hydrographic Unit 46, directly to the east, and ground water supplies replenished by these sources. The easterly limit of this unit is the Madera Canal. The southerly limit consists of the northerly boundary of the Fresno Irrigation District and the channel of the San Joaquin River. The westerly limit of the unit follows the easterly limit of the service area of the Columbia Canal Company and the San Joaquin River. The northerly limit of the unit consists of the Merced-Madera county line along the Chowchilla River, and the line between Townships 9 and 10 South.

Hydrographic Unit 56—Merced—This unit consists of that portion of the east side San Joaquin Valley floor whose major sources of water supply are the Merced River and other streams of Hydrographic Unit 47, directly to the east. The easterly boundary of this unit is the line of a possible canal diverting from the Merced River at an approximate elevation of 400 feet. The southerly limit of this unit consists of the Merced-Madera county line along the Chowchilla River and the line between Townships 9 and 10 South. The westerly limit is the San Joaquin River. The northerly limit follows Dry Creek (Snelling) and the Merced River.

Hydrographic Unit 57—Los Banos—This unit consists of that portion of the San Joaquin Valley floor obtaining the majority of its water supply from the San Joaquin River at the Mendota Pool, and by diversions from the left bank of the river between Mendota and Patterson. The easterly limit of this unit consists of the easterly limit of the Columbia Canal Company service area and the main stem of the San Joaquin River. The southerly limit coincides with the southerly boundary of the Mowry Ranch south of the San Joaquin River near Mendota. The westerly limit of the unit consists of the westerly limit of the Firebaugh Canal Company service area, the Delta-Mendota Canal, a generalized line representing the westerly limit of the service area of the former San Joaquin Canal Company, and the easterly boundary of the Salado Water District. The northerly limit of this unit coincides with the northerly boundary of the Central California Irrigation District near Crows Landing.

Hydrographic Unit 58—Modesto—This unit consists of that portion of the east side San Joaquin Valley floor receiving the major part of its water supply from the Tuolumne River. The easterly limit of this unit consists of possible canal lines diverting from the Tuolumne River at an elevation of approximately 300 feet. The southerly limit follows Dry Creek (Snelling) and the Merced River. The westerly limit of the unit is the San Joaquin River. The northerly limit consists of, from east to west, the line between Townships 2 and 3 South, Dry Creek (Modesto), the northerly boundary of the Modesto Irrigation District, and the Stanislaus River.

Hydrographic Unit 59—Vernalis—This unit consists of that portion of the west side San Joaquin Valley floor between Patterson and Tracy, whose major source of water supply is the San Joaquin River, with supplemental supply from the Delta-Mendota Canal. The easterly limit of this unit is the San Joaquin River. The southerly limit coincides with the northerly boundary of the Central California Irrigation District. The westerly limit of the unit consists of the westerly boundaries of the West Stanislaus and Banta-Carbona Irrigation Districts. The northerly limit coincides with the northerly boundary of the last named district.

Hydrographic Unit 60—Oakdale—This unit consists of that portion of the east side San Joaquin Valley floor whose major source of water supply is the Stanislaus River. The easterly limit of this unit follows the line of a possible canal diverting from the Stanislaus River at an elevation of approximately 300 feet. The southerly limit consists of, from east to west, the line between Townships 2 and 3 South, Dry Creek (Modesto), the northerly boundary of the Modesto Irrigation District, and the Stanislaus River. The westerly limit is the main channel of the San Joaquin River. The northerly limit of the unit consists of the northerly boundary of the drainage basin of Simmons Creek and the northerly boundary of the South San Joaquin Irrigation District.

Hydrographic Unit 61—Stockton—This unit consists of those portions of the east side San Joaquin Valley floor whose major sources of water supply are the Calaveras and Mokelumne Rivers, ground water

supplies replenished by streams of Hydrographic Units 50 and 51, and the proposed Folsom South Canal. The southerly limit of this unit consists of the northerly boundaries of the Simmons Creek drainage basin and of the South San Joaquin Irrigation District. South of the Mokelumne River the easterly limit of the unit follows the lines of possible canals to divert from the Calaveras River. The south diversion would be at an approximate elevation of 300 feet, while the north diversion would be at an elevation of about 550 feet. North of the Mokelumne River the easterly limit is the proposed Folsom South Canal at an approximate elevation of 100 feet. The northerly limit of the unit consists of the northerly boundary of the Cosumnes Rancho and, west of U. S. Highway 99, an irregular line to the northeast corner of Reclamation District 1002. The westerly limit coincides with the easterly limit of the Sacramento-San Joaquin Delta as outlined in the "Report of Sacramento-San Joaquin Water Supervision for 1948," issued by the State Division of Water Resources.

Hydrographic Unit 62—Ione—This unit consists of those portions of the lower foothills of western Amador and El Dorado Counties, and eastern San Joaquin and Sacramento Counties, which are capable of being irrigated from canals delivering water developed at the Nashville dam site on the Cosumnes River. The easterly limit of the unit follows the possible lines of these canals. The south canal would divert at an elevation of approximately 800 feet, with a secondary diversion from Dry Creek (Ione) at an elevation of about 400 feet. The north diversion would be at an elevation of about 800 feet. The southerly limit of the unit is the Mokelumne River. The westerly limit follows the line of the proposed Folsom South Canal at an approximate elevation of 100 feet. The northerly limit is the southerly edge of Folsom Reservoir.

Hydrographic Unit 63—Sacramento-San Joaquin Delta—This unit consists of the area of the Delta as outlined in the "Report of Sacramento-San Joaquin Water Supervision for 1948," issued by the State Division of Water Resources. An exception is in an area immediately north and west of Rio Vista, where Hydrographic Unit 63 extends into the Montezuma Hills, thus including irrigable acreage along the northeastern base of the hills whose natural source of water supply is the Sacramento-San Joaquin Delta.

LAHONTAN AREA

Hydrographic Unit 1—Surprise Valley—This unit includes the California portions of drainage basins tributary to the Upper, Middle, and Lower Alkali Lakes, as well as the California portions of the Twelve Mile Creek and Duck Flat drainage basins, both of which drain into neighboring states.

Hydrographic Unit 2—Madeline Plains—This unit consists of the California portions of drainage basins tributary to the Madeline Plains.

Hydrographic Unit 3—Honey Lake—This unit includes the drainage basins of the Susan River and other streams tributary to Honey Lake, as well as the basins of Pine Creek and other streams tributary to Eagle Lake. In addition, this unit includes the California portions of drainage basins of Smoke Creek and Rush Creek which flow into Nevada.

Hydrographic Unit 4—Truckee River—This unit consists of the California portion of the drainage basins of the Truckee River and its tributaries, including those portions of Lake Tahoe and its tributaries which lie within California.

Hydrographic Unit 5—Carson River—This unit consists of the California portions of the drainage basins of the East and West Forks of the Carson River and their tributaries.

Hydrographic Unit 6—Walker River—This unit consists of the California portions of the drainage basins of the East Walker and West Walker Rivers and their tributaries.

Hydrographic Unit 7—Mono Lake—This unit consists of the California portions of drainage basins tributary to Mono Lake.

Hydrographic Unit 8—Adobe Valley—This unit includes the drainage basin of Adobe Creek, southeast of Mono Lake, as well as the California portions of other minor basins tributary to Adobe Valley, including Black Canyon and the tributaries of Black Lake. In addition, this unit includes the California portion of the area tributary to Huntoon Valley in Nevada.

Hydrographic Unit 9—Owens River—This unit consists of the California portions of the drainage basins of the Owens River and its tributaries, as well as basins of other streams directly tributary to Owens Lake.

Hydrographic Unit 10—Death Valley—This unit consists of the California portion of the drainage basins of the Amargosa River, Salt Creek, and other tributaries of Death Valley, all of the California portions of basins draining the east side of the White Mountains, and many other enclosed basins between Owens Lake and the Mojave River. The most important of these enclosed basins are Eureka Valley, Saline Valley, Panamint Valley, Indian Wells Valley, and Searles Lake. The westerly limit of the unit consists of the crests of the White Mountains and the Inyo Mountains, the drainage boundary between Owens Lake and Haiwee Reservoir, and the summits of the Sierra Nevada and the Tehachapi Mountains to a point one mile east of Caliente Mountain. The southerly limit consists of the northerly drainage bound-

aries of basins tributary to Rosamond Lake, Rogers Lake, and the Mojave River, the crest of the Soda Mountains, a line through the Devil's Playground at Baker, the northerly drainage boundary of Halloran Wash, a line between Granite Spring and Cima, and the summit of the New York Mountains. The easterly limit is the California-Nevada state line.

Hydrographic Unit 11—Mojave River—This unit consists of the drainage basins of the Mojave River and other streams tributary to Soda Lake in the vicinity of Baker. In addition to the southerly, westerly, and northerly boundaries of the Mojave River drainage basin, the limit of the unit consists of the summit of the Soda Mountains, a line through the Devil's Playground at Baker, the northerly drainage boundary of Halloran Wash, a line between Granite Spring and Cima, and the northerly boundary of the Colorado Desert Area.

Hydrographic Unit 12—Antelope Valley—This unit consists of drainage basins tributary to Rosamond Lake, Rogers Lake, and Mirage Lake.

COLORADO DESERT AREA

Hydrographic Unit 1—Twentynine Palms—This unit consists of the major portion of the interior dissected drainage of the Colorado Desert, tributary to a number of dry lakes including Bristol Lake (with the exception of the long dry wash entering that lake from the northeast near Cadiz which is included in Hydrographic Unit 6). The more important of these lakes are Cadiz, Palen, Ford, Dale, Mesquite, Deadman, and Lucerne. The westerly and northerly limits of the unit are part of the easterly limit of the South Coastal Area and part of the southerly limit of the Lahontan Area. The easterly limit consists of the crests of the Marble Mountains, Ship Mountains, Old Woman Mountains, Iron Mountains, Granite Mountains, Little Maria Mountains, McCoy Mountains, and Mule Mountains, to the northwestern end of the Palo Verde Mountains. The southerly limit consists of a line through the summits of the Little Chuckawalla Mountains, Chuckawalla Mountains, Hexie Mountains, Orocopia Mountains, Eagle Mountains, and Little San Bernardino Mountains.

Hydrographic Unit 2—Coachella Valley—This unit includes the drainage basins of the Whitewater River and its tributaries, as well as other minor basins tributary to the Coachella Valley at the northwesterly end of the Salton Sea. These include Box Canyon Wash and an unnamed stream entering the Salton Sea one-half mile south of Mortmar, as well as Barton Canyon and an unnamed stream entering Salton Sea at Fish Springs.

Hydrographic Unit 3—Salton Sea—This unit includes all of the drainage basins directly tributary to the Salton Sea from the northeast and southwest, as well as those areas tributary to the Imperial Valley lying outside the Imperial Irrigation District. The northerly limit of the unit consists of the crest of the Santa Rosa Mountains, the northerly drainage boundary of a stream entering Salton Sea one mile east of Coolidge Springs, the northerly shore of Salton Sea, the northerly drainage boundary of a stream entering Salton Sea one-half mile east of Date Palm Beach, the crest of the Orocopia Mountains, the easterly drainage boundary of Salton Creek, the crest of the Chocolate Mountains, and a line drawn to meet the easterly boundary of the Imperial Irrigation District at a point eight miles south of Glamis. The southerly limit of this unit consists of the easterly, northerly, and westerly boundaries of the Imperial Irrigation District (except that north of Superstition Mountain the limit follows State Highway 78), and the southerly border of the State.

Hydrographic Unit 4—Imperial Valley—This unit includes the Imperial Irrigation District (with the exception of the district's Pilot Knob Unit), as well as certain other lands west of the Imperial Valley, including Superstition Mountain. The limits of the unit coincide with the boundaries of the irrigation district, with the exception of that portion north of Superstition Mountain, where the limit follows State Highway 78.

Hydrographic Unit 5—Colorado River—This unit includes the California portions of drainage basins tributary to the Colorado River (with the exception of that portion of the drainage basin of Piute Wash upstream from the narrowest portion of the gap between the Sacramento Mountains and the Dead Mountains), as well as tributaries of the Pilot Knob Mesa.

Hydrographic Unit 6—Lanfair Valley—This unit consists of the eastern portion of the interior dissected drainage basins of the Colorado Desert, including those of Lanfair Valley, tributaries of Danby Lake, the long dry wash tributary to Bristol Lake (in Hydrographic Unit 1), stretching from Goffs to Cadiz, Piute Wash upstream from the narrowest part of the gap between the Sacramento and the Dead Mountains, and other minor basins. The northerly limit of Hydrographic Unit 6 consists of the crest of the New York Mountains and the California-Nevada state line. The easterly limit consists of a line through the summits of the Dead Mountains, Center Hills, Turtle Mountains and Riverside Mountains. The southerly limit was drawn through the crests of the Big Maria Mountains, Little Maria Mountains, and Granite Mountains. The westerly limit follows a line through the crests of the Iron Mountains, Old Woman Mountains, Ship Mountains, Marble Mountains, Providence Mountains, and Mid Hills.

APPENDIX D

SOURCES AND DATES OF LAND USE SURVEY DATA

SOURCES AND DATES OF LAND USE SURVEY DATA

General area	Source of data	Approximate date of survey
North Coastal Area		
National Forest, outside Klamath River Drainage Basin	U. S. Forest Service	1948
Remainder of North Coastal Area	State Division of Water Resources	1948–53
San Francisco Bay Area		
Entire San Francisco Bay Area	State Division of Water Resources	1949
Central Coastal Area		
National Forest	U. S. Forest Service	1948
Upper Salinas Valley	U.S. Bureau of Reclamation	1948
Remainder of Central Coastal Area	State Division of Water Resources	1948–50
South Coastal Area		
National Forest	U. S. Forest Service	1948
Remainder of South Coastal Area	State Division of Water Resources	1948–49
Central Valley Area		
Sacramento River Basin		
National Forest	U. S. Forest Service	1948
Putah Creek Valley	U. S. Bureau of Reclamation	1947
Valley floor of the Sacramento Valley, excepting Sutter, Placer, and Yuba Counties, and Glenn-Colusa Irrigation District	U. S. Bureau of Reclamation	1946–50
Remainder of Sacramento River Basin	State Division of Water Resources	1948–50
San Joaquin River Basin		
National Forest	U. S. Forest Service	1948
Portions of the valley floor of the San Joaquin Valley	U. S. Bureau of Reclamation	1948
South San Joaquin Irrigation District	South San Joaquin Irrigation District	1948
Oakdale Irrigation District	Oakdale Irrigation District	1948
Modesto Irrigation District	Modesto Irrigation District	1948
Turlock Irrigation District	Turlock Irrigation District	1948
Waterford Irrigation District	Waterford Irrigation District	1948
Central Valley Area—Continued		
San Joaquin River Basin—Continued		
Merced Irrigation District	Merced Irrigation District	1948
West Side Irrigation District	West Side Irrigation District	1949
Byron-Bethany Irrigation District	Byron-Bethany Irrigation District	1949
East Contra-Costa Irrigation District	East Contra-Costa Irrigation District	1949
San Joaquin Canal Company	San Joaquin Canal Company	1948
Firebaugh Canal Company	Firebaugh Canal Company	1948
Columbia Canal Company	Columbia Canal Company	1948
San Luis Canal Company	San Luis Canal Company	1948
Remainder of the San Joaquin River Basin, including Delta	State Division of Water Resources	1947–50
Tulare Lake Basin		
Alta Irrigation District	Alta Irrigation District	1948
Kaweah and Tule River Delta	U. S. Bureau of Reclamation	1947–48
Kern County Land Company	Kern County Land Company	1950
West Side, San Joaquin Valley	U. S. Bureau of Reclamation	1950
Remainder of Tulare Lake Basin	State Division of Water Resources	1948–50
Lahontan Area		
National Forest	U. S. Forest Service	1948
Remainder of Lahontan Area	State Division of Water Resources	1950
Colorado Desert Area		
National Forest	U. S. Forest Service	1948
Imperial Valley	Imperial Irrigation District	1950
Reservation Division, Yuma Project	U. S. Bureau of Reclamation	1948
Remainder of Colorado Desert Area	State Division of Water Resources	1950

APPENDIX E

SOURCES OF LAND CLASSIFICATION SURVEY DATA

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SOURCES OF LAND CLASSIFICATION SURVEY DATA

NORTH COASTAL AREA

The lands of the Russian River drainage area, and of the Lower Eel River area around Eureka and Fortuna were classified according to the Index Rating of Soils developed by R. Earl Storie of the University of California. The index was applied to soil surveys made cooperatively by the United States Department of Agriculture and the University of California. Slight modifications of the ratings were made by the Division of Water Resources by projection of data on topographic quadrangles, and elimination of areas with excessively rough topography. The accuracy of the classification is considered to be fair.

Lands of the Klamath River drainage basin were classified by the Division of Water Resources on aerial photographs to a scale of 1/20,000. The accuracy of the classification is considered to be good.

Lands of the coastal area, except for the lower Eel River area and the Klamath River Basin, were classified by the Division of Water Resources on topographic quadrangles to a scale of 1/62,500. The accuracy of the classification is considered to be fair to good.

Lands of the remainder of the North Coastal Area were classified by the Division of Water Resources on topographic quadrangles to a scale of 1/125,000. The accuracy of the classification is considered to be fair.

SAN FRANCISCO BAY AREA

All lands were classified by the Division of Water Resources as to their suitability for urban use. The accuracy of the classification is considered to be good.

CENTRAL COASTAL AREA

Lands of the Pajaro Valley were classified by the Division of Water Resources on aerial photographs to a scale of 1/20,000. The accuracy of the classification is considered to be good.

Lands of the Carrizo Plain and the Cuyama Valley were classified by the Division of Water Resources on topographic quadrangles to a scale of 1/62,500. The accuracy of the classification is considered to be good to fair.

The United States Bureau of Reclamation land classification was used for the Santa Barbara area. The accuracy of the classification is considered to be good.

Lands of the remainder of the Central Coastal Area were classified according to the Storie Index Rating of Soils, as mapped in various soil surveys. The data were modified by the Division of Water Resources by projection on topographic quadrangles, with elimination of areas of excessively rough topography. The accuracy of the classification is considered to be fair.

SOUTH COASTAL AREA

Lands of Ventura County and the Santa Margarita River drainage area were classified by the Division of Water Resources on aerial photographs to a scale of 1/20,000. The accuracy of the classification is considered to be good.

In those other portions of the South Coastal Area where soil survey data were not available, the irrigable lands were delineated by the Division of Water Resources on topographic quadrangles to a scale of 1/62,500. The accuracy of the classification is considered to be good to fair.

In the remainder of the area, the classification of lands was made by the University of California by applying the Storie Index Ratings of Soils to the various soil surveys which had been made cooperatively by the United States Department of Agriculture and the University of California. The data were modified to some extent by a Division of Water Resources field check. The over-all accuracy of the classification is considered to be fair.

CENTRAL VALLEY AREA

For the Sacramento Valley floor area, the land classification data were obtained from the United States Bureau of Reclamation. A field check of the nonirrigable lands was made by the Division of Water Resources. Accuracy of the classification is considered to be good.

For the San Joaquin Valley floor area the land classification data were obtained from the United States Bureau of Agricultural Economics. A field check of the nonirrigable lands was made by the Division of Water Resources. Accuracy of the classification is considered to be good.

The foothill lands of the counties of the Mother Lode region, from Butte on the north to Mariposa on the south, and all the Upper Feather River drainage area were classified by the Division of Water Resources on aerial photographs to a scale of 1/20,000. The accuracy of the classification is considered to be good.

Lands of the Delta area were classified from soil survey data of the University of California and United States Department of Agriculture. The accuracy of the classification is considered to be good.

Lands of the Alturas and Big Valley areas were classified on the basis of the Storie Index Rating of

Soils, as mapped in soil surveys, with slight field modification. The accuracy of the classification is considered to be fair.

Lands of the San Joaquin Valley foothill and mountain areas and those of the Sacramento Valley west side foothills were classified by the Division of Water Resources on topographic quadrangles to a scale of 1/62,500. The accuracy of the classification is considered to be good to fair.

Lands of the remainder of the Central Valley Area were classified by the Division of Water Resources on topographic quadrangles and United States Forest Service maps to a scale of 1/125,000. The accuracy of the classification is considered to be fair.

LAHONTAN AREA

Lands of the Honey Lake and Surprise Valley areas were classified by the University of California by applying the Storie Index Ratings of Soils to the various soil surveys which had been made cooperatively by the United States Department of Agriculture and the University of California. These data were modified to some extent by the Division of Water Resources. The accuracy of the classification is considered to be fair.

Lands of the remainder of the Lahontan Area were classified by the Division of Water Resources on topographic maps to a scale of 1/125,000. The accuracy of the classification is considerd to be fair.

COLORADO DESERT AREA

Lands of the Colorado Desert Area, except for those lands having rights in and to the waters of the Colorado River, were classified by the Division of Water Resources on maps to a scale of 1/125,000. The accuracy of the classification is considered to be fair.

APPENDIX F

WATER REQUIREMENTS FOR FISH AND WILDLIFE IN CALIFORNIA

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TABLES

WATER REQUIREMENTS FOR FISH AND WILDLIFE IN CALIFORNIA

INTRODUCTION

The Division of Water Resources, in the course of the investigation leading to publication of this bulletin, requested that the California Department of Fish and Game prepare a series of estimates of the minimum flows of water required to protect and maintain the fish life in major streams of the State. These streams were divided by the Division into four classes, according to anticipated degree of water development for various purposes that would compete with recreational or commercial fishing requirements for water. The description of these classes is included in the attached explanatory communication, dated July 17, 1952, from the Department of Fish and Game. This communication suggests several revisions for the class definitions. Although the suggested revisions impinge mostly on classes of streams for which flow requirements were not requested by the Division, it seems desirable to present all of the considerations involved in the estimates submitted by the Department.

It must be pointed out that the Division of Water Resources does not necessarily concur in the position taken by the Department of Fish and Game, particularly with reference to the status of agricultural use of water. Regardless of the Department's contention, the Water Code of the State of California specifically states:

> "It is hereby declared to be the established policy of this State that the use of water for domestic purposes is the highest use of water and that the next highest use is for irrigation." Div. 1, Chap. 1, Sec. 106, ed. of 1951.

The second communicaton from the California Department of Fish and Game, dated August 1, 1952, consists of estimates of stream flow prepared by the Department, together with explanatory comments regarding some of the streams and contemplated developments. It should be pointed out that the Department considers these estimates preliminary and subject to revision.

STATE OF CALIFORNIA
SACRAMENTO 14

Inter-Departmental Communication

To: Mr. A. D. Edmonston, *State Engineer*
Department of Public Works
Division of Water Resources
Public Works Building
Sacramento 14, California

Date: July 17, 1952

Subject: Water Requirements for Protection and Maintenance of Fish Life

From: Division of Fish and Game

Since receipt of your inter-departmental communication of April 10, 1952, our staff has devoted considerable further study to flow requirements necessary to maintain fish life in various streams and at specific points in other streams. Our recommendations for such flows were requested by you, in your memorandum of November 9, 1951, for use in connection with Bulletin No. 2 of the Statewide Water Resources Board investigation of ultimate water requirements.

In your above memorandum you grouped the streams of California into four classes as regards water requirements for fish life. These classes were proposed as follows:

Class 1. Streams which will be developed for recreation only, with the use of water for the preservation of fish life to be paramount.

Class 2. Streams which will be developed for multiple purposes, including the maintenance of fish life.

Class 3. Streams of such present erratic flow that there is no fish life, or the demand for water for municipal or agricultural uses is so great that no water can be allocated for maintenance of fish life.

Class 4. Streams of such small flow that estimates will not be prepared.

The Department of Fish and Game has carefully considered the proposed classes suggested above and

is in general agreement with the classes as proposed. However, the Department of Fish and Game considers it imperative that the classes be further defined. For this reason the Department of Fish and Game has prepared its own definition of the various classes into which California streams may fall as regards water requirements for fish life. The essential definitions of Classes 1, 2 and 4 of the Division of Water Resources are followed but expanded.

A major disagreement between the classifications exists regarding the classification of water for agricultural use. The Department of Fish and Game can not agree that water for agricultural use should have complete priority over the use of water to maintain fish life and recreational values. As will be seen below the Department of Fish and Game classifies the agricultural use of water as one of the multiple uses of water, which include: power generation, flood control, the maintenance of fish life, recreation, and other beneficial water uses. Water for domestic use is considered to be the only use which takes complete priority over all other uses.

The classification of streams which is given below is recommended for inclusion as a permanent policy for streams in the California Water Plan. We believe that *the Department of Fish and Game must be consulted regarding the classification or change of classification of any streams.*

No attempt is being made at this time to classify all of the streams in California into one or another of these classes. The Department of Fish and Game will cooperate with the Division of Water Resources in the classification of individual streams as the need arises and upon request. It is understood, of course, that the classification of a stream may change either as a result of a change in the fishery or because of a change in the other water uses. Also, different sections of the same stream may fall into different classes.

CLASSES OF CALIFORNIA STREAMS

Class 1. Streams which would be reserved or developed primarily for the maintenance and development of fish life and other recreational uses. These streams fall into several categories.

(a) Those already set aside as inviolable, usually by Federal or State law. Examples: under Federal law, streams in National Parks and in wilderness areas; waters of the Klamath Fish and Game District, by State initiative measure. In most of these cases the aesthetic and recreational values are considered to transcend any other water uses, and past and possible future attempts to utilize these streams for other purposes have been and will be met with vigorous opposition by the public.

(b) Those where the economic value of the fishery alone outweighs any other present or contemplated economic use. Example: Rock Creek in Mono and Inyo counties.

(c) Those streams of special value as nursery waters for sport and commercial food fishes which spend a part of their life in the ocean. Examples: Big River and Noyo River, Mendocino County, and Deer Creek and Mill Creek, Butte County.

(d) Streams in which all or the major portion of the flow has been created by the Department of Fish and Game for the express purpose of maintaining fish life and recreational values.

Two facts should be emphasized regarding the waters falling into Class 1:

(1) There are relatively few such waters now and their number is more apt to decrease than increase; and,

(2) In many instances the water from these streams is available for other uses in the lower portions of the drainages.

Thus, while this is an important class, it affects only a small portion of the total waters in the State and, consequently, only a correspondingly small portion of the State's inland fishery resource.

Class 2. Those streams which will be developed for multiple-purpose use, including preservation and expansion of recreational and fisheries uses wherever possible.

Class 2 will include most of our major rivers and all streams where there is a conflict between use of the water to preserve or develop fisheries values and other use or uses, such as: power generation, irrigation, flood control, salinity control, waste disposal, etc. None of these other uses has complete priority *per se* over the use of water to maintain fish life. In each case of the development of a stream for multiple-purpose use, every possibility for the protection and/or development of a fishery will be investigated and integrated with the development of other water uses.

Proper consideration of the fishery resource must be given *early in the project planning stage* to such matters as flow releases, fish protective devices, operation of a recreational pool, etc., if maximum effectiveness and true multiple use is to be obtained. It must be recognized that the recreational benefits to be lost or to be gained *may be comparable to or may outweigh* the more easily evaluated economic benefits.

While it is true that in some multiple-purpose projects little consideration can be given to fish life, it is also true that in many such projects an additional beneficial use may be gained by proper consideration for a fishery, and that this gain may be achieved in a manner compatible with other water uses. For this reason it is imperative that the De-

partment of Fish and Game be consulted in the preliminary project planning stage and be included as one of the project planning agencies.

Class 3. Streams of such present intermittent or erratic natural flow that there is no existing fishery.

Utilization or development of these waters may be undertaken without further consideration of fish life requirements except in the case of impoundments. When impoundments are made upon such streams, consideration should be given to the establishment of permanent minimum pools for fish life. Typical examples of this category would be the low-level intermittent streams in the Central Valley and in Southern California. In general, streams in Class 3 must have no surface flow for at least part of the year in years of normal rainfall.

Class 4. Streams in which the demand for water for domestic uses is so great that no water can be allocated for maintenance of fish life or recreational values, providing the following statement is first considered.

The value of water for domestic uses is recognized as having the highest priority, but before any stream or water source is placed in Class 4 (whereby the entire flow is used for domestic purposes) every possible means of providing water for fish life and recreation should be exhausted to the fullest extent by all parties concerned during the planning stages of the project development.

Class 5. Streams of such minor importance, at the present time, for uses other than for recreation, including the maintenance of fish life, that the problems of conflicting uses have not arisen. This is ordinarily the result of geographical location, small flow, or both.

Streams in Class 5 may, however, be very important recreational waters, supporting wild or artificially stocked fish populations. For example, the bulk of the small streams in National Forests fall into this category. Individually these streams are unimportant but collectively they form an important part of the inland fishery resources of the State.

In general, a list will not be prepared nor required for the streams in this class, nor will special investigations of them be made. Some of these waters undoubtedly will require reclassification as a result of population growth, increased recreational values, and development of other water uses. When this occurs the stream will be taken from Class 5 and placed in another class.

We trust that the modifications of your proposed classes which we have suggested above will meet with your approval, and shall try to send you our specific flow recommendations by the end of the month.

Seth Gordon
Director

STATE OF CALIFORNIA
SACRAMENTO 14

Inter-Departmental Communication

To: Mr. A. D. Edmonston, *State Engineer*
Department of Public Works
Division of Water Resources
Public Works Building
Sacramento 14, California

Date: August 1, 1952

Subject: Water Requirements for Protection and Maintenance of Fish and Game in Connection with State Water Plan

The Department of Fish and Game has prepared the enclosed flow estimates for the maintenance of fish life as requested in your memorandum of November 9, 1951. We are also transmitting at this time the estimated water requirements for our game populations, including waterfowl.

These estimates must be considered preliminary as they are subject to review and possible modification by the Fish and Game Commission. Please refer to our memorandum of July 17, 1952, for additional comments on the water requirements of fish and wildlife.

Seth Gordon
Director

STATE OF CALIFORNIA
SACRAMENTO 14

Inter-Departmental Communication

To: Mr. A. D. Edmonston, *State Engineer*
Department of Public Works
Division of Water Resources
Public Works Building
Sacramento 14, California

Date: August 1, 1952

Subject: Water Requirements for Protection and Maintenance of Fish and Game in Connection With State Water Plan

In our interdepartmental communication of July 17, 1952, we set forth the general comments of the Department of Fish and Game on the flow requirements necessary to maintain fish life in various streams of California with particular emphasis on the proposed stream classifications to be used in Bulletin No. 2 of the State Water Plan now being developed by the Water Resources Board. We are now transmitting the specific flow estimates that were requested in your letter of November 9, 1951, together with our estimates of the ultimate water needs of the game resources of California.

PART I. WATER REQUIREMENTS FOR FISH LIFE

The Department of Fish and Game was originally requested to submit estimates of the amounts of water needed for the maintenance of fish life on certain streams and at specific points on other streams. As we stated in our memorandum of July 17, we believe that the classification system originally proposed should be more clearly defined and expanded. We believe the large number of streams which are extremely important to the Department of Fish and Game that were not included in the original request should definitely be considered in the preparation of any comprehensive State plan of water resources development. For example, we believe that there are a considerable number of streams which should be reserved or developed primarily for fish life or recreational development in addition to the few listed in your Class I. In any case we do not want to create the impression that our interest is confined only to the requested streams or that we are "writing off" any other stream for which flow recommendations are not made at this time. Also we feel that we must retain the right to adjust our recommendations upward or downward as additional information is developed by our fisheries management staff as we have not had personnel available to carry out anything but cursory investigations of these streams. We believe, however, that these flow estimates tend to be on the conservative side.

Flow estimates have been prepared for all streams requested except the Central Coastal Streams from the Big Sur River to Santa Rosa Creek. In our opinion no development is possible on these streams and the highest use of this water is probably for the rather limited amount of recreation furnished at the present time. These streams support runs of steelhead at the present time and it is felt that the summer recreational use will increase in the future.

The flow estimates given below are those which the Department of Fish and Game believes should be available for fish life in years of normal or nearly normal run off. With these flows the existing fish populations can be maintained but more water would be required to increase the population, probably in conjunction with other habitat improvement. Likewise, these estimates are not necessarily the minimum flow which could be endured for a single season without seriously damaging resident or migratory fish. To be of value, of course, these releases must actually be available to fish and not merely flows which pass a certain point only to be diverted a short ways down a stream. We recognize that in those years when there is a water shortage of such degree as to require the curtailment of water for agricultural use that the water available for the fisheries resources would be curtailed to the same degree. The exact details of such a flow reduction, however, will have to be carefully worked out for each stream. Under extreme drought conditions a small amount of water for fish life can be made to accomplish a great deal more if it is regarded as storage to be released during the season at times and in quantities requested by our fisheries management staff. This is particularly true on those streams which support anadromous fishes such as salmon and steelhead which require water during the period of migration.

In the original listing of streams furnished by Mr. Edmonston the flows were requested at certain gauging stations on the lower portions of the streams.

Some of the gauging stations listed are within the present range of migratory fishes but are of little use as a point of reference for flows required for fish life. For example, one of the points requested was on the American River below Folsom Dam. Now that Nimbus Dam is under construction the flows of interest will be those below Nimbus and the flow between Folsom and Nimbus will be of little importance. In such instances we have taken the liberty of recommending flows at the spot which is regarded as the key point on the stream for the maintenance of the fisheries.

It is also assumed that the flows recommended will be relatively stable. Widely fluctuating flows such as those below power plants that are utilized for peaking purposes without re-regulation will have a fish-carrying capacity approximately equal to the lowest flow of the cycle. Fluctuating flows of this type also cause damage by stranding fish when the flow is abruptly reduced. Another important point is that the actual flow releases that will be necessary will ultimately depend upon the plan of water resource development. For example, an impassable dam constructed near the mouth of a salmon and steelhead stream will obviously make a great difference in the flows previously estimated as being necessary for maintaining the run at some point upstream.

The Central Valley salmon rivers are probably the streams of greatest interest to your office and the Department of Fish and Game at the present time. It is felt that the following comments on these streams will be of value and will supplement the actual flow recommendations.

1. Sacramento River

Copper pollution entering this river below Shasta Dam may make it necessary to increase releases above the minimum flows given in order to dilute the copper to the point where it is non-lethal to fish. An investigation of this problem is underway at the present time.

2. Feather River

Present water conditions as they affect salmon and steelhead:

In the main stream above the Sutter Butte Dam there is ample water at all times during any but the driest years.

Below the Sutter Butte Dam the flows are usually adequate when there is no diversion at the Great Western or Sutter Butte Canals. When the diversion at Sutter Butte reduces the river flow to less than 400 c.f.s., that portion of the stream is of little use to salmon and steelhead, except as an avenue of escape to the upper portions of the stream. In the summer the river is completely diverted (except for the leaks in the Sutter Butte Dam), and the stream soon becomes entirely too warm for salmonids. Spring run salmon enter the Feather River from March to June, but the only ones which have much chance of survival are those which have passed the Sutter Butte Dam before the start of total diversion. The spring run salmon spend the summer in deep holes and spawn in the fall. Fall run salmon enter the Feather from September through December. The heaviest spawning is in November. The young of both runs migrate downstream from late January into June with the heaviest movement in February and March. Those fish which start their migration before the irrigation season have an excellent chance of survival. Judging from the action of salmon in other streams, there is little chance for those which are more than a few miles from the Sacramento River when total diversion starts. Suddenly reducing the flow to summer level seems to stop the migration even when there is enough return water to make such a migration theoretically possible. The indications are that few if any salmon are able to survive the heat of a Central Valley summer in return irrigation water.

The Probable Effects of the Oroville Dam

Oroville Dam will make many miles of spawning stream unavailable to salmon and steelhead. This is a distinct handicap. On the other hand, the dam could be so used as to improve conditions below it. If water is drawn from lower levels of the pool, it will presumably remain cold all summer. This would be a benefit to the spring run and early fall run fish. The later fall fish would not be affected as they normally encounter cold water when they arrive. If the reservoir is drawn down to the point where it starts discharging warm water into the river, the result could be the loss of the major part of that year's run. If such disasters do not occur too often, the natural resiliency of the fish should overcome the effect.

3. Yuba River

There is a spring and fall run of salmon and a run of steelhead in this stream. In past years fish have been handicapped by the lack of a functional fish ladder at Daguerre Point Dam and by inadequate flows below the dam. The Department of Fish and Game has recently completed two functional fish ladders over the dam, and anadromous fish are able to migrate as far upstream as the Narrows Dam. Bringing the Yuba under more complete control will, of course, result in greatly reduced flows in the spring. In the past these flows have been used by spring run fish and during periods of flow exceeding 10,000 second feet some fish have been able to get above the Daguerre Point Dam even without fish ladders. If the spring run is to continue to survive in this stream, it will be neeessary to provide an adequate flow of water below Daguerre Point Dam in May and June. If the flows below Daguerre Point are cut much below 350 second feet, it seems probable that the spring run will grad-

ually disappear. With flows in excess of 500 second feet the run should build up. Both the spring and fall runs require adequate water to cover the gravel and permit spawning during the period from October through December. An adequate downstream flow from January through May is required to hatch the eggs and enable the young to reach the Feather and Sacramento Rivers. During the period from July to September a relatively small flow needs to be provided below the Daguerre Point Dam for resident fish. Elimination of water flow at this time would cause less damage than at any other period of the year.

4. Bear River

At the present time this river has for all practical purposes no salmon run. We would like to explore the possibility of establishing a run in this stream and determine the amount of water which would be required. In the event that there would seem to be little chance of securing any appreciable flow during a period from October 1 to June 1, we would then feel there was no point in making such an investigation.

5. American River

If no dam were to be built below the town of Folsom, it would be a relatively simple problem to maintain a good salmon run in the American River and with adequate flows the steelhead might be able to spawn successfully in this section of stream. At the present time, however, the construction of Nimbus Dam appears to be a certainty. This structure will cut off or destroy about 70 per cent of the spawning grounds remaining below Folsom. The problem thus becomes one not only of securing sufficient water, but of creating artificial spawning grounds (made of dredger tailings) or of building conventional type hatcheries as well. It will be some time before we have any final answers on what can be accomplished with the stub of this once excellent salmon stream. In the interim we are proposing the water releases listed in the tables.

6. Cosumnes River

At the present time this is a marginal salmon stream. Moderate improvement in conditions might transform it into a moderately good stream. Any worsening of conditions would be apt to eliminate the runs almost entirely.

7. Mokelumne River

This stream has suffered from copper pollution, winery pollution, gold dredgers, illegal spearing, and from a bad fish block at the Woodbridge Dam. Potentially, it is one of the best tributary streams in the valley. There remains a small fall run which should be capable of growing into a much larger run.

At present there is almost no spring run, but we can see no reason why the stream could not produce a large spring run, if it were given proper help. This help would have to include several plantings of fish and a more reliable flow of water below Woodbridge Dam during May and June. If no effort is made to build up a spring run it would still be necessary to provide water below Woodbridge for the downstream migration of young fall run salmon. Probably this flow should last until the end of May. If the various hazards to fish life on the Mokelumne River can be controlled the present flow below Pardee Dam should be able to suport 20 to 40 times as many salmon as are now using this stream. The flows given below refer to the salmon producing potential of the stream rather than to the present run, since water flow has not been the most important factor in limiting the run in recent years.

8. Stanislaus River

This is an excellent fall salmon stream. There are the bare remnants of a spring run, and a small summer release might make it possible for this run to increase in size. The summer flow in question would have to be in the canyon above Knight's Ferry since that is the only part of the stream which would be satisfactory for spring run salmon on a low flow. The stream in the past has suffered from pollution and from widely fluctuating power releases at Melones Dam during the spawning season.

9. Tuolumne River

In recent years the Tuolumne River has had one of the best fall salmon runs in the State. It has almost no spring run and there would seem to be a little prospect of developing one. The worst problem has been that of pollution caused by industrial waste during the canning season at the city of Modesto. Another detriment has been a severe drop in the water level occurring about January 1. From about October 15 to December 31 the stream usually carries on the order of 1,000-1,500 second feet. The salmon spawn during this period. In January the flow is so greatly reduced that many salmon nests are left high and dry.

10. Merced River

This stream is at present a marginal salmon stream for both the spring and fall run. The area of good spawning gravel is tremendous and a slight increase in the water available at key times could well result in increasing the salmon run several hundred percent. At present during the irrigation season water is released in quantity from Exchequer Dam, passes through the power house at Merced Falls, and is picked up at the Merced Irrigation District diversion. A flow of about 135 second feet goes downstream to a gravel diversion dam at Snelling where the majority of it is diverted. There are other gravel dams and their diversions and one concrete dam found downstream. In the fall at the end of the irrigation season

ESTIMATED MINIMUM FLOWS REQUIRED TO MAINTAIN GAME FISH POPULATIONS AT PRESENT LEVELS

Name of stream and locality	SUMMER (*April-Sept.*)	WINTER (*Oct.-March*)
Class I Streams		
Gualala River	10 c.f.s.	200 c.f.s.
Garcia River	10 c.f.s.	200 c.f.s.
Navarro River	15 c.f.s.	350 c.f.s.
Big River	15 c.f.s.	200 c.f.s.
Noyo River	10 c.f.s.	200 c.f.s.
Ten-Mile River	20 c.f.s.	300 c.f.s.
Mattole River (possible power development)	40 c.f.s.	350 c.f.s.
Bear River (possible power development)	10 c.f.s.	200 c.f.s.
Redwood Creek (possible power development)	40 c.f.s.	250 c.f.s.
Carmel River	15 c.f.s.	200 c.f.s.
Big Sur River	35 c.f.s.	200 c.f.s.
Class II Streams		
1. Smith River		
a. At Fort Dick	250 c.f.s.	1,250 c.f.s.
b. South Fork at confluence with main stream	200 c.f.s.	800 c.f.s.
c. North Fork at confluence with main stream	100 c.f.s.	450 c.f.s.
d. Main stream above confluence with North Fork	150 c.f.s.	1,000 c.f.s.
2. Klamath River		
a. At Klamath	1,200 c.f.s.	2,000 c.f.s.
b. Trinity River at confluence with main stream	250 c.f.s.	1,000 c.f.s.
c. Main stream above confluence with Trinity River	650 c.f.s.	1,200 c.f.s.
d. Salmon River at confluence with main stream	150 c.f.s.	300 c.f.s.
e. Main stream above confluence with Salmon River	500 c.f.s.	1,000 c.f.s.
f. Scott River at confluence with main stream	100 c.f.s.	250 c.f.s.
g. Main stream above confluence with Scott River	500 c.f.s.	1,000 c.f.s.
h. Main stream at confluence with Shasta River		
without daily fluctuation	1,000 c.f.s.	1,000 c.f.s.
with daily fluctuation (high)	1,500 c.f.s.	1,500 c.f.s.
(low)	500 c.f.s.	500 c.f.s.
i. South Fork Trinity River at confluence with Trinity River	100 c.f.s.	1,000 c.f.s.
j. Trinity River at Lewiston		
January 400 c.f.s. / July 200 c.f.s.		
February 400 c.f.s. / August 200 c.f.s.		
March 400 c.f.s. / September 200 c.f.s.		
April 300 c.f.s. / October 300 c.f.s.		
May 300 c.f.s. / November 600 c.f.s.		
June 300 c.f.s. / December 400 c.f.s.		
3. Mad River		
a. At mouth	15 c.f.s.	350 c.f.s.
4. Eel River		
a. Main stream above confluence with Van Duzen River	100 c.f.s.	500 c.f.s.
b. Van Duzen River at confluence with main stream	25 c.f.s.	150 c.f.s.
c. Van Duzen River at Bridgeville	20 c.f.s.	100 c.f.s.
d. Main stream above confluence with South Fork	100 c.f.s.	150 c.f.s.
e. South Fork at confluence with main stream	50 c.f.s.	200 c.f.s.
f. Middle Fork at confluence with main stream	40 c.f.s.	350 c.f.s.
g. Main stream above confluence with Middle Fork	20 c.f.s.	125 c.f.s.
h. Eel River at Van Arsdale Dam	5 c.f.s.	100 c.f.s.
5. Russian River		
a. Main stream at mouth	200 c.f.s.	500 c.f.s.
b. Main stream at Ukiah	100 c.f.s.	250 c.f.s.
6. Sacramento River	(*Sept.-Dec.*)	(*Jan.-Aug.*)
a. Below Shasta Dam	4,000 c.f.s.	3,000 c.f.s.
b. Above confluence with Feather River	4,000 c.f.s.	4,000 c.f.s.
7. Feather River		
a. At driest point below Sutter-Butte Dam	(*Sept. 15-Dec.*)	(*Jan.-June*) / (*July-Sept. 14*)
	1,200 c.f.s.	900 c.f.s. / 250 c.f.s.
b. At Oroville (after Oroville Dam-cold water)	600 c.f.s.	400 c.f.s. / 400 c.f.s.

