THE NATION'S WATER RESOURCES 1975-2000

Volume 4: California Region

Second National Water Assessment by the U.S. Water Resources Council

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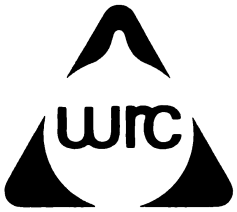

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FOREWORD

The Water Resources Planning Act of 1965 (Public Law 89-80) directs the U.S. Water Resources Council to maintain a continuing study of the Nation's water and related land resources and to prepare periodic assessments to determine the adequacy of these resources to meet present and future water requirements. In 1968, the Water Resources Council reported the results of its initial assessment. The Second National Water Assessment, a decade later, provides a comprehensive nationally consistent data base for the water resources of the United States. The results of the Second National Water Assessment were obtained by extensive coordination and collaboration in three phases.

Phase I: Nationwide Analysis

The Council member agencies researched, analyzed, and prepared estimates of current and projected water requirements and problems and the implications of the estimates for the future.

Phase II: Specific Problem Analysis

Regional sponsors, one for each of the 21 water resources regions, surveyed and analyzed State and regional viewpoints about (1) current and future water problems, (2) conflicts that may arise in meeting State and regional objectives, and (3) problems and conflicts needing resolution.

Phase III: National Problem Analysis

The Council conducted this final phase in three steps: (1) An evaluation of phases I and II, (2) an analysis that identified and evaluated the Nation's most serious water resources problems, and (3) the preparation of a final report entitled "The Nation's Water Resources--1975-2000."

The final report of the Second National Water Assessment consists of four separate volumes as described below. These volumes can assist Federal, State, local, and other program managers, the Administration, and the Congress in establishing and implementing water resources policies and programs.

Volume 1, Summary, gives an overview of the Nation's water supply, water use, and critical water problems for "1975," 1985, and 2000 and summarizes significant concerns.

Volume 2, Water Quantity, Quality, and Related Land Considerations, consists of one publication with five parts:

Part I, "Introduction," outlines the origin of the Second National Water Assessment, states its purpose and scope, explains the numerous documents that are part of the assessment, and ident-

ifies the individuals and agencies that contributed to the assessment.

II, "Water-Management Problem Profiles," identifies ten general water problem issues and their implications and potential consequences.

Part III, "Water Uses," focuses on the national perspectives regarding existing ("1975") and projected (1985 and 2000) requirements for water to meet offstream, instream, and flow-management needs. State-regional and Federal perspectives are compared.

Part IV, "Water Supply and Water Quality Considerations," analyzes the adequacy of fresh-water supplies (ground and surface) to meet existing and future requirements. It contains a national water budget; quantifies surface- and ground-water supplies, reservoir storage, and transfers of water within and between subregions; describes regional requirements and compares them to supplies; evaluates water quality conditions; and discusses the legal and institutional aspects of water allocation.

Part V, "Synopses of the Water Resources Regions," covers existing conditions and future requirements for each of the 21 water resources regions. Within each regional synopsis is a discussion of functional and location-specific water-related problems; regional recommendations regarding planning, research, data, and institutional aspects of solving regional water-related problems; a problem-issue matrix; and a comparative-analysis table.

Volume 3, Analytical Data, describes the methods and procedures used to collect, analyze, and describe the data used in the assessment. National summary data are included with explanatory notes. Volume 3 is supplemented by five separately published appendixes that contain data for the regions and subregions:

Appendix I, Social, Economic, and Environmental Data, contains the socioeconomic baseline ("1975") and growth projections (1985 and 2000) on which the water-supply and water-use projections are based. This appendix presents two sets of data. One set, the National Future, represents the Federal viewpoint; the other set, the State-Regional Future, represents the regional sponsor and/or State viewpoint.

Appendix II, Annual Water Supply and Use Analysis, contains baseline water-supply data and baseline and projected water withdrawal and water-consumption data used for the assessment. Also included are a water adequacy analysis, a natural flow analysis, and a critical-month analysis.

Appendix III, Monthly Water Supply and Use Analysis, contains

monthly details of the water-supply, water-withdawal, and water-consumption data contained in Appendix II and includes an analysis of monthly water adequacy.

Appendix IV, Dry-Year Conditions Water Supply and Use Analysis, contains both annual and monthly baseline and projected water-withdrawal and water-consumption data for dry conditions. Also, a dry conditions water-adequacy analysis is included.

Appendix V, Streamflow Conditions, contains detailed background information on the derivation of the baseline streamflow information. A description of streamflow gages used, correction factors applied, periods of record, and extreme flows of record, are given for each subregion. Also included is the State-Regional Future estimate of average streamflow conditions.

Volume 4, Water Resources Regional Reports, consists of separately published reports for each of the 21 regions. Synopses of these reports are given in Volume 2, Part V.

For compiling and analyzing water resources data, the Nation has been divided into 21 major water resources regions and further subdivided into 106 subregions. Eighteen of the regions are within the conterminous United States; the other three are Alaska, Hawaii, and the Caribbean area.

The 21 water resources regions are hydrologic areas that have either the drainage area of a major river, such as the Missouri Region, or the combined drainage areas of a series of rivers, such as the South Atlantic-Gulf Region, which includes a number of southeastern States that have rivers draining directly into the Atlantic Ocean and the Gulf of Mexico.

The 106 subregions, which are smaller drainage areas, were used exclusively in the Second National Water Assessment as basic data-collection units. Subregion data point up problems that are primarily basinwide in nature. Data aggregated from the subregions portray both regional and national conditions, and also show the wide contrasts in both regional and national water sources and uses.

The Second National Water Assessment and its data base constitute a major step in the identification and definition of water resources problems by the many State, regional, and Federal institutions involved. However, much of the information in this assessment is general and broad in scope; thus, its application should be viewed in that context, particularly in the area of water quality. Further, the information reflects areas of deficiencies in availability and reliability of data. For these reasons, State, regional, and Federal planners should view the information as indicative, and not the only source to be considered. When policy decisions are to be made, the effects at State, regional, and local levels should be carefully considered.

In a national study it is difficult to reflect completely the regional variations within the national aggregation. For example, several regional

reviewers did not agree with the national projections made for their regions. These disagreements can be largely attributed either to different assumptions by the regional reviewers or to lack of representation of the national data at the regional level. Therefore, any regional or State resources-management planning effort should consider the State-regional reports developed during phase II and summarized in Volume 4 as well as the nationally consistent data base and the other information presented in this assessment.

Additional years of information and experience show that considerable change has occurred since the first assessment was prepared in 1968. The population has not grown at the rate anticipated, and the projections of future water requirements for this second assessment are considerably lower than those made for the first assessment. Also, greater awareness of environmental values, water quality, ground-water overdraft, limitations of available water supplies, and energy concerns are having a dramatic effect on water-resources management. Conservation, reuse, recycling, and weather modification are considerations toward making better use of, or expanding, available supplies.

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Physiography

Description

The California Region includes the State of California and Klamath County, Oregon. The region has a medial length of approximately 780 miles and a width of 150 to 350 miles. Both the topography and the climate are characterized by variety, contrasts, and extremes. The region includes 164,839 square miles (105,497,000 acres)[1], of which 6,593 square miles are in Oregon. Figure 18-1 shows the boundaries of the region. Present land use is approximated on Figure 18-2.

The regional coastline is over 1,050 miles long and varies in character from the low, sandy beaches more characteristic of the southern part to the rock-girt headlands of Cape Mendocino, Monterey Peninsula, and the northern end of the region.

In topography and climate the large segment of the southern region that lies east of the Coast Range resembles that of the Great Basin. The two largest deserts of the United States, the Mojave and the Colorado, occupy most of this area. The greater part of this southern portion lacks proper soil characteristics and adequate water to be suitable for agriculture. But in the great Coachella and Imperial valleys, where most of the soil is alluvial and water is available for irrigation, the desert has been converted into one of the richest agricultural areas in the world. The Colorado River, which forms the California-Arizona boundary line, furnishes most of the water for this development and supplies significant amounts for municipal and industrial use throughout subregion 1806.

In the northern part of the region, in subregions 1801 and 1802, principal seaward-flowing streams such as the Klamath, Mad, Eel, Russian, and Sacramento Rivers drain an area producing 83 percent of the region's streamflow. Of the numerous streams that flow into the San Joaquin Valley from the Sierra Nevada, the Stanislaus, Tuolumne, Merced, San Joaquin, Kings, and Kern Rivers are the most important from a water supply standpoint. The long eastern slope of the sierra has only four important rivers, the Truckee, Carson, and Walker, which empty into lakes in Nevada, and the Owens, the longest of the four, which flows southward through a narrow, troughlike valley between the Sierra Nevada and the barren White-Inyo range.

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1 This is the sum of the areas of counties used to approximate the hydrologic area of the region. Land use and other socioeconomic data are related to this area. The drainage area within the hydrologic boundary is 176,510 square miles. In this region the county boundary approximation is the State of California plus Klamath County, Oregon.