Name of stream and locality	SUMMER (*April-Sept.*)	WINTER (*Oct.-March*)
Class II Streams—Continued		
7. Feather River—Continued		
c. East Branch North Fork at confluence with North Fork	(*Mar.-Oct.*) 25 c.f.s.	(*Nov.-Feb.*) 200 c.f.s.
d. Middle Fork at Sloat	45 c.f.s.	110 c.f.s
8. Yuba River		
a. Below Narrows Dam	(*Oct.-Dec.*) / (*Jan.-Apr.*) / (*May-June*) / (*July-Aug.*)	
	500 c.f.s. / 500 c.f.s. / 300 c.f.s. / 500 c.f.s.	
b. Driest point below Daguerre Point	500 c.f.s. / 350 c.f.s. / 500 c.f.s. / 75 c.f.s.	
9. Bear River		
No salmon run but see previous paragraph 4.		
10. American River	(*Sept. 15-Dec.*) / (*Jan.-Feb.*) / (*Mar.-Sept. 15*)	
a. At Folsom (below Nimbus Dam)	750 c.f.s. / 500 c.f.s. / 350 c.f.s.	
b. North Fork above confluence with Middle Fork	50 c.f.s. minimum at all times	
c. Middle Fork above confluence with North Fork	60 c.f.s. minimum at all times	
d. South Fork at Coloma	100 c.f.s. minimum at all times	
11. Cosumnes River		
a. Below Bridgehouse Dam	(*Nov.-Dec.*) / (*Jan.-May*) / (*June-Oct.*)	
	150 c.f.s. / 75 c.f.s. / Live stream to Hiway 99	
12. Mokelumne River		
a. Below Pardee Dam	(*Sept. 15-Dec.*) / (*Jan.-June*) / (*July-Sept. 14*)	
	500 c.f.s. / 300 c.f.s. / 300 c.f.s.	
b. Below Woodbridge Dam	250 c.f.s. / 150 c.f.s. / 25 c.f.s.	
13. Stanislaus River	(*Oct.-Dec.*) / (*Jan.-May*) / (*June-Sept.*)	
a. Below Tulloch Dam	150 c.f.s. / 100 c.f.s. / 10 c.f.s.	
14. Tuolumne River		
a. At La Grange	(*June-Sept.*) / (*Sept. 15-Oct. 15*) / (*Oct. 15-Dec.*) / (*Jan.-May*)	
	25 c.f.s. / 500 c.f.s. / 1,000 c.f.s. / 700 c.f.s.	
15. Merced River		
a. At driest point below Exchecquer	(*Oct.-Dec.*) / (*Jan.-Apr.*) / (*May-June*) / (*July-Sept.*)	
	35 c.f.s. / 35 c.f.s. / 300 c.f.s. / 15 c.f.s.	
16. San Joaquin River		
a. At Hills Ferry	500 c.f.s. minimum	
b. At Vernalis	1,000 c.f.s. minimum	
17. Susan River	(*Oct.-Mar.*)	(*Apr.-Sept.*)
a. At Susanville	25 c.f.s.	50 c.f.s.
18. Truckee River		
a. At Tahoe City	25 c.f.s. minimum	
b. At California Stateline	25 c.f.s. minimum	
19. Carson River		
a. West Fork at Stateline	15 c.f.s. minimum	
b. East Fork at Stateline	15 c.f.s. minimum	
20. Walker River		
a. West Fork at Stateline	30 c.f.s. minimum	
b. East Fork at Stateline	40 c.f.s. minimum	
21. Owens River		
a. Above Tinemaha Reservoir	100 c.f.s. minimum	

the water is cut down to about 35 second feet at Exchequer. Often the upper part of the stream is so low that salmon have difficulty finding satisfactory places to spawn and even more difficulty in making their way upstream from the mouth of the river. Any reduction of this 35 second feet flow might completely eliminate both spring and fall runs.

In the spring, Exchequer reservoir often spills, and flows in excess of 1,000 second feet going down the river channel. Spring run migrants find this cold snow water to their liking and many of them do not continue upstream past Snelling. This flow generally stops very suddenly when the spill ceases. The salmon which have gotten past the Mereed Irrigation District Dam have an excellent chance of survival. Those which are between Merced Irrigation District Dam and Snelling have a fair to good chance. Those which are downstream from Snelling are almost certain to be killed by the high summer temperatures, and they have almost no chance to migrate upstream to safety through the low flows and gravel dams below Snelling. The water currently wasted in the area downstream from Snelling by poor water management practices would greatly improve the salmon run if it were allowed to stay in the river instead of being totally diverted at intervals and allowed to leak back into the river from poorly kept ditches.

11. San Joaquin River

The flows given for this stream were intended to give the amount of water required at Hills Ferry and Vernalis to keep resident fish in good condition and to enable migratory fish to pass through on their way to the spawning grounds in the various San Joaquin tributaries. Our knowledge of flows required in this section is very limited. The necessary flow below Friant Dam has previously been discussed at length and as these estimates were not requested have not been included.

PART II. WATER REQUIREMENTS FOR THE MAINTENANCE OF GAME

Game water requirements have been subject to being overlooked or to relegation to a place of minor importance in any allocation of water. However, minor as the total water required for the maintenance of game numbers might be, still a definite, firm requirement is present, and should be recognized in any long range planning of water allocations. That game and game interests have a firm part in the economy of the State is evident both by the governmental recognition given to this endeavor, and by the large amounts of time and money invested in the fostering and pursuit of game by the public of the State.

That game water requirements should be planned for is implied in the State Water Resources Act of 1945, Chapter 1514 of the Statutes of 1945, "an act declaring the public policy of the State, relating to flood waters and control, conservation, and the use of the State's water resources." Section 2 of this Act states, "In studying water development projects, full consideration shall be given to all beneficial uses of the State's water resources, including preservation and development of fish and wildlife resources, and recreational facilities, but not excluding other beneficial uses of water."

It is the purpose of this report to state in general, on a statewide basis, what game water requirements are, and in the case of waterfowl, to state specifically the local needs in important areas in California.

For simplification, game water requirements will be stated in two general categories: water for big game and upland game, and water for waterfowl and other aquatic wildlife.

I. Water for Big Game and Upland Game

In general, water supplies for these game species, such as deer, antelope, quail, dove, etc., are not seriously threatened on a statewide basis at present under existing agricultural and economic practices. Locally threats to continued existence of these species are present, and with increasing economic development of marginal lands, will become an ever increasing hazard to continued existence of these species throughout the State.

These species do not require large quantities of water in any one spot; rather, their needs are best expressed in the form of small quantities measured in gallons rather than acre feet. The supply, however, must be widespread and scattered over the range of these animals in proper relation to basic food and cover sources.

One of the principal threats to the supply of water for these species lies in the unwise use of springs by livestock interests, and to an increasing degree by mining or pseudo-mining interests in arid regions. This threat is more important in the desert area of southeastern California than in other sections but is present to some degree throughout the drier foothill areas of the State. It reaches its height in instances where a livestock operator through a water filing or otherwise virtually locks up all the water in a spring or springs for a rather large area of range land. Such use often takes the form of completely utilizing the flow of a spring by boxing it, and piping the flow to a trough that is inaccessible to small game by reason of its location away from cover and feed, or by its construction in such a manner that game cannot reach the water without the hazard of drowning in the process. In most of these cases, some small inexpensive provision could be made for wildlife water; this provision would not affect in any material degree the water that would be available for livestock, and

would give measurable benefits to the wildlife in surrounding areas. Water applications for the use of springs in desert or semi-desert areas should have a provision that adequate water for wildlife should be left. The adequacy of such supply should be determined by the representatives of the official wildlife agency of the State.

Another more recent threat to game in foothill areas has been the recent controversy between large irrigation interests in valley lands versus livestock operators in the watershed areas that supply water for the irrigation districts. In some instances this has taken the form of questioning the rights of watershed land holders to build small stock dams on drainages flowing into big reservoirs on the theory that such small dams use an appreciable quantity of water that is subject to the prior right of downstream users. This subject has not yet affected fish or game interests to any considerable degree to date, but could conceivably do so in the future with the current increase in farm pond and stock-dam programs that are being fostered by fish and game interests. In this instance, game officials will be interested in seeing that proper water supplies are developed and maintained for upland and big game in watershed areas.

Water needs for this group of game varies considerably in different sections of the State. Areas of high potential game populations that abound in cover and desirable feeds have higher water needs than do areas of low game productivity. Within the generality above, areas that are desert, or semi-desert, in climate have higher needs for free water than do lush coastal areas. These generalities are expressed in Table I "Big Game and Upland Game Water Requirements."

Table I lists the water requirements by counties for upland and big game species. The needs are expressed in gallons per square mile. This gallonage figure might best be expressed as "gallons of free water available daily per square mile." It does not necessarily mean for instance that throughout a year, or even throughout a summer, that there must be a flow of say eight gallons per day per square mile. It does mean, however, that at some crucial, hot, dry time, or times during a year that a flow of eight gallons per day will be necessary and will be used by wildlife.

It should be emphasized that proper distribution of this water is paramount. Eight gallons of water per square mile if distributed on the basis of 800 gallons located on one section leaving 99 sections dry would be of little use. Ideally over most of the State having populations of deer, quail, etc., there should be available water for every quarter section, or at least for every section in drier areas.

One additional point with respect to the relation between game and water development should be made. It does not have to do with game use of water, but rather with hazards that water development projects may impose on game. The construction of open diversion ditches often creates a hazard to wildlife, especially so in regard to deer. Legislation would be desirable, making it mandatory for any corporation, irrigation district, water company, or any other party or parties constructing such ditches or other impoundments to install, or cause to be installed suitable escape ramps for the preservation of wildlife.

II. Water for Waterfowl and Other Aquatic Game

It is in the needs of water for waterfowl and other game species requiring wet lands for their existence that man's agricultural and economic water needs have made the greatest inroads. Vast acreages of former marsh or semi-marsh lands have been drained for farming or other purposes, pushing these species into a small existing area which in turn is further subject to demands for more land and more water. Waterfowl are vitally dependent on free water over productive land areas. Their continued existence depends on planned reservation of water for their use. Other minor aquatic wildlife species, such as shorebirds, muskrat, beaver, etc., will benefit from any planning for waterfowl.

In order to alloeate water for these species, such allocation must be done for specific areas of the State, since waterfowl have definite habits and needs for certain types of lands and feeds which cannot be met with alternate situations. In other words, wintering grounds for waterfowl must be met in warm valley areas capable of growing good reliable foods. They cannot be met on mountain areas, or on areas of poor winter climate or inferior soil. Farming development has taken over the vast majority of lands formerly available to these species; the needs found below are allocated to lands that remain available in some measure for waterfowl. Provision must be made with as much speed as possible to see that not only lands, but water for these lands are devoted to waterfowl.

That California has in this matter an obligation not only to her sister States of the Pacific Waterfowl Flyway, but to our neighbor Nations to the North and South, has been brought out by many waterfowl authorities. This State has been the traditional wintering ground for vast numbers of birds of the Pacific Flyway. It has assumed this position of responsibility to the birds, if such it may be called, by virtue of its valley areas and their attendant winter climates. There is no substitute which will serve if these birds are to survive. It is with full realization of these facts that the needs of waterfowl for their continued existence are presented in Tables II and III.

Table II presents the needs for water for existing State waterfowl areas. Table III denotes needs for areas that have been proposed for State acquisition in

order to perpetuate the resourec. Whether or not the State acquires these areas, the needs for waterfowl will continue to exist if the waterfowl resource is to be perpetuated.

No mention is made of requirements for Federally operated areas. It is assumed that the U. S. Fish and Wildlife Service will list their needs for areas under their control.

It should be emphasized that the requirements shown in Table III are minimum. Even though these are tied to specific areas for reasons outlined above, there are in some instances possibilities of nearby alternates for some of the areas listed.

It will be noted that in the larger areas, both presently owned and those proposed for future acquisition, that provision is made for crop water. This is done in the interests of crop protection for surrounding agriculturalists as well as a primary food source for ducks.

Regarding competition between use of water for growing food crops for waterfowl and use of water for commercial agriculture, it is pointed out that

1. In most cases the growing of food crops for waterfowl is primarily for the purpose of protecting commercial agriculture from waterfowl depredation.

2. A number of existing and proposed projects are not in competition with farming since they are located below agricultural diversions. These are Grizzly Island, Suisun Refuge, Lake Earl, and Humboldt Bay. The water supply for Grizzly Island and Suisun Refuge is secured from Montezuma and Suisun Sloughs, tributaries to Suisun Bay.

3. The use of water for waterfowl in the Colorado River drainage is considered only slightly competitive with agriculture since drain and spill waters may be largely utilized.

4. The water needs in acre feet listed in some of the wet land areas such as Lake Earl and Clear Lake are large open bodies of water presently existing.

Accurate data on privately owned lands used for waterfowl purposes are lacking. The figure of 200,000 acres has been widely used and is herein used for purposes of this report.

Of these 200,000 acres, at least one quarter (50,000 acres) is located on tidelands or at the extreme lower ends of drainages where only tide or waste water is used.

The remaining 150,000 acres are here considered to depend in varying degrees upon the use of waters pertinent to the State Water Plan.

TABLE I

BIG GAME AND UPLAND GAME WATER REQUIREMENTS

(Quantities expressed in gallons per day per square mile needed for drinking water)

County	Area in square miles	Average gallons per sq. mi.	Total gals. per County	County	Area in square miles	Average gallons per sq. mi.	Total gals. per County
Alameda	840	4	3,360	Placer	1,484	8	11,872
Alpine	575	22	12,650	Plumas	2,361	20	47,220
Amador	568	15	8,520	Riverside	7,008	4	28,032
Butte	1,764	8	14,112	Sacramento	988	8	7,904
Calaveras	990	8	7,920	San Benito	1,476	12	17,712
Colusa	1,080	10	10,800	San Bernardino	20,055	4	80,200
Contra Costa	750	4	3,000	San Diego	4,207	4	16,828
Del Norte	1,546	8	12,368	San Francisco	42	0	0
El Dorado	1,891	15	28,365	San Joaquin	1,370	0	0
Fresno	6,035	7	42,245	San Luis Obispo	3,500	6	21,000
Glenn	1,460	10	14,600	San Mateo	470	0	0
Humboldt	3,507	8	28,056	Santa Barbara	2,450	4	9,800
Imperial	4,316	4	17,264	Santa Clara	1,355	12	16,260
Inyo	10,224	4	40,896	Santa Cruz	425	4	1,700
Kern	8,159	4	32,636	Shasta	4,050	22	89,100
Kings	1,375	4	5,500	Sierra	957	15	14,355
Lake	1,332	9	11,988	Siskiyou	6,078	22	133,716
Lassen	4,750	8	38,000	Solano	911	4	3,644
Los Angeles	4,000	4	16,000	Sonoma	1,540	10	3,850
Madera	2,140	6	12,840	Stanislaus	1,486	8	11,888
Marin	516	10	5,160	Sutter	611	4	2,444
Mariposa	1,580	10	15,800	Tehama	3,200	8	25,600
Mendocino	3,400	8	27,200	Trinity	3,276	8	26,208
Merced	1,750	6	10,500	Tulare	4,863	6	29,178
Modoc	4,097	26	106,522	Tuolumne	2,282	8	18,256
Mono	2,796	4	11,184	Ventura	1,850	4	7,400
Monterey	3,150	8	27,600	Yolo	1,017	8	8,136
Napa	800	12	9,600	Yuba	625	8	5,000
Nevada	982	8	7,856				
Orange	780	12	9,360	Totals	157,390	487	1,229,205

NOTE. Average gallons per square mile have been carried to the nearest gallon.
Gallons per square mile may mean two gallons per square mile in some watersheds and as high as twenty in others, depending upon the locality.

TABLE II

ANNUAL WATER REQUIREMENTS

Existing State Waterfowl and Management Areas

Area	Location (county)	Total acreage planned	Average acres crop	Water requirements for crops (acre-feet)	Storage (ponds) water area acres	Water required for ponds (acre-feet)	Total water required (acre-feet)
Madeline Plains W.M.A.	Lassen	5,176	660	4,620	1,420	9,940	14,560
Tule Res.	Lassen				3,100		3,100
Honey Lake W.M.A.	Lassen	5,000	3,466	19,928	1,566	8,244	28,172
Gray Lodge	Butte	6,500	2,000	9,000	2,000	12,000	21,000
Suisun	Solano	1,900			1,500	9,000	9,000
Grizzly Island W.M.A.	Solano	8,600	1,200	3,000	3,500	12,250	15,250
Los Banos	Merced	3,000	1,500	7,125	1,000	4,000	11,125
Tupman	Kern	1,000	500	1,750	250	875	2,625
Imperial W.M.A.	Imperial	4,400	1,700	6,930	25	157	7,087
Imperial Refuge No. 1	Imperial	2,000			2,000	10,000	10,000
TOTALS		37,576	11,026	52,353	16,361	66,466	121,919

TABLE III

ANNUAL WATER REQUIREMENTS

Propased Waterfawl Management Areas

Area	Location (county)	Proposed acreage	Average acreage crop	Water requirements for crops (acre-feet)	Storage (ponds) area (acre-feet)	Water required for ponds (acre-feet)	Total water required (acre-feet)
Upper Butte	Butte	5,750	2,000	8,500	2,000	8,000	16,500
San Luis Is. W.M.A.	Merced	6,800	3,000	13,320	2,000	6,432	19,752
Madera W.M.A.	Madera	5,000	2,000	8,550	1,500	5,250	13,800
Tupman W.M.A.	Kern	4,000	2,000	8,550	500	2,000	10,550
Pit River W.M.A.	Shasta	4,000	1,000	4,000	2,000	8,000	12,000
Lake Earl Mgt. Area	Del Norte	400	400	800			800
Humboldt Bay Mgt. Area	Humboldt	1,600	1,600	3,200			3,200
Lower Colorado River Mgt. Area	Imperial (Palo Verde)	5,000					22,500
San Luis Wasteway	Merced	2,700	1,250	2,200	1,500	2,625	4,825
Carlsbad Lagoon	San Diego	250	50	100	200	700	800
San Antonio Creek	Santa Barbara	200			200	600	600
TOTALS		35,700	13,300	49,220	9,900	33,607	105,327

Private lands are rarely devoted exclusively for waterfowl purposes so that these lands can be considered to be in dual use, the most common pattern being livestock grazing combined with waterfowl shooting. It is the general custom to apply two-thirds of the available water in the fall, just prior to and during the hunting season. The remaining one-third is used in the spring.

Benefits derived from this type of water application should not be charged to two-thirds waterfowl and one-third to livestock grazing. The fall water serves to charge the soil, and start vegetation growing in late winter and early spring; without it, the spring applied water would be of far less livestock value. It is felt only fifty per cent of the water reserved for use on these lands can be justifiably charged to waterfowl.

In the "Grasslands" of the San Joaquin Valley, one foot of water per acre per year has given reasonably satisfactory operation of the area as a grazing

and gun club operation. This figure applied to the 150,000 acres in California devoted to similar use will require reservation of 150,000 acre feet of water, half of which is chargeable to waterfowl benefits.

Table IV denotes water requirements on minor waterfowl lands throughout the State, mostly in coastal areas. These are generally small in size and are by and large under private control. Many of them may be desirable for future acquisition by the State, but in the main, as long as water for ducks is provided, they may well serve their end for waterfowl by remaining in private ownership.

Based on the above principles, the total water needed for game use in California (exclusive of needs on Federally operated waterfowl lands) is estimated as follows:

(a) Upland Game Lands—8.75 gals. per sq. mile—1,229,-205 gallons
(b) Existing State Waterfowl Areas — 121,919 ac. ft.
(c) Proposed Waterfowl Areas — 105,327 ac. ft.
(d) Other Wet Lands — 964,400 ac. ft.
(e) Private Waterfowl Lands — 75,000 ac. ft.

TOTAL — *1,266,646 ac. ft.

NOTE: Estimates given here are subject to revision wherever and whenever it is deemed necessary to conform to changes in land and water uses.
* This total figure applies to waterfowl lands only.

TABLE IV

WATERFOWL WATER REQUIREMENTS IN OTHER AREAS NOT LISTED ABOVE

Area	County	Acreage	Water Required (Acre-feet)
Lake Earl	Del Norte		10,000
Fresh Water Lagoon	Humboldt		3,000
Stone Lagoon	Humboldt		2,400
Big Lagoon	Humboldt		5,000
Clear Lake	Lake		200,000
Butte Sink	Butte and Colusa	24,000	48,000
Grass Lands	Merced and Madera	98,234	33,000
South Bay	Santa Clara and Alameda	2,000	3,000
Dune Lakes	San Luis Obispo	1,000	2,000
Morro Bay	San Luis Obispo	6,000	1,500
Santa Maria River (Mouth)	San Luis Obispo	1,500	3,000
Elkhorn Slough	Monterey	1,200	2,000
Salinas River (Mouth)	Monterey	1,000	1,500
Santa Maria River	Santa Barbara	250	800
Guadalupe Lake	Santa Barbara	600	1,500
Santa Ynez River	Santa Barbara	200	500
Santa Clara River (Including McGrath Lake)	Ventura	200	500
Calleguas and Conejo	Ventura	250	500
Bolsa Chica	Orange	2,500	500
Newport	Orange	500	None
Carlsbad Lagoon	San Diego	250	800
San Marcos Lagoon	San Diego	1,000	1,250
Escondido Creek Lagoon	San Diego	750	800
Mission Bay	San Diego		25
Tijuana River Lagoon	San Diego	500	250
TOTALS		141,884	321,825

APPENDIX G

HYDROELECTRIC POWER INSTALLATIONS IN CALIFORNIA

12—99801

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HYDROELECTRIC POWER INSTALLATIONS IN CALIFORNIA

Hydrographic area, and plant name	Owner	Stream	Installed power capacity, in kilowatts	Estimated average annual generation, in 1,000 kilowatt-hours	Estimated average annual water requirement, in acre-feet	Gross head, in feet
North Coastal Area						
Copco No. 1	California Oregon Power Co.	Klamath River	20,000	106,000	1,499,000	122
Copco No. 2	Same	Same	27,000	130,000	1,476,000	151
Fall Creek	Same	Fall Creek	2,200	10,000	27,000	730
Junction City	Pacific Gas & Electric Co.	Trinity River	2,720	10,200	10,500	602
Salyer	Swanson Mining Corp.	Same	1,600	170		
Potter Valley	Pacific Gas & Electric Co.	Russian River	8,800	58,000	183,300	476
TOTALS, NORTH COASTAL AREA			62,320	314,370		
South Coastal Area						
Franklin Canyon	Los Angeles Department of Water and Power	Los Angeles Aqueduct	2,000	8,800	52,300	285
San Francisquito No. 1	Same	Same	58,875	210,000	323,500	935
San Francisquito No. 2	Same	Same	42,000	115,000	319,900	540
San Fernando	Same	Same	5,600	50,000	264,300	250
Azusa	City of Pasadena	San Gabriel River	3,000	14,000	43,000	401
Sierra	Southern California Edison Co.	San Antonio Creek	480	4,000	14,100	628
Ontario No. 1	Same	Same	600	4,800	15,100	700
Ontario No. 2	Same	Same	320	1,100	10,900	276
Lytle Creek	Same	Lytle Creek	400	4,000	18,300	472
Fontana	Same	Same	1,920	8,800	36,000	658
Santa Ana No. 1	Same	Santa Ana River	2,400	18,000	42,800	726
Santa Ana No. 2	Same	Same	800	8,000	40,300	310
Santa Ana No. 3	Same	Same	1,200	7,000	37,500	354
Mill Creek No. 3	Same	Mill Creek	1,800	14,000	14,000	1,911
Mill Creek No. 2	Same	Same	200	1,500	5,000	620
Mill Creek No. 1	Same	Same	800	4,700	21,500	510
Rincon	Escondido Mutual Water Co.	San Luis Rey River	240	300	360	824
Bear Valley	Same	Escondido Creek	520	4,800	19,200	400
TOTALS, SOUTH COASTAL AREA			123,155	478,800		
Central Valley Area						
Sacramento River Basin						
Alturas	California Oregon Power Co.	Pine Creek	450	1,700		365
Pit No. 1	Pacific Gas & Electric Co.	Pit River	56,000	288,100	725,900	454
Pit No. 3	Same	Same	72,900	382,400	1,644,000	315
Pit No. 5	Same	Same	128,000	826,000	1,563,000	615
Hat Creek No. 1	Same	Hat Creek	10,000	45,000	203,400	217
Hat Creek No. 2	Same	Same	10,000	50,800	304,800	198
Shasta	U. S. Bureau of Reclamation	Sacramento River	379,000	1,863,000	5,696,000	480
Keswick	Same	Same	75,000	347,000	5,915,000	101
Kilarc	Pacific Gas & Electric Co.	North Fork Cow Creek	3,000	16,900	24,700	1,192
Cow Creek	Same	Cow Creek	1,200	11,700	26,500	715
Volta	Same	North Fork Battle Creek	6,400	45,800	57,300	1,254
South	Same	South Fork Battle Creek	4,000	35,600	94,600	516
Inskip	Same	Same	6,000	40,000	178,500	378
Coleman	Same	Battle Creek	13,800	57,500	195,800	482
De Sabla	Same	Big Butte Creek	13,000	83,200	81,000	1,531
Centerville	Same	Same	6,400	35,600	105,700	577
Hamilton Branch	Same	Hamilton Branch, Feather River	4,800	15,000	61,500	389
Caribou	Same	North Fork Feather River	60,000	451,000	562,000	1,150
Bucks Creek	Same	Same	66,000	198,000	132,300	2,558
Rock Creek	Same	Same	113,400	454,000	1,386,000	535
Cresta	Same	Same	67,500	298,000	1,766,000	290
Big Bend No. 1	Same	Same	52,000	454,000	1,297,000	465
Lime Saddle	Same	West Branch, North Fork Feather River	1,600	11,300	41,200	462
Coal Canyon	Same	Dry Creek	800	7,500	20,500	350
Sierra City	Same	North Fork Yuba River	30			
Bullards Bar	Same	Same	6,500	38,900	382,300	166
Colgate	Same	Same	24,000	154,000	261,300	810
Spaulding No. 3	Same	South Fork Yuba River	6,300	29,100	150,300	318
Spaulding No. 1	Same	Same	6,400	42,100	381,200	197
Spaulding No. 2	Same	Same	3,750	20,000	104,600	344
Narrows	Same	Yuba River	9,350	89,000	454,300	240
Deer Creek	Same	Deer Creek	5,500	31,300	59,200	837
Drum	Same	Bear River	44,000	282,500	296,200	1,375

HYDROELECTRIC POWER INSTALLATIONS IN CALIFORNIA—Continued

Hydrographic area and plant name	Owner	Stream	Installed power capacity, in kilowatts	Estimated average annual generation, in 1,000 kilowatt-hours	Estimated average annual water requirement, in acre-feet	Gross head, in feet
Sacramento River Basin—Continued						
Alta	Same	Same	2,000	6,400	12,200	66
Dutch Flat	Same	Same	22,000	147,000	30,000	643
Halsey	Same	Dry Creek	10,000	66,800	232,100	331
Wise	Same	Auburn Ravine	10,000	90,700	202,500	519
El Dorado	Same	South Fork American River	20,000	97,700	77,600	1,910
American River	Same	Same	5,750	30,000	14,600	573
Subtotals, Sacramento River Basin			1,326,830	7,144,600		
San Joaquin River Basin						
Big Creek No. 8	Southern California Edison Co.	San Joaquin River	54,000	309,200	548,600	713
Big Creek No. 3	Same	Same	106,500	743,500	1,252,000	827
Big Creek No. 4	Same	Same	84,000	490,000	1,305,000	418
Kerekhoff	Pacific Gas & Electric Co.	Same	34,080	275,400	966,300	350
Big Creek No. 1	Southern California Edison Co.	Big Creek	67,000	583,600	308,800	2,131
Big Creek No. 2	Same	Same	57,750	506,600	319,300	1,858
Big Creek No. 2A	Same	Same	80,000	238,500	237,200	2,418
Crane Valley	Pacific Gas & Electric Co.	North Fork San Joaquin River	800	2,700	80,300	90
San Joaquin No. 3	Same	Same	4,800	20,300	73,500	405
San Joaquin No. 2	Same	Same	2,400	11,000	78,000	307
San Joaquin No. 1A	Same	Same	340	1,300	54,300	43
A. G. Wishon	Same	Same	12,800	85,900	249,100	1,412
Yosemite	National Park Service	Merced River	2,000	11,000	40,200	336
Exchequer	Merced Irrigation District	Same	25,000	127,800	805,100	300
Merced	Pacific Gas & Electric Co.	Same	3,440	16,100	628,200	27
Early Intake	San Francisco Utilities Comm.	Cherry Creek	3,600	28,000	100,500	343
Moccasin Creek	Same	Moccasin Creek	70,000	508,000	519,000	1,316
Don Pedro	Turlock-Modesto Irrigation District	Tuolumne River	26,990	199,800	1,339,000	261
La Grange	Turlock-Modesto Irrigation District	Tuolumne River	3,900	25,200	125,900	117
Spring Gap	Pacific Gas & Electric Co.	Middle Fork, Stanislaus River	6,000	48,200	35,600	1,865
Phoenix	Same	South Fork, Stanislaus River	1,600	9,000	13,000	1,087
Murphys	Same	Angels Creek	3,800			
Angels	Same	Same	1,400	7,000	19,900	448
Stanislaus	Same	Same	28,900	233,500	238,600	1,499
Melones	Same	Same	24,300	95,300	618,200	230
Bear River	Same	North Fork, Mokelumne River	29,700	141,000		2,104
Salt Springs	Same	Same	9,350	42,800	380,300	255
Tiger Creek	Same	Same	51,000	353,000	336,500	1,219
West Point	Same	Same	13,600	91,400	414,800	312
New Electra	Same	Mokelumne River	89,100	363,500	442,400	1,268
Pardee	East Bay Municipal Utility District	Same	15,000	90,000	362,400	327
Subtotals, San Joaquin River Basin			913,150	5,658,600		
Tulare Lake Basin						
Kern River No. 3	Southern California Edison Company	Kern River	32,000	197,500	302,200	821
Borel	Same	Same	8,200	63,800	229,800	270
Kern River No. 1	Same	Same	16,000	173,200	224,100	877
Kern Canyon	Pacific Gas & Electric Co.	Same	8,480	59,600	326,700	262
Tule River	Same	Middle Fork, Tule River	4,800	24,500	24,700	1,532
Tule	Southern California Edison Co.	Tule River	2,000	17,000	22,800	1,140
Kaweah No. 3	Same	Kaweah River	2,800	24,700	55,800	775
Kaweah No. 1	Same	Same	2,250	14,000	18,800	1,326
Kaweah No. 2	Same	Same	1,800	11,000	44,700	367
Balch	Pacific Gas & Electric Co.	North Fork Kings River	31,000	178,600	102,600	2,336
Subtotals, Tulare Lake Basin			109,330	763,900		
TOTALS, CENTRAL VALLEY AREA			2,349,310	13,567,100		

HYDROELECTRIC POWER INSTALLATIONS IN CALIFORNIA—Continued

Hydrographic area and plant name	Owner	Stream	Installed power capacity, in kilowatts	Estimated average annual generation, in 1,000 kilowatt-hours	Estimated average annual water requirement, in acre-feet	Gross head, in feet
Lahontan Area						
Farad	Sierra Pacific Power Co.	Truckee River	2,800	17,000	290,000	83
Rush Creek	California Electric Power Co.	Rush Creek	8,400	44,000	32,300	1,807
Poole	Same	Leevining Creek	10,000	26,000	29,600	1,675
Mill Creek	Same	Mill Creek	2,400	8,100	21,700	785
Haiwee	Los Angeles Department of Water and Power	Los Angeles Aqueduct	5,600	34,000	320,900	193
Cottonwood	Same	Cottonwood Creek	1,500	5,800	6,110	1,267
Division Creek No. 2	Same	Division Creek	600	3,000	4,460	1,250
Big Pine No. 3	Same	Big Pine Creek	3,200	15,000	15,600	1,245
Upper Gorge	Same	Owens River	37,500	155,000	197,800	792
Middle Gorge	Same	Same	37,500	155,000	197,800	767
Central Gorge	Same	Same	37,500	158,000	197,800	781
Laws	Champion Sillimanite, Inc	Milner Creek	312	400		1,017
Bishop Creek No. 2	California Electric Power Co.	Bishop Creek	6,320	39,000	65,300	953
Bishop Creek No. 3	Same	Same	6,600	35,000	65,300	809
Bishop Creek No. 4	Same	Same	6,300	44,000	65,300	1,112
Bishop Creek No. 5	Same	Same	3,500	18,000	68,000	420
Bishop Creek No. 6	Same	Same	1,800	11,300	68,000	620
TOTALS, LAHONTAN AREA			171,832	768,600		
Colorado Desert Area						
San Gorgonio No. 1	California Electric Power Co.	San Gorgonio Creek	1,500	3,000	910	1,773
San Gorgonio No. 2	Same	Same	750	1,500	910	898
Siphon Drop	U. S. Bureau of Reclamation	Yuma Canal	1,600	15,000	1,436,000	15
Drop No. 3	Imperial Irrigation District	All-American Canal	4,800	45,000	2,100,000	25
Drop No. 4	Same	Same	19,600	100,000	2,600,000	50
Parker	U. S. Bureau of Reclamation	Colorado River	120,000	700,000	8,445,000	76
TOTALS, COLORADO DESERT AREA			148,250	864,500		
Colorado River Power Installations						
Hoover	U. S. Bureau of Reclamation	Colorado River	1,249,800	5,348,000		530
Davis	Same	Same	225,000	1,065,000		145

APPENDIX H

MAJOR RESERVOIRS OF CALIFORNIA

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MAJOR RESERVOIRS OF CALIFORNIA

Reservoir	Stream	Section	Township	Range	Base and meridian	Purpose	Crest elevation, in feet above mean sea level	Storage capacity, in acre-feet
North Coastal Area								
Clear Lake	Lost River	8	47N	8E	M.D.	Irrigation	1,552	527,000
Lake Pillsbury (Scott Dam)	South Eel River	14 and 23	18N	10W	M.D.	Power	1,920	93,724
Copco No. 1	Klamath River	29	48N	4W	M.D.	Power	2,613	77,000
Dwinnell (Shasta River Dam)	Shasta River	25	43N	5W	M.D.	Irrigation	2,828	33,000
Sweasey	Mad River	16	5N	2E	H.	Municipal	200	3,000
Earl B. Fiock No. 2	Tributary of Shasta River	6	44N	5W	M.D.	Irrigation	2,625	2,249
Janes Flat	Mosquito Creek	25	47N	10E	M.D.	Irrigation	5,100	1,400
Benbow	East Fork of South Fork Eel River	36	4S	3E	H.	Power	374	1,060
Earl B. Fiock	Tributary Little Shasta River	1	44N	6W	M.D.	Irrigation	2,525	1,000
"M"	Tributary Fairchild Meadow	13	44N	9E	M.D.	Irrigation	5,050	1,000
San Francisco Bay Area								
Calaveras	Calaveras Creek	13	5S	1E	M.D.	Municipal	775	100,000
Anderson	Coyote River	10	9S	3E	M.D.	Irrigation, municipal	640	75,000
Lower Crystal Springs	San Mateo Creek	1	5S	5W	M.D.	Municipal	289	54,000
San Pablo	San Pablo Creek	12	1N	4W	M.D.	Municipal	328	43,193
Upper San Leandro	San Leandro Creek	16 and 17	2S	2W	M.D.	Municipal	475	41,436
Lake Hennessey (Conn Creek Dam)	Conn Creek	1	7N	5W	M.D.	Municipal	330	30,000
Coyote	Coyote Creek	29	9S	4E	M.D.	Irrigation, municipal	803	27,770
Lexington	Los Gatos Creek	29	8S	1W	M.D.	Municipal, irrigation	665	25,000
San Andreas	San Andreas Creek	16	4S	5W	M.D.	Municipal	456	18,500
Kent Lake (Peters Dam)	Lagunitas Creek	23	2N	8W	M.D.	Municipal	368	16,500
Upper Crystal Springs	Laguna Creek	12	5S	5W	M.D.	Municipal	292	15,500
Lake Chabot (Lower San Leandro Dam)	San Leandro Creek	30	2S	2W	M.D.	Municipal	245	12,600
Lake Curry	Gordon Valley Creek	19	6N	2W	M.D.	Municipal	392	10,700
Calero	Calero Creek	6	9S	2E	M.D.	Irrigation, municipal	490	9,300
Alpine	Lagunitas Creek	16	1N	7W	M.D.	Municipal	654	9,210
Austrian	Los Gatos Creek	24	9S	1W	M.D.	Municipal	1,125	6,000
Novato Creek	Novato Creek	9	3N	7W	M.D.	Municipal	195	4,430
Rector Creek	Rector Creek	19	7N	4W	M.D.	Municipal, irrigation	380	4,400
Bon Tempe	Lagunitas Creek	11	1N	7W	M.D.	Municipal	724	4,000
Stevens Creek	Stevens Creek	27	7S	2W	M.D.	Irrigation, municipal	545	4,000
Guadalupe	Guadalupe Creek	32	8S	1E	M.D.	Irrigation, municipal	627	3,500
Lafayette	Lafayette Creek	36	1N	3W	M.D.	Municipal	466	3,500
Mallard	Tributary Suisun Bay	13	2N	2W	M.D.	Municipal	36	3,113
Pilarcitos	Pilarcitos Creek	33	4S	5W	M.D.	Municipal	700	3,100
Lake Herman	Sulphur Springs Valley Creek	24	3N	3W	M.D.	Municipal	122	2,210
Almaden	Almaden Creek	11	9S	1E	M.D.	Irrigation, municipal	615	2,000
Milliken	Milliken Creek	7	6N	3W	M.D.	Municipal	923	2,000
Lake Madigan	Wild Horse Valley Creek	4	5N	3W	M.D.	Municipal	1,383	1,744
Lake Chabot	Sulphur Springs Creek	6	3N	3W	M.D.	Municipal	85	1,430
Lake Frey	Wild Horse Valley Creek	9	5N	3W	M.D.	Municipal	1,207	1,075
Central Coastal Area								
Cachuma	Santa Ynez River	24	6N	30W	S.B.	Irrigation, municipal	776	210,000
Salinas	Salinas River	8	30S	14E	M.D.	Municipal	1,320	26,000
Santa Barbara (Gibraltar Dam)	Santa Ynez River	14	5N	27W	S.B.	Municipal	1,402	15,000
Elmer J. Chesbro	Llagas Creek	30	9S	3E	M.D.	Irrigation, municipal	535	7,500
Jameson Lake (Juncal Dam)	Santa Ynez River	28	5N	25W	S.B.	Municipal, irrigation	2,230	7,064
North Fork	Pacheco Creek	22	10S	6E	M.D.	Irrigation	483	6,150
Paicines	Tributary Tres Pinos Creek	11	14S	6E	M.D.	Irrigation	701	4,500
Los Padres	Carmel River	8	18S	3E	M.D.	Municipal	1,053	3,000
San Clemente	Carmel River	24	17S	2E	M.D.	Municipal	535	2,154
South Coastal Area								
Prado	Santa Ana River	20	3S	7W	S.B.	Flood control	566	223,000
Henshaw	San Luis Rey River	10	11S	2E	S.B.	Irrigation	2,740	203,581
El Capitan	San Diego River	7	15S	2E	S.B.	Municipal	770	118,000
Santa Felicia	Piru Creek		4N	18W	S.B.	Irrigation, power, municipal	1,075	100,000
Lake Mathews	Tributary Cajalco Creek	12	4S	6W	S.B.	Municipal	1,371	100,000
San Vincente	San Vincente Creek	31	14S	1E	S.B.	Municipal	650	90,231
Big Bear Lake (Bear Valley Dam)	Bear Creek	22	2N	1W	S.B.	Irrigation	6,746	72,400
Morena	Cottonwood Creek	14	17S	4E	S.B.	Municipal	3,049	53,700
Vail	Temecula Creek	10	8S	1W	S.B.	Irrigation	1,479	51,000
Lower Otay (Savage Dam)	Otay River	18	18S	1E	S.B.	Municipal	492	49,126
San Gabriel No. 1	San Gabriel River	6	1N	9W	S.B.	Flood control	1,481	43,825
Barrett	Cottonwood Creek	22	17S	3E	S.B.	Municipal	1,617	42,899
Bouquet Canyon	Bouquet Creek	29	6N	14W	S.B.	Municipal	3,008	36,200
Hansen	Big Tujunga Creek	18	2N	14W	S.B.	Flood control	1,087	35,800
Morris	San Gabriel River	13	1N	10W	S.B.	Municipal	1,175	35,171
Whittier Narrows	San Gabriel River and Rio Hondo	1, 4, 5, and 6	2S	12W	S.B.	Flood control	239	35,000
Lake Hodges	San Dieguito River	18	13S	2W	S.B.	Municipal	330	33,482