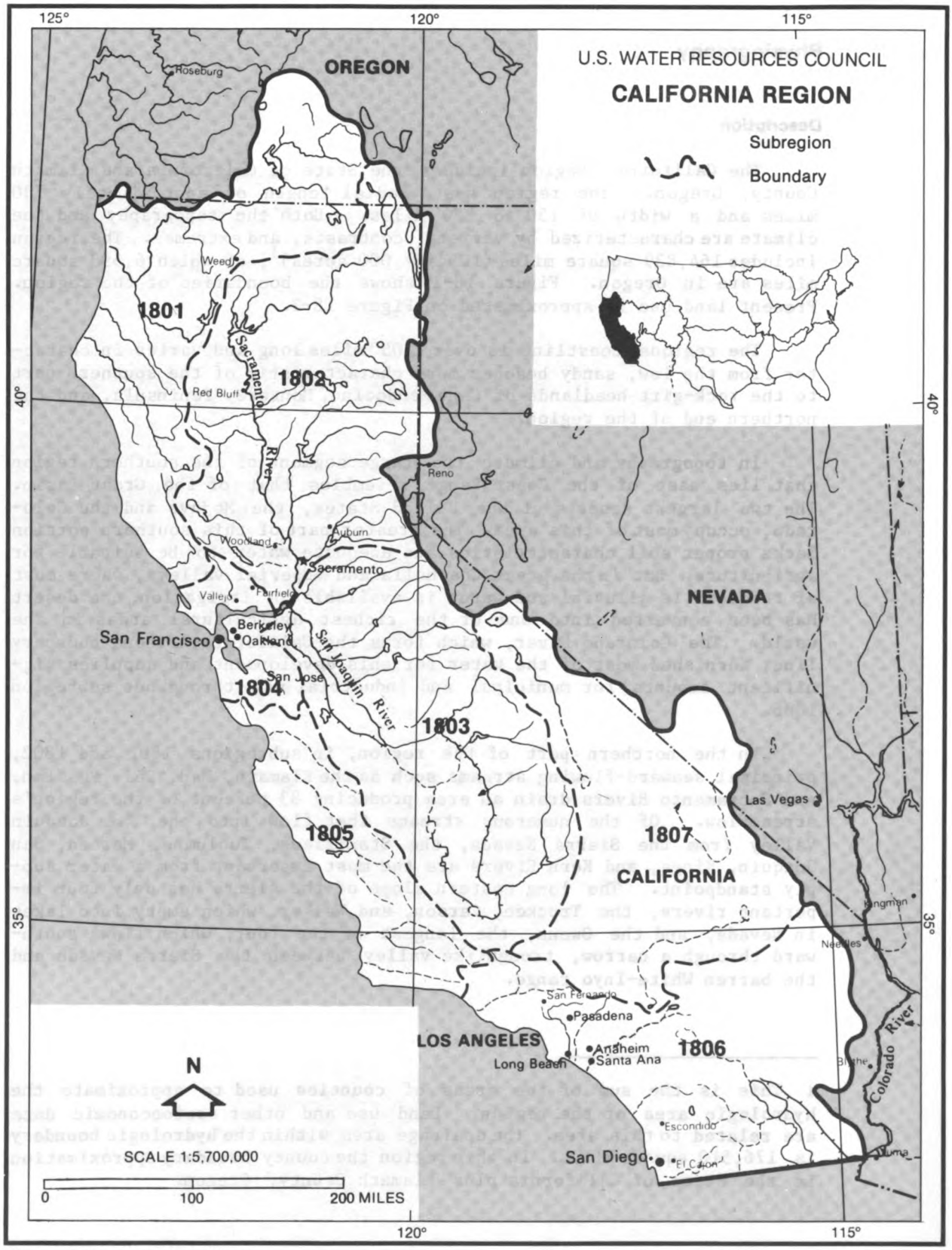

Figure 18-1. Region Map

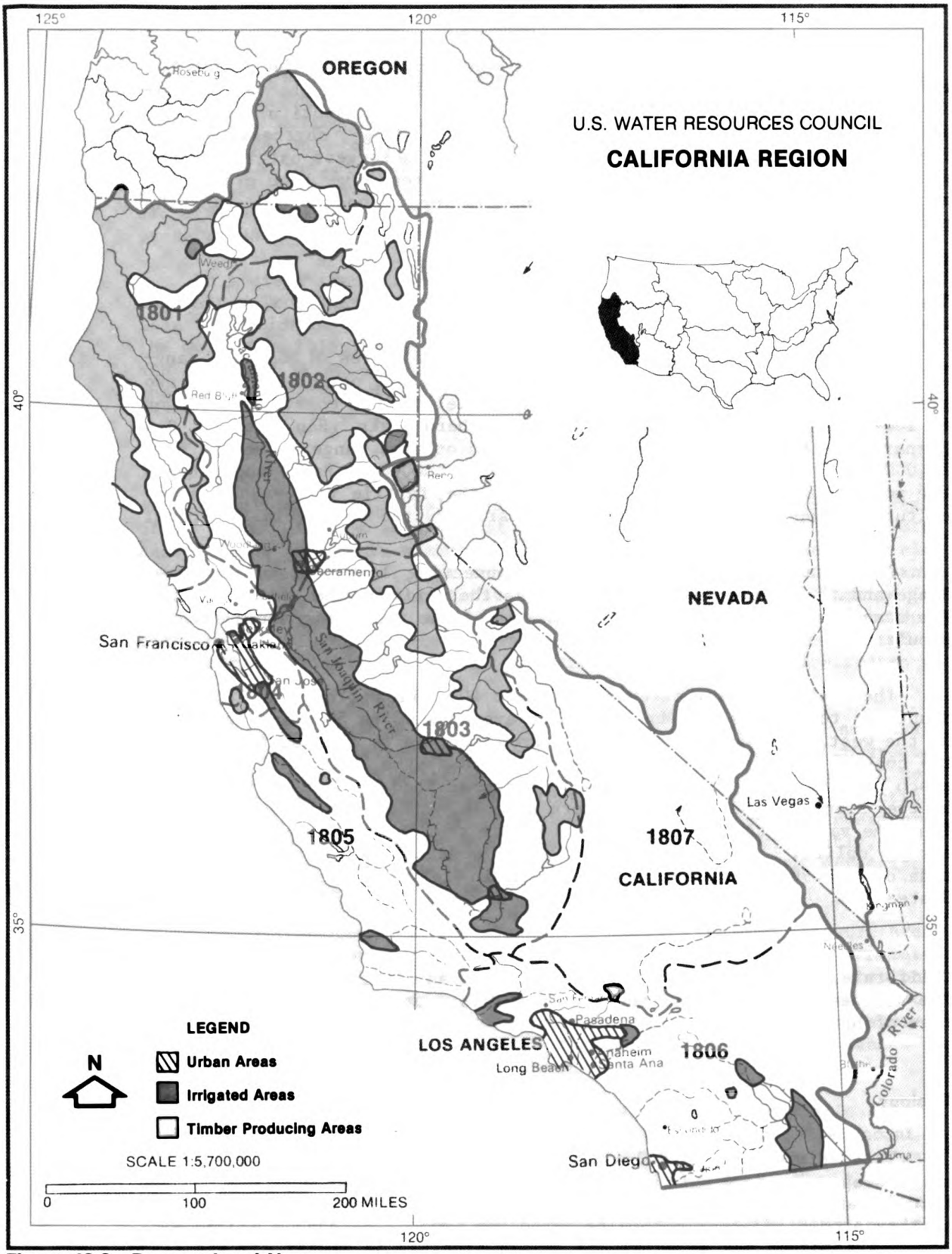

Figure 18-2. Present Land Use

Fresh-water lakes are rare in the southern parts of the region but exist in large numbers in the Sierra Nevada. Lake Tahoe, on the California-Nevada boundary line, is considered one of the most beautiful bodies of water in the world. Clear Lake in the Coast Range, northeast of San Francisco, covers about 84 square miles and is the largest natural fresh-water lake in the region. Large artificial lakes have been created in many sections for water supply and conservation, flood control, and the generation of hydroelectric power.

Topography

The California Region is characterized by a series of mountain ranges and intervening valleys. The Coast Range, part of the region's two great mountain systems, runs roughly parallel to the coast from Oregon to lower California. More than four southern peaks (San Antonio, San Bernardino, San Gorgonio, San Jacinto, and others) range in height from 10,000 to 11,600 feet. Within the spurs of the Coast Range and between the mountains and the sea lie several of the fertile valleys and agricultural lands of the region particularly suited to specialty crops.

The Tehachapi Mountains, a short connecting link between the Coast Range and the Sierra Nevada, mark the northern rim of the Mojave Desert. The same range forms the southern boundary of the rich agricultural region popularly called the Central Valley.

The Central Valley extends northward 400 miles from the Tehachapi Mountains to the Cascade Mountains and averages 40 to 50 miles in width. On the west, the valley is shut off from the sea by the Coast Range and the coastal plain except for its outlet through the delta and San Francisco Bay; on the east the valley is circumscribed throughout its length by the Sierra Nevada. The western slope of the sierra rises gradually from the valley to the ridge, in contrast to the eastern side with its abrupt uplift. Mount Whitney, near the southern end, reaches an altitude of 14,496 feet, the highest mountain in the conterminous United States.

North of the Central Valley, the Cascade Mountains jut down into California, culminating at Mount Shasta, with an altitude of 14,161 feet. The northeastern corner of the region consists of a large volcanic plateau of broken lava beds.

Geology

The sediment which fills the hugh trough of the Central Valley is miles deep. Some of this sediment is marine, deposited when the valley formed part of a shallow sea; some is continental, deposited by rivers as they eroded adjacent mountains.

Beneath what today is the Sierra Nevada, massive invasions of molten granite rock contorted the layered rocks above them, then cooled and solidified. During the period that followed, rivers and glaciers exhumed this granite and today it lies exposed throughout much of the Sierra Nevada. In the process of erosion, the rivers carried mud, sand, and gravel downstream and deposited the sediment in a sea to the west. These sediments have since folded and uplifted and now lie exposed in the present Coast Range.

In ancient times, the Gulf of California extended northward through the Salton Trough and inundated both the Imperial and Coachella valleys. Then the Colorado River, extending its delta, built a land bridge across the Gulf. The inland body of water evaporated, exposing the Salton Trough, and the land bridge remains as the southern part of the Imperial Valley and the adjoining Mexicali Valley in Mexico.

Climate

The climate of the California Region is essentially mild. Instead of the usual four seasons, most of the region has two--a wet winter season and a dry, warm summer season. The coast has a marine-type climate with warm winters, cool summers, little daily and seasonal range in temperature, and high relative humidity. Inland, as the marine influence lessens, the climate becomes more continental with warmer summers, colder winters, a greater range in daily and seasonal temperatures, and lower humidity. The change from marine to continental climates is determined by the topography.

Although the range in latitude is great, latitude does not exert the influence on climate that it does elsewhere. Topography is of greater importance, causing isotherms to follow topographic contours and move in a north-south direction rather than the usual east-west direction. Because of the abrupt changes in topography, the range in temperature, wind velocities, and amount of precipitation can vary greatly, often within a few miles. The Sierra Nevada and Cascade Range effectively block the movement of air masses from the east.

The Pacific Ocean and the movement of the Pacific high pressure areas also affect the climate. The ocean's influence makes summer and winter temperatures along the coast more equable. The Pacific high stationed offshore moves southward in the winter; cold Canadian air and winter storms can then enter the northern part of the region. In the summer, the high moves northward, deflecting the cool air masses from Canada to the north of the region.

Winter storms from the west bring precipitation which falls as rain at lower elevations and is deposited as snow in the mountains. The amount of precipitation increases from south to north and is heaviest on the west side of the mountains up to elevations of about 6,000 feet. When the snowpack melts in the spring, the runoff is heaviest in streams on the west side of the mountains. In the southernmost portion, heavy rains in early fall are the result of cyclonic storms occurring to the southeast.

Most of the region's inhabitants live in the zones classified as Mediterranean, where winters are mild and wet, and summers are warm and dry. The coast has a marine or Mediterranean-type climate with warm winters, cool summers, little daily and seasonal range in temperature, and high relative humidity. Inland, as the marine influence lessens, the climate becomes more continental with warmer summers, colder winters, greater range in daily and seasonal temperatures, and lower humidity. The change from Mediterranean to continental climates is determined by the topography.

Thunderstorms occur in summer in the interior and in higher mountains and desert areas. Where precipitation is very light, lightning can cause destructive forest fires. Thunderstorms on the coast are weak and infrequent and can occur in any month. Tornadoes occur in the region on an average of about once a year. Although flooding can occur at any time of the year, the worst floods usually occur in winter as a result of prolonged storms accompanied by high temperatures which melt the snowpack. Small drainages are also subject to flooding from localized, short-duration, convective-type storms. Occasionally, persistently dry weather or droughts occur during the winter season.

Most crops grown anywhere in the United States can be grown in the California Region. In addition, because of the favorable climate, many crops are grown in the California Region which cannot be grown commercially elsewhere. Although distribution of the rainfall is generally unfavorable for dryland crop production, with irrigation the agricultural lands produce abundant crops.

Topography controls the amounts and distribution of winter precipitation. In large portions of the windward slopes of the Coast Ranges in northern California and Monterey County, in the Cascade-Sierra Nevada, particularly in northern California, and in much of the northern mountain region, mean annual precipitation is 50 inches or more. Annual totals decrease to less than 20 inches in the Sacramento Valley floor, less than 10 inches over much of the San Joaquin Valley, and less than five inches in the southeastern deserts. Mean annual precipitation ranges from 120 inches in the Coast Range to less than two inches in parts of Death Valley. Most of the precipitation falls during the winter season which is five months (November to March) in the southern part, and seven months (October to April) in the northern part of the region.

Snow in moderate amounts falls in the sierra at altitudes as low as 2,000 feet, but does not remain long below elevations of 4,000 feet. In the middle sierra, the zone of heavy snowfall is from 7,000 to 8,000 feet. Snowfall at Tamarack in Alpine County is about 450 inches annually.

Temperatures varying all the way from 134°F to -45°F have been reported in the region. Based on long continued periods of heat, Death Valley is the hottest place in the world. Along the coast the range in temperature from day to night and from winter to summer is very small. Daily and seasonal ranges in temperature inland increase with distance from the coast.

The frost-free period ranges from 365 days in the extreme south coast to about 260 days in the north coast and Central Valley. In the northeastern interior valleys it averages 100 to 120 days, and in the Imperial Valley, 282 to 322 days.

Winds from the northwest prevail along the coast, due largely to the presence of the semipermanent Pacific high. Elsewhere, surface winds are influenced by local topography, mountain barriers, atmosphere pressure gradients, and proximity to the ocean.

The comparatively high relative humidities on the coast generally increase from south to north, and from winter to summer. Humidities on the north coast are high during the entire year. The interior lowland areas west of the Cascade-Sierra Nevada have very low humidity in summer and high humidity in winter. East of the Cascade-Sierra Nevada ranges, low humidities are common in summer.

People and the Resources

An analysis of current and future activities is basic to any identification of water and related land resources in the California Region. The foundation for this analysis is the collection of estimates and projections of the regional population, economy, land use, water resources availability and use, and other related factors. These and other estimates and projections were made for the California Region and are explained elsewhere in the national assessment report. These data for the region and subregions are referred to as the National Future (NF). Where projected into the future, these data are based on allocation to the region of a share of national production and are consistent with national projections. State and regional representatives were encouraged to prepare alternative estimates, called the State/Regional Future (SRF), where they felt NF data did not reflect their view of future development and resources use in the region. All information presented in this section is based on NF data unless specifically identified as SRF data. A comparison and discussion of the differences between NF and SRF data and implications of the variations is included at the end of this section.

Population

European settlement of California began in the eighteenth century with the establishment of Spanish missions and garrisons. During the 1830's and 1840's, when California was part of Mexico, American and European settlers began arriving at a slowly increasing rate. Two events of 1848 increased the settlement sharply--the discovery of gold near Sutter's sawmill on January 24, and Mexico's cession of California to the United States by the Treaty of Guadalupe Hidalgo on February 2. By 1849 the rush for gold had touched off a westward migration of people who came to mine or to engage in supportive commercial and agricultural activities. Settlement of the Oregon portion of the region started in the 1840's. Growth there was much slower than in California.

The population of the region exceeded 21 million in 1975 and is projected to be about 27 million by the year 2000. More than half, about 12 million people, presently reside in subregion 1806, which contains the Los Angeles and San Diego metropolitan areas. Subregion 1804, which includes the San Francisco area, is expected to have the largest rate of population increase by the year 2000. Population growth rates are expected to generally exceed the national average, and to increase the percentage of the total United States population living in the region from 9.8 percent in 1975 to 10.1 percent in the year 2000.