MAJOR RESERVOIRS OF CALIFORNIA—Continued

Reservoir	Stream	Section	Township	Range	Base and meridian	Purpose	Crest elevation, in feet above mean sea level	Storage capacity, in acre-feet
South Coastal Area—Continued								
Santa Fe	San Gabriel River	6	1S	10W	S.B.	Flood control	514	33,000
Sutherland	Santa Ysabel Creek	21	12S	2E	S.B.	Municipal	2,074	29,000
Lake Loveland	Sweetwater River	17	16S	2E	S.B.	Municipal	1,368	27,700
Sweetwater	Sweetwater River	17	17S	1W	S.B.	Municipal	240	27,689
Santiago Creek	Santiago Creek	33	4S	8W	S.B.	Irrigation	810	25,000
Lower San Fernando	San Fernando Creek	5	2N	15W	S.B.	Municipal	1,142	18,900
Sepulveda	Los Angeles River	17	1N	15W	S.B.	Flood control	725	17,400
Puddingstone	Walnut Creek	15	1S	9W	S.B.	Flood control	982	17,190
Railroad Canyon	San Jacinto River	2	6S	4W	S.B.	Irrigation	1,390	15,200
Lake Hemet	South Fork San Jacinto River	7	6S	3E	S.B.	Irrigation	4,336	14,000
Cuyamaca	Boulder Creek	5	14S	4E	S.B.	Irrigation, municipal	4,641	11,600
Cogswell	West Fork San Gabriel River	19	2N	10W	S.B.	Flood control	2,405	10,915
Chatsworth	Tributary Los Angeles River	25	2N	17W	S.B.	Municipal	898	10,500
Stone Canyon	Stone Canyon Creek	9	1S	15W	S.B.	Municipal	856	7,960
Lake Wohlford	Escondido Creek	5	12S	1W	S.B.	Municipal, irrigation	1,479	7,500
Matilija	Matilija Creek	29	5N	23W	S.B.	Flood control	1,138	7,000
Murray	Chapparel Canyon	13	16S	2W	S.B.	Municipal	540	5,885
Pacoima	Pacoima Creek	19	3N	14W	S.B.	Flood control	2,015	4,714
San Joaquin Flood Control	Tributary Newport Bay	18	6S	9W	S.B.	Flood control	30	4,500
Big Tujunga No. 1	Big Tujunga Creek	1	2N	13W	S.B.	Flood control	2,304	4,236
Brea	Brea Creek	21	3S	10W	S.B.	Flood control	295	4,090
Hollywood (Mulholland Dam)	Weid Canyon	3	1S	14W	S.B.	Municipal	756	4,034
Encino	Encino Creek	24	1N	16W	S.B.	Municipal	1,022	3,230
Upper Otay	Procter Valley Creek	36	17S	1W	S.B.	Municipal	555	2,793
Lake Sherwood	Triunfo Creek	27	1N	19W	S.B.	Recreation, irrigation	954	2,694
Devils Gate	Arroyo Seco	7	1N	12W	S.B.	Flood control	1,070	2,504
Silver Lake	Tributary Balona Creek	8	1S	13W	S.B.	Municipal	458	2,162
Yorba	Tributary Santa Ana River	34	3S	9W	S.B.	Municipal	290	2,000
Upper San Fernando	San Fernando Creek	31	3N	15W	S.B.	Municipal	1,219	1,640
Dry Canyon	Dry Canyon Creek	35	5N	16W	S.B.	Municipal	1,514	1,325
Sycamore	Sycamore Canyon	31	2S	4W	S.B.	Flood control	1,013	1,150
San Dieguito	Tributary Escondido Creek	16	13S	3W	S.B.	Municipal	250	1,128
Lee Lake	Temescal Creek	7	5S	5W	S.B.	Irrigation	1,153	1,100
Palos Verdes	Tributary Los Angeles Harbor	33	4S	14W	S.B.	Municipal	330	1,100
Peters Canyon	Peters Canyon	31	4S	8W	S.B.	Irrigation	538	1,090
Lower Franklin	Franklin Canyon	12	1S	15W	S.B.	Municipal	586	1,052
San Dimas	San Dimas Creek	24	1N	9W	S.B.	Flood control	1,470	1,042
Mocking Bird	Mockingbird Canyon	21	3S	5W	S.B.	Irrigation	1,010	1,000
Central Valley Area								
Shasta	Sacramento River	15	33N	5W	M.D.	Power, irrigation	1,078	4,492,000
Monticello	Putah Creek	29	8N	2W	M.D.	Irrigation, flood control	456	1,600,000
Lake Almanor	North Fork Feather River	28	27N	8E	M.D.	Power	4,515	1,308,000
Pine Flat	Kings River	2	13S	24E	M.D.	Irrigation, flood control	970	1,000,000
Folsom	American River	24	10N	7E	M.D.	Flood control, irrigation, power, municipal	480	1,000,000
Isabella	Kern River	19	26S	32E	M.D.	Flood control, irrigation	2,634	550,000
Millerton Lake (Friant Dam)	San Joaquin River	5	11S	21E	M.D.	Flood control, irrigation	582	520,500
Clear Lake	Cache Creek	6	12N	6W	M.D.	Irrigation	1,328	420,000
Hetch Hetchy (O'Shaughnessy Dam)	Tuolumne River	16	1N	20E	M.D.	Municipal, power	3,812	360,000
Lake McClure (Exchequer Dam)	Merced River	13	4S	15E	M.D.	Irrigation, power	710	289,000
Don Pedro	Tuolumne River	35	2S	14E	M.D.	Irrigation, power	609	289,000
Cherry Valley	Cherry River	5	1N	19E	M.D.	Municipal, flood control, power	4,715	268,000
Pardee	Mokelumne River	26	5N	10E	M.D.	Municipal, power	575	210,000
Buena Vista Lake	Kern River	32	30S	25E	M.D.	Irrigation	300	205,000
Salt Springs	North Fork Mokelumne River	33	8N	16E	M.D.	Power	3,960	139,400
Shaver Lake	Stevenson Creek	13	9S	24E	M.D.	Power	5,371	135,283
Wishon	North Fork Kings River	6	11S	28E	M.D.	Power	6,550	128,000
Vermillion Valley	Mono Creek	25 and 26	6S	27E	M.D.	Power	7,650	125,000
Melones	Stanislaus River	11	1N	13E	M.D.	Irrigation, power	723	112,500
Bucks Creek	Bucks Creek	33	24N	7E	M.D.	Power	5,168	103,000
Beardsley	Middle Fork Stanislaus River	14 and 15	4N	17E	M.D.	Irrigation, power	3,405	97,500
Huntington Lake	Big Creek	14	8S	25E	M.D.	Power	6,954	88,834
Big Sage	Rattlesnake Creek	7	43N	12E	M.D.	Irrigation	4,907	77,000
Hogan	Calaveras River	31	4N	11E	M.D.	Flood control	654	76,000
Lake Spaulding	South Fork Yuba River	20	17N	12E	M.D.	Power, irrigation, municipal	5,014	74,488
Englebright (Upper Narrows)	Yuba River	14	16N	6E	M.D.	Debris, power	542	70,000
Tulloch	Stanislaus River	1	1S	12E	M.D.	Irrigation, power	515	68,400
Bowman Lake	Canyon Creek	5	18N	12E	M.D.	Irrigation, power	5,567	68,000

MAJOR RESERVOIRS OF CALIFORNIA—Continued

Reservoir	Stream	Section	Township	Range	Base and meridian	Purpose	Crest elevation, in feet above mean sea level	Storage capacity, in acre-feet
Central Valley Area—(Continued)								
Donnell	Middle Fork Stanislaus River	35	6N	18E	M.D.	Irrigation, power	4,917	64,500
Florence Lake	South Fork San Joaquin River	36	7S	27E	M.D.	Power	7,329	64,406
Farmington	Littlejohns Creek	25	1N	9E	M.D.	Flood control	174	52,000
East Park	Little Stony Creek	3	17N	6W	M.D.	Irrigation	1,202	51,000
Stony Gorge	Stony Creek	16	20N	6W	M.D.	Irrigation	847	50,200
Butt Valley	Butt Creek	13	26N	7E	M.D.	Power	4,144	49,768
Owen	Tributary Tuolumne River	31	3S	13E	M.D.	Irrigation	233	49,000
Lower Bear River	Bear River	18	8N	16E	M.D.	Power	5,820	48,500
Lake Fordyce	Fordyce Creek	34	18N	13E	M.D.	Power, irrigation, municipal	6,481	46,662
Bass Lake (Crane Valley Dam)	North Fork San Joaquin River	25	7S	22E	M.D.	Power	3,380	45,410
Sly Park	Sly Park Creek	17 and 18	10N	13E	M.D.	Irrigation	3,482	41,000
Lake Britton (Pit River No. 3 Dam)	Pit River	30	37N	3E	M.D.	Power	2,770	40,600
Tule Lake	Cedar Creek	33	38N	14E	M.D.	Irrigation, preservation of wild fowl	5,524	39,500
Woodward	Simmons Creek	9	1S	10E	M.D.	Irrigation	215	35,000
Big Creek No. 7	San Joaquin River	15	9S	23E	M.D.	Power	1,414	35,000
Bullards Bar	North Fork Yuba River	24	18N	7E	M.D.	Power	1,590	31,489
Lake Eleanor	Eleanor Creek	3	1N	19E	M.D.	Power, municipal	4,661	27,800
Dallas-Warner	Tributary Tuolumne River	20	3S	12E	M.D.	Irrigation	215	27,000
Scotts Flat	Deer Creek	11	16N	9E	M.D.	Irrigation, municipal	3,050	26,300
Mountain Meadows (Indian 'Ole Dam)	Hamilton Creek	13	28N	8E	M.D.	Power	4,962	24,800
Keswick	Sacramento River	21	32N	5W	M.D.	Irrigation, power	596	24,000
Twin Lake	Silver Fork of South Fork American River	18	10N	18E	M.D.	Power	7,960	21,250
Strawberry	South Fork Stanislaus River	15	4N	18E	M.D.	Power, irrigation, municipal	5,620	18,600
West Valley	West Valley Creek	18	39N	14E	M.D.	Irrigation	4,775	17,700
Relief	Relief Creek	13	5N	20E	M.D.	Power	7,340	15,122
Mariposa	Mariposa Creek	30	7S	17E	M.D.	Flood control	456	15,000
Big Dry Creek	Big Dry Creek	22	12S	21E	M.D.	Flood control	435	15,000
North Fork	North Fork American River	31	13N	9E	M.D.	Debris	718	14,600
French Lake	Canyon Creek	17	18N	13E	M.D.	Irrigation, power	6,664	12,500
Dorris	Stockdill Slough	8 and 17	42N	13E	M.D.	Irrigation	4,360	11,100
Salt Springs Valley	Rock Creek	16	2N	11E	M.D.	Irrigation	1,178	10,900
Lake Combie	Bear River	2	13N	8E	M.D.	Irrigation	1,610	9,000
Silver Lake	Silver Fork of South Fork American River	32	10N	17E	M.D.	Power	7,209	8,726
Lake Wilenor	Conecow Creek	16	22N	4E	M.D.	Irrigation	1,970	8,600
Lake Valley	North Fork of North Fork American River	35	17N	12E	M.D.	Power	5,853	8,127
Loon Lake	Gerle Creek	4 and 5	13N	15E	M.D.	Irrigation, municipal	6,500	8,000
Nimbus	American River	16	9N	7E	M.D.	Irrigation, municipal, power	132	7,700
Upper Blue Lake	Blue Creek	18	9N	19E	M.D.	Power	8,131	7,500
Burns	Burns Creek	25	6S	15E	M.D.	Flood control	320	7,000
Lake Yosemite	Fahrens Creek	33	6S	14E	M.D.	Irrigation	255	7,000
Bear River	Bear River	9	8N	16E	M.D.	Power	5,882	6,756
North Big Dobe	Tributary Rattlesnake Creek	22	44N	12E	M.D.	Irrigation	5,000	6,530
Lake Van Norden	South Fork Yuba River	23	17N	14E	M.D.	Power	6,770	5,874
Meadow Lake	Tributary North Fork Mokelumne River	27	9N	18E	M.D.	Power	7,773	5,850
Bucks Diversion	Bucks Creek	29	24N	7E	M.D.	Power	5,029	5,843
Lyons	South Fork Stanislaus River	24	3N	16E	M.D.	Irrigation, power, municipal	4,226	5,508
Medley Lakes	Pyramid Creek	30	12N	17E	M.D.	Power	8,210	5,350
Coyote Flat	Coyote Creek	31	36N	9E	M.D.	Irrigation	4,807	5,250
Lost Creek	Lost Creek	24	20N	7E	M.D.	Irrigation	3,112	5,200
Camp Far West	Bear River	21	14N	6E	M.D.	Irrigation	198	5,000
Philbrook	Philbrook Creek	13	25N	4E	M.D.	Irrigation, power	5,424	4,875
Round Valley	North Canyon Creek	15	26N	9E	M.D.	Irrigation	4,470	4,800
Meadow Lake	Tributary Fordyce Creek	27	18N	13E	M.D.	Power	7,252	4,800
Misselbeck	North Fork Cottonwood Creek	31	31N	7W	M.D.	Irrigation	2,200	4,800
Rock Creek	North Fork Feather River	26 and 35	25N	6E	M.D.	Power	2,220	4,660
Silver Valley	Tributary North Fork Stanislaus River	9	7N	18E	M.D.	Power	7,304	4,600
Cresta	North Fork Feather River	2	23N	5E	M.D.	Power	1,680	4,400
Kerckhoff Diversion	San Joaquin River	24	9S	22E	M.D.	Power	994	4,300
Lower Blue Lake	Blue Creek	30	9N	19E	M.D.	Power	8,040	4,300
Essex (S-X)	Tributary Pit River	6	42N	11E	M.D.	Irrigation	4,600	4,225
Tiger Creek Afterbay	North Fork Mokelumne River	23	7N	13E	M.D.	Power	2,340	3,960
Silva Flat	Juniper Creek	10	36N	9E	M.D.	Irrigation	5,400	3,900
South Big Dobe	Tributary Rattlesnake Creek	26	44N	12E	M.D.	Irrigation	5,000	3,860
Spicers Meadows	Highland Creek	3	6N	18E	M.D.	Power	6,421	3,800
Owens Creek	Owens Creek	23	7S	16E	M.D.	Flood control	422	3,600
Magalia	Little Butte Creek	25	23N	3E	M.D.	Irrigation, municipal	2,234	3,540

MAJOR RESERVOIRS OF CALIFORNIA—Continued

Reservoir	Stream	Section	Township	Range	Base and meridian	Purpose	Crest elevation, in feet above mean sea level	Storage capacity, in acre-feet
Central Valley Area (Continued)								
Spooner	Tributary Ash Creek	30	37N	12E	M.D.	Irrigation	5,500	3,123
Sawmill Lake	Canyon Creek	11	18N	12E	M.D.	Irrigation, power	5,780	3,040
Wallace	Tributary Mokelumne River	15	4N	9E	M.D.	Mining	300	3,000
Mendota Diversion	San Joaquin River	19	13S	15E	M.D.	Irrigation	168	3,000
Sequoia Lake	Mill Flat Creek	1	14S	27E	M.D.	Recreation	5,400	3,000
Payne	Tributary South Fork Pit River	15	41N	13E	M.D.	Irrigation	5,000	2,850
Pit No. 1 Forebay	Fall River	25	37N	4E	M.D.	Power	3,330	2,800
Duncan	Tributary Pit River	33	43N	9E	M.D.	Irrigation	4,900	2,575
Lodi Lake (Woodbridge Diversion and Dam)	Mokelumne River	34 and 35	4N	6E	M.D.	Irrigation	48	2,464
Utica	North Fork Stanislaus River	21	7N	18E	M.D.	Power	6,775	2,400
Priest	Rattlesnake Creek	31	1S	16E	M.D.	Municipal, power	2,254	2,350
Big (Morning Star Dam)	Shirttail Canyon	17	15N	11E	M.D.	Domestic	4,100	2,200
Pit No. 4	Pit River	8	36N	2E	M.D.	Power	2,458	2,000
Union	North Fork Stanislaus River	28	7N	18E	M.D.	Power	6,852	2,000
Sutter Butte Diversion	Feather River	33	19N	3E	M.D.	Irrigation	120	2,000
Lake Francis	Dobbins Creek	5	17N	7E	M.D.	Power	1,650	1,905
Los Verjels	Dry Creek	34	18N	6E	M.D.	Irrigation	1,355	1,830
Schaad (Middle Fork Dam)	Middle Fork Mokelumne River	9	6N	14E	M.D.	Municipal	3,035	1,718
Detert Lake	Bucksnort Creek	9	10N	6W	M.D.	Irrigation	1,082	1,700
Everly	Bean Flat	26	47N	12E	M.D.	Irrigation	5,000	1,700
Lake Sterling	Sterling Creek	10	17N	13E	M.D.	Power	6,700	1,648
Upper Peak Lake	Tributary South Fork Yuba River	32	17N	14E	M.D.	Power	6,611	1,607
Antelope (Huffman)	Clover Swale	11	43N	10E	M.D.	Irrigation	4,800	1,550
Taylor Creek No. 1	Taylor Creek	8	39N	7E	M.D.	Irrigation	4,200	1,500
Kidd Lake	Tributary South Fork Yuba River	29	17N	14E	M.D.	Power	6,772	1,492
Emigrant Lake	North Fork Cherry Creek	30	4N	21E	M.D.	Recreation	8,800	1,491
Long Lake	Gray Eagle Creek	6	21N	12E	M.D.	Industrial	6,531	1,478
Antelope "C"	Antelope Plains	13	44N	10E	M.D.	Irrigation	5,000	1,450
Upper Sardine Lake	Tributary Yuba River	9	20N	12E	M.D.	Recreation	6,048	1,435
Hume Lake	Ten Mile Creek	4	13S	28E	M.D.	Recreation	5,300	1,410
Lower Empire Weir	South Fork Kings River	20	20S	20E	M.D.	Irrigation	203	1,400
Deer Creek Diversion	Deer Creek	10	16N	9E	M.D.	Irrigation	2,902	1,400
Davis No. 2	Tributary of Calaveras River	6	2N	9E	M.D.	Irrigation	144	1,400
Little Juniper	Little Juniper Creek	4	40N	13E	M.D.	Irrigation	4,800	1,370
Lake Wyandotte	North Fork Honcut Creek	16	19N	5E	M.D.	Irrigation	1,388	1,300
Twin Lakes	Tributary North Fork Mokelumne River	25	9N	18E	M.D.	Power	8,172	1,300
Round Valley	West Branch North Fork Feather River	30	26N	5E	M.D.	Power	5,498	1,285
Webber Creek	Webber Creek	18	10N	12E	M.D.	Irrigation	2,275	1,275
Davis Creek Orchards	Ewing Creek	30	45N	14E	M.D.	Irrigation	4,800	1,200
Lake Tabeaud	Jackson Creek	28	6N	12E	M.D.	Municipal, power	1,968	1,165
Pit No. 5 Open Conduit Embankment	Sugar Pine Creek	5	36N	1E	M.D.	Power	2,046	1,147
Fuller Lake	Jordan Creek	17	17N	12E	M.D.	Power	5,379	1,130
Blue Lake	Tributary Rucker Creek	9	17N	12E	M.D.	Power	5,964	1,123
Toreson	Tom's Creek	16	41N	10E	M.D.	Irrigation	4,850	1,118
Grizzly Creek Forebay	Grizzly Creek	34	24N	6E	M.D.	Power	4,321	1,112
Barron No. 1	Ash Creek	13 and 14	37N	11E	M.D.	Irrigation	5,222	1,061
North Battle Creek	North Fork Battle Creek	20	32N	3E	M.D.	Power	5,246	1,016
Kelsey	Tributary South Fork Dry Creek	31	4S	15E	M.D.	Irrigation	390	1,000
Nelson	Dry Creek	24	38N	12E	M.D.	Irrigation	5,400	1,000
McBrien	Pit River	27	42N	11E	M.D.	Irrigation	4,600	1,000
Jackson Lake	Jackson Creek	31	19N	13E	M.D.	Irrigation, power	6,600	1,000
Lahontan Area								
Lake Tahoe	Truckee River	6	15N	17E	M.D.	Irrigation, power	6,233	732,000
Lake Crowley (Long Valley Dam)	Owens River	19	4S	30E	M.D.	Municipal, power	6,796	183,743
Haiwee	Rose Valley	2	21S	37E	M.D.	Municipal, power	3,774	60,000
Grant Lake	Rush Creek	15	1S	26E	M.D.	Municipal, power	7,145	47,500
Lake Arrowhead	Little Bear Creek	14	2N	3W	S.B.	Recreation	5,116	47,000
Bridgeport	East Walker River	34	6N	25E	M.D.	Irrigation	6,469	42,455
Boca	Little Truckee River	28	18N	17E	M.D.	Irrigation	5,612	41,200
Independence	Independence Creek	35	19N	15E	M.D.	Power	6,952	18,500
Gem Lake	Rush Creek	30	2S	26E	M.D.	Power	9,053	17,604
McCoy Flat	Susan River	23	30N	9E	M.D.	Irrigation	5,542	17,290
Tinemaha	Owens River	25	10S	34E	M.D.	Municipal, power	3,882	16,605
South Lake (Hillside Dam)	South Fork Bishop Creek	15	9S	31E	M.D.	Power	9,708	13,368
Lake Leavitt	Tributary Susan River	15	29N	13E	M.D.	Irrigation	4,100	12,100
Saddlebag Lake	Leevining Creek	6	1N	25E	M.D.	Power	10,093	11,138
Donner Lake	Donner Creek	18	17N	16E	M.D.	Power, irrigation	5,937	11,000
Red Rock No. 1	Red Rock Creek	22	36N	16E	M.D.	Irrigation	5,600	9,560
Hog Flat	Tributary Susan River	25	30N	9E	M.D.	Irrigation	5,500	8,000
Fairmont	Antelope Valley	12	7N	15W	S.B.	Municipal, power	3,043	7,487
Sabrina	Middle Fork Bishop Creek	31	8S	31E	M.D.	Power	9,089	7,350
Harold	Tributary Antelope Valley	2 and 3	5N	12W	S.B.	Irrigation	2,826	6,575
Fallen Leaf Lake	Taylor Creek	2	12N	17E	M.D.	Recreation	6,382	6,400
Round Valley	Round Valley Creek	30	31N	12E	M.D.	Irrigation	5,000	5,000
Rush Creek Meadows	Rush Creek	14	2S	25E	M.D.	Power	9,413	4,970

MAJOR RESERVOIRS OF CALIFORNIA—Continued

Reservoir	Stream	Section	Township	Range	Base and meridian	Purpose	Crest elevation, in feet above mean sea level	Storage capacity, in acre-feet
Lahonton Area—Continued								
Littlerock	Littlerock Creek	27	5N	11W	S.B.	Irrigation	3,264	4,300
Pleasant Valley	Owens River	24	6S	31E	M.D.	Municipal	4,409	3,825
Lundy Lake	Mill Creek	16	2N	25E	M.D.	Power	7,808	3,820
Poison Springs	Rock Creek	33	46N	17E	M.D.	Irrigation	5,200	3,750
Cramer	Tributary Horse Lake	9	32N	13E	M.D.	Irrigation	5,063	3,000
Heenan Lake	Heenan Creek	3	9N	21E	M.D.	Irrigation	7,200	3,000
Lake Gregory	Huston Creek	23	2N	4W	S.B.	Municipal	4,530	2,300
Willow Creek	Willow Creek	5	30N	13E	M.D.	Irrigation		2,200
Red Rock No. 3	Tributary Red Rock Creek	4	35N	16E	M.D.	Irrigation	5,400	2,100
Lower Twin Lake	Robinson Creek	33	4N	24E	M.D.	Irrigation	7,079	2,000
Buckhorn	Buckhorn Creek	31	35N	17E	M.D.	Irrigation	5,950	2,000
Echo Lake	Tributary Upper Truckee River	1	11N	17E	M.D.	Power	7,460	1,900
Upper Twin Lake	Robinson Creek	5	3N	24E	M.D.	Irrigation	7,100	1,500
Antelope	Madeline Plains	3	34N	13E	M.D.	Irrigation	5,300	1,500
Tioga Lake	Tributary Leevining Creek	19	1N	25E	M.D.	Power	9,657	1,386
Branham Flat	Branham Creek	9	33N	13E	M.D.	Irrigation	5,600	1,200
Poore Lake	Poore Creek	2	5N	22E	M.D.	Irrigation	7,361	1,200
Big Pine Creek No. 2	Big Pine Creek	33	9S	32E	M.D.	Power	10,036	1,071
Colorado Desert Area								
Parker	Colorado River	3	2N	27E	S.B.	Municipal, power	455	717,000
Imperial	Colorado River	9	15S	24E	S.B.	Irrigation, power	197	85,000
Copper Basin	Copper Basin	11	2N	26E	S.B.	Municipal	1,038	22,000
Gene Wash	Gene Wash	32	3N	27E	S.B.	Municipal	746	6,300

M. D.—Mount Diablo Base and Meridian.
H.—Humboldt Base and Meridian.
S. B.—San Bernardino Base and Meridian.

APPENDIX I

WATER QUALITY CONSIDERATIONS AFFECTING USE OF THE WATERS OF CALIFORNIA

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WATER QUALITY CONSIDERATIONS AFFECTING USE OF THE WATERS OF CALIFORNIA

TABLES

WATER QUALITY CONSIDERATIONS AFFECTING USE OF THE WATERS OF CALIFORNIA

Unprecedented demands for water by a rapidly growing population and by expanding agricultural and industrial activities, coupled with the impact of recurrent drought, require the thorough consideration of problems of water quality in developing plans for future utilization of the waters of California. Increasing upstream uses of water impose the concomitant requirement that adequate facilities for treatment, disposal, or diversion of municipal, industrial, or agricultural waste waters be provided in order that the quality of water supplies for downstream uses is not adversely affected.

General aspects of the quality of water problem in California, particularly as it relates to water requirements, are presented in the following discussion.

DEFINITIONS

The terms "standards", "criteria", and "objectives", as applied to water quality, are often used interchangeably as synonyms. In reality they have distinct meanings. In order to provide a consistent basis for expression of ideas, the following definitions are used by the Division of Water Resources: *Standards* are official limits of quality for beneficial uses established by regulation or statute. *Criteria* are unofficial but recognized values or limits of quality for beneficial uses based on experience and research. *Objectives* are desired limits of quality for specific waters based on the beneficial uses of the water, use for waste disposal, legal standards, research criteria, common experience, and physical, political, and economic considerations. Compliance with water quality standards, criteria, or objectives is measured by test or analysis of representative water samples.

STANDARDS AND CRITERIA OF WATER QUALITY

Certain criteria or standards have been developed which are generally accepted as useful guides in determining whether water is of suitable quality for various beneficial uses. The quality criteria given in the following pages are for purposes of reference and comparison only. It should not be inferred that they are mandatory except in certain cases, as described in the text, where they have been adopted by regulation or statute.

Tests of Water Quality

The more common tests to determine the quality characteristics of representative samples of natural or waste waters are included in the following groups:

Mineral. A complete mineral analysis includes the determination of all of the mineral or inorganic constituents of water. As the term is generally used, mineral analysis signifies determination of those major constituents which are generally present in natural waters in significant quantity, including calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, nitrate, boron, silica, fluoride, and hardness. The pH and the specific electrical conductance, generally reported in micromhos at 25° C., are also determined at the time of the analysis. A partial analysis, including limited mineral determinations, is made when the requirements of a particular investigation will be satisfied thereby, and when the number of samples is too great to permit more comprehensive analyses.

Physical. A physical analysis includes determination of the physical properties of water, such as temperature, color, turbidity, odor, and electrical conductance.

Sanitary. A sanitary chemical and biochemical analysis comprises the determination of certain substances and characteristics of sanitary significance. It may include dissolved oxygen, biochemical oxygen demand, oxygen consumed from chromic acid, nitrogen in its various forms, such as nitrate, ammonia, albuminoid, and total organic constituents, ether-soluble matter, such as fats, grease, etc., settleable solids, and total and suspended solids and ignition losses. Sanitary surveys consisting of investigation and evaluation of field conditions are required for accurate interpretation of the sanitary analysis.

Bacterial. A bacteriological examination comprises tests for presence of coliform organisms, which are used as an indicator of the sanitary quality of water for human consumption. Certain organisms of the coliform group are normal inhabitants of the intestines of man and other vertebrates, and therefore the presence of such organisms is considered presumptive evidence of contact of water supplies with human sewage. Results of the bacteriological examination are usually expressed in terms of the concentration of organisms in a given volume of sample. Concentrations are determined by statistical analysis of results of the tests and are reported as the Most Probable Number of coliform organisms.

Biological. The value of biological examination in appraising water quality has long been recognized, but the degree of scientific knowledge and skills required has often prevented its use. It comprises the collection, examination, identification, and quanti-

tative measurement of aquatic organisms present in a body of water and on the stream bottom, and appraisal of their significance. Both visible (macroscopic) and invisible (microscopic) life forms are sought. The biological examination may serve any of the following purposes important to the water supply engineer: (1) to explain the causes of undesirable color, turbidity, odor, and taste in water, and to indicate methods for their removal; (2) to aid in interpreting other types of water analysis; (3) in special cases, to identify a source of water; (4) to identify organisms causing clogging of pipe lines and filters; (5) to indicate pollution by sewage and industrial wastes; and (6) to indicate progress of self-purification in natural surface waters.

Biological examination of water offers at least two important advantages as compared to ordinary methods of chemical analysis. First, it is to a large extent integrating with respect to time; that is to say, the distribution and condition of aquatic organisms reflect water quality conditions for a considerable period in the past. In contrast, the usual random or "grab" method of sampling employed for chemical analysis of water indicates water quality only at the instant of sampling, and often gives an untrue or abnormal impression of water quality. Secondly, aquatic organisms are often sensitive to toxic constituents which are not revealed in ordinary chemical analysis. Biological examinations are therefore a very useful supplement to chemical methods.

Quality Standards and Criteria for Various Water Uses

The suitability of a water supply for a specific use may be ascertained by comparison of its determined quality characteristics with the accepted quality criteria for the use under consideration. Values used to define suitability or acceptability of water for various beneficial uses are based upon the best information currently available. These values are general approximations but serve as a guide to judgment of suitability for the use under consideration. With respect to criteria, which, as heretofore stated, are not mandatory, the particular circumstances of each individual case must be assessed before a final determination of the suitability of a particular water supply can properly be made.

In applying quality criteria to water for a particular use, the rule of reasonableness should be considered. For example, it might be unreasonable to expect that the quality of the source water of an industrial water supply be maintained such that no treatment is required prior to use. Industries which have particularly exacting quality requirements ordinarily accept the necessity for special treatment of water at their own expense. In general, the responsibility of a public agency supplying industrial water is considered to be met if such water is of potable quality.

Drinking Water. No domestic water may be purveyed publicly in California without a permit from the State Board of Public Health. Such water supplies shall at all times be pure, wholesome, and potable.

Requirements have been promulgated by the United States Public Health Service governing the quality of waters used on interstate carriers. These standards have been incorporated by reference in the California Health and Safety Code. According to these standards, the chemical substances contained in drinking water supplies, either natural or treated, should not exceed the concentrations shown in Table I-1. Standards which are starred are mandatory, while the remainder are merely recommended as a desired objective. This table of constituents is by no means complete. Other mineral compounds may be included if their presence renders the water hazardous for safe use. As an example, in a letter to the Central Valley Regional Water Pollution Control Board, concerning the McClellan Air Force Base industrial waste discharge, the California Department of Public Health, Bureau of Sanitary Engineering, recommended that the safe limit for nickel in the receiving water at the water supply intake of the City of Sacramento be limited to one part per million.

Bacteriological requirements of the United States Public Health Service for drinking water are quoted as follows:

TABLE I-1

LIMITING CONCENTRATIONS OF MINERAL CONSTITUENTS FOR DRINKING WATER

United States Public Health Service Drinking Water Standards, 1946

Constituent	Upper limit of concentration, in parts per million
Fluoride (F)	1.5*
Iron (Fe) and manganese (Mn) together	0.3
Magnesium (Mg)	125
Chloride (Cl)	250
Sulfate (SO_4)	250
Lead (Pb)	0.1*
Selenium (Se)	0.05*
Hexavalent chromium	0.05*
Copper (Cu)	3.0
Arsenic (As)	0.05*
Zinc (Zn)	15
Phenol	0.001
Total solids	500 (1,000 permitted)

* Mandatory upper limits; others are recommended.

"3.21 Of all the standard ten milliliter (10 ml.) portions examined per month in accordance with the specified procedure, not more than ten (10) percent shall show the presence of organisms of the coliform group.

"3.22 Occasionally three (3) or more of the five (5) equal ten milliliter (10 ml.) portions constituting a single standard sample may show the presence of organisms of the coliform group, provided

that this shall not be allowable if it occurs in consecutive samples or in more than:

(a) Five (5) percent of the standard samples when twenty (20) or more samples have been examined per month.

(b) One (1) standard sample when less than twenty (20) samples have been examined per month.

"Provided further that when three or more of the five ten milliliter (10 ml.) portions constituting a single standard sample show the presence of organisms of the coliform group, daily samples from the sampling point shall be collected promptly and examined until the results obtained from at least two consecutive samples show the water to be of satisfactory quality."

Water as supplied to the consumer for domestic or municipal uses should conform to the above standards for drinking water. Where these supplies are used for other purposes, such as incidental irrigation or industrial use, it may be necessary to consider mineral quality requirements for such uses in addition to the requirements for drinking purposes.

An additional factor with which operators of public water supply systems are concerned is the so-called "hardness" of the supplies. Hardness in water is principally due to carbonates and sulfates of calcium and magnesium, and is generally evidenced to the consumer by inability to develop suds when using soap. Hardness is an important consideration to industrial organizations, due to its effect on plant maintenance and manufacturing processes. However, in general domestic use, hardness can result in increased soap consumption, excessive repairs to plumbing, and the necessity or desirability of maintaining individual water softener appliances. Waters which have a hardness below 55 parts per million seldom cause complaint, but above 100 parts per million they may well be termed "hard" and above 200 parts per million can be called "very hard." Treatment to remove hardness is often combined with other treatment processes prior to distribution of the water supply to the consumer.

Irrigation Water. In establishing the *relative* suitabilities of surface and ground waters for irrigation use it is necessary to consider the effects of mineral constituents of the water on both the plant and the soil. The deleterious effects of salts on plant growth can result from: (a) direct physical effects of salts in preventing uptake of water by plants (osmotic effects); (b) direct chemical effects on metabolic reactions of plants; and/or (c) indirect effects through changes in soil structure, permeability, and aeration. The most significant water quality factors in these three types of injury are total dissolved salts, deleterious substances found in low or trace concentrations, and certain percentage combinations of the predominant cations calcium, magnesium, sodium, and potassium, and anions carbonate, bicarbonate, chloride, and sulfate.

The total salt content, the main effect of which is osmotic, is generally stated in terms of specific electrical conductance, a measure of concentration of ions per unit of water, and/or in terms of total dissolved solids in parts per million parts of water. Osmotic effects are caused primarily by the cations calcium, magnesium, sodium, and potassium, and the anions carbonate, bicarbonate, sulfate, chloride, and nitrate, and in part by the constituents present in the water in low or trace concentrations. The individual constituents which may affect metabolic reactions of plants include nearly all of the elements already cited if they are present in abnormally large quantities. Chlorides and sulfates are specifically mentioned in this regard.

Constituents present in water in very low or trace concentrations which seriously affect the metabolic reactions of plants include boron, lithium, iron, and other heavy metals, the exact symptomatic effects of which are presently unknown. Boron is now considered to be the most important minor constituent in water, and is the only so-called "minor" or "trace" element that is routinely considered in evaluating suitability of water for irrigation. Although used by plants in metabolic reactions in small amounts, boron is extremely toxic if present in irrigation water in amounts exceeding from about 0.5 to 2 parts per million.

The percentage combinations of a mineral constituent in water are generally expressed as percentage reacting values to the totals of the cations or anions as the case may be. Per cent sodium is particularly important because, at certain percentage values, sodium reacts with the soil in such a way as to render it relatively impermeable to water and in some instances to plant roots. Such sodium-affected soils are commonly termed alkali soils if carbonates are the predominant anions in the soil solution, or saline soils if chlorides or sulfates are the predominant anions. Sodium-saturated soils, either alkali or saline, characteristically support little or no plant growth.

The limits of permissible mineral concentration in irrigation waters have been resolved into classifications or divisions of the waters into broad categories of quality designated as: "excellent to good," or "suitable under most conditions"; "good to injurious," or "harmful to some plants under certain conditions"; and "injurious to unsatisfactory," or "harmful to most plants under most conditions." Occasionally, these classes have been further subdivided into groupings labeled "excellent," "good," "permissible," "injurious," and "unsatisfactory."

TABLE 1-2

CRITERIA FOR CLASSIFICATION OF IRRIGATION WATERS

Reference*	Percent sodium, Na×100 / K+Na+Mg+Ca as milliequivalents per liter	Conductance, EC×10⁶ at 25°C.	Total salts in parts per million	Boron, in parts per million: Sensitive plants	Boron, in parts per million: Semitolerant plants	Boron, in parts per million: Tolerant plants	Chlorides, in milliequivalents per liter	Sulfates, in milliequivalents per liter
Class I, excellent to good, or suitable for most plants under most conditions								
A	0–60	0–1,000	0–700		0–0.5		0–5	0–10
B	0–30	0–500	0–350	0–0.5	0–1.0	0–1.5	0–5.5	0–5.5
C	0–60	0–750		0–0.5	0–1.0	0–2.0		
Class II, good to injurious, harmful to some under certain conditions of soil, climate, practices								
A	60–75	1,000–3,000	700–2,100		0.5–2.0		5–10	10–20
B	30–70	500–2,500	350–1,750	0.5–1.12	1–2.25	1.5–3.35	5.5–16.0	5.5–16.0
C	60–70	750–3,000		0.5–1.0	1.0–2.0	2.0–3.0		
Class III, injurious to unsatisfactory, unsuitable under most conditions								
A	75–	3,000–	2,100–		2.0–		10–	20–
B	70–	2,500–	1,750–	1.12–	2.25–	3.35–	16–	16–
C	70–	3,000–		1.0–	2.0–	3.0–		

*A California State Water Resources Board, "Water Resources of California." Bulletin No. 1, 1951.
B Scofield, Carl S. "The Salinity of Irrigation Water." Smithsonian Report, 1951.
C Chapman, H. D., Wilcox, L. V., and Hayward, H. E. "Water Quality from an Agricultural Point of View." Report of Interim Fact-Finding Committee on Water Pollution, California State Assembly, 1949.

Five parameters are primarily used in such classifications. These are: (1) per cent sodium; (2) total dissolved mineral solids; (3) boron concentration; (4) chloride concentration; and (5) sulfate concentration. Criteria proposed by various agencies for the classification of irrigation waters are presented in Table 1-2. The latest published proposals for irrigation waters are found in "Diagnosis and Improvement of Saline and Alkali Soils," Agricultural Handbook No. 60, Regional Salinity Laboratory, United States Department of Agriculture. The State of California does not have any officially adopted standards for quality of irrigation waters.

It is here noted that the criteria for the classification under Reference A in Table 1-2 were taken from information supplied to the Division of Water Resources by Dr. L. D. Doneen, Professor in the Department of Irrigation of the University of California at Davis, and have been used for some time by the Division for classifying irrigation waters.

Recent research performed by Dr. Doneen has pointed out certain inadequacies of the total salt concept, and he has suggested a revision of standards based on a new method for calculating salinity of irrigation water. A statement submitted by Dr. Doneen in regard to the suggested change follows:

"This proposed standard for total salts of an irrigation water is based on the premise that the salts will accumulate in the soil due to evaporation from the soil surface and water used by the plants in transpiration. Plants usually remove only a small percentage of the total salts occurring in the irrigation water. As the soil solution becomes concentrated certain salts will precipitate. Because of the low solubility, the first to precipitate will be calcium carbonate, followed by magnesium carbonate and finally by calcium sulfate. Those salts will not produce a saline soil. Other salts normally occurring in irrigation water in any significant concentration are extremely soluble and accumulate in the soil solution as salines. These salines are listed as 'effective salinity.' Therefore, calcium and magnesium carbonates and calcium sulfate should not be considered in establishing standards for total salts as is now the practice in the use of electrical conductance, total parts per million or milliequivalents per liter concentration.

"The following table suggests standards for effective salinity of the irrigation water with and without restricted drainage. The crucial concentrations are those listed in Class I for the three soil conditions. Class II and III indicate increasing concentration, and the build-up of soil salinity should be checked periodically and irrigation practices adjusted to remove salinity with the minimum loss of water.

"TENTATIVE CLASSIFICATION FOR EFFECTIVE SALINITY OF IRRIGATION WATER

Soil conditions	Terms used	Class I	Class II	Class III
Little or no leaching of the soil can be expected	ion milliequivalents	3	3– 5	5
	parts per million	165	165– 275	275
	lbs/acre-foot	450	450– 750	750
Some leaching but restricted; deep percolation or drainage slow	ion milliequivalents	5	5– 10	10
	parts per million	275	275– 550	550
	lbs/acre-foot	750	750–1500	1500
Open soils; deep percolation of water easily accomplished	ion milliequivalents	7	7– 15	15
	parts per million	385	385– 825	825
	lbs/acre-foot	1050	1050–2250	2250

end of quotation

The relative tolerance of crop plants to salt constituents in the soil solution has been arranged in the order of increasing tolerance in Table I-3. Data presented in this tabulation are based upon research at the University of California and the United States Regional Salinity Laboratories at Riverside.

The tolerance of various crops to boron in irrigation water is presented in Table I-4. Those plants which can withstand only relatively low concentrations are designated as sensitive, an intermediate group as semi-tolerant, and a final group as tolerant. Within a given group the more sensitive plants are listed first. The grouping is based upon research at the University of California and the United States Regional Salinity Laboratory at Riverside.

With regard to bacteriological requirements for irrigation water, the State Department of Public Health has established regulations governing use of sewage for crop irrigation purposes. Pertinent extracts of these regulations state:

"Raw, i.e., untreated, sewage containing human excrement shall not be used for irrigating growing crops. Use of bar screens, grit, or detritus tanks is not to be considered as sewage treatment under these regulations."

* * * * *

"Effluents of septic tanks, Imhoff tanks or of other settling tanks, or partially disinfected effluents of sprinkling filters or activated sludge plants or similar sewages, shall not be used to water any growing vegetables, garden truck, berries, or low-growing fruits such that the fruit is in contact with the ground, or to water vineyards or orchard crops during seasons in which the windfalls or fruit lie on the ground. . . .

"Nursery stock, cotton, and such field crops as hay, grain, rice, alfalfa, sugar beets, fodder corn, cowbeets, and fodder carrots may be watered with such settled or undisinfected or partially disinfected sewage effluents provided that no milch cows are pastured on the land while it is moist with

TABLE I-3

RELATIVE TOLERANCE OF CROP PLANTS TO SALT CONSTITUENTS IN THE SOIL SOLUTION

(In order of increasing tolerance)

Crops which may be grown on soils of weak salinity		Crops which may be grown on soils of medium salinity		Crops which may be grown on soils of strong salinity
Fruit Crops				
Lemon	Almond	Olive		Date palm
Orange	Pear	Grape		
Apple	Grapefruit	Fig		
Plum	Peach	Pomegranate		
Apricot				
Field and Truck Crops				
Green beans		Wheat	Oats	Cotton
Potato		Pepper	Rye	Kale
Sweet potato		Onion	Barley	Rape
Eggplant		Squash	Sorghum	Milo
Artichoke		Spinach	Foxtail millet	Garden beets
Cabbage		Carrot	Asparagus	Sugar beets
Celery		Lettuce	Tomato	
Peas		Cantaloupe	Flax	
Vetch		Sunflower	Alfalfa	
		Rice		
Forage Crops				
Burnet		Sickle milk vetch	Orchard grass	Western wheat grass
Ladino clover		Sour clover	Tall fescue	Beardless wild rye
Red clover		Cicer milk vetch	Alfalfa	Canada wild rye
Alsike clover		Tall meadow oat grass	Herban clover	Rhodes grass
Meadow foxtail		Smooth brome	Sudan grass	Rescue grass
White dutch clover		Big trefoil	Dallis grass	Bermuda grass
		Reed canary	Strawberry clover	Salt grass
		Meadow fescue	Birdsfoot trefoil	Nuttail alkali grass
		Blue grass	Sweet clover	Alkali sacaton

sewage, or have access to ditches carrying such sewage.