Economy

American development of the region in the 1880's and 1900's has been characterized by four successive periods of activity: (1) cattle and sheep ranching, widely prevalant until the 1880's; (2) grain farming, especially important from the 1870's to 1890's; (3) irrigated agriculture, principally since 1900; and (4) industrialization and urbanization, primarily since World War I, with a dramatic expansion since 1940. All portions of the region have experienced all four phases, and all types of activity are expected to continue in varying degrees into the future.

The American stage of economic development began at the end of the Mexican War in 1848. California's spectacular Gold Rush and the economic boom which accompanied it was the basis for the expansion and development of natural resources in the northern portion of the region. San Francisco quickly became a major trade and financial center maintaining that status to the present.

Southern portions of the region underwent more subtle changes during this period. Small rural communities sprang up as agriculture passed from the ranchero phase to an intensive agriculture involving cotton, citrus, and vegetable crop production. This agricultural development provided the area with an economic base which supported the 1900 to 1920 in-migration.

With the advent of World War II, the California Region became heavily industrialized. Defense-oriented industries were stimulated by the war, especially aircraft and shipbuilding activities. Defense and the related aerospace industries have continued to be significant to the region's economy. Since 1962 the trend in these industries has been away from the production of aircraft and toward the production of electronics and instrumentation. Attempts have been made to reduce the region's heavy dependence upon defense-related activities and to diversify the industrial base to include more nondefense activities. There has been some success in this regard with strong growth in the trade, transportation, finance, services, and governmental sectors of the economy.

Total employment in the California Region during 1975 averaged 8,828,000. This represented a gain of two million over the 1964 average. The 1975 total earnings were over $115 billion. Major earnings were in the "other" category with about 75 percent of the total. The "other" category includes wholesale and retail trade, government, services, transportation, communities, public utilities, contract construction, finance, insurance, and real estate. Approximate shares of earnings for remaining categories were: agriculture (3 percent), manufacturing (22 percent), and mining (less than 1 percent). Though they accounted for only 3 percent of total earnings in California, the agricultural earnings are 10 percent of the national total. Although agricultural earnings make up larger shares of total earnings in other regions, no State has higher agricultural earnings than California.

Earnings are expected to increase to over $279 billion by the year 2000 and to reflect a slightly changed distribution among the several categories. The "other" category is expected to increase its share to $221 billion, or about 79 percent of the total earnings.

Table 18-1.--California Region earnings -- 1975, 1985, 2000
(million 1975 dollars)

Earnings sector	1975	1985	2000
Manufacturing	25,141	35,251	53,916
Agriculture	3,456	3,447	4,055
Mining	483	522	578
Other	86,312	128,051	220,892
Total	115,392	167,271	279,441

Manufacturing earnings are projected to more than double to almost $54 billion, 19 percent of the year 2000 total earnings. Agriculture and mining earnings in the year 2000 are estimated to be respectively $4,055 million (1.5 percent) and $578 million (less than 1 percent).

Natural Resources

The California Region has an abundance of natural resources including land, minerals, and water. Water resources are discussed separately in a later section.

From an agricultural standpoint, the land resources of the California Region include some of the best and some of the poorest in the Nation. Lands suitable for the production of harvested crops, livestock, and timber play a prominent part in the economic life of the region. Scenic and recreational resources--beaches, forests, lakes, mountains, deserts, and wildlife--are outstanding. The deserts and barren mountain tops, although relatively unproductive, provide some of the most spectacular scenery and some of the most interesting environmental aspects of the region.

Table 18-2.--California Region surface area and 1975 land use

Surface area or land use type	1,000 acres	Percentage of total surface area
Surface area		
Total	105,497	100.0
Water	1,607	1.5
Land	103,890	98.5
Land use		
Cropland	10,885	10.3
Pasture and range	28,021	26.6
Forest and woodland	43,227	41.0
Other agricuture	1,218	1.2
Urban	3,328	3.1
Other	17,211	16.3

The comparative amount of land used for various purposes is shown in Table 18-2. About 3.3 million acres, or 3.2 percent of the total area in the region, are presently classified as urban. Agricultural uses for harvested crops occupy 9.0 million acres, and there are about 1.9 million acres of other nonharvested cropland. Total cropland is projected to decrease by about 5 percent by the year 2000, while harvested cropland is expected to decrease only slightly.

Table 18-3.--Projected changes in cropland and irrigated farmland in the California Region -- 1975, 1985, 2000

Land category	1975	1985	2000
Total cropland ----------	10,885	10,633	10,355
Cropland and harvested ----------	8,979	9,243	8,947
Irrigated farmland ----------	8,729	9,342	10,079

Much of the land is used for two or more purposes, often at the same time. For example, lands devoted primarily to other purposes are utilized by wildlife while only a small portion is used exclusively for wildlife. Similarly, livestock graze on lands being used for timber production, for wilderness, for recreation, and many other purposes.

Minerals

The California Region maintains a role as one of the chief contributors to the Nation's mineral resource base. Excluding petroleum, the region is the leader in tonnage and value received for many mineral commodities.

The region's mineral fuel resources are primarily oil and gas produced in the five adjoining California counties of Los Angeles, Kern, Ventura, Orange, and Santa Barbara. Natural gas is found in over 26 California counties, but nearly half the annual production is from fields in Kern, Los Angeles, and Ventura Counties.

The region is a principal domestic producer of tungsten and mercury and contains the free world's largest known concentration of rare-earth minerals. Copper, silver, lead, zinc, molybdenum and the platinum-group metals are mined chiefly as byproducts or co-products with other minerals.

Nonmetallic mineral production is also high. The California Region produces annually about 90 percent of the world's boron minerals and more than half of the domestic output of gypsum, iodine, sodium compounds, and sulfur ore. It also is the world's principal source of diatomite and produces about 80 percent of the amount of that mineral produced in the United States. California is the principal producing State for asbestos, cement, sand, and gravel. Large quantities of lithium minerals and compounds, and wollastonite are also produced. Barite, clays, feldspar, gemstones, mica, pumice, salt, talc, soapstone, and pyrophyllite deposits are mined at various locations, and bromine, calcium chloride, carbon dioxide, fluorspar, magnesite, perlite, and potassium salts are produced in some quantity. Four plants process sea water or salt works residues to produce annually more than $18 million worth of magnesium oxide and other magnesium compounds.

Agriculture

Livestock was one of the first major industries in the region and has remained the leading agricultural commodity in terms of receipts. Originally, most of the rich bottomlands of the great valleys were grass-covered and ranches were established in all parts of the region. Much of this land was later converted to croplands, and pastureland was used for grazing and hay production. California's prominence relates to the ideal conditions such as good weather, availability of prime land, adaptability of crops, and extensively developed surface-water and ground-water irrigation supplies, all of which have advanced agriculture's position in the economy.

Nearly three-fourths of the region's cultivated lands are in the Sacramento and San Joaquin Valleys within subregions 1802 and 1803. These two valleys contain all of the region's rice land and almost all of the acres devoted to cotton. Cotton, grapes, hay, citrus fruits, and tomatoes are the leading crops. California leads the Nation in the production of 42 other crops, most of which are grown in these valleys.

The region's coastal valleys contain more than 1.6 million acres of cultivated land. Because of the very favorable conditions in these valleys, a wide variety of climatically adapted crops are grown. Most of the Nation's artichokes, brussel sprouts, avocados, spinach, other vegetables, and flower seeds are produced in these areas.

The interior desert valleys of Imperial, Antelope, and Coachella contain more than 700 acres of cultivated lands. Winter truck crops from these valleys account for a large share of the region's seasonal supply. Other principal crops of these areas include grapefruit, lemons, dates, and alfalfa.

The Klamath Basin in southern Oregon and northern California is another important agricultural area. The most important farm crops in this area are potatoes and malting barley.

The remaining cultivated lands occur in scattered mountain plateaus and valleys. They represent a relatively small part of the region's cultivated land, but produce forage and hay crops that are extremely important to the livestock industry in those localities.

The pasturelands, some of which are cultivated, planted, and often irrigated, are very productive and are intensively grazed. Agricultural lands are also important for wildlife habitat, as watersheds, and for limited recreation use.

Energy

Rapid growth and industrialization of the California Region have directly caused the rapid development of its natural resources to supply energy. Energy resources that have been controlled and put to use in the region include hydroelectric power, petroleum, natural gas, geothermal energy, and nuclear energy.

Following the displacement of coal by petroleum and hydroelectric power at the beginning of the century, the only major development in the structure of energy consumption in California before World War II was the shift from manufactured to natural gas. The major developments in the postwar period which have significantly altered the basic pattern of energy supply in the region are: (1) the construction of natural gas pipelines from Canada and the Southwest; (2) the shift to net imports of petroleum products; and (3) the transition to primary reliance on thermal electric generating plants that ended a half century of preeminence of hydroelectric power.

The amount of steam electric and hydroelectric power generated in the region during 1975 was estimated at over 120,000 gWh. Conventional hydroelectric facilities currently produce about 36,000 gWh of electricity. About 71,000 gWh or 84 percent of the total steam electric generation, currently uses once-through cooling facilities located on ocean and estuarine waters.

Projections for the year 2000 indicate over 343,000 gWh will be produced, of which about 32,000 gWh will be by 82 conventional hydroelectric facilities, about 220,000 gWh by nuclear plants, and about 92,000 gWh by fossil fuel sources. These values should be regarded as approximations because the regulatory and political environment will determine the mix of future nuclear and fossil generation. At present, this issue is unresolved and conjectural.

Table 18-4 shows the 1975 and expected future distribution of electric power production between fossil- and nuclear-fueled plants.

Table 18-4.--California Region electric power generation--1975, 1985, 2000 (gigawatt-hours)

Fuel source	1975	1985	2000
Fossil	78,693	114,712	91,704
Nuclear	6,070	83,775	219,929
Conventional hydropower	36,038	28,545	32,154
Total generation	120,801	227,032	343,787

Navigation

The California Region has a variety of commercial and recreational navigation features along its ocean shoreline, its natural bays and estuaries, and on the Sacramento-San Joaquin river system. The region is fortunate in having a large natural bay and a major river system that provide access to the rich heartland of the region. The region's two major population centers, the San Francisco and Los Angeles metropolitan areas, have developed commercial navigation facilities. San Francisco Bay provides both a harbor and a gateway to the Central Valley which initiated the growth of San Francisco as a center of population and commerce. As the Los Angeles metropolitan area developed, continuing growth required facilities for commercial navigation, leading to the construction of one of the world's largest manmade harbors on the open coast in the lee of a headland. Navigation features are shown on Figure 18-3.

The vast majority of the region's waterborne commerce is handled through the port complexes in San Francisco Bay and Los Angeles-Long Beach harbors. Other facilities in the region handling significant waterborne commmerce are offshore petroleum terminals in subregions 1805 and 1806; the inland ports in subregions 1802 and 1803; San Diego Harbor in subregion 1806; Humboldt and Crescent City Harbors in subregion 1801; and Port Hueneme in subregion 1806. Minor amounts of waterborne commerce also move through other coastal ports including Noyo Habor, Port San Luis, Santa Barbara Harbor, and Newport Bay Harbor. Most of these ports are also used by recreational boats.

Every commodity group is represented in the region's waterborne commerce. Petroleum and petroleum products constitute the major share of the total waterborne commerce with metals, automobiles, chemicals, lumber, and agricultural products accounting for most of the remainder.

The recreational fleet is berthed in marinas located within deep-draft navigation projects; in Federal small-craft navigation projects; and in numerous private marinas located along the Sacramento-San Joaquin river system, the Colorado River, within San Francisco Bay, and in coastal facilities. The recreational fleet is heavily concentrated in the San Francisco Bay and Los Angeles metropolitan areas. Public and private interests have constructed facilities on the navigable rivers, in the bays, and at coastal harbors and other protected coastal sites for the launching of trailered recreational boats.