"The foregoing restrictions do not apply against the use of well oxidized nonputrescible, and reliably disinfected or filtered effluents which always meet the following bacterial standard: in any 20 consecutive samples, from which five 10 c.c. portions each are examined, not over ten portions shall be positive for members of the Coli-aerogenes group, and in no single sample shall over half the .1 c.c. portions of the sample of the effluent be positive for the above organisms. Samples shall be analyzed according to the latest Standard Methods of Examination of Water and Sewage of American Public Health Association."

It is important that the local conditions be considered carefully before passing judgment on the suitability of a particular water for irrigation. In this connection, a water may be suitable in respect to one characteristic and doubtful or unsuitable in another. Because of great differences in salt tolerance of plants on the one hand, and the influence of natural modifying conditions such as soil permeability, temperature, humidity, and rainfall on the other, it is impossible, for general application, to establish fixed limits. The variables introduced by the soil permeability factor are particularly noteworthy. For example, the rapid percolation of rainfall and irrigation water through permeable sandy soil tends to leach the salts downward, and thus to prevent accumulation of salts in the effective root zone. In heavy clay soils the leaching effects are not as well pronounced, and the salt content builds up at a relatively rapid rate with successive irrigations. In especially heavy soils of restricted permeability it is possible that a twofold or more increase in salt content may develop from use of a given water during a single irrigation season.

In determining the suitability of water for irrigation use, it is necessary to consider the characteristics of the water not only with respect to the conditions of its use, but also with respect to artificial modifications that could be imposed on the conditions of use for the purpose of increasing its usefulness. A modification that may be imposed with respect to water of high sodium content, for example, is the application of gypsum to the irrigation water or to the soil being irrigated. A modification that may be imposed with respect to water of high salt content is the application of excess water to effect leaching. Fertilizers may also be used to enhance suitability of waters for irrigation purposes.

Fish and Other Aquatic Life, Including Shellfish. Water of suitable quality is a fundamental requirement for the existence of an abundant supply of food and game fish in California's streams and lakes. Quality of the water must be such as to maintain an abundant supply of food required by fish and other

TABLE I-4

TOLERANCE OF VARIOUS CULTIVATED PLANTS TO BORON

(In order of increasing tolerance)

Sensitive	Semi-tolerant	Tolerant
Lemon	Lima bean	Tobacco
Grapefruit	Sweet potato	Carrot
Avocado	Bell pepper	Lettuce
Orange	Tomato	Cabbage
Thornless blackberry	Pumpkin	Turnip
Apricot	Zinnia	Onion
Plum	Oat	Broad bean
Prune	Milo	Muskmelon
Peach	Corn	Gladiolus
Cherry	Wheat	Alfalfa
Kadota fig	Olive	Garden beets
Grape	Rose	Mangel
Apple	Radish	Sugar beets
Pear	Sweet pea	Artichoke
American elm	Cotton	Palms
Navy bean	Sunflower	Asparagus
English walnut	Field pea	Sweet clover
Black walnut	Potato	
Pecan	Celery	
Cow pea	Vetch	
Persimmon	Barley	

desirable forms of aquatic life. The various substances or impurities carried in solution and suspension by a stream or body of water determine whether the waters present environmental conditions favorable or unfavorable for fish and other aquatic organisms.

The quantity of impurities in water that adversely affects fish life, or a particular form of sustaining aquatic life, is rather difficult to ascertain because of the inter-dependence of most forms of aquatic life. However, waters utilized for the propagation of fish and aquatic life should be free of toxic or harmful concentrations of mineral and organic substances and excessive turbidity. Extensive field and laboratory studies conducted by the United States Fish and Wildlife Service result in the conclusion that the water in streams supporting a mixed population of fish should have the following properties:

(a) Dissolved oxygen not less than 5 parts per million, or at least 85 per cent of saturation.

(b) pH range between 7.0 and 8.5.

(c) Ionizable salts as indicated by a conductivity between 150 and 500 micromhos at 25° Centigrade and in general not exceeding 1,000 micromhos.

(d) Ammonia not exceeding 1.5 parts per million.

(e) Suspensoids of a hardness of 1 or greater, so finely divided that they will pass through a 1,000-mesh (to the inch) screen; and so diluted that the resultant turbidity would not reduce the millionth intensity depth for light penetration to less than 5 meters.

It is indicated that the metallic cations least harmful to fish are sodium, calcium, strontium, and mag-

nesium. Cations of relatively low toxicity are potassium, lithium, barium, manganese, and cobalt. High toxicity to fish is produced by silver, mercury, copper, lead, zinc, cadmium, aluminum, nickel, trivalent chromium, tin, iron, gold, cerium, platinum, thorium, and palladium. Extremely toxic solutions are cupric, mercuric, and silver salts.

If favorable conditions are to be maintained in waters supporting fish and aquatic life, all pollutants not readily oxidizable or removable by the flow of a stream should be excluded. It is particularly important that formation of sludge banks be avoided. The excluded products include particularly all cellulose pulp and wastes carrying heavy metallic ions. In this respect, the California Fish and Game Code is quoted as follows:

> "481. It is unlawful to deposit in, permit to pass into, or place where it can pass into the waters of this State, any petroleum, acid, coal or oil tar, lamp black, aniline, asphalt, bitumen, or residuary product of petroleum, or carbonaceous material, or substance, or any refuse, liquid or solid, from any refinery, gas house, tannery, distillery, chemical works, mill or factory of any kind, or any sawdust, shavings, slabs, edgings, or any factory refuse, or any lime, any cocculus indicus, or any slag, or any substance or material deleterious to fish, plant life, or bird life.
>
> "481.5. Whenever it is determined by the commission that a continuing and chronic condition of pollution exists, the commission shall report such condition to the appropriate regional water pollution control board, and shall cooperate with and act through such board in obtaining correction in accordance with any laws administered by such board for control of practice for sewage and industrial waste disposal."

Increasing use of detergents for household and industrial purposes and the use of poisons and insecticides in agriculture pose a serious hazard to fish life. Modern detergents contain a high percentage of phosphates, which may radically change the entire aquatic biota of the receiving water. Detergents, particularly the nonionic types, are extremely toxic to fish life. Studies by the California Department of Fish and Game indicate that the toxic level for common household detergents may be as low as 10 to 20 parts per million.

Shellfish are readily and adversely affected by contaminated water, and have often been a factor in the transmission of water-borne diseases. Oysters are particularly important in this respect because they are frequently eaten raw. A history of epidemics ascribed to infected shellfish led to the development by the United States Public Health Service, about thirty years ago, of sanitary standards in waters used for growing shellfish which enter interstate commerce. Growing areas are classified, according to density of coliform bacteria of their waters, and according to their freedom from contamination as revealed by a sanitary survey. Three classifications of waters are recognized: "approved," having a median coliform density under 70 per 100 milliliters (ml.), and free from discharges of human sewage; "closed," having a coliform density over 700 per 100 ml., and contaminated by known sources of sewage; and "restricted," an intermediate class of growing areas from which shellfish may be taken only under severe precautions. The California Department of Public Health has adopted regulations to control shellfish production which are based on those of the United States Public Health Service, and uses the bacterial standards cited above as a guide in appraising suitability of shellfish growing areas.

Development and use of water resources, including the construction of dams for storage of water, frequently affect water temperatures which in turn affect fish and other aquatic life. Optimum temperatures for cold-water fish, such as trout and salmon, are not well known, but probably lie between 50° and 60° Fahrenheit. The cold-water species are generally intolerant of temperatures above 61° Fahrenheit, and will seek the lower temperature where possible. Warm-water fish, such as minnows, carp, catfish, perch, sunfish, and bass, normally live in water having temperatures ranging from near 32° to 86° Fahrenheit. Acclimation enables the warm-water species to live in water having temperatures as high as 91° Fahrenheit, although they migrate to waters below 86° Fahrenheit where possible.

Waterfowl are seriously affected by conditions which destroy an abundant supply of aquatic life. Botulism, which has occurred at a number of places in California, accounts for the death of thousands of ducks. The cause of the disease is a toxin produced by bacterial organisms under certain conditions of septicity and temperature. The incidence of the disease has been halted by supplying fresh water to the affected area.

Recreation. No minimum sanitary requirements have been established for natural fresh-water bathing places, but the State Board of Public Health uses the following criteria in establishing quarantine of public salt-water bathing areas:

(1) The area shall be free of visible solids of sewage origin.

(2) The waters shall not contain more than 10 per milliliter of coliform organisms in more than 20 per cent of the samples taken for sanitary analysis.

In addition to the above requirements, waters to be used for recreation should be free from odor, color, grease, suspended matter, floating matter, toxic ma-

terials, and constituents adversely affecting aquatic life in natural streams and lakes.

In California the minimum regulations governing artificially constructed swiming pools are set forth by the State Department of Public Health as follows:

> "Every swimming pool shall be provided with an adequate water supply including such water purification works as may be necessary so that (a) the water in the pool shall at all times of use be sufficiently bright and clear that the body of the bather or an object simulating it on the bottom of the pool in its deepest part will be plainly visible from the edge of the pool surrounding the deep end; and (b) the bacterial condition of water in the pool and of water as admitted to the pool shall be such that at all times, including times of intense use of the pool, samples of water taken from any part of the pool will not contain more than 1,000 bacteria per cubic centimeter when plated on standard Agar medium for 24 hours at 37° C., nor B. Coli in more than one of two one cubic centimeter portions of water when confirmed on solid medium . . ."

Navigation. Water quality is incidental to the actual movement of vessels through the water unless navigation is physically blocked by sediment and debris, floating or otherwise. Ships and small boats are frequently damaged by caustic or acid wastes which corrode the paint or cause deposits of unsightly residue on the sides of the vessels. The fire hazard of oil is also important when considering quality standards for navigational waters. In harbors and dockage areas the disposal of organic wastes may corrode the hulls of vessels because of the hydrogen sulfide that is generated from decomposition of the materials. Corrosion of bronze propellers and gunmetal sleeves on propeller shafts is caused by presence of sulfide in polluted waters. These decomposing organic wastes also give off offensive odors.

Salinity Control. One of the principal objectives of the Central Valley Project is to protect the Sacramento-San Joaquin Delta from intrusion of salt water from Suisun Bay. It is necessary to maintain a net inflow of about 3,300 second-feet to the Delta over and above consumptive requirements in the Delta, in order to achieve the objective of maintaining chlorides of no more than 1,000 parts per million in the Sacramento River near Antioch. The necessary volume of water for control of seawater intrusion is met wholly or in part from operation of Shasta Reservoir.

Another salinity problem that is of increasing importance is the accretion to streams of waters containing large amounts of dissolved minerals, principally return waters from irrigation. Control of this type of salinity is best achieved by dilution with water of low mineral content. The success of the control measures, in this instance, is dependent not only on the volume of water that can be made available for this purpose, but also upon the mineral content of the diluting water. The quality requirements for this purpose are variable and cannot be readily formulated except as related to a specific stream and plan of development.

Industry. Industrial uses of water are quite variable with regard to suitable water quality. Requirements vary from the extremely exacting criteria for make-up water for high-pressure boilers to the very low requirements of water used for cooling condensers in steam plants. Make-up water for high-pressure boilers must be limited to extremely low concentrations of dissolved mineral solids and organic matter, whereas even sea water may be used for cooling of condensers.

Industrial waters include those utilized for food processing purposes. With the single exception of fish canning operations, such waters must at least conform to the quality standards previously cited for drinking water supplies. Some food processing industries are even more exacting with respect to water quality, particularly from the standpoint of concentration and composition of mineral solubles.

Bacteriological and quality standards of the State Board of Public Health for salt water used in fish canning operations are quoted as follows:

"(a) Waters satisfactory without treatment
- (1) For whole fish handling operations:
  - a) Not subject to contamination with human fecal discharges
  - b) Maximum of 7 E. coli organisms per cc
  - c) Bacterial Standard may be exceeded in not more than 5% of the samples

(b) Waters satisfactory after treatment
- (1) For whole fish handling operations:
  - a) Not subject to gross contamination with human feeal discharges before treatment
  - b) Maximum of 3 E. coli organisms per cc after treatment
  - c) Bacterial Standard may be exceeded in not more than 20% of the samples
- (2) For cut fish handling operations:
  - a) Not subject to gross contamination with human fecal discharges before treatment
  - b) Maximum of 3 E. coli organisms per cc after treatment
  - c) Bacterial Standard may be exceeded in not more than 5% of the samples
  - d) The treatment shall include filtration or the equivalent as one of the steps of the treatment process

TABLE I-5

WATER QUALITY FOR INDUSTRIAL USES [a]

(Allowable limits, in parts per million)

Use	Turbidity	Color	Odor and taste	Iron as Fe	Manganese as Mn	Total solids	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Hydrogen sulfide	Miscellaneous requirements	
										Health	Other
Air conditiong			Low	0.5[b]	0.5				1.0		No corrosiveness or slime formation.
Baking	10	10	Low	0.2[b]	0.2				0.2	Potable	
Brewing											
Light beer	10		Low	0.1[b]	0.1	500		75	0.2	Potable	NaCl less than 275 parts per million—pH 6.5-7.0.
Dark beer	10		Low	0.1[b]	0.1	1,000		150	0.2	Potable	NaCl less than 275 parts per million—pH 7.0 or more.
Canning											
Legumes	10		Low	0.2[b]	0.2		25-72		1.0	Potable	
Carbonated beverages	2	10	Low	0.2	0.2	850	250	50-100	0.2	Potable	Organic color plus oxygen consumed less than 10 parts per million.
Confectionery			Low	0.2[b]	0.2	100			0.2	Potable	pH above 7.0 for hard candy.
Cooling	50			0.5[b]	0.5		50		5.0		No corrosiveness or slime formation.
Food, general	10		Low	0.2[b]	0.2					Potable	
Ice	5	5	Low	0.2[b]	0.2		50			Potable	SiO_2 less than 10 parts per million.
Laundering				0.2[b]	0.2		50				
Plastics, clear	2	2		0.2[b]	200.0	200					
Paper and pulp											
Ground wood	50	20		1.0[b]	0.5		180				No grit or corrosiveness.
Kraft pulp	25	15		0.2[b]	0.1	300	100				
Soda and sulfide	15	10		0.1[b]	0.05	200	100				
High-grade, light papers	5	5		0.1[b]	0.05	200	50				
Rayon (viscose)											
Pulp production	5	5		0.05[b]	0.03	100	8	Total 50; hydroxide 8			Al_2O_3 less than 8 parts per million; SiO_2 less than 25 parts per million; Cu less than 5 parts per million.
Manufacture	.3			0.0	0.0		55				pH 7.8 to 8.3.
Textiles, general	5	20		0.25	0.25						
Dyeing	5	5-20		0.25[b]	0.25	200					Constant composition; residual alumina less than 0.5 parts per million.

[a] From "Progress Report of the Committee on Quality Tolerances of Water for Industrial Uses." Journal New England Water Works Association. Volume 54, Page 271. 1940.
[b] Limit given applies to both iron alone and the sum of iron and manganese.

"Samples for bacteriological analysis shall be analyzed by an approved method set forth in the latest edition of the APHA Manual entitled, 'Standard Methods for the Examination of Water and Sewage.' Those methods shall be employed which give the most specific reliable means of measuring organisms having their origin in the intestines of man and other warm-blooded animals."

Because of the large number of industrial uses of water and the extremely varied requirements, it is difficult to establish other than broad requirements of quality. These variable conditions make it desirable to consider water quality in general terms and, where possible, for groups of related industries. The general quality requirements of several individual and major groups of water uses are listed in Table I-5.

Quality requirements for boiler make-up waters are more exacting than those set forth in Table I-5, and the allowable concentrations of physical and mineral characteristics for that use are presented in Table I-6.

Recharge of Ground Water. In general, the mineral quality of water that is to be used for recharge should be at least comparable to the quality of the native ground waters. However, in those instances where the native ground waters are of very high mineral quality, it may be reasonable to use a water of somewhat lower quality for recharge. Conversely, where the ground waters are close to the border line

TABLE I-6

WATER QUALITY LIMITS FOR BOILER FEED WATER [a]

(Allowable limits, in parts per million)

Item	Pressure, in pounds per square inch			
	0-150	150-250	250-400	Over 400
Turbidity	20.0	10.0	5.0	1.0
Color	80.0	40.0	5.0	2.0
Oxygen consumed	15.0	10.0	4.0	3.0
Dissolved oxygen[b]	1.4	0.14	0.0	0.0
Hydrogen sulfide (H_2S)	5.0[c]	3.0[c]	0.0	0.0
Total hardness as $CaCO_3$	80.0	40.0	10.0	2.0
Sulfate-carbonate ratio (A.S.M.E. Na_2SO_4:Na_2CO_3)	1:1	2:1	3:1	3:1
Aluminum oxide (Al_2O_3)	5.0	0.5	0.5	0.01
Silica (SiO_2)	40.0	20.0	5.0	1.0
Bicarbonate (HCO_3)[b]	50.0	30.0	5.0	0.0
Carbonate (CO_3)	200.0	100.0	40.0	20.0
Hydroxide (OH)	50.0	40.0	30.0	15.0
Total solids[d]	3,000-500	2,500-500	1,500-100	50.0
pH value (minimum)	8.0	8.4	9.0	9.6

[a] Moore, E. W. "Progress Report of the Committee on Quality Tolerances of Water for Industrial Uses." Journal New England Water Works Association. Volume 54, Page 263. 1940.
[b] Limits applicable only to feed water entering boiler, not to original water supply.
[c] Except when odor in live steam would be objectionable.
[d] Depends on design of boiler.

with respect to quality for the uses thereof, only waters of higher quality should be used for artificial recharge. Recharge waters should not contain substances which are toxic either in character or concentration, and the ground water should not be contaminated with pathogenic organisms.

Mining. The quality of water required for mining uses will vary depending on the type of material mined and the methods used in processing the ore. The water should not contain constituents which would react with chemicals used in the operation and adversely affect production, nor should the water contain constituents which would damage machinery or other equipment with which it may come in contact.

CAUSES OF DETERIORATION OF WATER QUALITY

Before considering the major causes of impairment of water quality it may be helpful to classify them by type. Ample legal precedent exists for such classification. The California Legislature, in 1949, recognized two types of deterioration, namely, contamination and pollution, both of which are defined in Section 13005 of the Water Code.

Contamination is defined as impairment of the quality of the waters of the State by sewage or industrial waste to a degree which creates an actual hazard to the public health through poisoning or through the spread of disease. This comprehends only those wastes resulting from human activity which contain, or may contain, physiologically harmful amounts of toxic or irritant substances, or pathogenic organisms.

Pollution is defined as impairment of the quality of the waters of the State by sewage or industrial waste to a degree which does not create an actual hazard to the public health, but which does adversely and unreasonably affect such waters for domestic, industrial, agricultural, navigational, recreational, or other beneficial use. This recognizes the detrimental economic effects of the uncontrolled discharge of sewage and industrial wastes.

There is another type of impairment of quality of water which concerns neither sewage nor industrial wastes. In some cases, the presence of man may be immaterial, and in others his activity may be only an indirect or contributing factor. The term "degradation" has been adopted for this type of impairment, which comprises all damage to quality of water not due to disposal of sewage or industrial wastes.

Among the more common causes of impairment in quality of waters are the following:

Contamination and Pollution

1. Domestic and municipal sewage
2. Industrial wastes
   - A. Organic wastes
     - (1) Food processing
       - (a) Fruit and vegetable canneries
       - (b) Fish canneries and fish reduction plants
       - (c) Slaughtering plants
       - (d) Wineries
       - (e) Breweries
       - (f) Sugar refineries
     - (2) Lumber processing
       - (a) Mill ponds
       - (b) Sawdust and bark
       - (c) Pulp mills
   - B. Mineral wastes
     - (1) Metal processing industries
       - (a) Plating works
       - (b) Steel mills
     - (2) Mining and ore extraction industries
       - (a) Drainage from mines
       - (b) Water from processing ores
       - (c) Dredging
       - (d) Gravel pits
     - (3) Oil industries
       - (a) Drilling wastes
       - (b) Production wastes, brines, oils
       - (c) Refinery wastes
       - (d) Terminal loading wastes
       - (e) Abandoned oil and gas wells
     - (4) Chemical industries
     - (5) Miscellaneous
   - C. Cooling water
3. Solid and semi-solid refuse

Degradation

1. Effects of development, use, and re-use of water
   - A. Irrigation return water
     - (1) Surface drainage
     - (2) Percolation
   - B. Interchange between aquifers due to improperly constructed, defective, or abandoned wells
   - C. Interchange between aquifers due to differentials in pressure levels resulting from excessive withdrawal
   - D. Overdraft conditions
     - (1) Sea-water intrusion
     - (2) Salt balance
     - (3) Upward or lateral diffusion of connate brines and/or juvenile water due to overpumping
   - E. Contamination from the surface due to improperly constructed wells

2. Natural causes
   A. Inflow and/or percolation of juvenile water from highly mineralized springs and streams
3. Other causes
   A. Accelerated erosion
   B. Mineralization resulting from plant transpiration and/or evaporation

The effects of improperly constructed and abandoned wells, although locally serious, are not involved in the development of The California Water Plan, and hence are not discussed further here.

Domestic Sewage

The most widely known cause of impairment of water quality is domestic or municipal sewage. Three general types of sewage have been distinguished, which are:

a. *Sanitary sewage*, a watery mixture or suspension of solid and liquid wastes resulting from man's metabolism and domestic habits.

b. *Storm sewage*, the runoff from the surface of the land, originating in natural precipitation, that may be admitted or infiltrate into a drain not used for conveyance of sanitary sewage.

c. *Combined sewage*, a mixture, in varying proportions, of the two preceding types.

Sanitary sewage has the greatest effect as a cause of contamination and pollution and usually contains from 0.02 to 0.05 per cent (200 to 500 parts per million) of solid wastes, of which two-thirds or more may be putrescible organic matter. It is readily amenable to treatment to reduce its harmful properties, and an elaborate technology has been developed for treatment by chemical, mechanical, and biological processes. The quantity of sanitary sewage produced is related to water consumption, and generally varies between 50 and 100 gallons daily per capita in urban areas. A city of 10,000 population, therefore, may be expected to discharge up to 1,000,000 gallons per day of sanitary sewage, containing, in its untreated state, one to two tons of putrescible sewage solids.

Storm sewage is normally lower in organic matter than sanitary sewage and may be discharged harmlessly into many surface waters. It usually contains a small amount of polluting organic matter picked up in its flow over the surface. In addition, it is likely to carry a considerable amount of suspended mineral matter flushed off the ground. This suspended matter, commonly called grit, may need to be removed if the sewage is to be pumped or treated.

Combined sewage is of declining importance, since modern engineering practice provides separate systems for sanitary and storm sewage. Combined systems are still found in some older communities in California, notably in the San Francisco Bay Area. An extensive program for their elimination has been followed in recent years.

Sewage solids may be present in receiving waters in a dissolved, colloidal, or suspended state. Those solids which settle out of the water form concentrated mixtures of unstable organic compounds commonly termed sludge. Under the action of biological organisms, the solids slowly decompose into mineral and relatively stable organic materials. Decomposition of sewage solids take place under stream conditions where oxygen dissolved in the water is available (aerobic) or where dissolved oxygen has been exhausted (anaerobic). Aerobic decomposition is orderly and inoffensive. In absence of sufficient oxygen (anaerobic) these solids slowly decompose or putrefy, producing various odorous and unsightly substances, solid, liquid, or gaseous. During the process of aerobic decomposition dissolved oxygen is removed from the water. The quantity of oxygen required is definitely measurable and is known as biochemical oxygen demand or the "BOD" of the sewage. This demand may be so large as to exhaust completely the oxygen content of the receiving waters.

The crux of this situation is that certain irreducible minimums of dissolved oxygen are needed to maintain a semblance of clean waters without nuisance. These minimums have been variously estimated at 25 to 50 per cent of the saturation value, or theoretical maximum. Lacking sufficient oxygen, stream degradation sets in quickly. The sewage solids decompose with production of foul odors and gases; noxious bacteria multiply; the stream becomes black, greasy and unsightly; and fish and other denizens of normal waters die.

In recent years the phosphorus content of sewage has been greatly increased due to use of cleansing detergents which contain phosphates. Such detergents magnify the problems of sewage and water treatment plants. The phosphates added to receiving streams and lakes through sewage and industrial cleansing waste disposal, under certain conditions, are capable of causing excessive growth of undesirable algae to an extent that fish life is destroyed and offensive odor and water taste is created.

The undesirable effects of sewage pollution of water may be summed up as follows:

a. Sewage bacteria, except in minute concentrations, render water unfit for drinking and other personal and domestic uses.
b. Such bacteria also impair water quality for swimming and similar recreational purposes.
c. Gross pollution by sewage destroys all normal aquatic life of receiving waters.
d. Certain sewage gases, notably hydrogen sulfide, are corrosive to metals and harmful to paints. Much damage has been done to ships' hulls and other submerged and floating structures by contact with waters heavily polluted with sewage.

e. Waters made unsightly or odorous by sewage depreciate the value of shore property.
f. Sewage pervading waters utilized for culture of shellfish may cause them to become unsafe for consumption. Such shellfish beds must be condemned by health authorities, and a valuable food resource is thereby destroyed.
g. Sewage pollution may make water unsafe for certain agricultural uses, for example, stock-watering, especially of dairy cattle, and the irrigation of truck garden crops.
h. Phosphates in sewage create undesirable conditions in receiving water as regards its biota. Excessive growth of algae may deoxygenate the stream, destroy fish life, and give rise to offensive odors and water taste.

Solid and Semisolid Refuse

The rapid growth of population and industry in California has created acute problems in the disposal of solid and semisolid wastes in many areas, particularly in southern California. This class of materials comprises all wastes not discharged into public sewers. Three general classes may be distinguished, in decreasing order of chemical activity and their potential for polluting public waters: (1) general industrial wastes, including acids, alkalies, sludges, slurries, organic chemicals, solvents, tars, spent lubricating oils, etc.; (2) general domestic and municipal refuse, including such substances as tin cans, junk metals, paper and paper products, cloth, lawn and shrubbery clippings, garbage, and dead animals; and (3) solid and relatively inert waste products, such as earth, concrete fragments, glass, plasterboards, steel mill slag, and manufactured rubber products. Population pressure and rises in value of land have made it no longer cheap or easy, in many cases, to obtain refuse disposal sites which are sufficiently isolated, and at the same time close enough to be within economical hauling distance. In southern California especially, such sites are at a permium, current sales of dump sites having reached a price as high as 50 cents per cubic yard of capacity.

During the past few years the Division of Water Resources, the State and Regional Water Pollution Control Boards, and other agencies have been actively concerned in investigation of this problem. Studies by the Division of Water Resources for the Los Angeles, Santa Ana, and San Diego Regional Water Pollution Control Boards have resulted in the development of a system of classification for dump sites, according to the degree of protection which they afford the vicinal ground water. Class I dump sites are defined as "sites located on nonwater-bearing rocks or underlain by isolated bodies of unusable ground water, which are protected from surface runoff and where surface drainage can be restricted to the site or discharged to a suitable waste way." Class II sites are those "underlain by usable, confined or free ground water when the minimum elevation of the dump can be maintained above anticipated high ground water elevation, and which are protected from surface runoff and where surface drainage can be restricted to the site or discharged to a suitable waste way." The poorest dump sites are those in Class III, which are defined as "dump sites so located as to afford little or no protection to usable waters of the State."

Refuse disposal sites in the first or safest class are considered satisfactory to receive any type of refuse without hazard to ground or surface waters. Dump sites in the second class are considered satisfactory to receive solid inert wastes, as well as the types of domestic and municipal refuse mentioned in the opening paragraph of this section, provided that dumping is confined to zones not less than two to five feet above anticipated high ground water elevations in the vicinity. Solid, inert materials as previously described may be deposited safely in a dump of any class.

Formal recommendations have been made by the Division of Water Resources for the protection of ground waters from the effects of unregulated dumping of wastes in the Santa Ana and San Diego regions and in Los Angeles County.

The investigations of the Division of Water Resources have been most usefully complemented by research carried on by the University of Southern California under the sponsorship of the State Water Pollution Control Board. Reports published in 1952 and 1954 describe the hazards to be anticipated from improper disposal of incinerator ash and of sanitary land fill, and the precautions which should be observed to minimize risk of pollution of ground waters.

Industrial Wastes

The variety of industrial wastes is almost infinite and the quantities, strength, and toxicity may be such as to greatly exceed the effects of ordinary sewage. Certain wastes produced by typical industries important to the California economy, such as the food canning, sugar refining, and meat packing trades, may require from ten to a hundred times more oxygen than domestic sewage in order to be rendered harmless. Metal-working and plating industries produce poisonous wastes, such as chromates and cyanides, which can render water unfit for fish life and unsafe for domestic or municipal use in concentrations as low as one part in ten million. The beet-sugar industry in California has been estimated to produce liquid wastes equivalent in pollutional effect to the sewage of 5,000,000 people before treatment. Enormous loadings of organic wastes have been discharged into certain of the waters of California by food processing plants.

Fruit and Vegetable Canneries. About one-half of the nation's supply of fruits, and one-fourth of

the vegetable specialty crops are produced and processed in California. Despite growing diversification of our economy, agriculture and the associated processing activities continue to be the State's largest industry, and the canning of fruits and vegetable products is an important segment of that activity.

Canning-factory wastes vary in nature according to the products handled, and according to the type of factory, i.e., whether the plant is a full-line establishment processing a variety of products, or a specialty plant packing only one item. In general, the liquid wastes from full-line plants are large in volume and not much stronger than sewage in regard to their oxygen requirements. However, the effluent of specialty canneries is likely to be much more concentrated, displaying an oxygen demand of two to fifty times that of an equal volume of sewage. In addition to liquid wastes canneries produce large volumes of solid wastes such as seeds, skin, pulp, pits, etc.

Direct discharge of untreated cannery wastes into municipal sewerage systems would in many cases create an intolerable burden on the sewage treatment facilities. At some locations, facilities are adequate for treatment of the liquid cannery wastes, after removal of part of the solids by screening or sedimentation at the cannery. At a few locations, special treatment works to handle the flow of industrial wastes have been constructed, in addition to the facilities provided for treatment of sewage. In other cases, provision must be made by the individual industry for treatment of its wastes to a point where they can safely be discharged into the State's waters.

The most prevalent method for cannery waste treatment in California is screening to remove part of the solids, followed by sedimentation and biological oxidation in open ponds or lagoons. Disposal of solids is usually by dumping, spreading, or plowing into privately owned land, and for hog feed. In a few cases, by-products of economic value can be recovered from solid wastes. Other forms of treatment such as chemical precipitation of solids, partial stabilization of liquid wastes in trickling filters, and chlorination, are feasible and are widely practiced throughout the United States. With increasing land values, the food processing industry in California may be impelled to adopt such methods in the interest of economy, as the system of lagooning requires extensive areas of land, as well as isolation, in order to minimize the odor nuisance.

Beet-Sugar Refineries. The beet-sugar industry is historically important in California. The first successful beet-sugar factory in the United States was founded in 1866 at Alvarado. From that beginning the industry has grown to one that annually processes more than 2,500,000 tons of beets. Latest available statistics (1949) indicate a yearly output of beet-sugar and byproducts worth more than $25,000,000.

Geographically the industry is well distributed in California. Major centers of production are in the valleys of the Sacramento, Salinas, and northern San Joaquin Rivers, and the Imperial Valley. Other important producers are located in Alameda, Santa Clara, Santa Barbara, Ventura, Los Angeles, and Orange Counties. The activities of the refineries are seasonal. In northern California the season lasts from August to December, while in the southern part of the State the season is usually somewhat longer, extending from May through December.

The wastes of beet-sugar refineries are characterized by large volume, high BOD, and a large content of suspended and dissolved solids. Introduction of untreated beet-sugar wastes into a stream can cause mass killing of fish, inhibition of diatom growth, stimulation of sewage fungus, and the destruction of normal benthol organisms. The lethal effect is attributed to a combination of the deoxygenating effect of the BOD and the toxicity of the beet saponins.

Waste water flows of several million gallons per day are not unusual. Liquid wastes consist of various wash waters, pulp-press water, and process liquors used in extraction of the sugar. Additionally, it is necessary to dispose of a large amount of spent lime slurry which is used in the refining process. The organic wastes vary widely in strength. Wash waters are often comparable to sewage in respect to BOD, while wastes from the so-called Steffens process may be as much as forty times as great. Suspended solids content is likely to be high in all types of wastes of this industry. Beet pulp, the solid residue of the sugar refining process, has high economic value for cattle feed, and the salvage of the maximum amount of this profitable by-product is of benefit to the industry.

Treatment of the wastes often consists simply of clarification and oxidation in shallow artificial ponds or lagoons. Liquids may be discharged through a series of such ponds, each one successively removing a portion of the suspended matter and contributing some of the oxygen needed for ultimate stabilization of the organic matter present. Efforts are frequently made to provide pond capacity great enough to hold the seasonal discharge so that no waste need be discharged into surface streams. In such cases the liquid is dissipated by evaporation and by percolation into the ground.

Disposal methods as outlined above have the disadvantage of requiring ample land area and are becoming increasingly uneconomic as land values rise. Ponds must be isolated in order to obviate odor complaints by nearby property owners.

Sugar factory wastes respond well to some of the methods employed to treat domestic sewage, including coagulation, settling, and filtration. These methods are often used in other regions, and in Europe, where high land cost is a deterrent to the ponding sys-

tem. Considerable research has also been made upon processes to eliminate, recirculate, or salvage waste waters from some of the refining processes, with varying degrees of success.

Oil Field Wastes. Petroleum seeping from natural springs was known to the aboriginal inhabitants of California, but it was not until about 1861 that the first well was drilled for oil. Throughout the closing years of the nineteenth century production increased slowly. By 1895 annual output exceeded 1,000,000 barrels. The automobile and two world wars stimulated production to such a degree that during 1951 nearly 357,000,000 barrels were withdrawn from over 29,400 producing wells. For many years the petroleum industry has been outranked only by agriculture in the value of production to the economy of the State. At present California produces about one-sixth of the national supply of crude petroleum.

Water underlies oil in most oil fields. Such water is usually saline to a degree sometimes exceeding that of ocean water. The production of waste water from California oil fields in 1951 amounted to about 562,000,000 barrels (73,000 acre-feet), an average of 1.58 barrels of water to each barrel of oil. Dissolved salts are not the only objectionable ingredients of oil field waste water, or brine. The separation of crude oil and water is seldom complete in the field, and a small percentage of oil is inevitably wasted with the brine. Additional losses associated with oil production occur by accidental spills, leaks, and washing of equipment.

Preservation of quality of both surface and ground waters requires that oily and highly saline wastes be prevented from reaching usable water supplies. Concentrations of chlorides above 300-500 parts per million make water unpalatable, and at about 1,000 parts per million it becomes practically undrinkable. Most crops cannot tolerate more than 350 parts per million of chlorides in irrigation water, nor more than 2,000 parts per million of total dissolved solids. Boron, a frequent ingredient of oil field brines, is injurious to many fruit trees in concentrations as low as one part per million. Fish are killed by concentrated oil field brines, and cattle or hogs drinking such waters may be severely affected. Oil in surface waters is an unsightly and persistent nuisance, and destroys their value for most beneficial uses.

At present there is no economically feasible method of demineralizing oil field brines. Disposal must be made in such a way that fresh water resources will not be affected unreasonably. Operators of coastal oil wells, such as those in portions of Los Angeles and Orange Counties, can usually discharge brines directly into the ocean without harm, except for the residual oil content which may adversely affect fish and aquatic life, and adjacent beaches. Careful separation of the oil is a corollary requirement in such cases.

The disposal problem is more difficult for interior fields, such as those of the western San Joaquin basin, which generally yield highly concentrated, strong brines. Safe disposal there requires either: (1) physical transport of the brines to areas where surface spreading and percolation will do no damage; (2) evaporation in lined, impervious sumps; or (3) return to deep subterranean strata by pumping into abandoned oil wells or specially drilled injection wells. These methods of disposal are costly, and both experience and judgment are needed in their selection.

Irrigation Return Flow

Irrigation waters not consumptively used by the crops but disposed of through surface runoff and deep percolation constitute a major cause of degradation to natural surface and underground water resources of California. The amount of this return flow varies widely with irrigation practices and with different soil conditions and crops, but generally losses amount to about one-half to one-third of the applied irrigation water. Estimates by the Division of Water Resources indicate that about three acre-feet of irrigation water is applied annually to approximately 7,000,000 acres of farm lands in California. Assuming for purposes of illustration an over-all irrigation efficiency of about $66\frac{2}{3}$ per cent, the total annual irrigation return flow would amount to about 7,000,000 acre-feet.

Basic research has as yet been accomplished only to a minor extent in evaluating the adverse effects of irrigation losses on quality of receiving waters. However, available data for surface streams indicate that the effects on such supplies are quite serious. This is particularly true of the Sacramento and San Joaquin Rivers in the Central Valley Area and the Santa Ana River in the South Coastal Area. Irrigation losses returning to these streams either as surface or subsurface inflow cause significant changes in both the concentration and composition of mineral solubles therein. For example, in June, 1953, the irrigation drainage that gained access to a 57-mile stretch of the San Joaquin River between Temple Slough and Fremont Ford had increased the dissolved mineral content of water in the stream from its natural content of about 35 parts per million to 420 parts per million. The increased mineralization of water in surface streams is in turn reflected in waters of underground reservoirs recharged thereby. This fact may account in part for the increase in content of dissolved solids that has occurred since 1931 in the underground waters of the Santa Ana River Forebay below Santa Ana River Narrows.

Another important aspect which requires consideration is the effect of irrigation runoff on the biological environment of surface waters. Nitrates and phosphates are especially important in this regard

since both are added as fertilizers to the soil or to the irrigation water. Nitrates and phosphates are neeessary nutrients to the biota of lakes, reservoirs, and rivers. The greater the pereentage of phosphorus and nitrates the more extensive is the growth of both algae and higher plants. Such teeming populations of algae, called "blooms," ereate at least three water quality problems: first, an overproduction of oxygen during daylight hours, which may cause death of fish by anoxemia (a condition similar to the "bends" suffered by deep-sea divers); second, a eomplete exhaustion of dissolved oxygen in the water at night, owing to its extraetion by algae in their metabolic life-processes after photosynthesis has eeased; and third, the ereation of offensive tastes and odors owing to death and decomposition of algae on a scale vastly exceeding normal, or to the very presenee of certain species.

Insecticides and herbicides may also be classed as potential pollutants of surface waters. This is especially true after heavy rains in instanees where a herbicide is used to control plant growth along stream channels and algal growth in tributary irrigation drains. Recent increases in use of airplane sprays for plant and insect eontrol have aggravated this problem.

Sea-Water Intrusion

Geologic evidenee indicates that water-bearing deposits along the seaward and bayward margins of the ground water basins bordering the California coast and inland bays may be in direet contact with the ocean or bay floor, or may extend beneath the floor as confined pressure aquifers and at some distance offshore be in contaet with sea water. Long continued draft, a protraeted period of dry years, and increasing agricultural, municipal, and industrial demands sinee 1940, have lowered ground water elevations below sea level along the seaward margins of many of these basins. As a result, the natural seaward hydraulic gradient has been reversed and sea water has eneroached upon the eoastal margins of many ground water basins.

Encroachment of sea water has already oeeurred, or an immediate or potential danger of intrusion exists in at least 80 major and minor ground water basins bordering the California coast and inland bays. Of this total, there is definite evidenee of intrusion into 13 basins, immediate danger exists in 7 basins, and potential danger exists in 15 basins and probably in an additional 45 basins about which little is known.

Extensive damage due to sea-water intrusion has already occurred in numerous basins, with resultant large economic losses. Unless measures for prevention and control of this souree of degradation are undertaken in the near future, further widespread deterioration of ground water supplies will follow.

Connate Waters

Connate waters are those waters entrapped in the interstices of a sedimentary rock at the time it was deposited. These waters may be fresh, brackish, or saline. They are, however, predominantly sodium ehloride in type and are of a quality unsuitable for domestie and irrigation purposes.

Connate waters are generally found in water-bearing lenses of Tertiary roeks which underlie or flank the uneonsolidated fresh-water-bearing Recent and Plio-Pleistocene deposits. In some instances, flushing of eonnate saline waters in the uneonsolidated Quaternary deposits has been incomplete, resulting in isolated bodies of diluted connate saline waters within the main body of fresh water.

Degradation of fresh-water-bearing deposits by connate saline waters of poor quality is apparently direetly related to ground water extractions. As ground water levels in a basin are drawn down, hydraulie gradients may be established whieh would allow connate saline waters in sediments adjaeent to a ground water basin to enter and degrade fresh water aquifers, or connate saline waters underlying the main body of fresh water to migrate upward in areas of heavy ground water extractions. Deep wells may penetrate connate saline waters underlying fresh waters and pump from the saline bottom waters or allow interchange between saline and fresh-water bodies.

Very little information is available to indieate the extent of degradation of fresh-water-bearing deposits by eonnate saline waters. Evidence aecumulated to date indieates that some degree of degradation due to invasion by these waters has taken place in at least 10 ground water basins in California.

Inflow From Highly Mineralized Natural Waters

A common cause of degradation of water oecurs through the mingling of natural surface waters of widely different mineral quality. Numerous instances have been found among streams of the State where a soft water of low mineral content in one stream is degraded by inflow of inferior quality from a braneh or tributary. The offending water may originate in a mineral spring, inflow from a saline lake, in mine drainage, or in artesian discharge from an abandoned well. However, in most instances, the differences in quality may be attributed to the mineralogical eharacteristies of the respective drainage basins.

Land Erosion

Land erosion is the process of wearing away of the land surfaee by the action of running water, wind, or other agents. Erosion is divided into the general classifieations of geologic, or normal erosion, and soil, or accelerated erosion. Soil erosion follows as the result of unbalaneing the normal equilibrium of natural

processes of soil building and soil transportation by activity of man in agricultural and industrial endeavors, as well as by other causes, such as rodent infestation, etc.

When man disturbs the soil cover he causes accelerated erosion to occur. Agricultural development has made waste areas out of many once rich agricultural lands. There are no geographical limits to this destruction. Archeologists have uncovered many buried cities in the deserts of the world. These indicate that many civilizations have ceased to exist because of the effects of erosion. Wasteful erosion is due largely to man's unbalancing of nature's soil equilibrium, and also to his lack of conservation and control methods and practices. Removing the soil cover destroys nature's means of preventing erosion. Vegetative cover decreases the destructive velocity of runoff and cushions the effect of wind and impact of raindrops. Vegetation also functions as minute debris dams, for as particles of soil are transported either by water or wind the vegetation tends to intercept and stop their movement. Vegetation also acts as a soil binder through action of the root systems in keeping the soil particles clustered together. The vegetative soil cover is removed by tillage and only partially replaced by the planting of crops. In some cases, the total area is planted to crops but the land is laid bare for the destructive effect of erosion between plantings. Irrigation also adds its effect to the erosion resulting from natural causes. Soil thus lost becomes part of the stream into which the return water enters. A phase of agriculture which tends to aggravate erosion is the pasturing of cattle, sheep, goats, horses, and other domestic animals. The stock consumes the covering grasses and reduces the protection of the underlying soil.