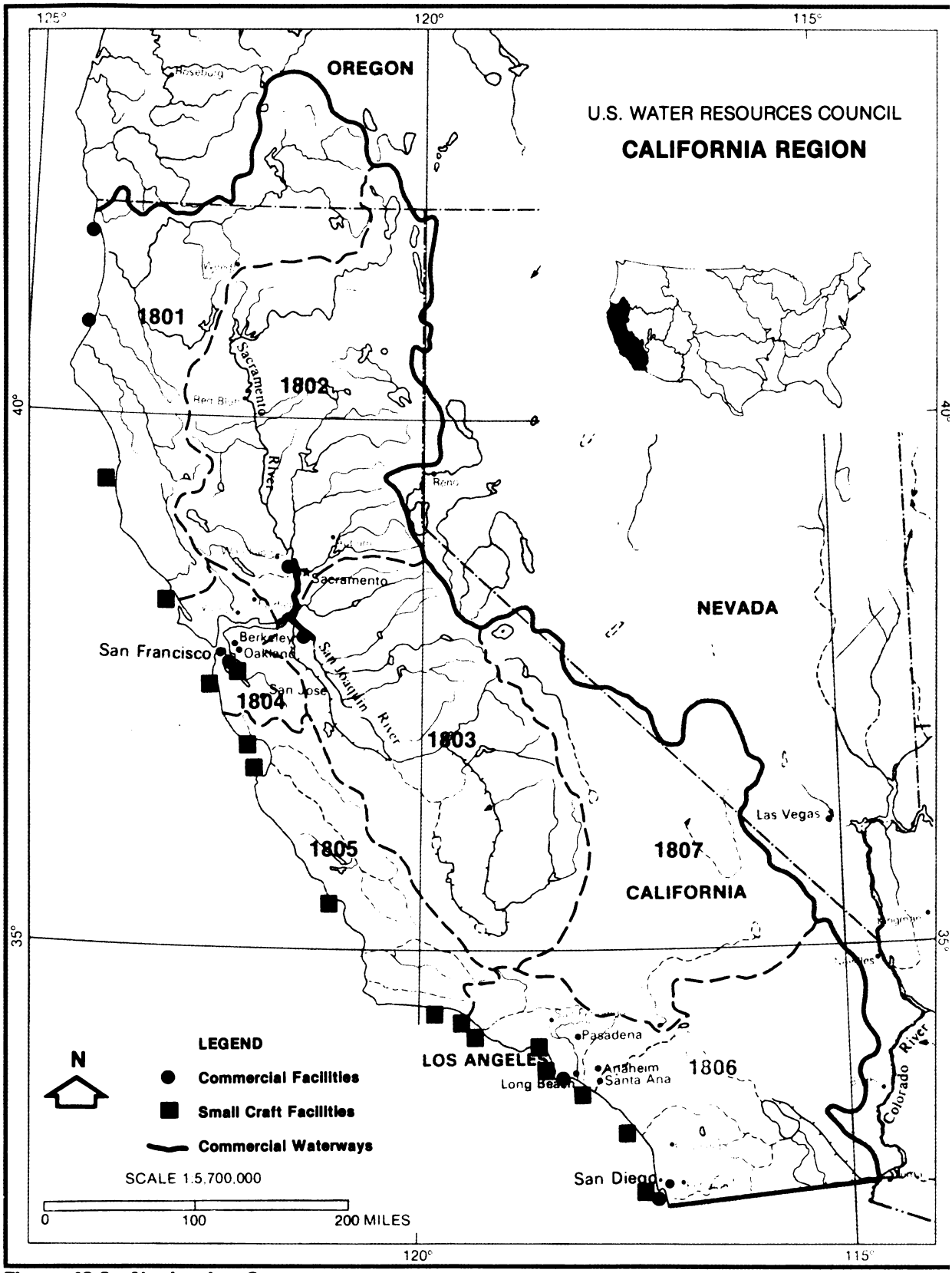

Figure 18-3. Navigation System

Environment

The environmental resources of the California Region are extensive and diverse. They include fish and wildlife, scenic and other natural areas, and historical sites of various types. The mild climate and accessibility of recreational resources encourage high use of these resources.

There are several well known national parks in the region, including Lassen Volcanic National Park (163 square miles), Yosemite National Park (1,184 square miles), Kings Canyon National Park (700 square miles), and Sequoia National Park (600 square miles). Other attractions are the Point Reyes National Seashore and the Redwood National Park which lie along the North Coast. There are over 20 national forests widely scattered throughout the region which cover a total of over 25 million acres. National monuments include such diverse and widely separated scenic spots as the rough Modoc lava beds in the northeastern corner of the State; the majestic grove of California redwoods (Sequoia sempervirens) known as Muir Woods, in Marin County; and Death Valley, weird, desolate, fantastically colored and eroded, in the Mojave Desert. Other scenic monuments include Joshua Tree, Pinnacles, Devil's Postpile, and Channel Islands. In addition to the parks, monuments, and forest reserves of the Federal Government, the State of California maintains its own park system of over 250 parks, beaches, and monuments, designed chiefly for conservation and recreation.

Historical sites in the region include those of archeological interest: trails, missions and other colonial buildings, and mining sites from the Spanish, Mexican, and early American periods and other more recent sites. Eastward in the foothills of the sierra are a number of old gold-mining towns.

Prior to modern development, a large variety of wildlife lived and prospered in the California Region. Chronicles of early explorers and trappers abound with references to these animals.

While some wildlife forms have disappeared, others have been introduced. Introduced fish species have provided millions of angler-days of sport fishing annually. These species include striped bass, American shad, brown trout, brook trout, lake trout and such warm-water game fish as largemouth bass, crappies, bluegill and other sunfishes, white and channel catfishes, bullheads, and carp.

Marine areas are attractive to many people and these areas receive high recreational use. Salt-water fishing is very popular and a wide variety of species are taken by shore (surf, rock, jetty), pier, skin, SCUBA and boat fishermen. Some of the more common fishes taken include white croaker, surfperch, rockfish, flatfish, top and jack smelt, queen fish, cabezon, kelp and sand bass, and opaleye. Albacore, bonito, salmon, and striped bass are caught in season by inshore anglers. Clamming, abalone picking, and dip netting for smelt are also quite popular.

The Heritage Conservation and Recreation Service has identified 76 areas as critical for recreation purposes; the National Park Service has identified 106 areas as critical for educational, historical, and archeological values; and the Fish and Wildlife Service has designated 3,040 miles of streams as nationally significant for fish and wildlife. Twenty-seven areas have been designated as wilderness areas and more will probably be added to the system by the year 2000. Existing wilderness, wild river, and primitive areas are shown in Figure 18-4.

The region provides the habitat for 20 endangered species, some of which place very definite constraints on developmental activities. Critical fish and wildlife habitats outside already protected wilderness and primitive areas are also shown in Figure 18-4.

About 81 percent of the water-related recreation in 1975 was in the San Francisco and southern California areas. Demand for water-related recreation is expected to increase by the year 2000.

About 0.8 million acres of water surface were available for recreation in 1975. More than half of this area is in the upper Sacramento River Basin and in southern California. Fresh-water surface area needed for recreation is projected to increase more than 50 percent by the year 2000. About 1.2 million acres will be needed in the region at the time. However, the need for additional water surface area will not be met in the year 2000, because it is projected that there can not be an additional 400,000 acres of water surface.

Water

All the data collected and projected in the preparation of this report are for the purpose of assessing the region's water situation, as well as current and potential problems related to water and its use. The water withdrawals and consumption data given are for average conditions.

Water is one of the California Region's most valuable natural resources, and effective use of the water supply is a primary consideration. The California Region has an annual mean natural streamflow without ground-water mining of 68,050 mgd, (76.4 million acre feet (AF) per year). The total available flow including imports from the Colorado, but subtracting pond and reservoir evaporation and not counting ground-water mining, is 71,819 mgd (80,580,000 AF). The precipitation that provides this supply is distributed so unevenly and varies so widely, both geographically and with time, that maldistribution of supply and demand creates problems.