Industrially, man causes accelerated erosion by mining, by the release of large quantities of water from storage as a result of developing the power resources of water, by quarrying for gravel in the stream bed, and in the harvesting of lumber. Mining, through disturbance to the surface soil and the addition of waste material obtained from within the earth, is an accelerated soil erosion agent. Surface mining, whether open pit, placer, hydraulic, or dredging, accelerates natural soil erosion. In timbering operations the vegetative cover crop is removed, and temporary roads are built which lay open the soil to the erosional forces of wind and rain. Utilization of streams as a means of transportation for logs creates disturbance to the stream bed and increases soil and bed load movement.

The detrimental effects of accelerated soil erosion are numerous. Silt, the product of accelerated soil erosion, is both a pollutant and a degradant. The silt resulting from agricultural and stream bank erosion constitutes a degradant to natural waters. Erosional characteristics which result from mining and quarrying operations constitute pollutants. However, the harmful effects produced by each of the above are similar, and the only practical difference in the two types of erosion is that it is possible to compel the abatement of pollution due to erosion. Silt and other debris created by mining, with emphasis on hydraulic and placer mining, is a deterrent to fish and wildlife propagation and to navigation. Other beneficial uses of the water adversely affected by silt or other debris are recreational uses, irrigation by diversion or pumping of natural or artificial streams, power development, and municipal and industrial uses.

WASTE-LOADING CAPACITY OF NATURAL AND ARTIFICIAL STREAM CHANNELS

Prior concepts of maintaining an arbitrary standard of quality in water resources are yielding to the newer ideas of economic utilization. This doctrine postulates reasonable use of water resources for all beneficial purposes, including use for waste disposal. It recognizes the fact that purity and safety of a water are relative and must always be appraised with reference to its intended use. Pollution must be evaluated in relation to the local situation. Thus, a waste discharge that would be intolerable in Lake Tahoe might be quite permissible in San Francisco Bay.

In California, domestic water supply and irrigation, in that order, are legally recognized as the paramount uses of water. Many other beneficial uses are universally acknowledged, including maintenance and propagation of fish and wildlife, sport and commercial fishing, shellfish culture, stock watering, food processing, industrial process water, power development, navigation, and recreational uses. Waste disposal is a legitimate use but must be controlled to the extent necessary to prevent adverse unreasonable deterioration of the water for some higher purpose. It is further recognized that treatment of wastes is required only to the extent necessary to preserve actual or definitely planned stream uses.

From the ideas expressed above, it follows that the allowable waste-loading capacity of a specific water resource, like water quality, must be evaluated in relation to water uses. The principal patterns of use usually recognized for perennial streams in California are hereinafter set forth. Rivers originating in mountainous, snow-fed areas, characterized by waters of high purity, are generally devoted to those uses of water requiring highest quality, and thus require maximum protection from contamination and pollution. Their waste-loading capacity therefore is practically nil. As the streams enter the valley floor, use for irrigation and industrial purposes is intensified. Use of the streams for waste disposal is often unavoidable, and some deterioration in quality must be

accepted as the price of development of agriculture and industry. Finally, in the lower reaches extending to tidewater, discharges resulting from urban and industrial activity may be such as to tax the natural allowable waste-loading capacity of the waters. In those areas all of the reserve capacity to absorb wastes without detriment must sometimes be utilized.

Natural Purification Capacity of Water

In the preceding section it has been set forth that the allowable waste-loading capacity of waters may vary in a restrictive sense, i.e., in accordance with a policy of keeping wastes out, or of limiting the strength and amount of such discharges. The term is used in another and quite different sense to signify the capacity of waters for self-purification by natural agencies. This phenomenon which occurs in both surface and underground waters is discussed in the following paragraphs.

Surface Waters. The ability of a stream to purge itself of impurities is traditional, and has found expression in such folklore as "running water purifies itself in seven miles." Only in recent years, however, has a close study been made of the actions involved.

The mere presence of abnormal amounts of suspended matter, however stable and inert, can cause a condition of pollution or nuisance. Thus, such wastes as sawdust, clay, silt, chemical sludges, and waste oils render rivers and their banks unsightly, destroy fish, and impair water quality for domestic supply, irrigation, industrial use, and recreation. Prolonged silting may render navigation channels useless. The capacity of natural waters to accept waste loadings depends on many factors, including volume and transporting power. Large volumes of water reduce color, turbidity, and the toxic and irritant effects of wastes simply by diluting to concentrations where they are harmless and unnoticeable. Swiftly flowing waters may comminute and disperse suspended matter and remove it to areas where further dilution can render it harmless.

One of the most striking aspects of natural purification is bacterial self-purification. Contrary to popular impression, this effect is not confined to running water; indeed, it is usually more pronounced in bodies of standing water than in streams. Rapid and very high bacterial death rates are often observed. The explanation of this phenomenon is rather complicated but appears to lie fundamentally in the removal of the organisms to an alien and unfavorable environment outside the body of their host.

A third aspect of self-purification of natural waters is their capacity for biochemical self-purification. The significance of dissolved oxygen in stabilizing putrescible organic wastes has been discussed briefly heretofore. This consumption of oxygen constitutes a drain upon the oxygen resources of a stream, and if no natural compensating factors were at work, pollution problems would be aggravated enormously. In fact, however, nature works constantly to restore the oxygen balance of waters to normal.

The agencies of this restoration, (or reaeration) are complex. Under the influence of sunlight, green plants growing in water produce and release oxygen in such quantities that they may actually cause supersaturation. This phenomenon is restricted to the hours of daylight. Hence it may happen that a water supersaturated by day may lose all oxygen during the hours of night. Other factors affecting reaeration are solution by surface contact, diffusion from points of higher concentration of oxygen, and mixing by waves, winds, tidal currents, and turbulent flow. Mathematical expression of the phenomenon is possible, and for any given stream oxygen balance can be calculated with fair accuracy once the characteristics of that stream have been determined by field study.

Ground Waters. Natural processes of purification which prevail in the surface may be present below ground in weaker form, or perhaps be totally absent. Sunlight and air are lacking, plant and animal life exist in the top soil layers, turbulent flow is rare, and dilution is a much slower process.

The problem of gross organic pollution of subsurface waters is rarely met, largely because of inherent difficulties in introducing large quantities of common organic wastes below ground. Cesspools, recharge wells, and surface spreading grounds all tend to remove suspended solids by infiltration and bacteria and colloidal matter by biological action. It is possible, by massive application of sewage, to introduce bacteria below ground in considerable numbers. Several factors, however, are present to limit both their range and survival in homogeneous soils.

Pollution of ground water by substances in solution is more serious. Solutions of inorganic acids, bases, and salts, and organic liquids and solutions such as many industries employ, can pass readily into the soil, and once introduced are difficult to remove or neutralize. Natural dilution tends to be slow; artificial flushing is usually difficult and expensive; and treatment of the water is generally impracticable. The effects of such pollution may be long-lasting or permanent. Lateral and vertical diffusion of materials introduced into the ground water body may be very slow, resulting in a zone of high concentration downstream from the point of discharge. Efforts must be directed, therefore, toward excluding from ground water such wastes in harmful quantities, in order that the tremendous underground storage capacity is not destroyed by unwise or wasteful disposal practices.

QUALITY ASPECTS IN PLANNING FOR WATER PROJECTS

Protection of sources of water supplies from deterioration to the extent that their waters are rendered unusable for the beneficial purposes to which they must be put is a continuing consideration in California. Planning activities necessary to the development of additional water supplies and maintenance of the quality of existing supplies must provide for adequate disposal of wastes. This may entail the use of the dilution capacity of natural streams and of natural or artificial water bodies, the planned disposal of wastes in areas not contributing to usable water supplies, the provision of separate drainage facilities and ultimate disposal in the ocean or bays, or other feasible methods of preventing adverse effect on usable water supplies. These problems are being considered in the formulation of The California Water Plan, and, to the extent necessary to provide for the full development and utilization of the State's water resources, physical solution will be incorporated in the plan.

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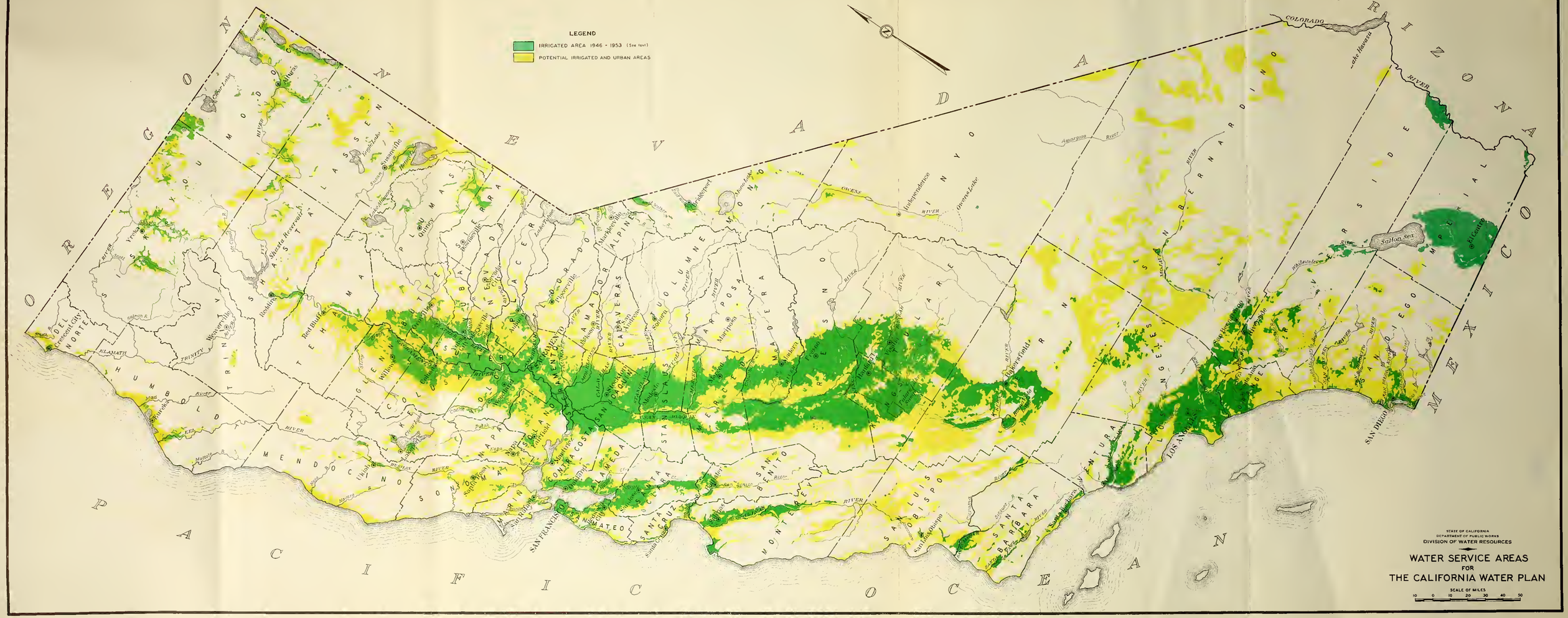
PLATE 1



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

WATER SERVICE AREAS FOR THE CALIFORNIA WATER PLAN

SCALE OF MILES
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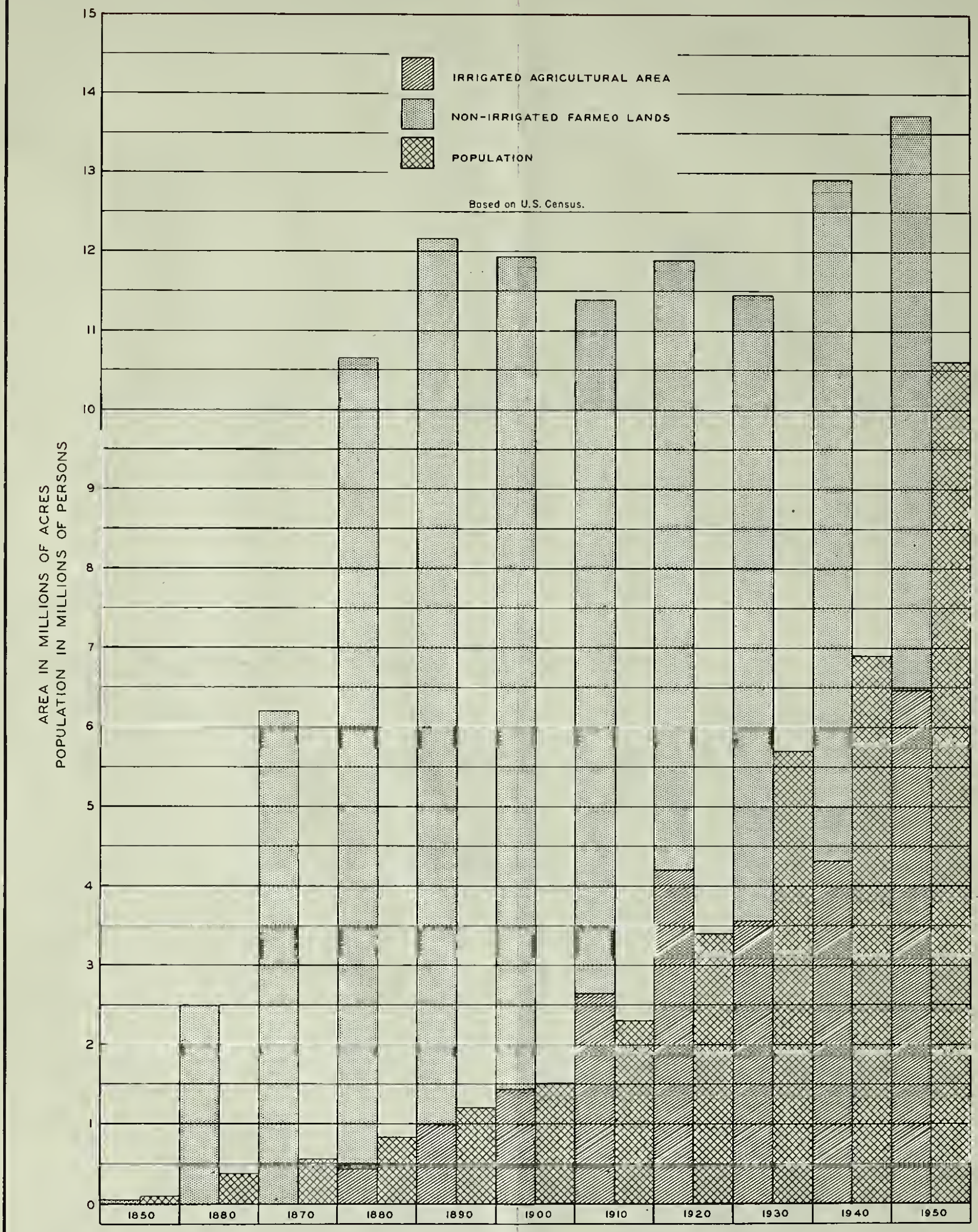

GROWTH OF POPULATION AND CULTIVATED AND IRRIGATED LANDS OF CALIFORNIA

DIVISION OF WATER RESOURCES


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
IRRIGATION AND WATER STORAGE DISTRICTS
1954
SCALE OF MILES
10 0 10 20 30 40
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
DEL NORTE
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
SIERRA
BUTTE
GLENN
MENDOCINO
LAKE
COLUSA
SUTTER
YUBA
NEVADA
PLACER
EL DORADO
YOLO
SONOMA
NAPA
MARIN
SOLANO
SACRAMENTO
AMADOR
ALPINE
CALAVERAS
SAN JOAQUIN
TUOLUMNE
MONO
CONTRA COSTA
ALAMEDA
SAN MATEO
SANTA CLARA
SANTA CRUZ
STANISLAUS
MERCED
MARIPOSA
MADERA
FRESNO
SAN BENITO
MONTEREY
KINGS
TULARE
INYO
SAN LUIS OBISPO
KERN
SANTA BARBARA
VENTURA
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
Goose Lake
Eagle Lake
Honey Lake
Lake Almanor
Shasta Reservoir
Clear Lake
Lake Tahoe
Mono Lake
Salton Sea
LONG VALLEY RESERVOIR
COLORADO RIVER AQUEDUCT
ALL AMERICAN CANAL
PARKER DAM
Sacramento River
San Joaquin River
Owens River
Colorado River
Salinas River
Russian River
Eel River
Trinity R.
Klamath
Feather
Kern
Kings River
Kaweah River
Merced
Tuolumne
Stanislaus River
Mokelumne
Cache Cr.
Putah Cr.
Stony Creek
Mojave River
Santa Ynez River
Santa Clara R.
Los Angeles R.
San Gabriel R.
Santa Ana River
San Luis Rey
Crescent City
Eureka
Yreka
Alturas
Redding
Red Bluff
Weaverville
Willows
Ukiah
Lakeport
Santa Rosa
Napa
San Rafael
Martinez
Oakland
San Francisco
Redwood City
San Jose
Santa Cruz
Hollister
Salinas
Quincy
Downieville
Marysville
Yuba City
Woodland
Auburn
Placerville
Jackson
San Andreas
Markleeville
Bridgeport
Sonora
Stockton
Modesto
Merced
Mariposa
Madera
Fresno
Hanford
Visalia
Independence
Bakersfield
San Luis Obispo
Santa Barbara
Ventura
Los Angeles
San Bernardino
Riverside
Santa Ana
San Diego
El Centro
TULELAKE I.D.
HOT SPRING VALLEY I.D.
SOUTH FORK I.D.
BIG VALLEY I.D.
BUTTE VALLEY I.D.
MONTAGUE WATER CONSERVATION DIST.
BIG SPRINGS I.D.
GRENADA I.D.
SCOTT VALLEY I.D.
ANDERSON-COTTONWOOD I.D.
EL CAMINO I.D.
DEER CREEK I.D.
PARADISE I.D.
GLENN-COLUSA I.D.
PROVIDENT I.D.
PALO VERDE I.D.
BARD I.D.
IMPERIAL I.D.
BEAUMONT I.D.
LITTLEROCK CR. I.D.
PALMDALE I.D.
LA CANADA I.D.
VISTA I.D.
SAN YSIDRO I.D.
STEEL CANYON I.D.
CORCORAN I.D.
DELANO-EARLIMART I.D.
SAUCELITO I.D.
TEAPOT DOME I.D.
TERRA BELLA I.D.
BUENA VISTA W.S.D.
SHAFTER-WASCO I.D.
ARVIN-EDISON WATER STORAGE DIST.
TULARE LAKE BASIN W.S.D.
KINGS RIVER DELTA I.D.
EMPIRE WEST SIDE I.D.
STRATFORD I.D.
LAGUNA I.D.
RIVERDALE I.D.
CONSOLIDATED I.D.
JAMES I.D.
CENTRAL CALIFORNIA I.D.
MERCED I.D.
WEST STANISLAUS I.D.
BYRON-BETHANY I.D.
WEST SIDE I.D.
SOLANO I.D.
POTTER VALLEY I.D.
WATERFORD I.D.
LINDSAY-STRATHMORE I.D.
EXETER I.D.
ALPAUGH I.D.
VANDALIA I.D.
STONE CORRAL I.D.
ORANGE COVE I.D.
ALTA I.D.


LEGEND
DRAINAGE AREA BOUNDARY
NORTH COASTAL AREA
SAN FRANCISCO BAY AREA
CENTRAL COASTAL AREA
SOUTH COASTAL AREA
CENTRAL VALLEY AREA
LAHONTAN AREA
COLORADO DESERT AREA
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
SACRAMENTO
SAN FRANCISCO
LOS ANGELES
SAN DIEGO
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
VALLEY FILL AREAS
1953
SCALE OF MILES
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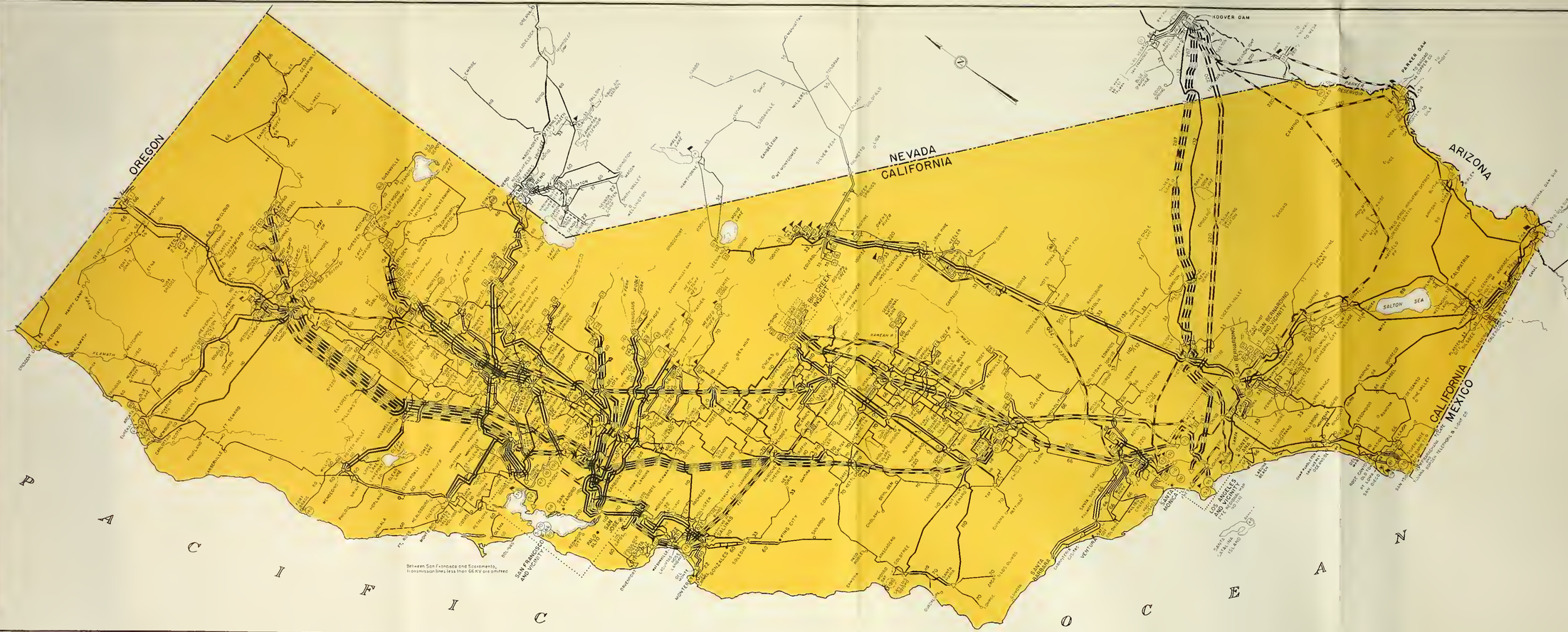

LEGEND

GENERATING STATIONS

	HYDRO	FUEL
		(1) UNDER CONSTRUCTION
		(2) EXISTING
	(1)	(1) PUBLICLY OWNED (NON FEDERAL)
	(2)	(2) PUBLICLY OWNED (FEDERAL)
	(3)	(3) PRIVATELY OWNED
CAPACITY BASED ON NAME PLATE RATING	(1)	(1) 100,000 KILOWATTS AND OVER
	(2)	(2) 50,000 TO 100,000 KILOWATTS
	(3)	(3) 15,000 TO 50,000 KILOWATTS
	(4)	(4) 1,000 TO 15,000 KILOWATTS

TRANSMISSION SUBSTATIONS

△ TRANSMISSION SUBSTATION WHERE CHANGES OF VOLTAGE ARE SHOWN NOTE- STEP UP SUBSTATIONS AT GENERATING PLANTS NOT INDICATED BY SEPERATE SYMBOL

△ DISTRIBUTION SUBSTATION- OMITTED WHEN IT COINCIDES WITH A COMMUNITY

TRANSMISSION LINES

WHERE TWO NUMBERS OCCUR (viz 44/110) THE FIRST NUMBER INDICATES OPERATING VOLTAGE AND THE SECOND NUMBER INDICATES INSULATED OR DESIGN VOLTAGE.

LINES LESS THAN 22 KV INDICATED IN SPECIAL CASES ONLY NOMINAL OPERATING VOLTAGES INDICATED IN THOUSANDS OF VOLTS

- 22 EXISTING — 22 — UNDER CONSTRUCTION — 11 — UNDERGROUND
- 189,000 VOLT CIRCUIT AND OVER
- 100,000 TO 154,000 VOLT CIRCUIT
- 55,000 TO 88,000 VOLT CIRCUIT
- 22,000 TO 50,000 VOLT CIRCUIT
- 33C CIRCUITS OTHER THAN 60 CYCLE FREQUENCY INDICATED
- INTERCONNECTION BETWEEN AFFILIATED COMPANIES
- INTERCONNECTION BETWEEN NON-AFFILIATED COMPANIES
- TRANSMISSION LINE OF ONE COMPANY CROSSING STATE BOUNDARY (SEPARATE OWNERSHIP NUMBERS REFER TO EACH STATE)

COMMUNITIES

(-·-) OR ★ 25,000 POPULATION AND OVER
● 10,000 TO 25,000 POPULATION
○ LESS THAN 10,000 POPULATION

Reprinted with minor deletions from Regional Transmission Map No.11, 1954, of the Federal Power Commission.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

ELECTRIC POWER DEVELOPMENT
1954

SCALE OF MILES

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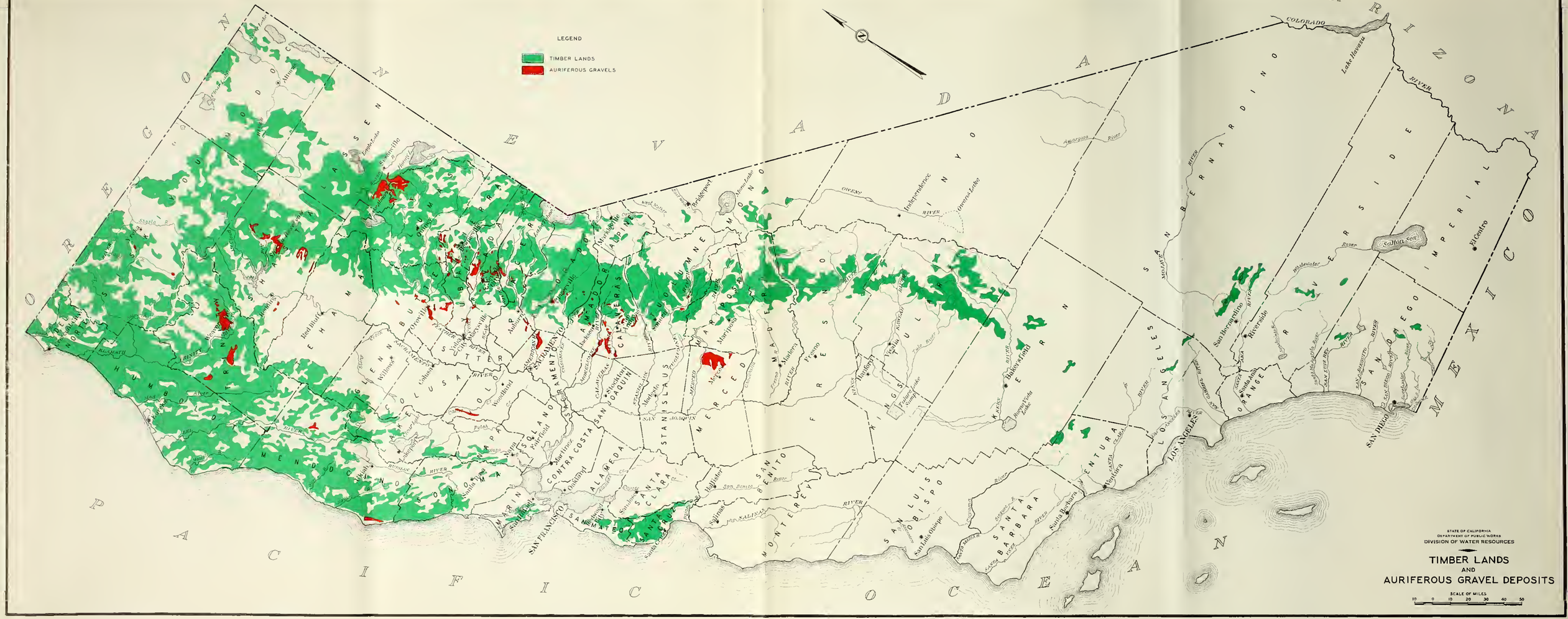

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

TIMBER LANDS AND AURIFEROUS GRAVEL DEPOSITS

SCALE OF MILES
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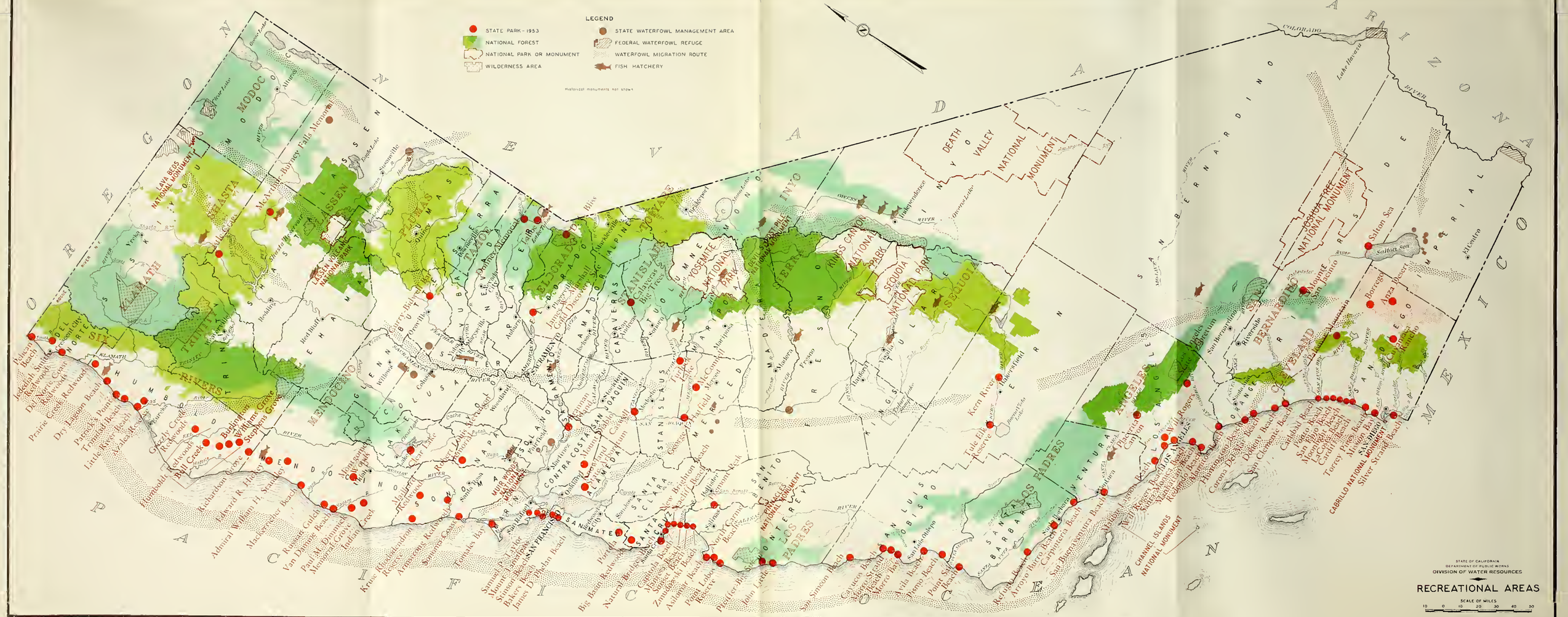

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

RECREATIONAL AREAS

SCALE OF MILES
10 0 10 20 30 40 50


LEGEND
1 NORTH COASTAL AREA
2 SAN FRANCISCO BAY AREA
3 CENTRAL COASTAL AREA
4 SOUTH COASTAL AREA
5 CENTRAL VALLEY AREA
A SACRAMENTO RIVER BASIN
B SAN JOAQUIN RIVER BASIN
C TULARE LAKE BASIN
6 LAHONTAN AREA
7 COLORADO DESERT AREA
DRAINAGE AREA BOUNDARY
HYDROGRAPHIC UNIT AND NUMBER
O R E G O N
N E V A D A
A R I Z O N A
M E X I C O
P A C I F I C O C E A N
SAN FRANCISCO
LOS ANGELES
SAN DIEGO
SACRAMENTO
Stockton
Fresno
Bakersfield
Salton Sea
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
MAJOR HYDROGRAPHIC AREAS
AND
HYDROGRAPHIC UNITS
1953
SCALE OF MILE
10 0 10 20 30 40

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

CLASSIFICATION OF LANDS FOR WATER SERVICE FROM THE CALIFORNIA WATER PLAN

INDEX TO SHEETS

SCALE OF MILES
20 0 20 40 60

CLASSIFICATION OF LANDS FOR WATER SERVICE

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DIVISION OF WATER RESOURCES

SHEET 2

SHEET 3

SCALE OF MILES

4 0 4 8 12

N

O R E G O N

SHEET 1

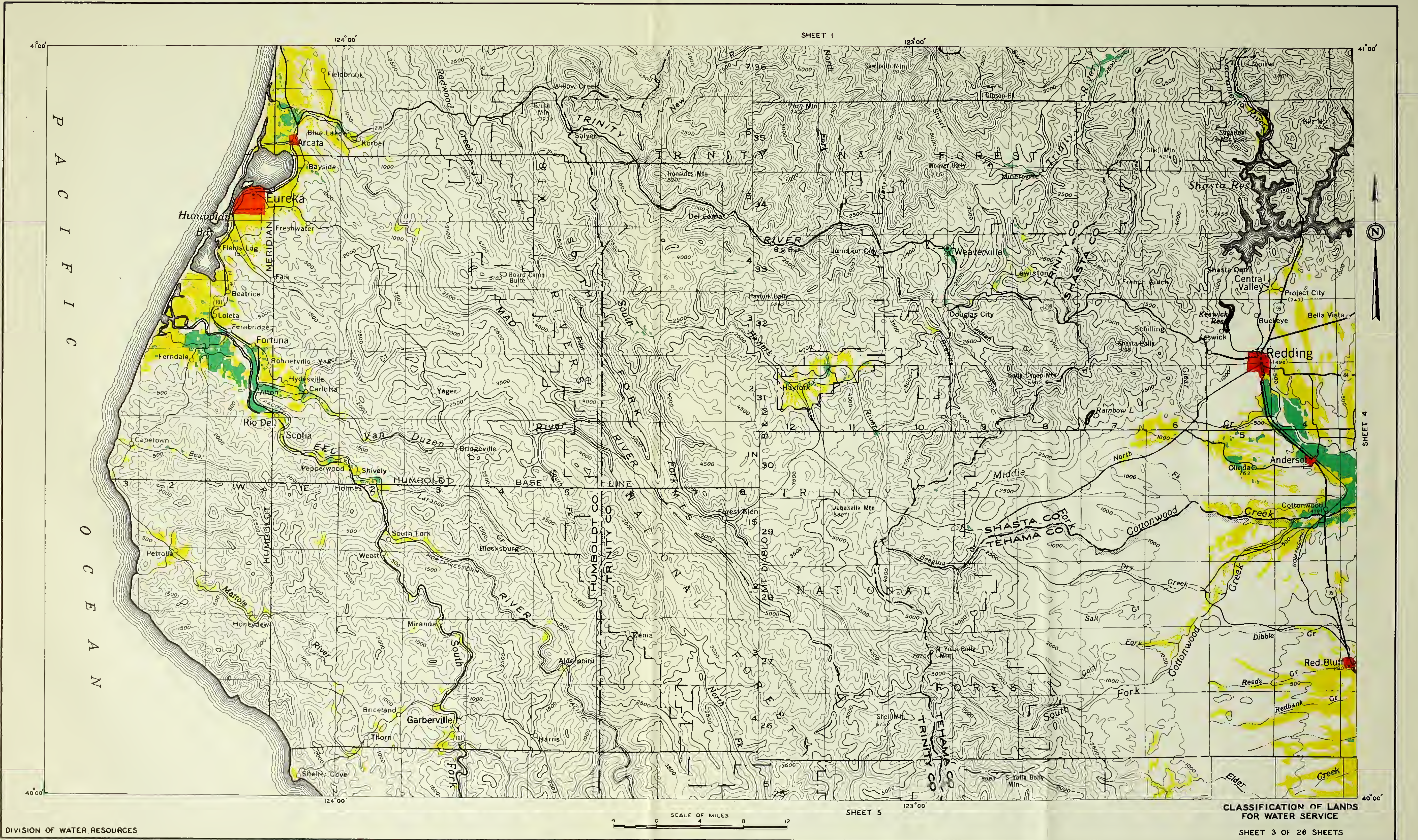
SHEET 4

SHEET 2 OF 26 SHEETS

CLASSIFICATION OF LANDS FOR WATER SERVICE

DIVISION OF WATER RESOURCES

SCALE OF MILES 4 0 4 8 12



CLASSIFICATION OF LANDS FOR WATER SERVICE

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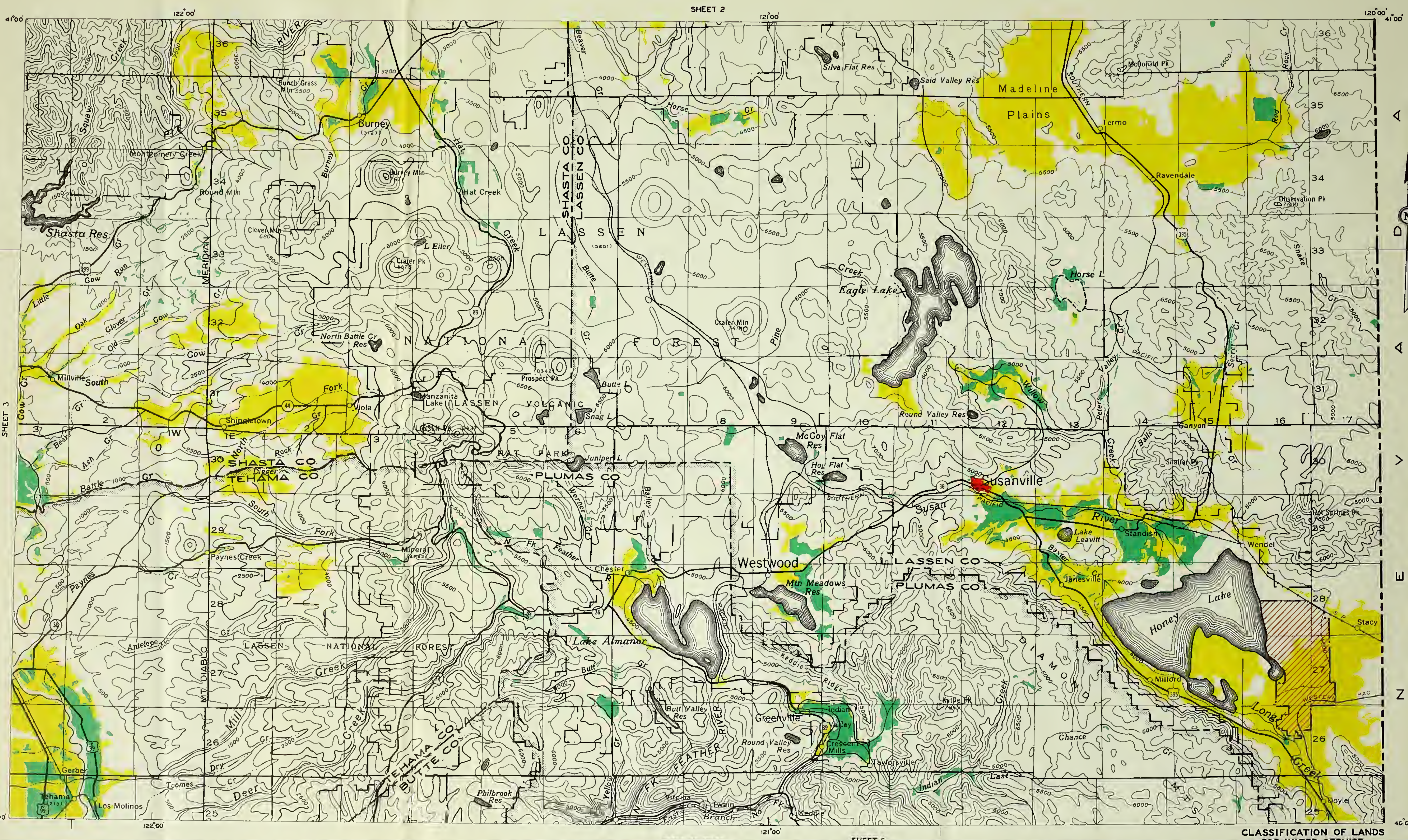

DIVISION OF WATER RESOURCES

CLASSIFICATION OF LANDS FOR WATER SERVICE

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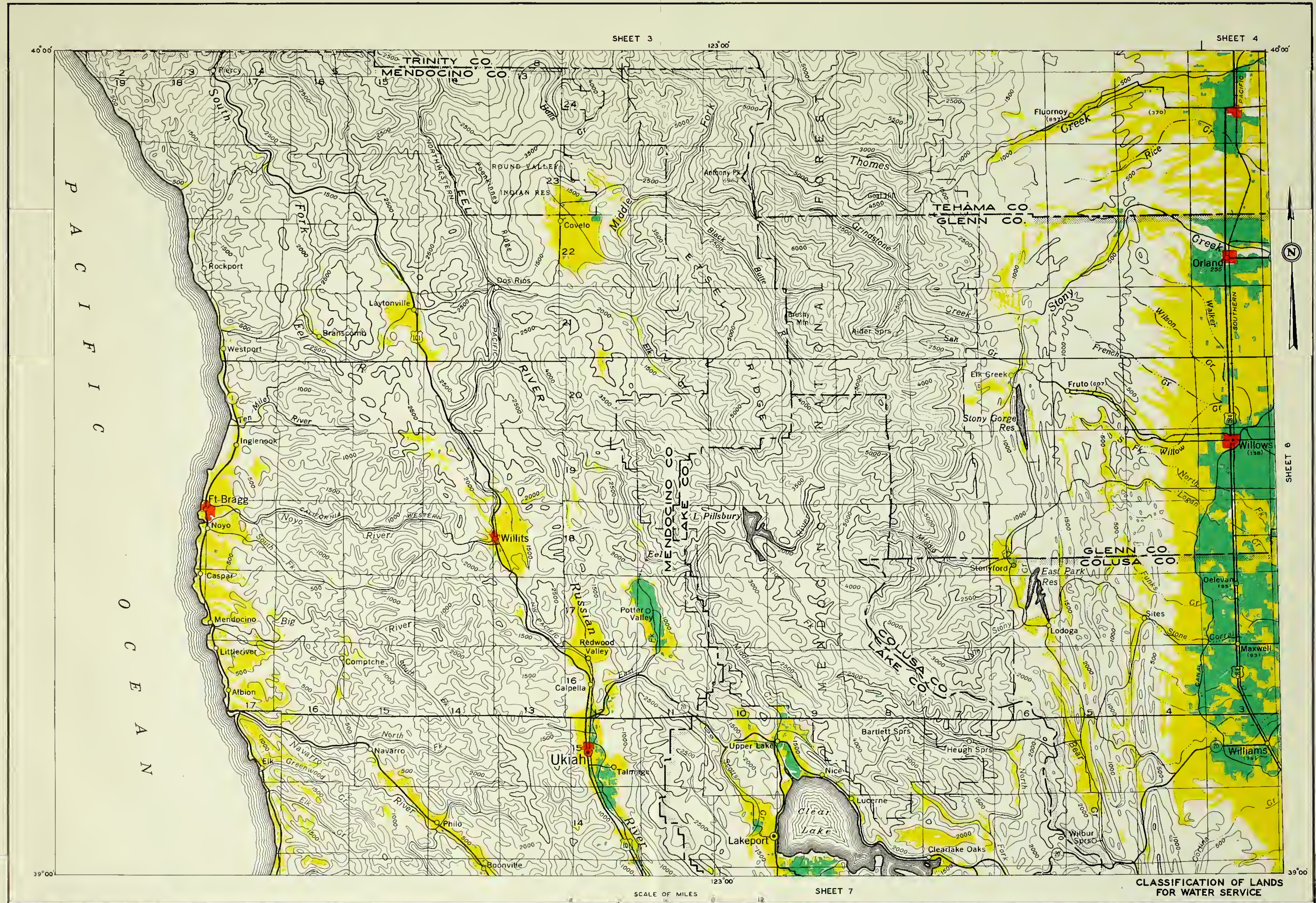

CLASSIFICATION OF LANDS FOR WATER SERVICE

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DIVISION OF WATER RESOURCES

SHEET 4

SHEET 5

SHEET 8 | SH. 9

CLASSIFICATION OF LANDS FOR WATER SERVICE

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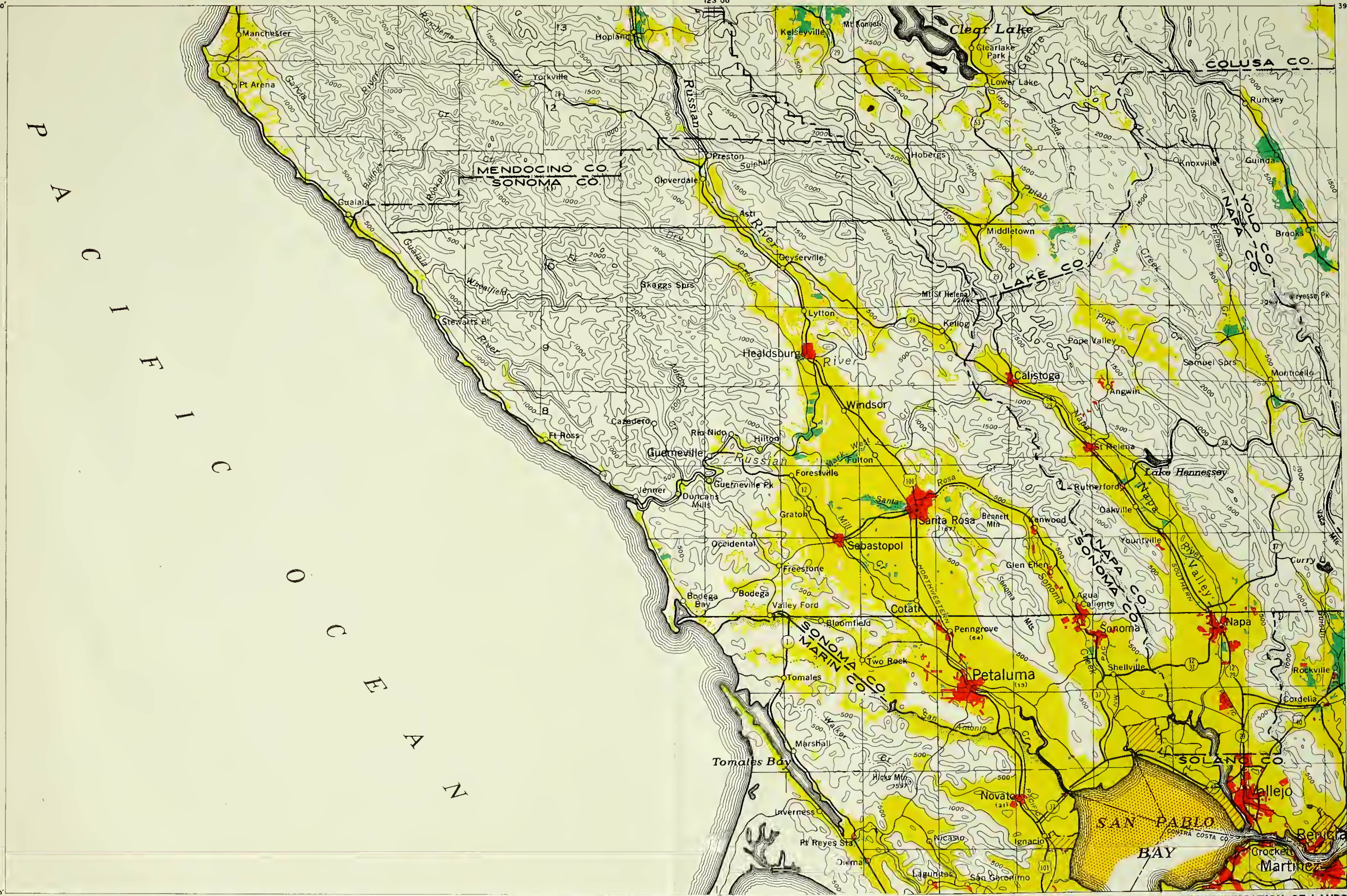
DIVISION OF WATER RESOURCES

SCALE OF MILES 4 0 4 8 12

SHEET 5



SCALE OF MILES
4 0 4 8 12

DIVISION OF WATER RESOURCES

CLASSIFICATION OF LANDS FOR WATER SERVICE

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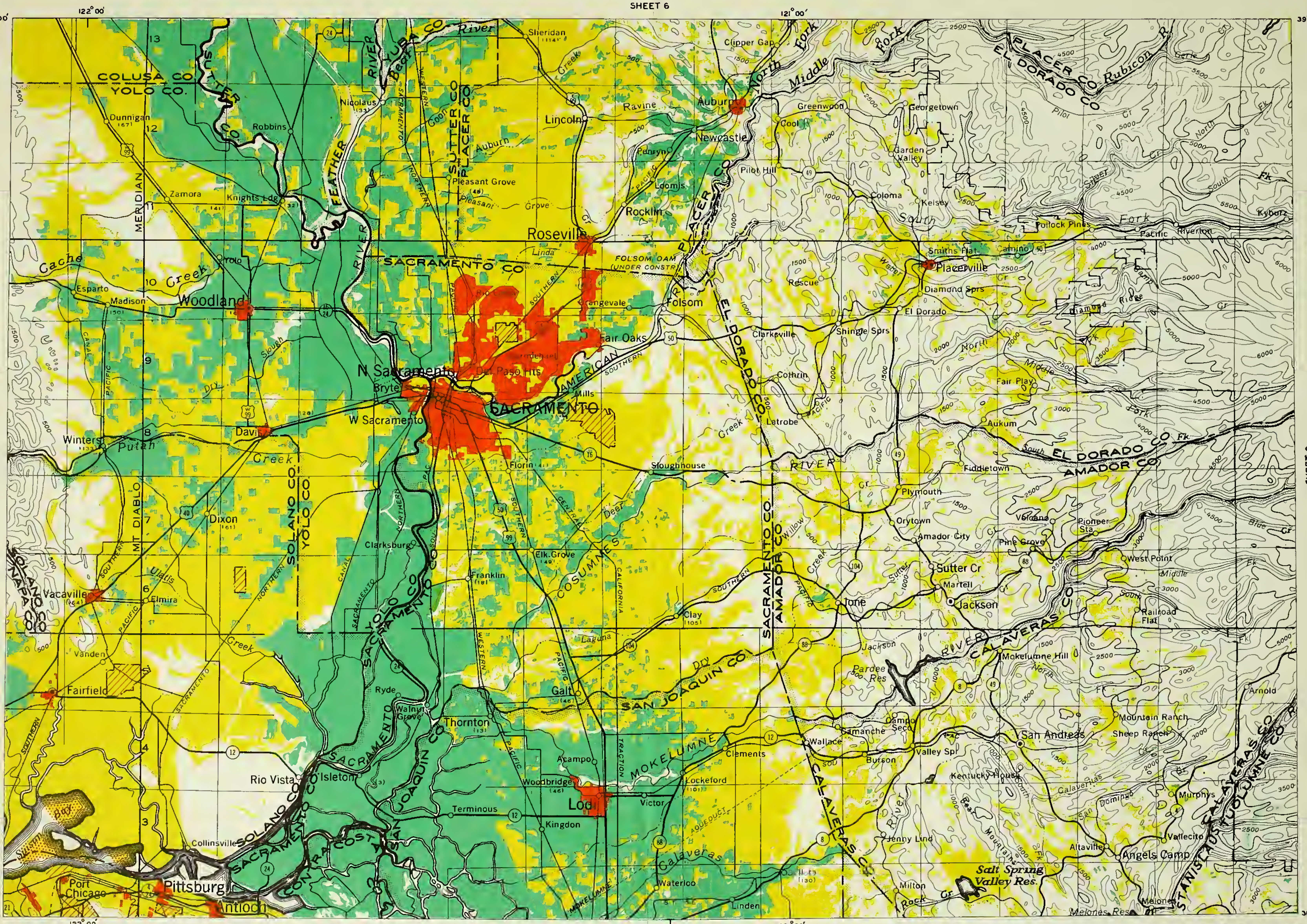
SHEET 6



SHEET 7 SHEET 9

SHEET 10 SHEET 11

SCALE OF MILES

4 0 4 8 12

DIVISION OF WATER RESOURCES

CLASSIFICATION OF LANDS FOR WATER SERVICE

SHEET 8 OF 26 SHEETS

SHEET 6

SHEET 8

SHEET 11

SHEET 12

39°00'

120°00'

119°00'

38°00'

Lake Tahoe

Tahoe

Fallen Leaf L

Desolation Valley

Meyers

Fredricksburg

Hawkins Pk 10000

Markleeville

Twin L

Silver Lake

Blue Lake

Mokelumne

Highland Pk 10955

Topaz Lake

Topaz

Coleville

Walker River

North Salt Sprs Res

Bull Run Pk 9480

Big Meadows

Spicer Meadows Res

Dardanelle

Douglas Flat

Sweetwater Mts

Wheeler Pk 11045

Bridgeport Reservoir

Bridgeport

Bodie

Tuolumne Pinecrest

Long Barn

Robinson

Twin Lakes

Mono Valley

Mono Lake

Mono Lake

EL DORADO CO

AMADOR CO

ALPINE CO

CALAVERAS CO

TUOLUMNE CO

MONO CO

NEVADA

STANISLAUS NATIONAL FOREST

SCALE OF MILES

4 0 4 8 12

DIVISION OF WATER RESOURCES

CLASSIFICATION OF LANDS FOR WATER SERVICE

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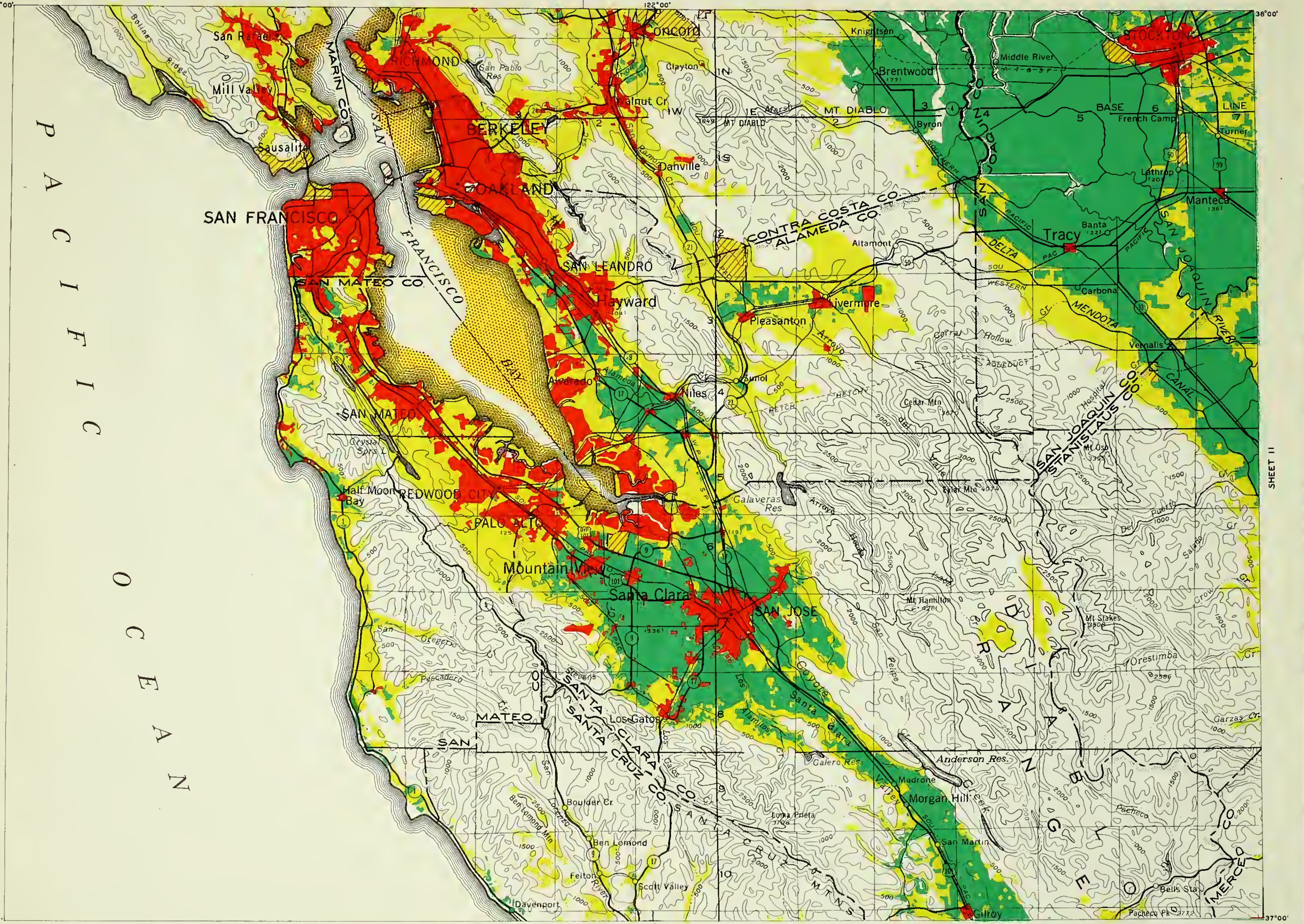

CLASSIFICATION OF LANDS FOR WATER SERVICE

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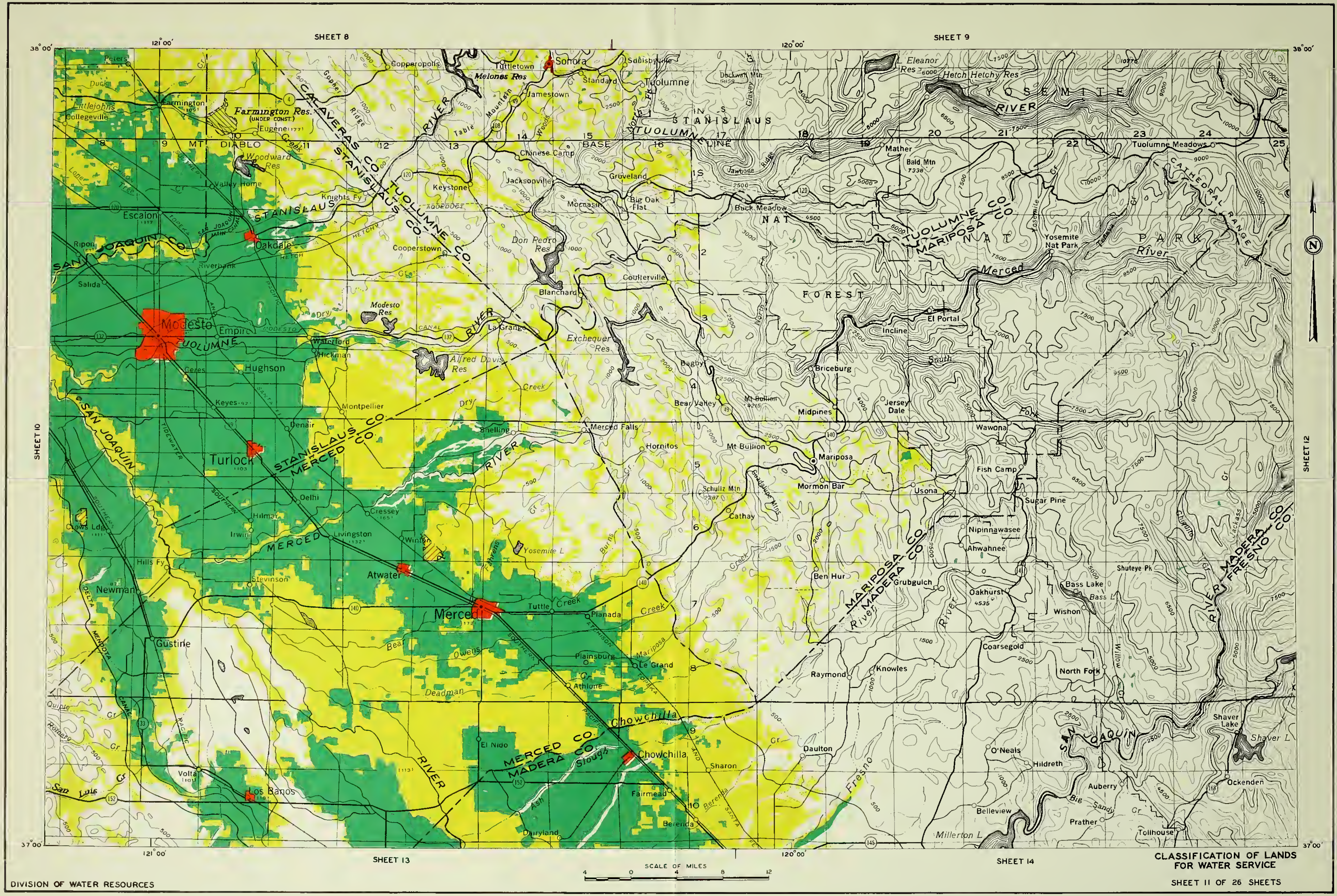
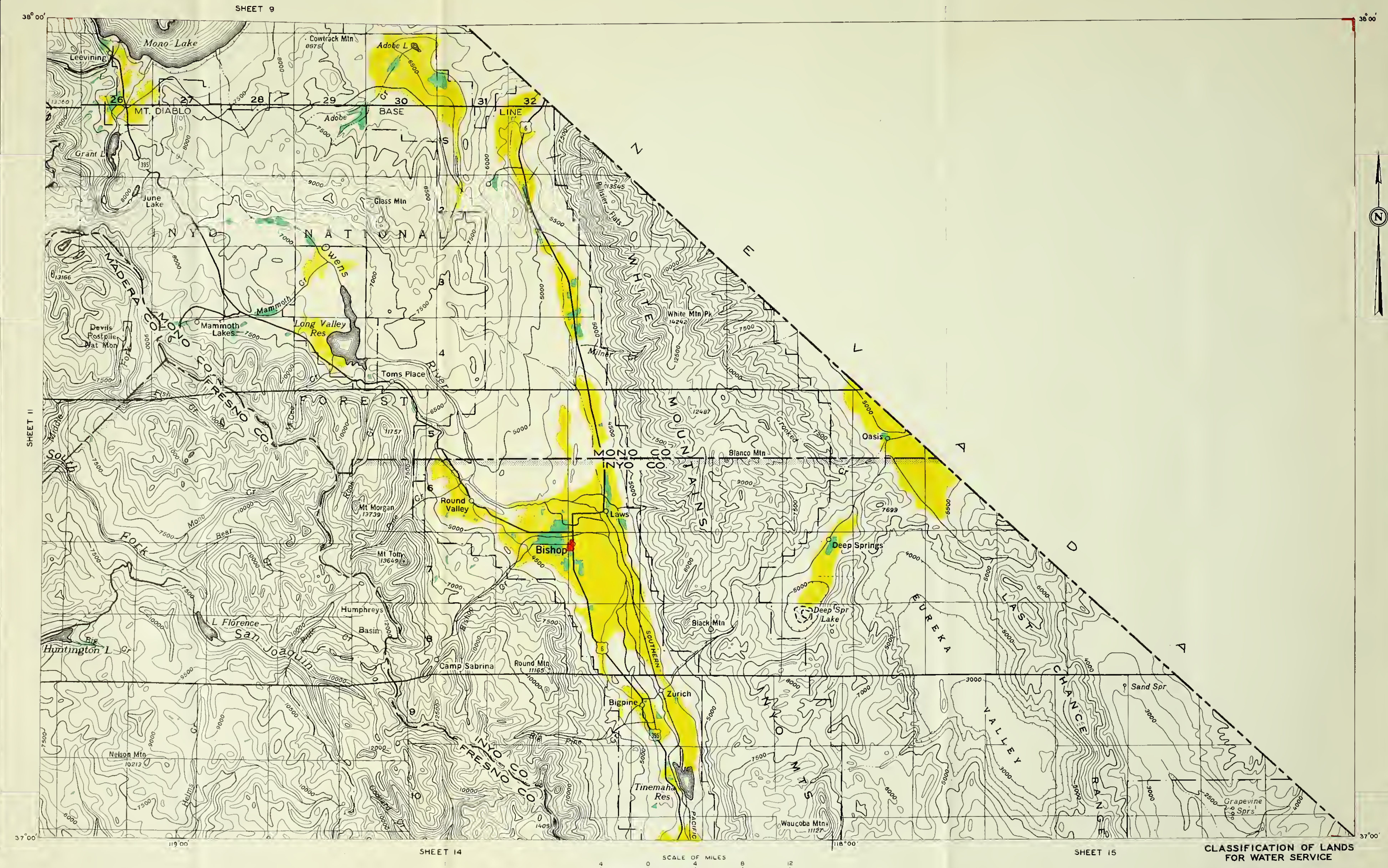
SCALE OF MILES

4 0 4 8 12


SHEET 8
SHEET 9
SHEET 10
SHEET 12
SHEET 13
SHEET 14
38°00'
37°00'
121°00'
120°00'
Farmington Res.
(UNDER CONST.)
MT DIABLO BASE LINE
CALAVERAS CO.
STANISLAUS CO.
TUOLUMNE CO.
MARIPOSA CO.
MERCED CO.
MADERA CO.
FRESNO CO.
SAN JOAQUIN CO.
STANISLAUS
TUOLUMNE
MERCED
RIVER
SAN JOAQUIN
YOSEMITE
NAT PARK
STANISLAUS NAT FOREST
CATHEDRAL RANGE
Modesto
Turlock
Merced
Oakdale
Atwater
Chowchilla
Los Banos
Sonora
Escalon
Ripon
Salida
Riverbank
Empire
Waterford
Hickman
Hughson
Ceres
Keyes
Denair
Delhi
Hilmar
Irwin
Livingston
Cressey
Winton
Stevinson
Newman
Gustine
Volta
Hills Fy
Crows Ldg
El Nido
Planada
Le Grand
Plainsburg
Athlone
Fairmead
Berenda
Dairyland
Sharon
Daulton
Raymond
Knowles
Coarsegold
Oakhurst
Wishon
North Fork
Bass Lake
O'Neals
Hildreth
Auberry
Prather
Tollhouse
Ockenden
Shaver Lake
Belleview
Millerton L
Mariposa
Mormon Bar
Usona
Ben Hur
Cathay
Hornitos
Merced Falls
Snelling
Montpellier
La Grange
Coulterville
Bagby
Briceburg
Midpines
Jersey Dale
Bear Valley
Mt Bullion
Wawona
Fish Camp
Sugar Pine
Nipinnawasee
Ahwahnee
Grubgulch
El Portal
Incline
Yosemite Nat Park
Tuolumne Meadows
Mather
Bald Mtn
Buck Meadow
Groveland
Big Oak Flat
Moccasin
Chinese Camp
Jacksonville
Keystone
Knights Fy
Cooperstown
Blanchard
Don Pedro Res
Exchequer Res.
Modesto Res
Alfred Davis Res
Yosemite L
Jamestown
Tuttletown
Melones Res
Standard
Soulsbyville
Tuolumne
Copperopolis
Farmington
Collegeville
Eugene
Valley Home
Woodward Res
Peters
Dardanelle
Eleanor Res
Hetch Hetchy Res
Tuttle
Chowchilla
Ash Slough
Berenda
Fresno
Deadman
Bear
Owens
Mariposa
San Luis Cr
Quinto
Romero
Shaver L
Big Sandy Cr
Shuteye Pk
SCALE OF MILES
4 0 4 8 12
CLASSIFICATION OF LANDS FOR WATER SERVICE
SHEET 11 OF 26 SHEETS
DIVISION OF WATER RESOURCES



CLASSIFICATION OF LANDS FOR WATER SERVICE

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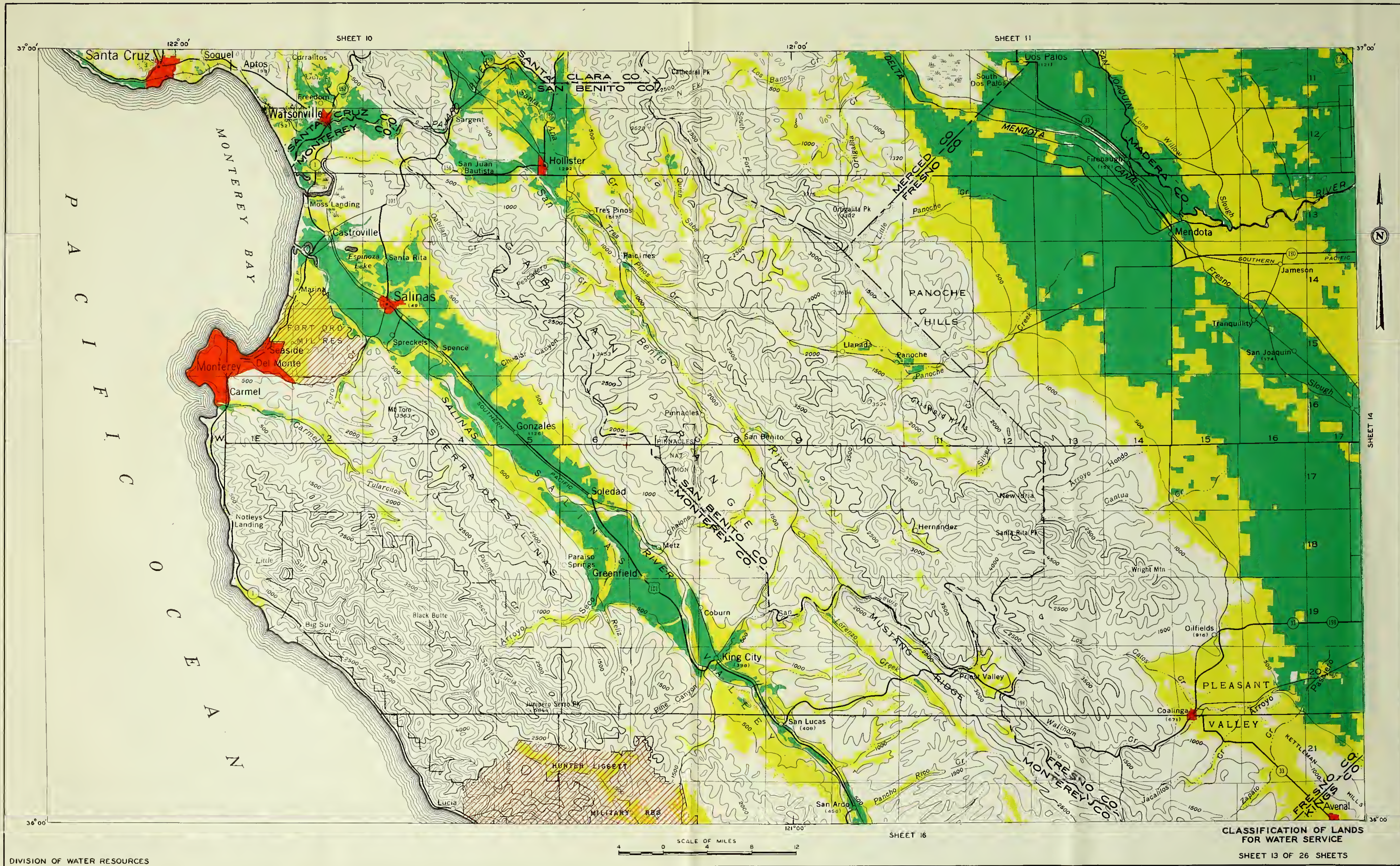
DIVISION OF WATER RESOURCES



CLASSIFICATION OF LANDS FOR WATER SERVICE

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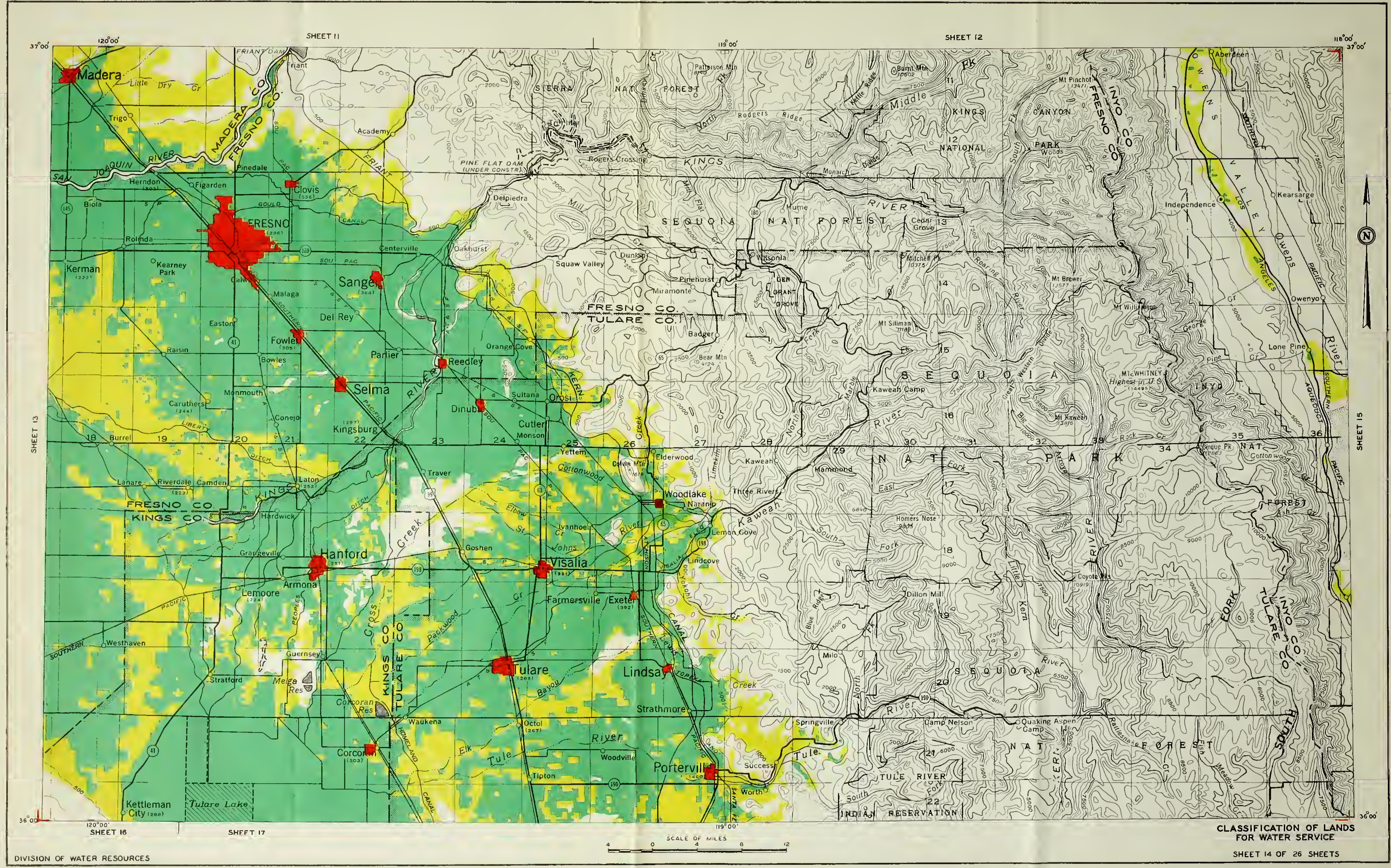
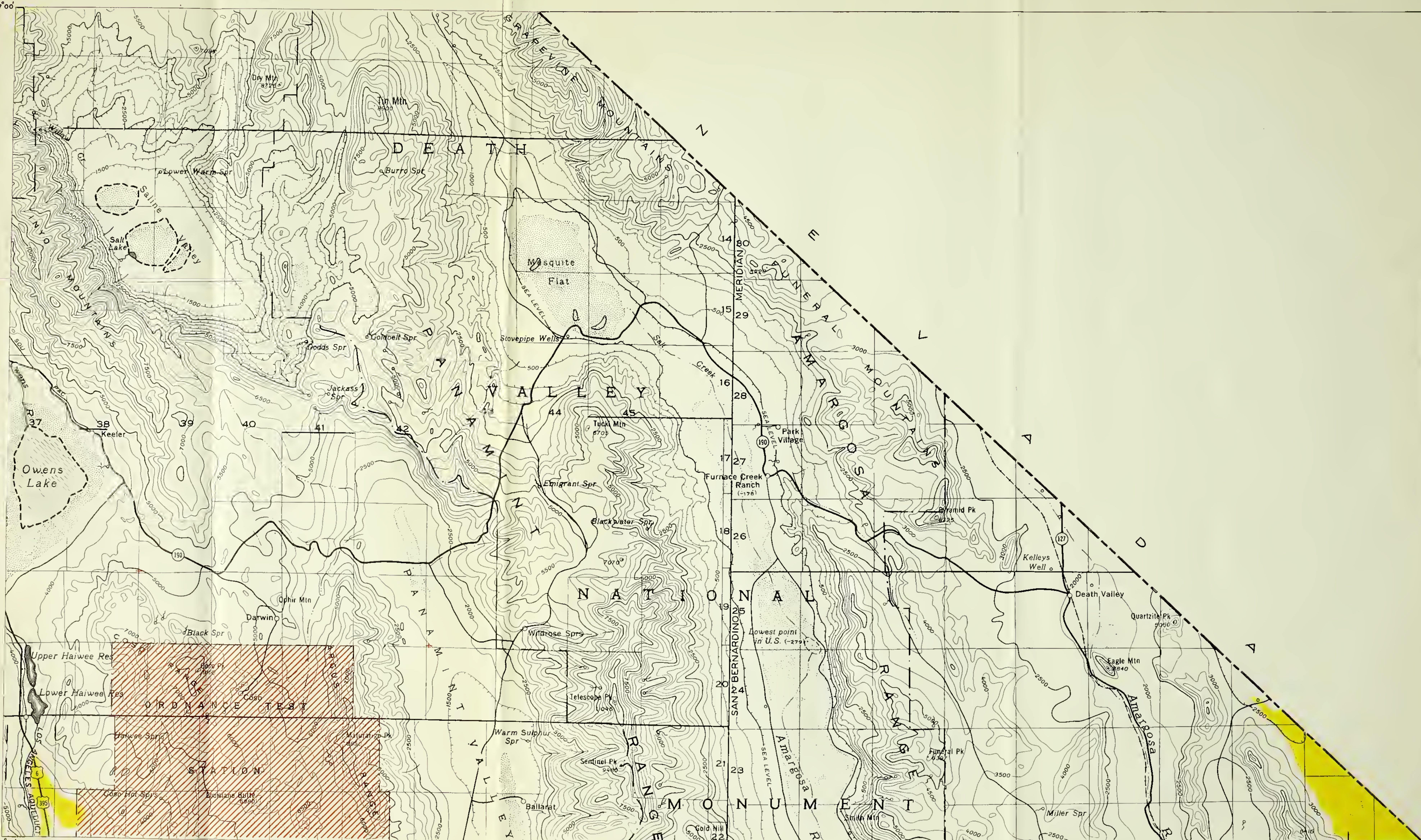

SHEET 11
SHEET 12
SHEET 13
SHEET 15
SHEET 16
SHEET 17
37°00'
36°00'
120°00'
119°00'
118°00'
Madera
Fresno
Clovis
Sanger
Fowler
Selma
Reedley
Dinuba
Kingsburg
Hanford
Visalia
Tulare
Lindsay
Exeter
Woodlake
Corcoran
Porterville
Lemoore
Kerman
Independence
Lone Pine
MADERA CO.
FRESNO CO.
KINGS CO.
TULARE CO.
INYO CO.
SIERRA NAT FOREST
SEQUOIA NAT FOREST
SEQUOIA NAT PARK
KINGS CANYON NATIONAL PARK
TULE RIVER INDIAN RESERVATION
Tulare Lake
PINE FLAT DAM (UNDER CONSTR.)
SAN JOAQUIN RIVER
KINGS RIVER
Kaweah
Tule River
OWENS VALLEY
Mt WHITNEY Highest in U.S.
SCALE OF MILES
4 0 4 8 12
DIVISION OF WATER RESOURCES
CLASSIFICATION OF LANDS FOR WATER SERVICE
SHEET 14 OF 26 SHEETS

SHEET 12



SHEET 14

SHEET 18

SCALE OF MILES

4 0 4 8 12

SHEET 19

CLASSIFICATION OF LANDS FOR WATER SERVICE

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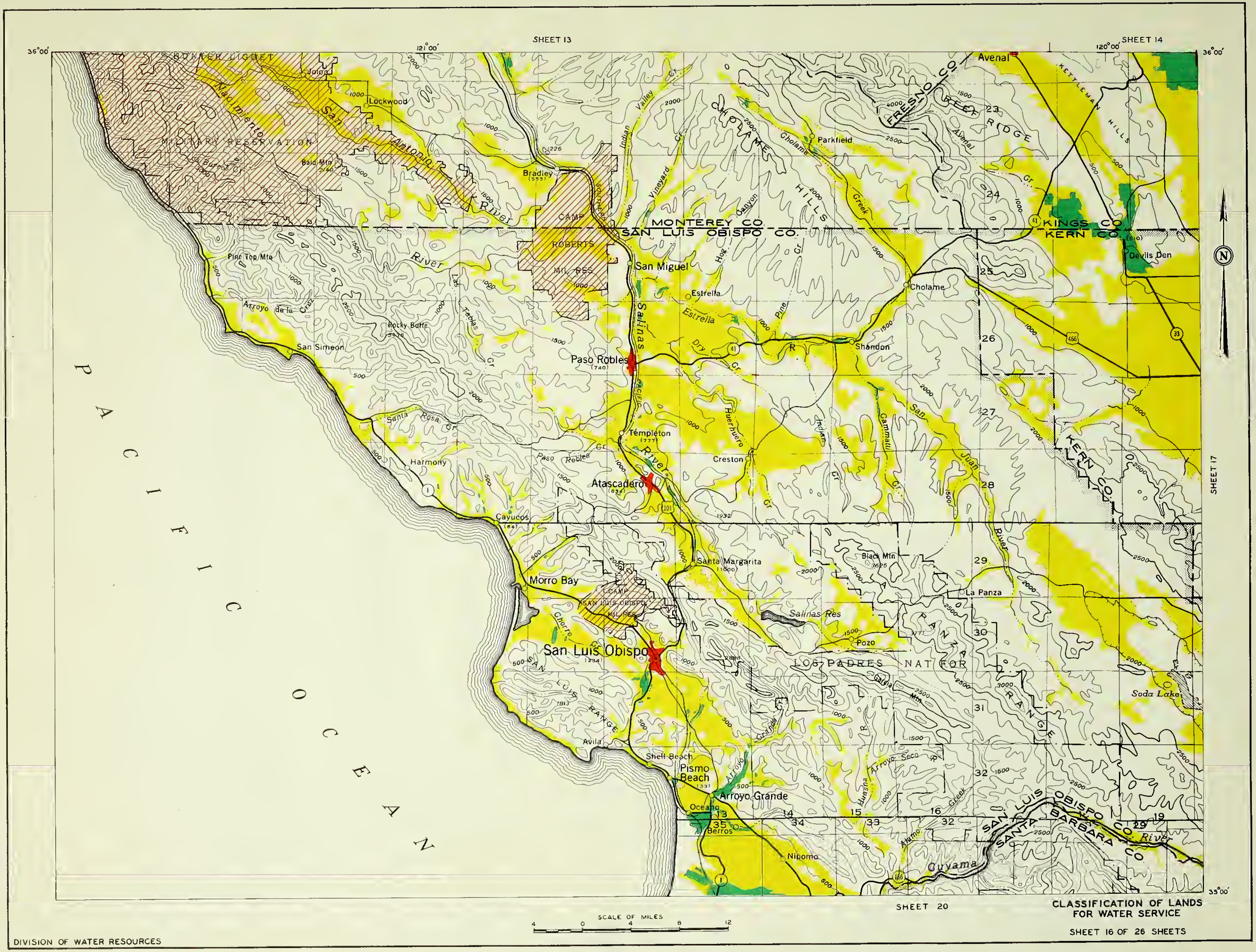
DIVISION OF WATER RESOURCES



CLASSIFICATION OF LANDS FOR WATER SERVICE

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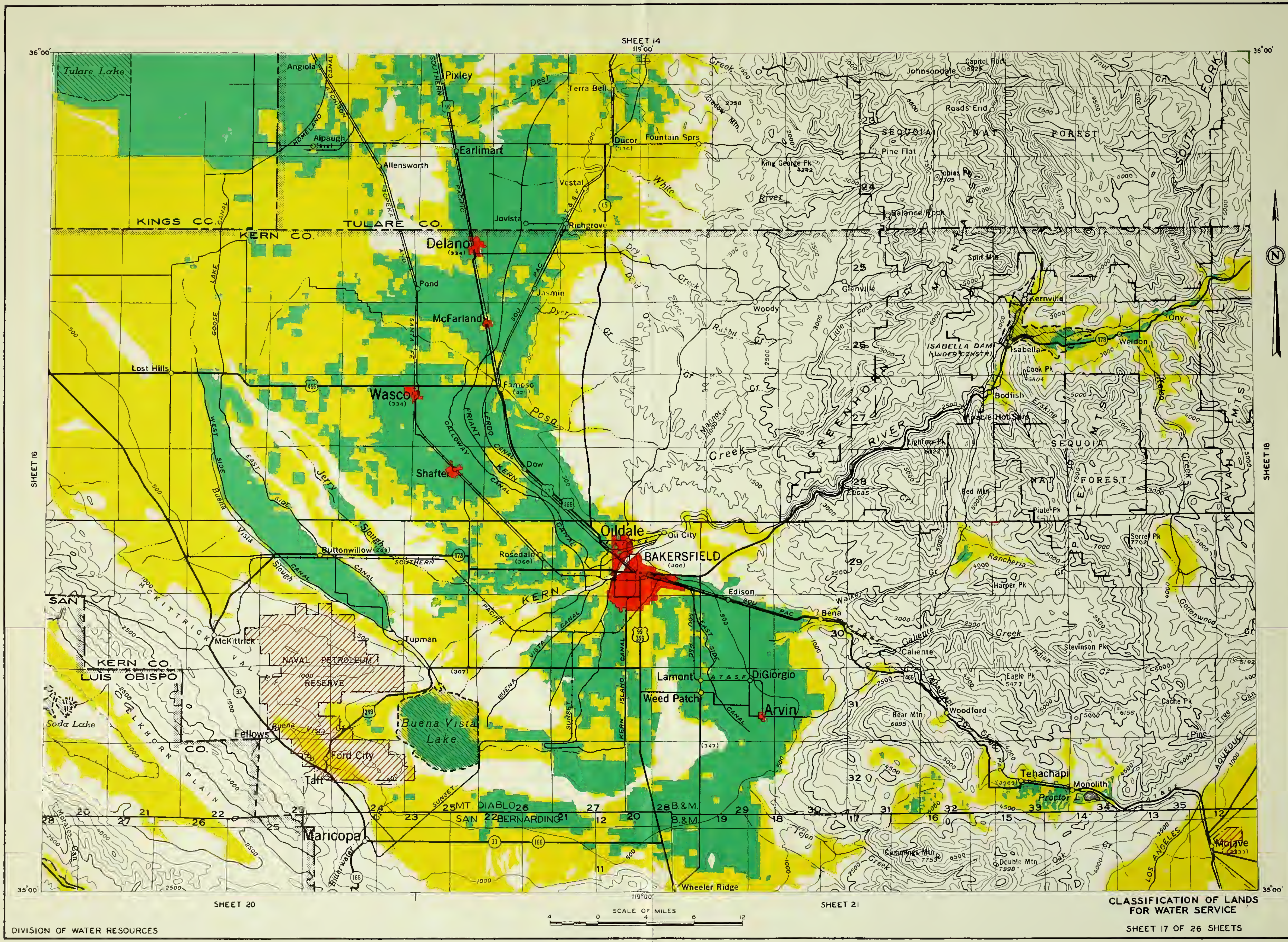
SCALE OF MILES

DIVISION OF WATER RESOURCES



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SHEET 17 | SHEET 19

SHEET 21 | SHEET 22

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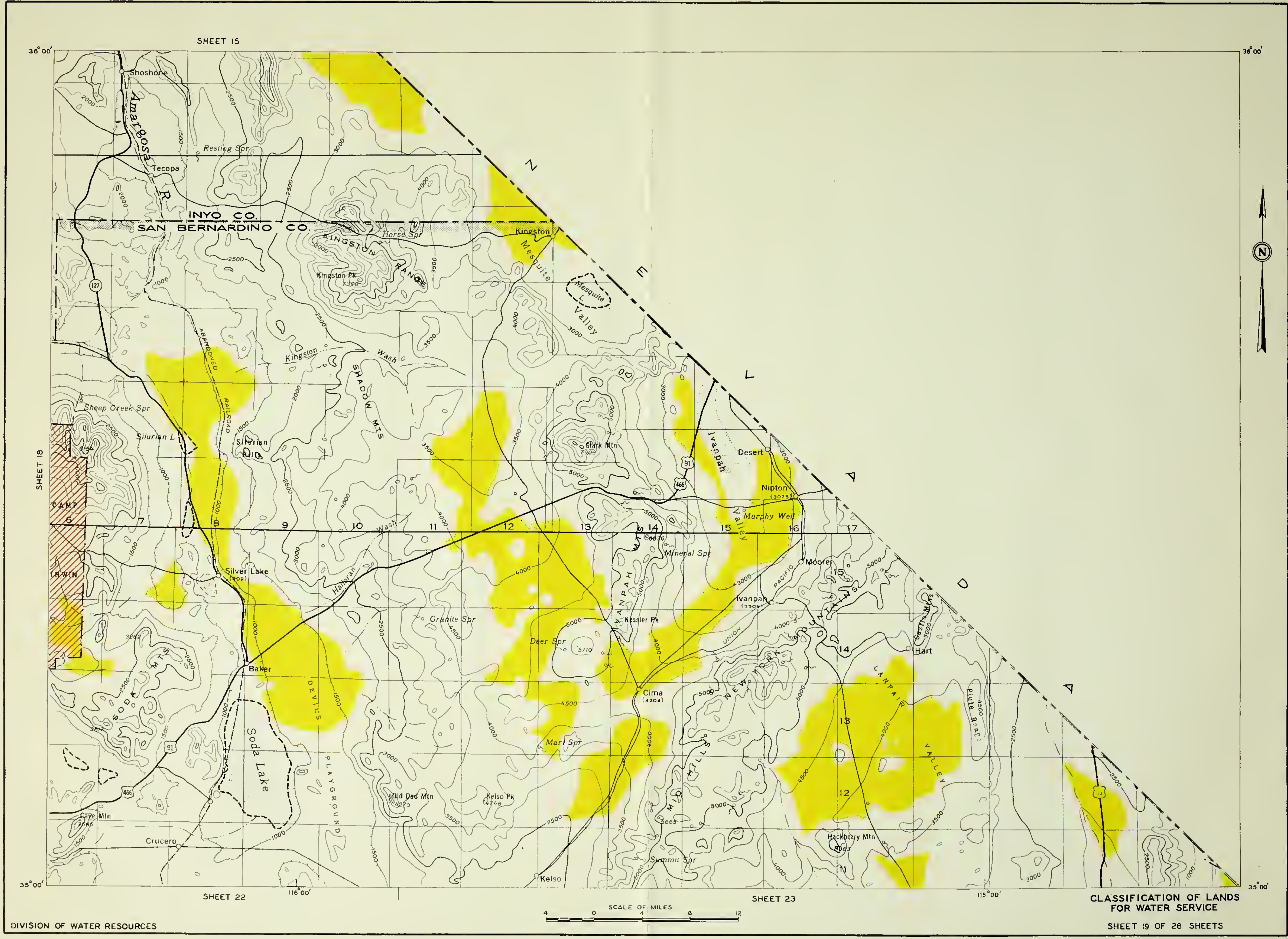
DIVISION OF WATER RESOURCES

SCALE OF MILES



CLASSIFICATION OF LANDS FOR WATER SERVICE

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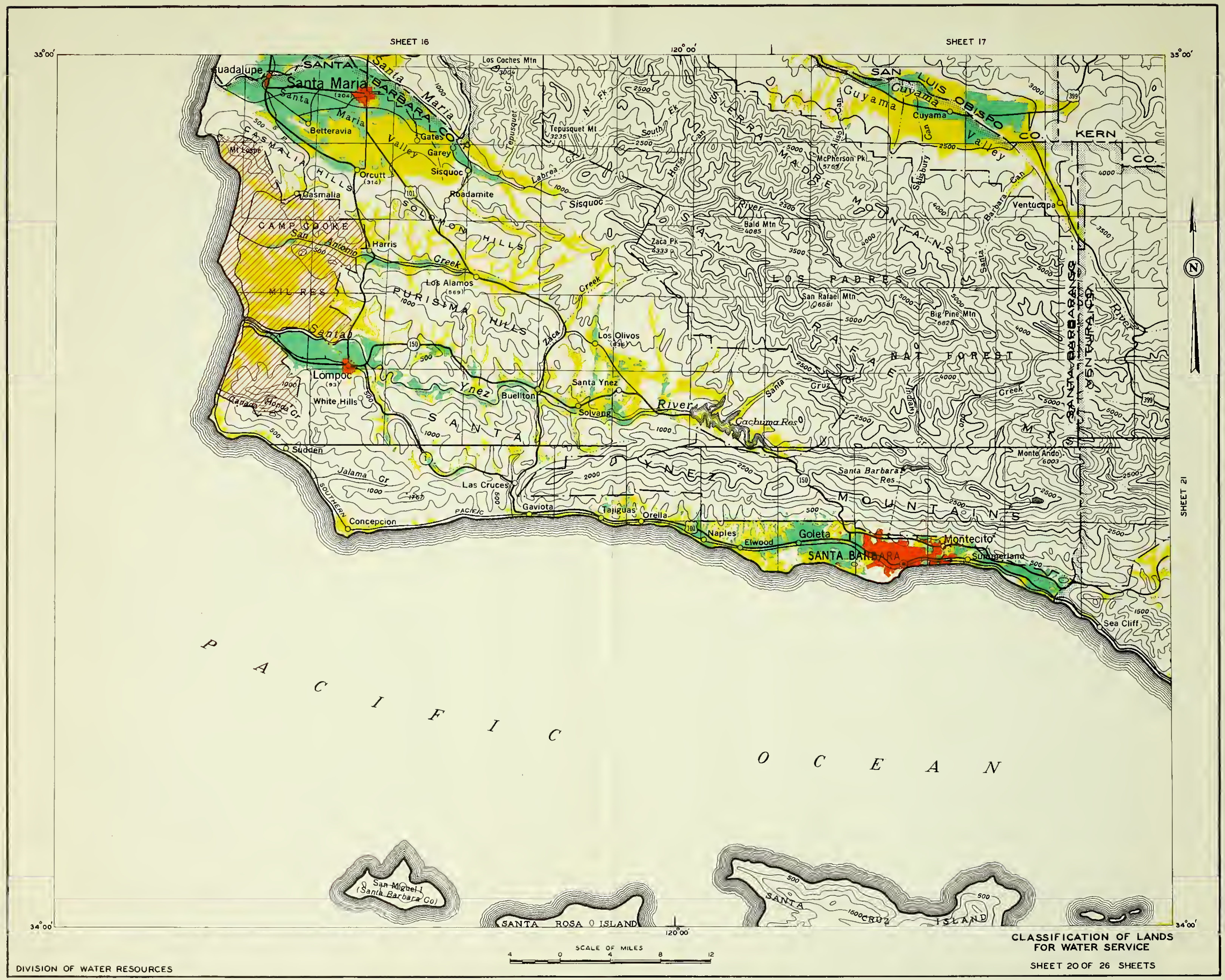
SHEET 16
SHEET 17
SHEET 21
Santa Maria
Guadalupe
Betteravia
Orcutt
Garey
Sisquoc
Casmalia
CAMP COOKE
MIL RES
Harris
Los Alamos
Lompoc
White Hills
Buellton
Solvang
Santa Ynez
Los Olivos
Cachuma Res
Gaviota
Las Cruces
Concepcion
Sudden
Tajiguas
Orella
Naples
Elwood
Goleta
SANTA BARBARA
Montecito
Summerland
Sea Cliff
Cuyama
Ventucopa
SAN LUIS OBISPO CO.
SANTA BARBARA CO.
KERN CO.
VENTURA CO.
SIERRA MADRE MOUNTAINS
SAN RAFAEL MTS
SANTA YNEZ MOUNTAINS
LOS PADRES NAT FOREST
SOLOMON HILLS
PURISIMA HILLS
CASMALIA HILLS
PACIFIC OCEAN
San Miguel I (Santa Barbara Co)
SANTA ROSA ISLAND
SANTA CRUZ ISLAND
SCALE OF MILES
4 0 4 8 12
CLASSIFICATION OF LANDS FOR WATER SERVICE
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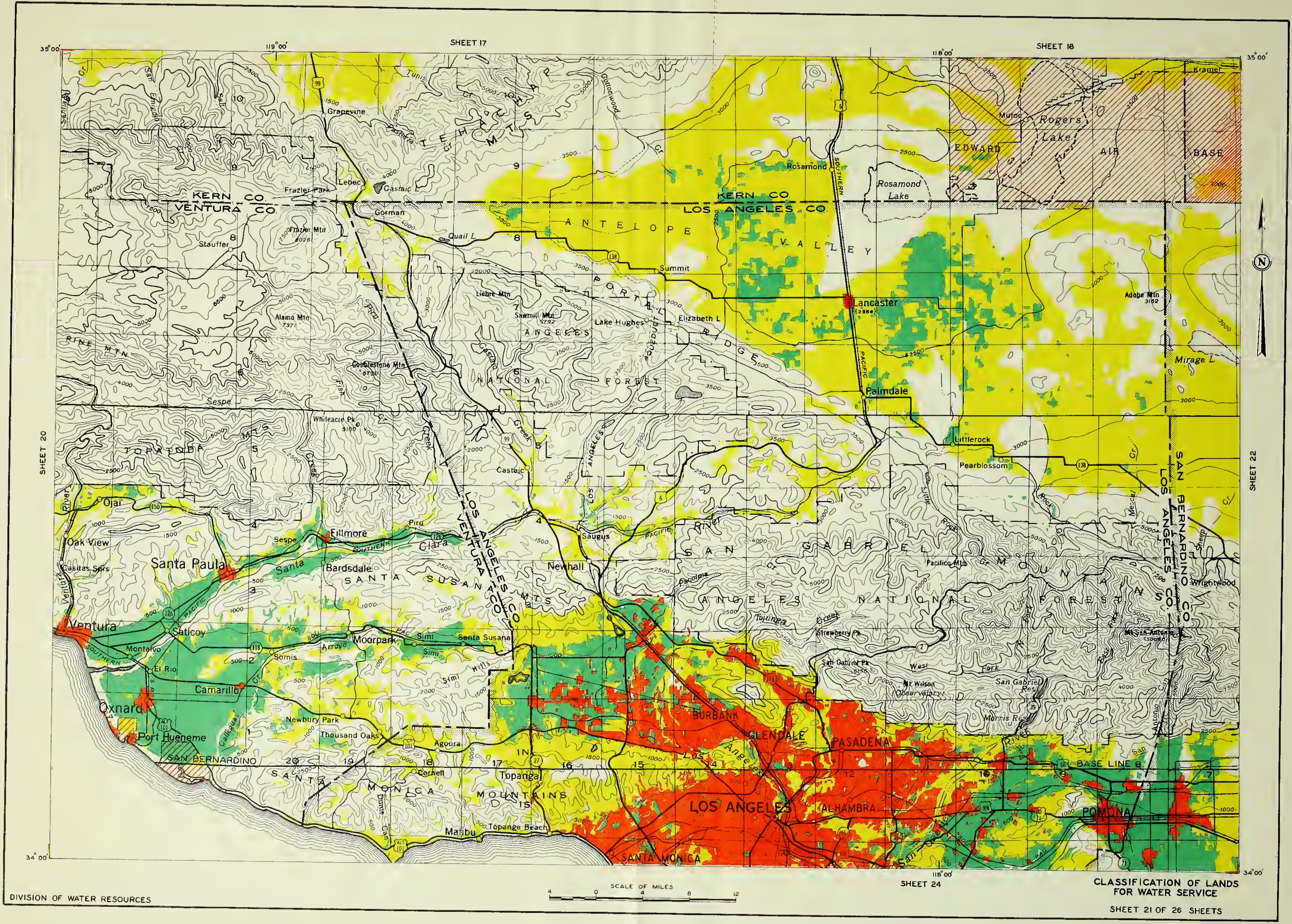
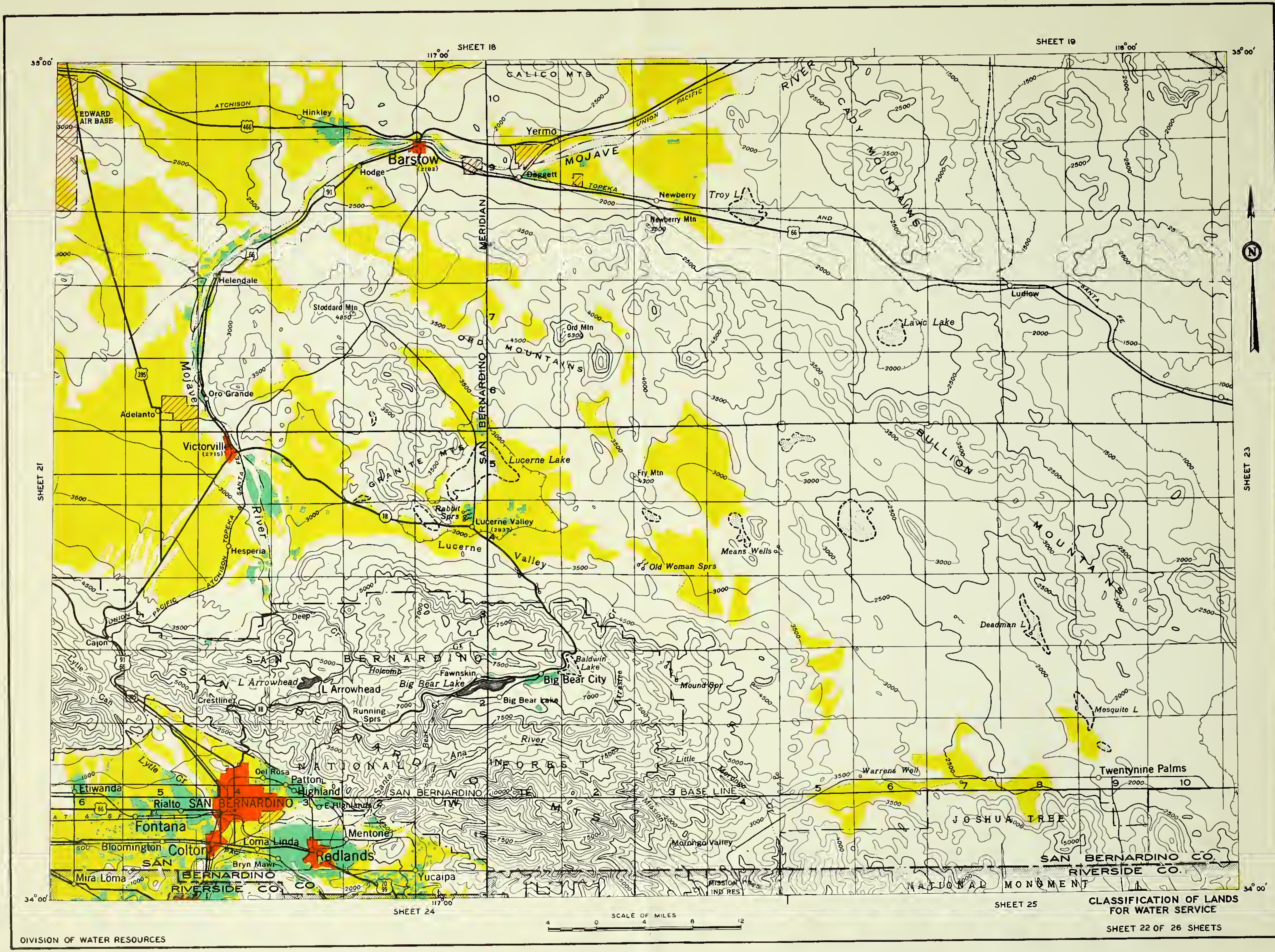
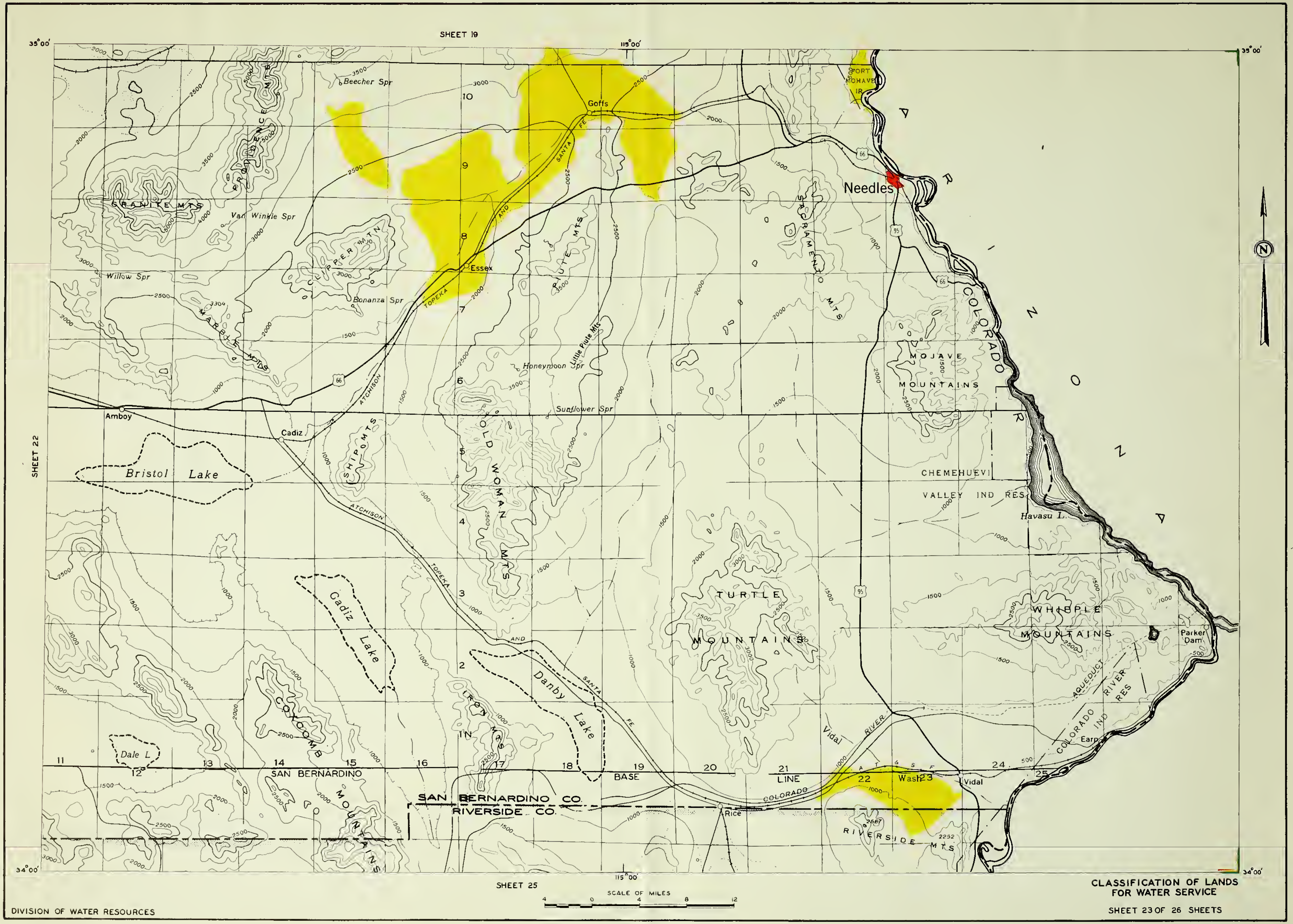
DIVISION OF WATER RESOURCES


SHEET 17
SHEET 18
SHEET 20
SHEET 22
SHEET 24
KERN CO.
VENTURA CO.
LOS ANGELES CO.
SAN BERNARDINO CO.
ANTELOPE VALLEY
EDWARD AIR BASE
Rogers Lake
Rosamond Lake
Rosamond
Lancaster
Palmdale
Littlerock
Pearblossom
Mirage L.
Kramer
Muroc
Gorman
Lebec
Frazier Park
Grapevine
Castaic
Saugus
Newhall
Fillmore
Piru
Santa Paula
Ojai
Oak View
Ventura
Saticoy
Montalvo
El Rio
Oxnard
Port Hueneme
Camarillo
Moorpark
Somis
Simi
Santa Susana
Thousand Oaks
Newbury Park
Agoura
Topanga
Topanga Beach
Malibu
BURBANK
GLENDALE
PASADENA
LOS ANGELES
ALHAMBRA
SANTA MONICA
POMONA
BASE LINE
SAN GABRIEL MOUNTAINS
ANGELES NATIONAL FOREST
SANTA SUSANA MTS
SANTA MONICA MOUNTAINS
TOPATOPA MTS
PINE MTN
TEHACHAPI MTS
PORTAL RIDGE
Mt Wilson Observatory
Mt San Antonio
SAN BERNARDINO
SCALE OF MILES
4 0 4 8 12
DIVISION OF WATER RESOURCES
CLASSIFICATION OF LANDS FOR WATER SERVICE
SHEET 21 OF 26 SHEETS


SHEET 18
SHEET 19
SHEET 21
SHEET 23
SHEET 24
SHEET 25
35°00′
34°00′
117°00′
116°00′
EDWARD AIR BASE
ATCHISON
TOPEKA
SANTA FE
UNION PACIFIC
Hinkley
Barstow
(2182)
Hodge
Yermo
Daggett
MOJAVE
RIVER
Newberry
Troy L
Newberry Mtn
AND
CALICO MTS
CADY MOUNTAINS
Ludlow
Lavic Lake
Helendale
Stoddard Mtn
4850
Ord Mtn
5300
ORD MOUNTAINS
Oro Grande
Adelanto
Victorville
(2715)
Mojave
River
SAN BERNARDINO MERIDIAN
GRANITE MTS
Lucerne Lake
Rabbit Sprs
Lucerne Valley
(2937)
Lucerne Valley
Fry Mtn
4300
BULLION MOUNTAINS
Means Wells
Old Woman Sprs
Hesperia
Deadman L
Mesquite L
Deep Cr
Cajon
Lytle Cr
Cajon
SAN BERNARDINO MTS
Holcomb
Fawnskin
L Arrowhead
L Arrowhead
Big Bear Lake
Big Bear City
Baldwin Lake
Big Bear Lake
Crestline
Running Sprs
Mound Spr
Arrastre
Bear Cr
Santa Ana River
Little Morongo Cr
Mission Cr
NATIONAL FOREST
SAN BERNARDINO BASE LINE
Warrens Well
Twentynine Palms
JOSHUA TREE NATIONAL MONUMENT
Etiwanda
Rialto
SAN BERNARDINO
Del Rosa
Patton
Highland
E Highlands
Fontana
Bloomington
Colton
Loma Linda
Mentone
Redlands
Bryn Mawr
Yucaipa
Mira Loma
Morongo Valley
MISSION IND RES
SAN BERNARDINO CO.
RIVERSIDE CO.
SCALE OF MILES
4 0 4 8 12
N
CLASSIFICATION OF LANDS FOR WATER SERVICE
SHEET 22 OF 26 SHEETS
DIVISION OF WATER RESOURCES



CLASSIFICATION OF LANDS FOR WATER SERVICE

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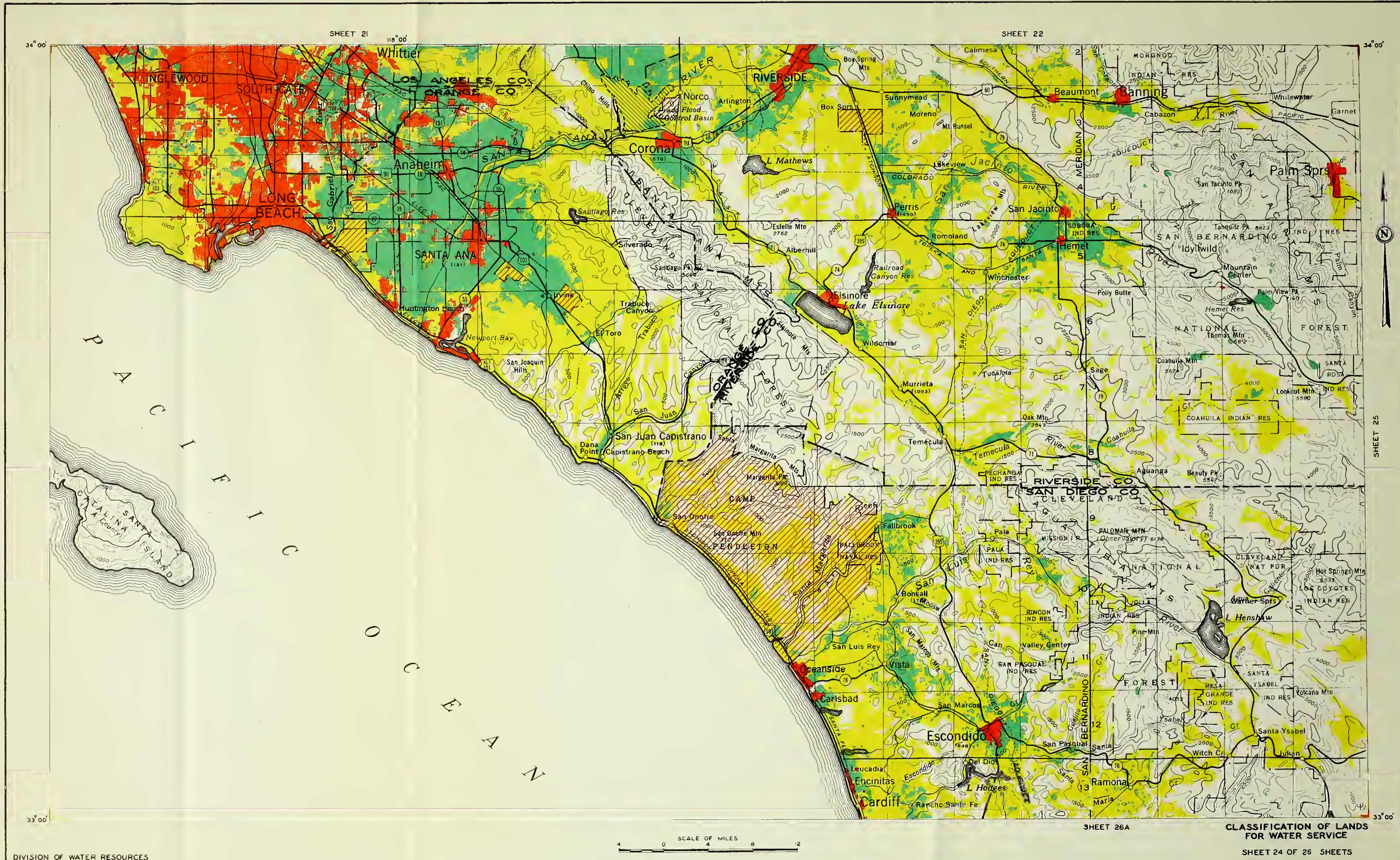
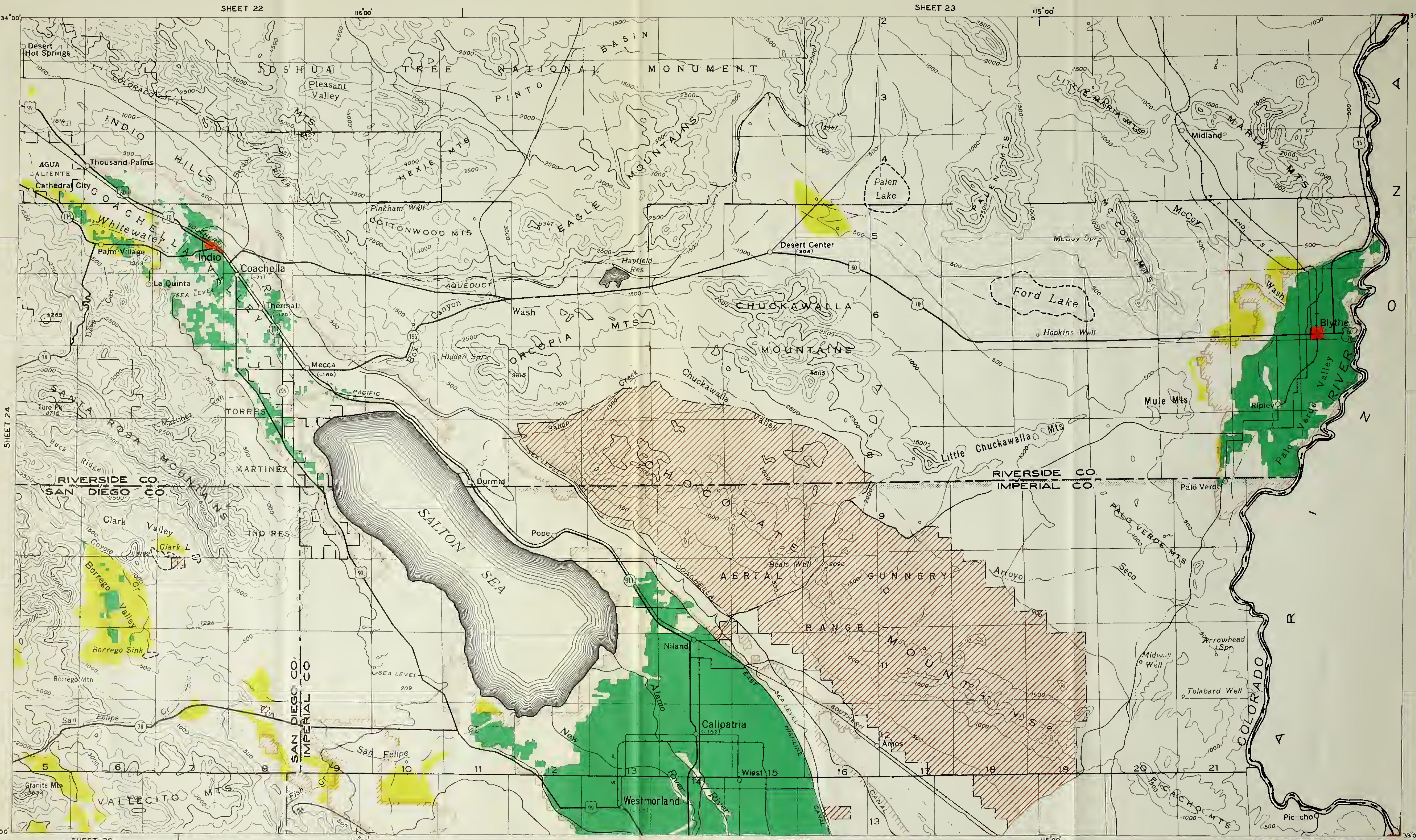

SHEET 21
SHEET 22
SHEET 25
SHEET 26A
PACIFIC OCEAN
LOS ANGELES CO
ORANGE CO
RIVERSIDE CO
SAN DIEGO CO
Whittier
INGLEWOOD
SOUTH GATE
LONG BEACH
Anaheim
SANTA ANA
Huntington Beach
Newport Bay
Corona
Norco
Arlington
RIVERSIDE
Beaumont
Banning
Palm Sprs
Perris
San Jacinto
Hemet
Elsinore
Lake Elsinore
San Juan Capistrano
Dana Point
Capistrano Beach
Temecula
Fallbrook
Oceanside
Carlsbad
Vista
San Marcos
Escondido
Leucadia
Encinitas
Cardiff
L Hodges
Ramona
Julian
Santa Ysabel
L Henshaw
CAMP PENDLETON
SANTA CATALINA ISLAND
CLASSIFICATION OF LANDS FOR WATER SERVICE
SHEET 24 OF 26 SHEETS
SCALE OF MILES
DIVISION OF WATER RESOURCES


SHEET 22
SHEET 23
SHEET 24
SHEET 26
SHEET 26
34°00'
33°00'
116°00'
115°00'
Desert Hot Springs
JOSHUA TREE NATIONAL MONUMENT
PINTO BASIN
Pleasant Valley
INDIO HILLS
COACHELLA VALLEY
Thousand Palms
AGUA CALIENTE
Cathedral City
Whitewater
Palm Village
Indio
Coachella
La Quinta
Thermal
Mecca
TORRES
MARTINEZ
SANTA ROSA MOUNTAINS
Toro Pk
HEXIE MTS
EAGLE MOUNTAINS
COTTONWOOD MTS
Pinkham Well
Hayfield Res
AQUEDUCT
Desert Center
Palen Lake
PALEN MTS
CHUCKAWALLA MOUNTAINS
Chuckawalla Valley
OROCOPIA MTS
Hidden Sprs
Box Canyon Wash
PACIFIC
LITTLE MARIA MTS
MARIA MTS
Midland
McCOY MTS
McCoy Wash
McCoy Spr
Ford Lake
Hopkins Well
Blythe
Ripley
Palo Verde Valley
Palo Verde
Mule Mts
Little Chuckawalla Mts
RIVERSIDE CO.
SAN DIEGO CO.
IMPERIAL CO.
SALTON SEA
Durmid
Pope
Salton
CHOCOLATE MOUNTAINS
AERIAL GUNNERY RANGE
Beals Well
COACHELLA CANAL
PALO VERDE MTS
Arroyo Seco
Arrowhead Spr
Midway Well
Tolabard Well
PICACHO MTS
Picacho
COLORADO RIVER
ARIZONA
Clark Valley
Clark L
Coyote Cr
Borrego Valley
Borrego Sink
Borrego Mtn
San Felipe Cr
Fish Cr
Granite Mtn
VALLECITO MTS
IND RES
Niland
Calipatria
Alamo River
New River
Westmorland
Wiest
EAST HIGHLINE CANAL
SOUTHERN PACIFIC
Amos
SEA LEVEL
N

SCALE OF MILES

4 0 4 8 12

Areas having rights in Colorado River

DIVISION OF WATER RESOURCES

CLASSIFICATION OF LANDS FOR WATER SERVICE

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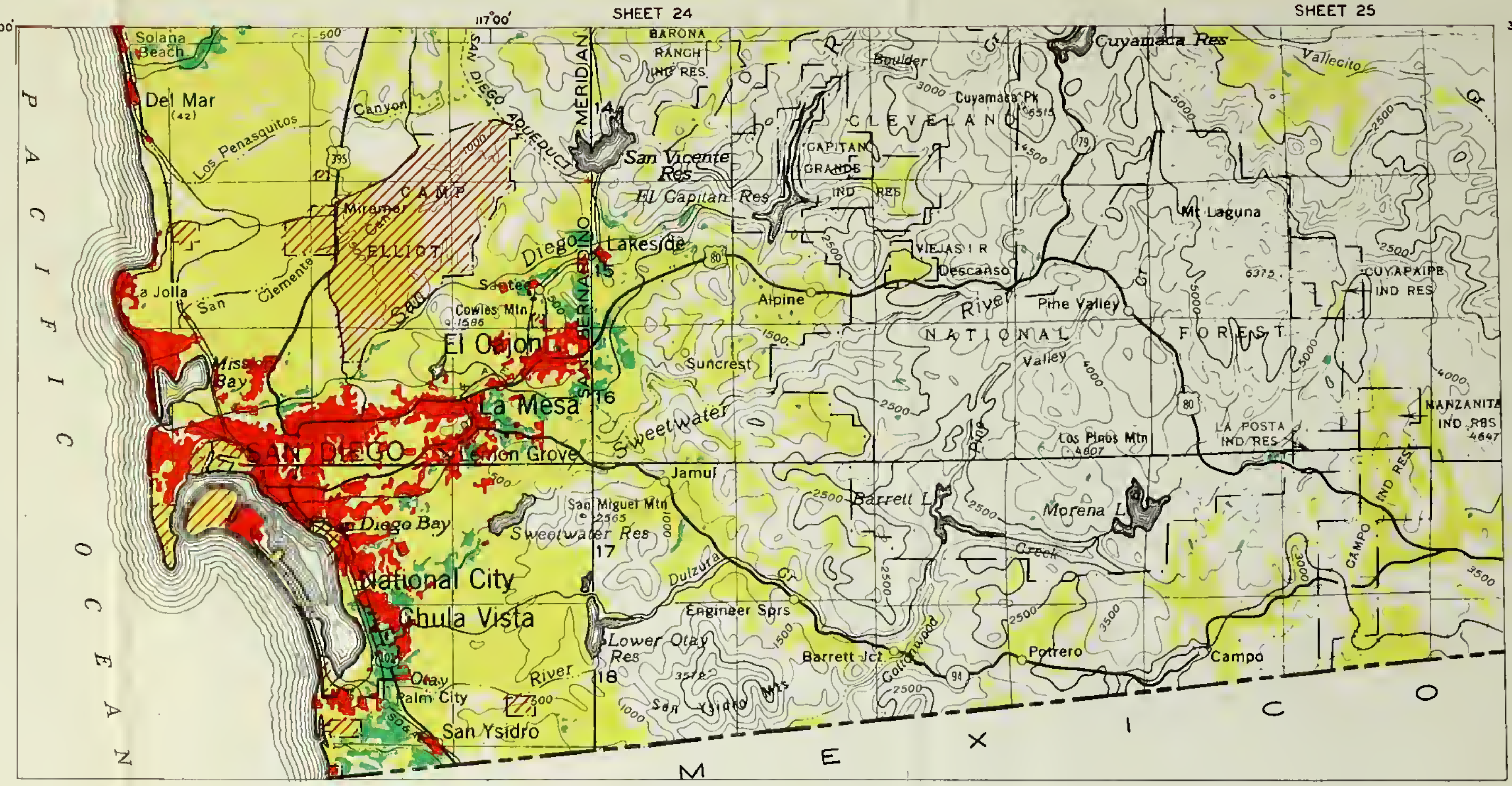

SCALE OF MILES

4 0 4 8 12

CLASSIFICATION OF LANDS FOR WATER SERVICE

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DIVISION OF WATER RESOURCES

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

PRESENT LAND USE IN SAN FRANCISCO BAY AREA 1949

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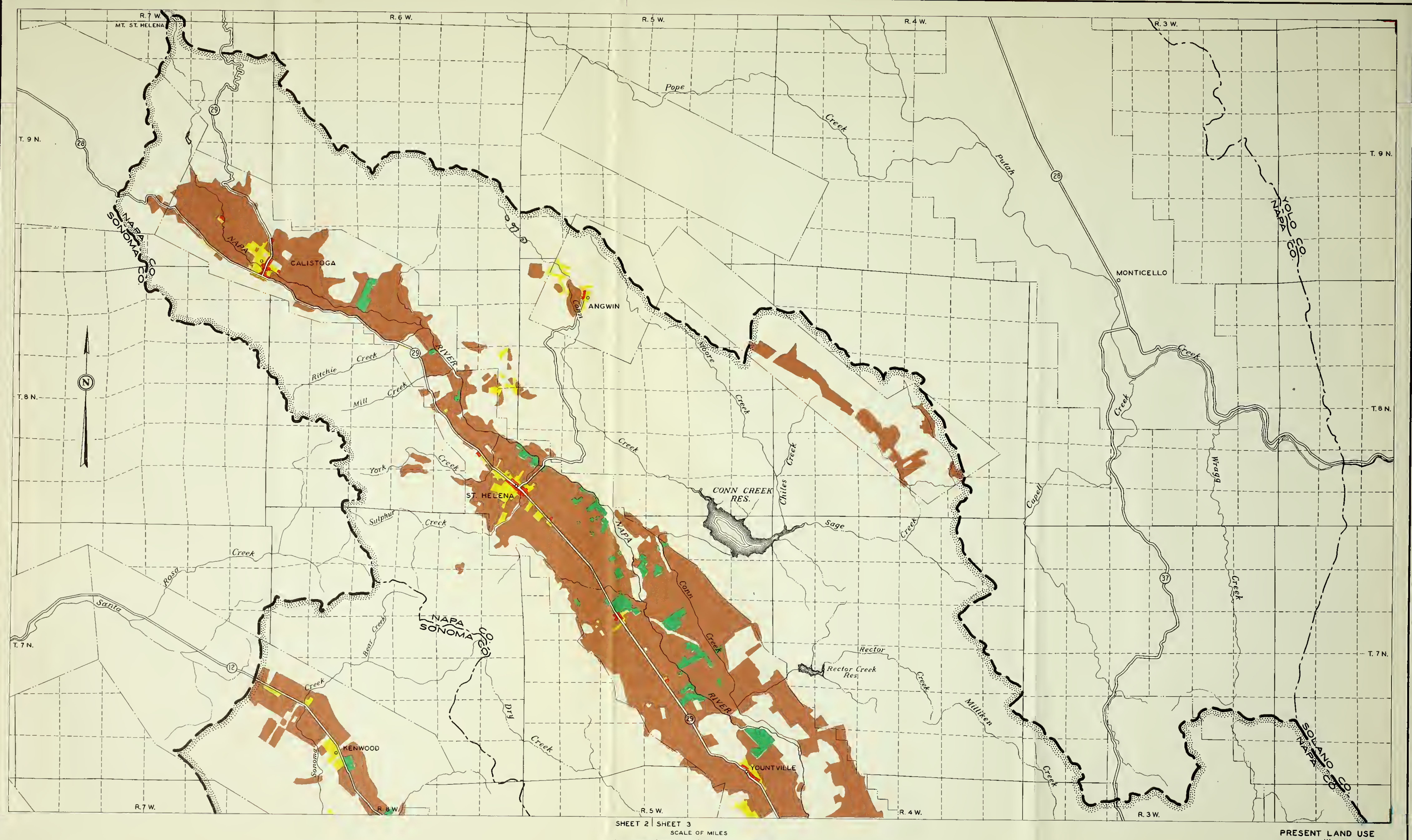


DIVISION OF WATER RESOURCES

PRESENT LAND USE IN SAN FRANCISCO BAY AREA
1949
SHEET 1 OF 11 SHEETS

SHEET 1

R. 10 W. R. 9 W. R. 8 W. R. 7 W. R. 6 W.

T. 6 N. T. 5 N. T. 4 N.

PACIFIC OCEAN

TOMALES BAY

Estero Americano

Americano Creek

Laguna de Santa Rosa

Stemple Creek

Walker Creek

Chileno Creek

Lichau Creek

Willow Brook

Petaluma Creek

Lynch Creek

Adobe Creek

San Antonio Creek

Novato Cr.

Sonoma Creek

Stuart Creek

Hooker Creek

Carriger Creek

Lewis Creek

Rodgers Creek

Arroyo Seco

Tolay Creek

Petaluma Creek

SONOMA MARIN CO.

NAPA SONOMA CO.

SONOMA CO. MARIN CO.

GLEN ELLEN

Suttenfield Res.

BOYES SPRINGS

SONOMA

PETALUMA

101 1 12 37 48

N

SHEET 3

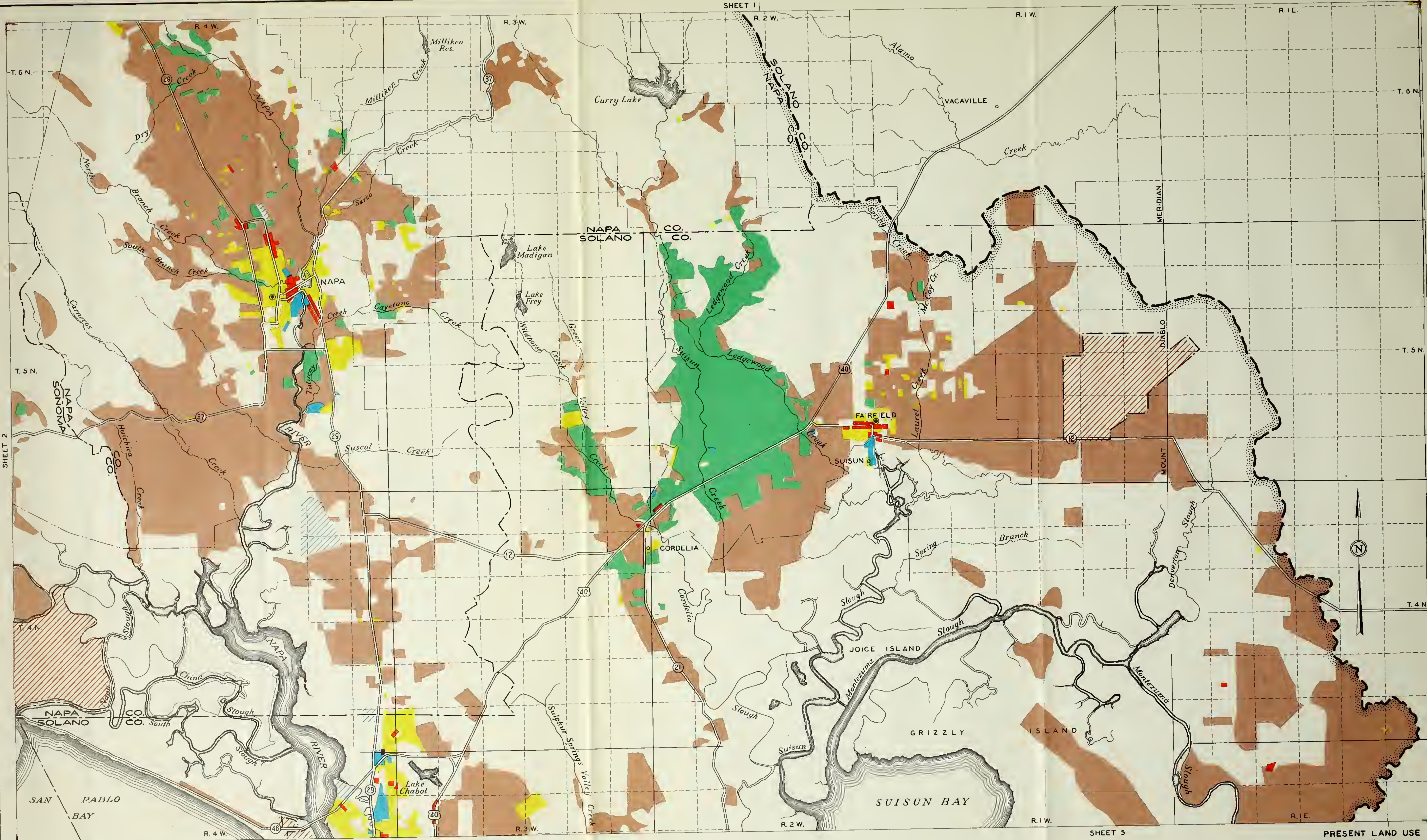
SHEET 4

SCALE OF MILES

0 1 2 3

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 2 OF 11 SHEETS

DIVISION OF WATER RESOURCES



SCALE OF MILES
0 1 2 3

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 3 OF 11 SHEETS

DIVISION OF WATER RESOURCES

SHEET 2

R. 10 W. R. 9 W. R. 8 W. R. 7 W. R. 6 W.

T. 3 N.

T. 2 N.

T. 1 N.

SONOMA CO. / MARIN CO.

CONTRA COSTA CO. / MARIN CO.

INVERNESS

TOMALES BAY

POINT REYES STATION

Lagunitas Creek

Olema Creek

Arroyo Halleck Creek

Nicasio Creek

Novato Creek

NOVATO

DRAKES ESTERO

DRAKES BAY

POINT REYES

PACIFIC OCEAN

San Geronimo Creek

LAGUNITAS

Lagunitas Creek

Pine Gulch Creek

FAIRFAX

SAN ANSELMO

SAN RAFAEL

SAN RAFAEL BAY

Alpine Res.

Bon Tempe Res.

Phoenix Res.

ROSS

Lake Lagunitas

SAN QUENTIN

LARKSPUR

MT. TAMALPAIS

CORTE MADERA

Bolinas Lagoon

BOLINAS

BOLINAS BAY

MILL VALLEY

RICHARDSON BAY

BELVEDERE

ANGEL I.

SAUSALITO

R.R.W.

SAN PABLO BAY

MARIN CO.

SHEET 5

SHEET 6

SCALE OF MILES

1 0 1 2 3

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 4 OF 11 SHEETS

DIVISION OF WATER RESOURCES

SAN PABLO BAY

SONOMA CO.
MARIN CO.
SOLANO CO.
CONTRA COSTA CO.

CARQUINEZ STRAIT

SUISUN BAY

CONTRA COSTA CO.

SAN FRANCISCO BAY

CONTRA COSTA CO. AND CITY AND COUNTY OF SAN FRANCISCO

ALAMEDA CO.

R.4W. R.3W. R.2W. R.1W. R.1E.

T.3N. T.2N. T.1N. T.1S.

VALLEJO
BENICIA
CROCKETT
RODEO
PINOLE
SAN PABLO
RICHMOND
EL CERRITO
ALBANY
BERKELEY
ANGEL ISLAND
MARTINEZ
CONCORD
PITTSBURG
WALNUT CREEK
ORINDA
MOUNT DIABLO
SIMMONS IS.
HAMMOND ISLAND
WHEELER ISLAND
RYER ISLAND
ROE IS.
HONKER BAY
VAN SICKLE ISLAND
CHIPPS ISLAND
BROWNS ISLAND
WINTER ISLAND

Sulphur Springs Valley Creek
Goodyear Slough
Montezuma Slough
San Joaquin River
Sacramento River
Pacheco Creek
Seal Creek
Mallard Res.
Marlinez Res.
Hambre Creek
Rodeo Creek
Pinole Creek
San Pablo Creek
Wildcat Creek
Arroyo del Pinole
SAN PABLO RES.
Bear Creek
Grayson Creek
Pine Creek
Walnut Creek
Las Trampas Creek
Lafayette Res.
Temescal Lake
Kirker Creek
Mitchell Creek
San Ramon Creek

CONTRA COSTA CANAL
MOKELUMNE AQUEDUCT
LAFAYETTE WATER TUNNEL
DIABLO CANAL
WALNUT CREEK PUMPING PLANT
MOUNT DIABLO BASE LINE
MT. DIABLO

SCALE OF MILES
0 1 2 3

SHEET 4
SHEET 6 | SHEET 7

DIVISION OF WATER RESOURCES

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 5 OF 11 SHEETS

PACIFIC OCEAN

R.6W. R.5W. R.4W. R.3W. R.2W.

ALCATRAZ ISLAND
TREASURE ISLAND
GOLDEN GATE
GOLDEN GATE BRIDGE
YERBA BUENA ISLAND
SAN FRANCISCO OAKLAND BAY BRIDGE
PIEDMONT
OAKLAND
Lake Merritt
ALAMEDA
San Leandro Creek
Bolinger Creek
CONTRA COSTA CO.
ALAMEDA CO.
UPPER SAN LEANDRO RES.
SAN FRANCISCO
LAKE MERCED
SAN FRANCISCO CITY AND CO.
SAN MATEO CO.
DALY CITY
COLMA
SAN LEANDRO
Lake Chabot
Cull Creek
T.2 S.
SAN LORENZO
San Lorenzo Creek
HAYWARD
T.3 S.
SOUTH SAN FRANCISCO
SKYLINE BLVD.
SAN BRUNO
ALAMEDA CO.
SAN MATEO CO.
MT. EDEN
Mt. Eden Cr.
SAN MATEO BRIDGE
SAN ANDREAS LAKE
San Pedro Cr.
San Mateo Cr.
BURLINGAME
Alameda Cr.
Coyote Hills Sl.
SAN MATEO
T.4 S.
BAY
SAN FRANCISCO

SHEET 7

SHEET 8

SCALE OF MILES
0 1 2 3

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 6 OF 11 SHEETS

SHEET 5

SHEET 6

SHEET 9

R.1W. R.1E. R.2E. R.3E. R.4E.

MT. DIABLO MERIDIAN

DANVILLE

SAN RAMON

CONTRA COSTA CO.
ALAMEDA CO.

T.2S.

T.3S.

T.4S.

LIVERMORE

PLEASANTON

NILES

TRACY

Alamo Creek

Tassajero Creek

Cayetano Creek

Arroyo las Positas

Arroyo Mocho

Arroyo del Valle

Arroyo Seco

San Antonio Creek

Mountainhouse Creek

Delta Mendota Canal

Grant Line Canal

Fabian and Bell Canal

Old River

HETCH HETCHY AQUEDUCT

ALAMEDA CO.
SAN JOAQUIN CO.

SCALE OF MILES
0 1 2 3

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 7 OF 11 SHEETS

DIVISION OF WATER RESOURCES

R.6W. R.5W. R.4W. R.3W. R.2W.

T.5S. T.6S. T.7S.

PACIFIC OCEAN

MONTARA
PILLAR POINT
HALFMOON BAY
HALFMOON BAY
SAN GREGORIO
LA HONDA
BELMONT
SAN CARLOS
REDWOOD CITY
MENLO PARK
PALO ALTO
MOUNTAIN VIEW
SUNNYVALE
CENTERVILLE
NEWARK

San Vicente Creek
Denniston Creek
Pilarcitos Lake
San Mateo Creek
Lower Crystal Springs Res.
Upper Crystal Springs Res.
San Mateo Cr.
Laurel Cr.
Belmont Cr.
Belmont Channel
Redwood Creek
Cordilleras Cr.
Frenchman Creek
Pilarcitos Creek
Purisima Creek
Lobitos Creek
Tunitas Creek
De Madera Creek
Clear Creek
El Corte Bogess Creek
San Gregorio Creek
Pomponio Creek
Harrington Creek
Honda Creek
Union Bear Creek
Searsville Lake
Sausal Cr.
Los Trancos Creek
Corte Madera Cr.
Matadero Creek
Adobe Creek
Permanente Creek
Stevens Creek
Mindego Creek
Alpine Creek
Stevens Creek Res.
Calabazas Creek
Campbell Creek
Francisquito Creek
Newark Slough
Plummer Cr.
Morey Slough
Alviso Slough
Coyote Creek
Dumbarton Bridge
Bay

HETCH HETCHY AQUEDUCT

ALAMEDA CO.
SAN MATEO CO.
SANTA CLARA CO.
SAN FRANCISCO BAY

SHEET 9

SHEET 10

SCALE OF MILES
0 1 2 3

DIVISION OF WATER RESOURCES

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 8 OF 11 SHEETS

SHEET 7

R.1W. R.1E. R.2E. R.3E. R.4E. R.5E.

T.5S. T.6S. T.7S.

IRVINGTON
MISSION SAN JOSE
ALVISO
MILPITAS
SANTA CLARA
SAN JOSE
MT. HAMILTON
CALAVERAS RES.

ALAMEDA CO.
SANTA CLARA CO.
SAN JOAQUIN CO.
STANISLAUS CO.
SANTA CLARA CO.

AQUEDUCT
HETCH HETCHY
Alameda Creek
La Costa Cr.
Arroyo del Valle
Arroyo Mocho
Colorado Creek
Sulphur Spring Cr.
San Antonio Cr.
Arroyo Bayo
Isabel Creek
Arroyo Aguague
Smith Creek
Sulphur Creek
Hondo Creek
Calaveras Creek
Arroyo Calaveras
Coyote Creek
Guadalupe River
Penitencia Creek
Silver Creek
Dry Creek
San Tomas Aquinas Cr.
Campbell Creek
Los Gatos Cr.

SHEET 8
SHEET 10 | SHEET 11

SCALE OF MILES
0 1 2 3

N

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 9 OF 11 SHEETS

DIVISION OF WATER RESOURCES

SHEET 8 | SHEET 9

R. 5 W. R. 4 W. R. 3 W. R. 2 W. R. 1 W.

T. 8 S.

T. 9 S.

T. 10 S.

PACIFIC OCEAN

PESCADERO

SARATOGA

LOS GATOS

SAN MATEO CO.
SANTA CRUZ CO.

SANTA CLARA CO.

Pescadero Creek
Butano Creek
Little Butano Creek
Gazos Creek
San Vicente Creek
Waddell Creek
Scott Creek
San Lorenzo River
Bean Creek
Newell Creek
Zayante Creek
Boulder Creek
Stevens Creek
Campbell Creek
Aquinas Cr.
San Tomas Creek
Los Gatos Creek
Guadalupe Creek
Los Gatos Creek
Branciforte Creek
Soquel Creek

Guadalupe Res.
AUSTRIAN RES.

MOUNT DIABLO MERIDIAN

SHEET 11

SCALE OF MILES
0 1 2 3

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 10 OF 11 SHEETS

DIVISION OF WATER RESOURCES

SHEET 9

SHEET 10

R.1E. R.2E. R.3E. R.4E. R.5E. R.6E.

T.8S. T.9S. T.10S.

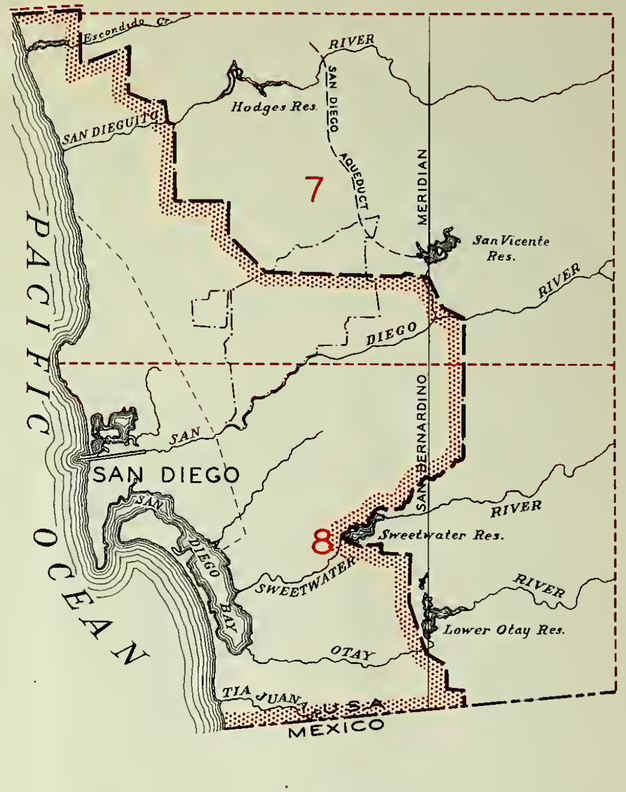
Dry Creek
San Felipe Creek
Las Animas Creek
Middle Fork Coyote Creek
East Fork Coyote Creek
Coyote Creek
Pacheco Creek
Alamitos Creek
Arroyo Calero Creek
Guadalupe Res.
CALERO RES.
Almaden Res.
ANDERSON RES.
Packwood Creek
COYOTE RES.
MADRONE
MORGAN HILL
GILROY
Llagas Creek
Uvas Creek
Soquel Creek
SANTA CLARA-SANTA CRUZ CO.
SANTA CLARA-STANISLAUS CO.
COYOTE CREEK
101

SCALE OF MILES
0 1 2 3

DIVISION OF WATER RESOURCES

PRESENT LAND USE
IN
SAN FRANCISCO BAY AREA
1949
SHEET 11 OF 11 SHEETS

VICINITY MAP



LEGEND

- RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- MILITARY RESERVATION
- IRRIGATED AGRICULTURE

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

PRESENT LAND USE
IN
LOS ANGELES AND SAN DIEGO METROPOLITAN AREAS
1950

INDEX TO SHEETS

SCALE OF MILES
6 0 6 12 18

R17W R16W R15W R14W R13W

T4N T3N T2N

SANTA CLARA RIVER

LOS ANGELES VENTURA COUNTY

Pico Canyon

Upper San Fernando Res.

Lower San Fernando Res.

Chatsworth Res.

SAN FERNANDO

ANGELES NATIONAL FOREST

Pacoima Creek

Pacoima Res.

Tujunga Wash

Little Tujunga Canyon

Big Tujunga Canyon

Gold Cr.

HANSEN FLOOD CONTROL BASIN

LA CRESCENTA

99 6 118 27 7

N

SCALE OF MILES 0 1 2 3

SHEET 2

DIVISION OF WATER RESOURCES

PRESENT LAND USE IN LOS ANGELES METROPOLITAN AREA 1950

SHEET 1 OF 8 SHEETS

SHEET 1

R17W R16W R15W R14W R13W

TIN TIS

LOS ANGELES CO
VENTURA CO

CANOGA PARK
SEPULVEDA FLOOD CONTROL BASIN
SHERMAN OAKS
Encino Res.
Tujunga Wash
BURBANK
GLENDALE
LOS ANGELES
Hollywood Res.
BASE LINE
Stone Canyon Res.
Lower Franklin Res.
Silver Lake Res.
Arroyo Seco
BEVERLY HILLS
CULVER CITY
SANTA MONICA
LOS ANGELES
INGLEWOOD
RIVER
SAN BERNARDINO
Malibu Creek
Malibu Lake
Cold Creek
SANTA MONICA BAY
PACIFIC OCEAN

SHEET 3

SHEET 4

SCALE OF MILES
0 1 2 3

DIVISION OF WATER RESOURCES

PRESENT LAND USE
IN
LOS ANGELES METROPOLITAN AREA
1950
SHEET 2 OF 8 SHEETS

R12W R11W R10W R9W R8W

ANGELES NATIONAL FOREST

Flood Control Res. N°1

Santa Anita Res.

Morris Res.

Sawpit Res.

Big Dalton Res.

San Dimas Res.

T1N

PASADENA

SIERRA MADRE

MONROVIA

GLENDORA

ARROYO SECO

SANTA ANITA WASH

RIVER

SANTA FE FLOOD CONTROL BASIN

DALTON WASH

DIMAS WASH

SAN BERNARDINO BASE LINE

BASE LINE

RUBIO WASH

ALHAMBRA

BIG SAN DIMAS CREEK

COVINA

Puddingstone Reservoir

T1S

EL MONTE

WALNUT

POMONA

SAN GABRIEL RIVER

HONDO

PUENTE

SAN ANTONIO

LOS ANGELES

CHINO

MONTEBELLO

RIO HONDO

WHITTIER

Arnold Res.

T2S

LOS ANGELES

SAN BERNARDINO COUNTY

SHEET 2

SHEET 4

SHEET 5

SCALE OF MILES

0 2 3

DIVISION OF WATER RESOURCES

PRESENT LAND USE
IN
LOS ANGELES METROPOLITAN AREA
1950
SHEET 3 OF 8 SHEETS

SHEET 2

SHEET 3

R14W

R13W

R12W

T3S

T4S

T5S

EL SEGUNDO

HAWTHORNE

REDONDO BEACH

TORRANCE

GARDENA

COMPTON

BELLFLOWER

NORWALK

Dominguez Slough

LOS ANGELES RIVER

SAN GABRIEL RIVER

Bouton Lake

Bixby Slough

WILMINGTON

LONG BEACH

SAN PEDRO

LOS ANGELES HARBOR

SAN PEDRO BAY

ORANGE — LOS ANGELES

PACIFIC OCEAN

SHEET 5

SCALE OF MILES

0 1 2 3

PRESENT LAND USE
IN
LOS ANGELES METROPOLITAN AREA
1950
SHEET 4 OF 8 SHEETS

DIVISION OF WATER RESOURCES

SHEET 3

SHEET 4

SHEET 6

R11W R10W R9W R8W R7W

T3S T4S T5S

LOS ANGELES CO.

ORANGE CO.

SAN BERNARDINO CO.

RIVERSIDE CO.

LA HABRA

FULLERTON

BUENA PARK

ANAHEIM

STANTON

ORANGE

GARDEN GROVE

WESTMINSTER

SANTA ANA

SAN BERNARDINO

RIVERSIDE

PRADO FLOOD CONTROL BASIN

SANTA ANA RIVER

Santiago Creek

Fremont Canyon

Santiago Res.

Silverado Canyon Creek

CLEVELAND NATIONAL FOREST

101 22 18 91

N

SCALE OF MILES 0 1 2 3

DIVISION OF WATER RESOURCES

PRESENT LAND USE IN LOS ANGELES METROPOLITAN AREA 1950

SHEET 5 OF 8 SHEETS

SHEET S

R11W R10W R9W R8W R7W

T6S

T7S

HUNTINGTON BEACH

SANTA ANA RIVER

NEWPORT BEACH

LAGUNA BEACH

DANA POINT

Sand Canyon Res.

Laguna Res.

Bonita Res.

Veeh Res.

Trabuco Creek

Gobernadora

Arroyo Aliso

Cañada San Juan

Creek

101

P A C I F I C O C E A N

N

SCALE OF MILES
0 1 2 3

ORANGE
SAN DIEGO

PRESENT LAND USE
IN
LOS ANGELES METROPOLITAN AREA
1950
SHEET 6 OF 8 SHEETS

DIVISION OF WATER RESOURCES

R4W R3W R2W R1W

T12S

T13S

T14S

T15S

PACIFIC OCEAN

Batiquitos Lagoon

ENCINITAS

Escondido Creek

San Dieguito Lagoon

San Dieguito Res

Hodges Res.

RIVER

DIEGUITO

SOLANA BEACH

SAN

DEL MAR

Cr.

Canyon

McGonigle

Penasquitos

Los

Carrol

Rose

San Clemente

LA JOLLA

101

395

Creek

SAN BERNARDINO MERIDIAN

San Vicente Res.

San Vicente Cr.

RIVER

LAKESIDE

SAN DIEGO

12

80

N

SCALE OF MILES

0 1 2 3

SHEET 8

DIVISION OF WATER RESOURCES

PRESENT LAND USE
IN
SAN DIEGO METROPOLITAN AREA
1950
SHEET 7 OF 8 SHEETS

SHEET 7

R3W R2W R1W R1E

T16S T17S T18S

PACIFIC OCEAN

MEXICO

PACIFIC BEACH
MISSION BAY
OCEAN BEACH
SAN DIEGO
CORONADO
NATIONAL CITY
CHULA VISTA
IMPERIAL BEACH
OTAY
SAN YSIDRO
LA MESA
SPRING VALLEY
LEMON GROVE
EL CAJON

Rose Canyon Cr.
Tecolote Cr.
SAN DIEGO RIVER
SWEETWATER RIVER
OTAY RIVER
TIA JUANA RIVER
SAN DIEGO BAY
Sweetwater Res.
Upper Otay Res.
Lower Otay Res.
Judson Res.

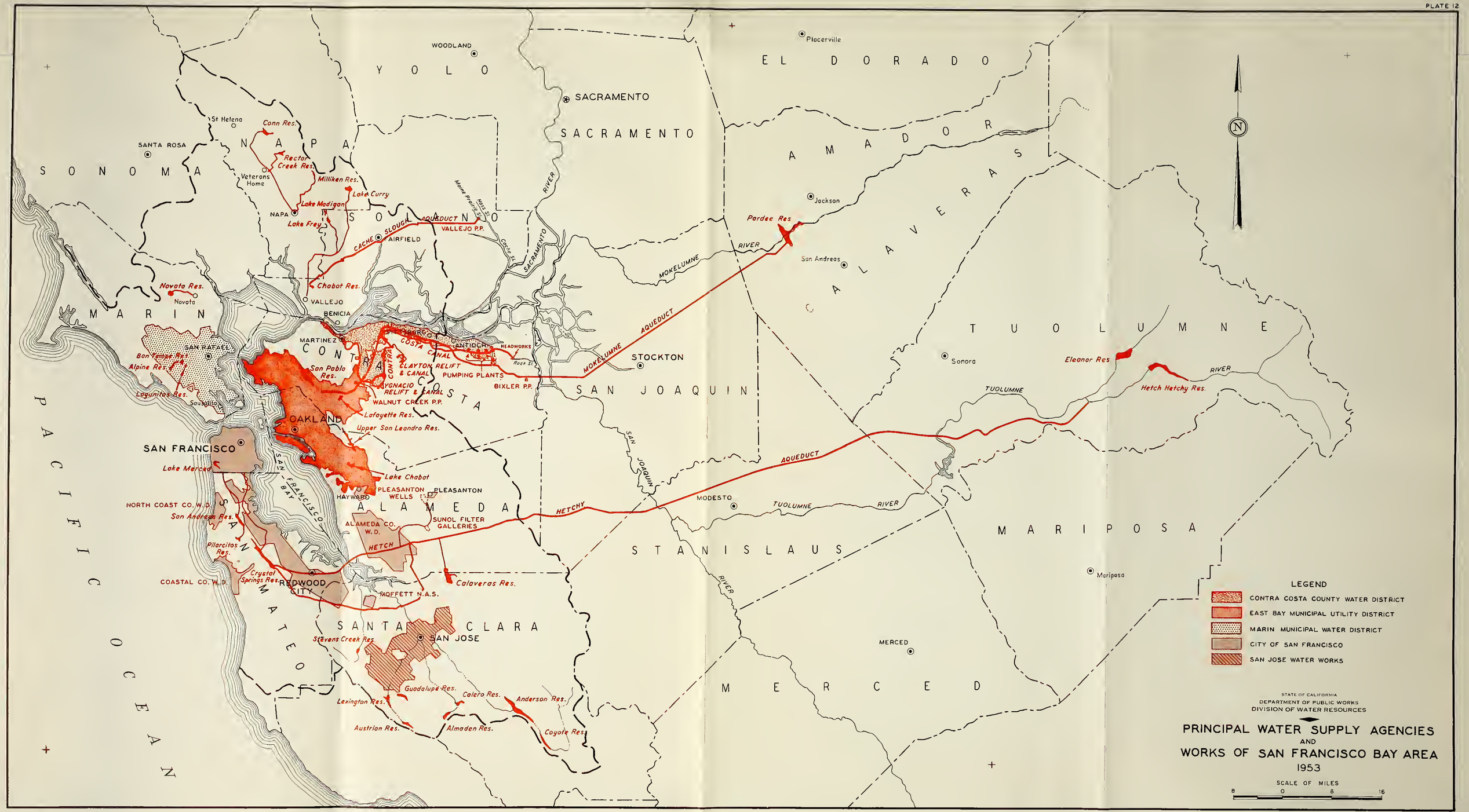
101 395 80 94

SAN BERNARDINO MERIDIAN

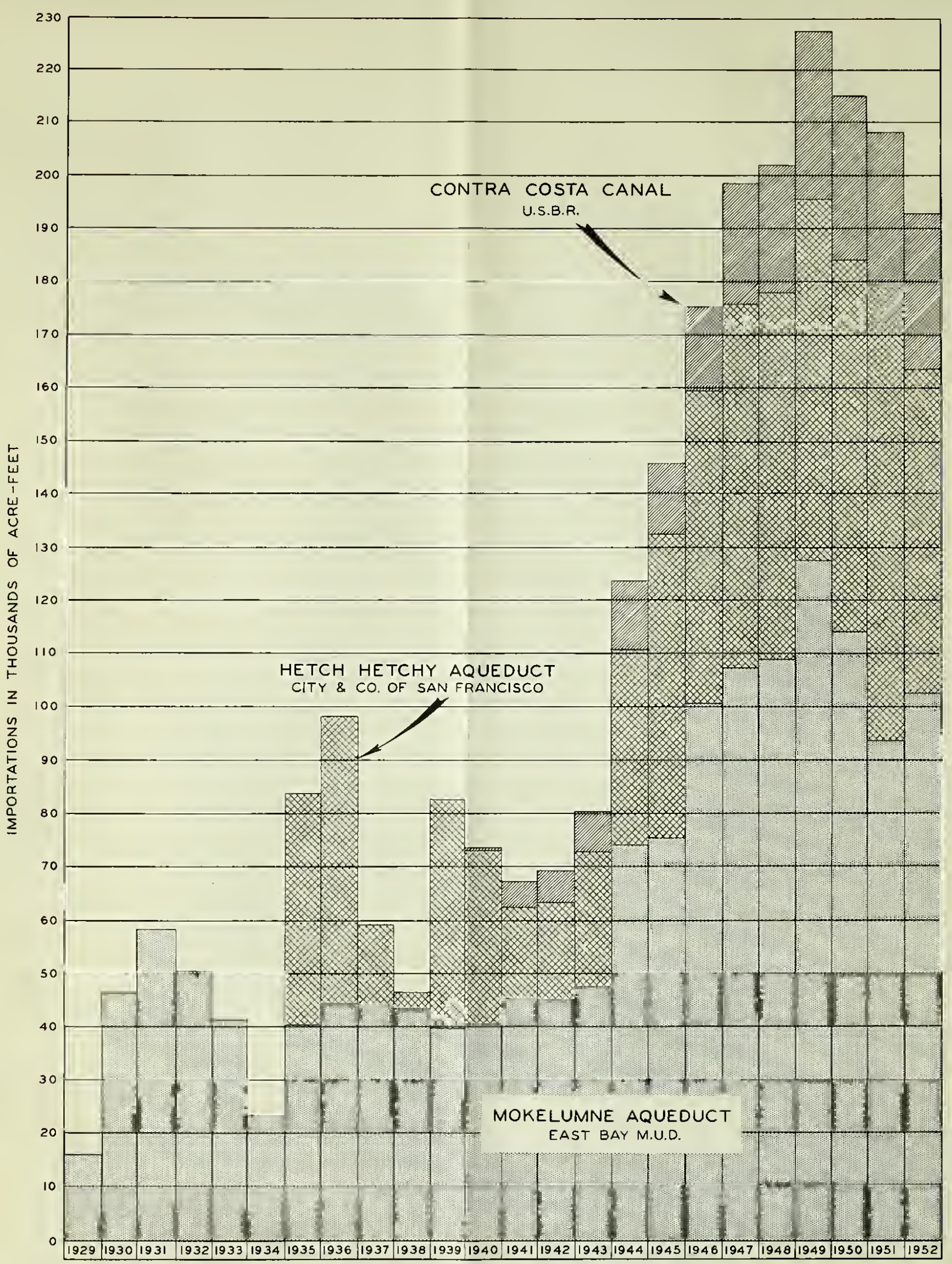
SCALE OF MILES
0 1 2 3

DIVISION OF WATER RESOURCES

PRESENT LAND USE
IN
SAN DIEGO METROPOLITAN AREA
1950
SHEET 8 OF 8 SHEETS

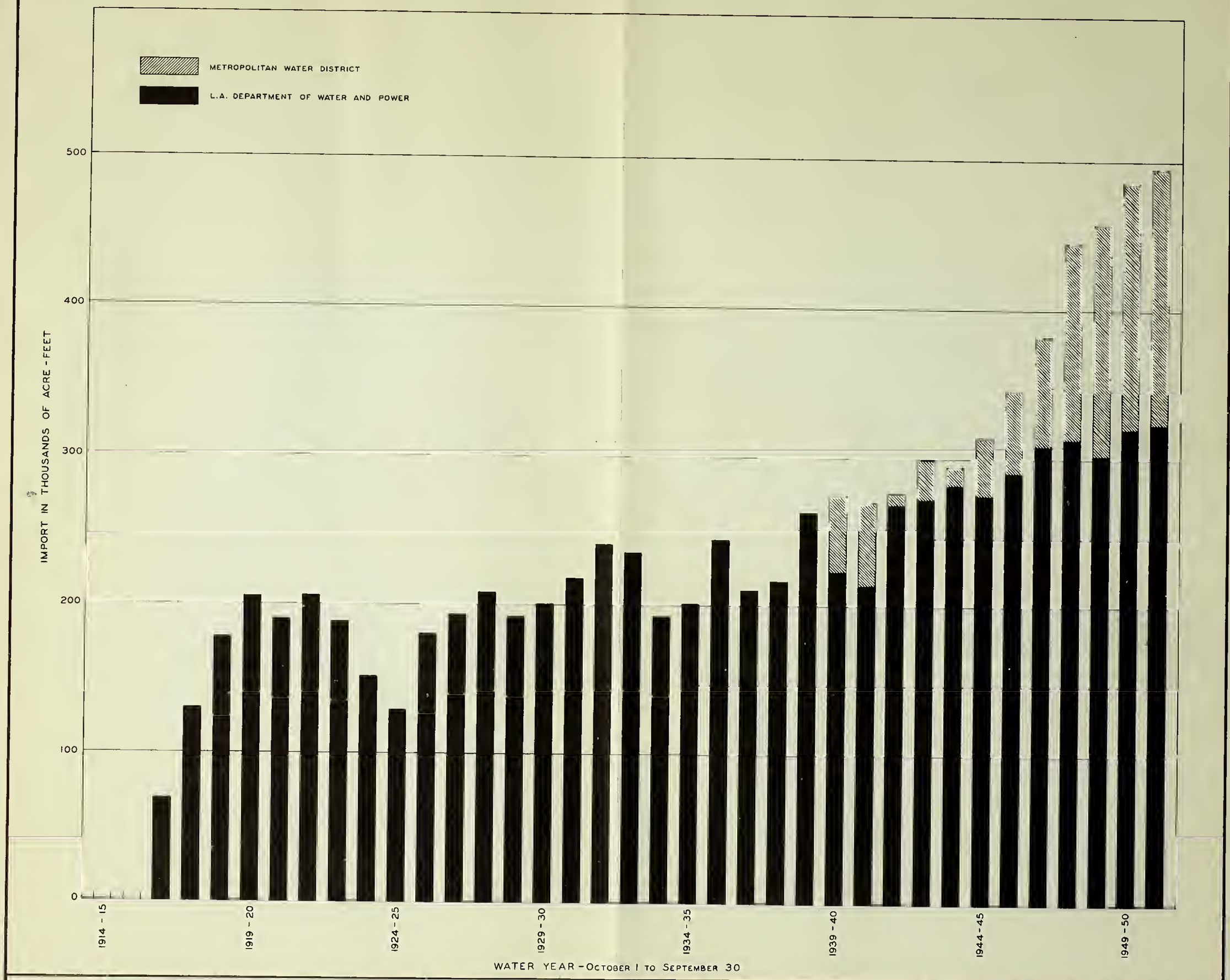

WOODLAND
Placerville
SACRAMENTO
Y O L O
E L D O R A D O
S A C R A M E N T O
A M A D O R
C A L A V E R A S
St Helena
Conn Res.
SANTA ROSA
S O N O M A
N A P A
Rector Creek Res.
Veterans Home
Milliken Res.
Lake Curry
Lake Madigan
NAPA
Lake Frey
S O L A N O
Jackson
Pardee Res.
CACHE SLOUGH AQUEDUCT
VALLEJO P.P.
FAIRFIELD
Morse Prairie St.
Cordelia St.
SACRAMENTO RIVER
MOKELUMNE RIVER
San Andreas
Novato Res.
Novato
Chabot Res.
VALLEJO
BENICIA
M A R I N
MARTINEZ
CROCKETT
ANTIOCH
HEADWORKS
Rock St.
CONTRA COSTA CANAL
CLAYTON RELIFT & CANAL
PUMPING PLANTS
BIXLER P.P.
MOKELUMNE AQUEDUCT
STOCKTON
SAN RAFAEL
Bon Tempe Res.
Alpine Res.
San Pablo Res.
CONTRA COSTA CANAL
IGNACIO RELIFT & CANAL
WALNUT CREEK P.P.
Lagunitas Res.
Sausalito
C O N T R A C O S T A
S A N J O A Q U I N
Sonora
Eleanor Res.
TUOLUMNE RIVER
Hetch Hetchy Res.
OAKLAND
Lafayette Res.
Upper San Leandro Res.
SAN FRANCISCO
Lake Merced
SAN FRANCISCO BAY
Lake Chabot
HAYWARD
PLEASANTON WELLS I.D.
PLEASANTON
NORTH COAST CO. W.D.
San Andreas Res.
A L A M E D A
ALAMEDA CO. W.D.
SUNOL FILTER GALLERIES
HETCHY AQUEDUCT
MODESTO
TUOLUMNE RIVER
Pilarcitos Res.
HETCH HETCHY
COASTAL CO. W.D.
Crystal Springs Res.
REDWOOD CITY
MOFFETT N.A.S.
Calaveras Res.
S T A N I S L A U S
M A R I P O S A
Mariposa
SAN JOSE
Stevens Creek Res.
Guadalupe Res.
Calero Res.
Anderson Res.
Lexington Res.
Austrian Res.
Almaden Res.
Coyote Res.
MERCED
M E R C E D
P A C I F I C O C E A N
N
LEGEND
CONTRA COSTA COUNTY WATER DISTRICT
EAST BAY MUNICIPAL UTILITY DISTRICT
MARIN MUNICIPAL WATER DISTRICT
CITY OF SAN FRANCISCO
SAN JOSE WATER WORKS
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
PRINCIPAL WATER SUPPLY AGENCIES
AND
WORKS OF SAN FRANCISCO BAY AREA
1953
SCALE OF MILES
8 0 8 16


REGIONAL MAP
SHOWING
SOURCES OF IMPORTED SUPPLY
SCALE OF MILES
0 25 50
MONO
Mono Lake
Long Valley Res.
INYO
NEVADA
LOS ANGELES AQUEDUCT
COLORADO RIVER AQUEDUCT
PARKER DAM
Lake Mead
Hoover Dam
ALL AMERICAN CANAL
MEXICO
ARIZONA
MEMBERS OF THE METROPOLITAN WATER DISTRICT
LOS ANGELES
BEVERLY HILLS
BURBANK
SANTA MONICA
WEST BASIN M. W. D.
COMPTON
TORRANCE
LONG BEACH
FOOTHILL M. W. D.
GLENDALE
PASADENA
SAN MARINO
POMONA VALLEY M. W. D.
CHINO BASIN M. W. D
FULLERTON
ANAHEIM
SANTA ANA
COASTAL M. W. D. (INCLUDING BREA)
ORANGE COUNTY M. W. D.
EASTERN M. W. D.
SAN DIEGO COUNTY WATER AUTHORITY
MEMBERS OF THE SAN DIEGO COUNTY WATER AUTHORITY
SAN DIEGO
FALLBROOK P. U. D.
OCEANSIDE
SAN DIEQUITO I. D
ESCONDIDO
SANTA FE I. D.
LAKESIDE I. D.
LA MESA, LEMON GROVE & SPRING VALLEY I. D.
NATIONAL CITY
SOUTH BAY I. D.
CREST P. U. D.
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
PRINCIPAL WATER SUPPLY AGENCIES
AND
WORKS OF LOS ANGELES AND SAN DIEGO
METROPOLITAN AREAS
1953
SCALE OF MILES
8 0 8 16
KERN
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
ORANGE
SAN DIEGO
VENTURA
MEXICO
PACIFIC OCEAN
SALTON SEA
LOS ANGELES AQUEDUCT
COLORADO RIVER AQUEDUCT
SAN DIEGO AQUEDUCT
Hayfield Res.
Lake Mathews
San Jacinto Regulating Res.
Fairmont Res.
Bouquet Res.
Morris Res.
Santiago Res.
Sutherland Res.
Cuyamaca Res.
El Capitan Res.
San Vicente Res.
Loveland Res.
Barrett Res.
Morena Lake
Lower Otay Res.
Sweetwater Res.
Lake Hodges
Lake Henshaw
Lake Elsinore
Big Bear Lake
Lake Arrowhead
DULZURA CONDUIT
ORANGE COUNTY FEEDER
PALOS VERDES FEEDER
UPPER FEEDER
EASTERN MUNICIPAL WATER DISTRICT
FALLBROOK PUBLIC UTILITY DISTRICT
COASTAL MUNICIPAL WATER DISTRICT
WEST BASIN MUNICIPAL WATER DISTRICT
ORANGE COUNTY MUNICIPAL WATER DISTRICT
FOOTHILL MUNICIPAL WATER DISTRICT
POMONA VALLEY MUNICIPAL WATER DISTRICT
CHINO BASIN MUNICIPAL WATER DISTRICT
PASADENA
GLENDALE
BURBANK
BEVERLY HILLS
SANTA MONICA
TORRANCE
COMPTON
LONG BEACH
ANAHEIM
FULLERTON
SANTA ANA
POMONA
ONTARIO
CORONA
RIVERSIDE
SAN BERNARDINO
REDLAND
PALM SPRINGS
OCEANSIDE
ESCONDIDO
SAN DIEGO
NATIONAL CITY
BARSTOW
Mojave
Palmdale
SAN FERNANDO
LAGUNA BEACH
Malibu Beach



IMPORTED WATER SUPPLIES OF SAN FRANCISCO BAY AREA

DIVISION OF WATER RESOURCES



IMPORTED WATER SUPPLIES OF LOS ANGELES AND SAN DIEGO METROPOLITAN AREAS

DIVISION OF WATER RESOURCES