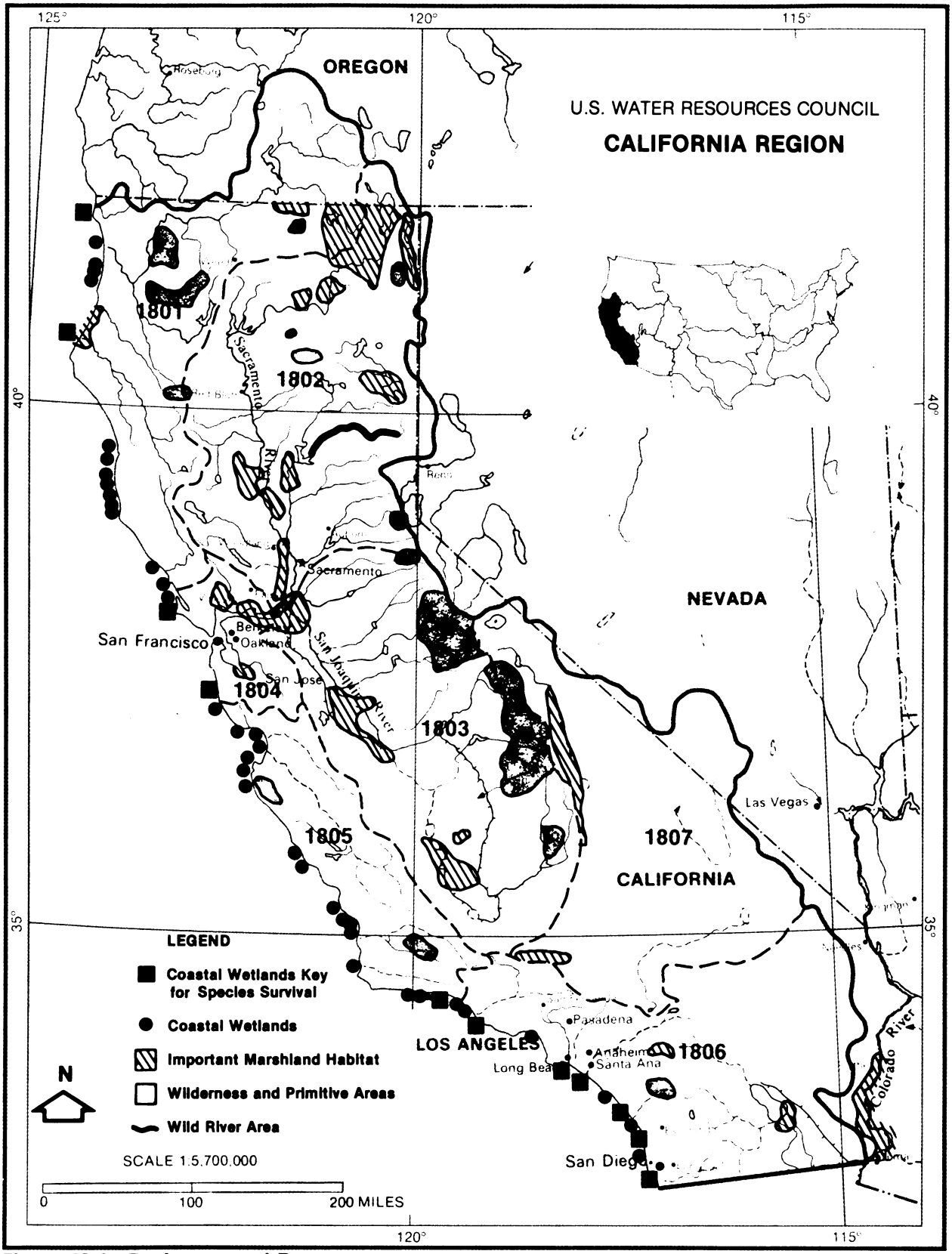

Figure 18-4. Environmental Resources

Surface Flows

The principal accretion of water to streams in the region occurs in the highland areas where precipitation generally is greatest. Many streams emerge from the mountains into broad alluvial valleys, where a part of the flow infiltrates or percolates into the underlying soils.

The principal rivers of the California Region flow into the Pacific Ocean through Coast Range valleys and San Francisco Bay. These rivers include: the Mad, Russian, Klamath, and Eel in subregion 1801; the Sacramento and San Joaquin in subregion 1802 and 1803; the Pajaro, Salinas, Santa Maria, and Santa Ynez in subregion 1805; and the Santa Clara, Los Angeles, San Gabriel, and Santa Ana in subregion 1806. The many east-side tributaries of the Sacramento and San Joaquin Rivers collect a vast quantity of water from the gently rising western slopes of the Sierra Nevada. The abrupt eastern slopes, however, have relatively little runoff. The only significant streams are the Truckee River draining into Nevada from subregion 1802, the Carson and Walker Rivers draining into Nevada from subregion 1807, and the Owens River draining into Owens Lake in subregion 1807. Mean annual outflow from each subregion is shown in Figure 18-5.[1]

The areal distribution of mean annual runoff in the region is an important factor in availability. Of equal importance, however, is the time distribution of runoff. Annual runoff in the California Region has varied greatly over the years and with the exception of 1938, northern and southern parts of the region have not experienced their wet or dry periods concurrently in recent years.

The monthly, or within-year, distribution of streamflow is also of importance. Most of the precipitation occurs in the winter whereas the greatest water demand is in the summer.

The response of runoff to precipitation varies throughout the region. Four general types of response are easily recognizable. In low-altitude areas underlain by rocks of low permeability, such as the Coast Ranges, winter storm runoff is intense but poorly sustained and streamflow recedes to extremely low values by late May. In areas of low permeability but high altitude, such as the Sierra Nevada, the mountains acquire a snowpack which melts in spring and early summer, sustaining runoff to the extent that extremely low values do not generally occur until about late July. In areas underlain by highly permeable rock, such as the Cascade Mountains and Modoc Plateau, effluent seepage often maintains the runoff at more constant levels during the entire year. In arid areas, such as the deserts of southeastern California, runoff is generally ephemeral and streams are usually dry within a few days after rains cease.

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[1] A very large surface water source, 4.9 million acre-feet annually (4438 mgd), which has been omitted from Figure 18-5 is the supply imported from the Colorado River, which forms part of the eastern boundary of the region. Transfers between the subregions which also are very large are not shown. See Volume 3, analytical data.

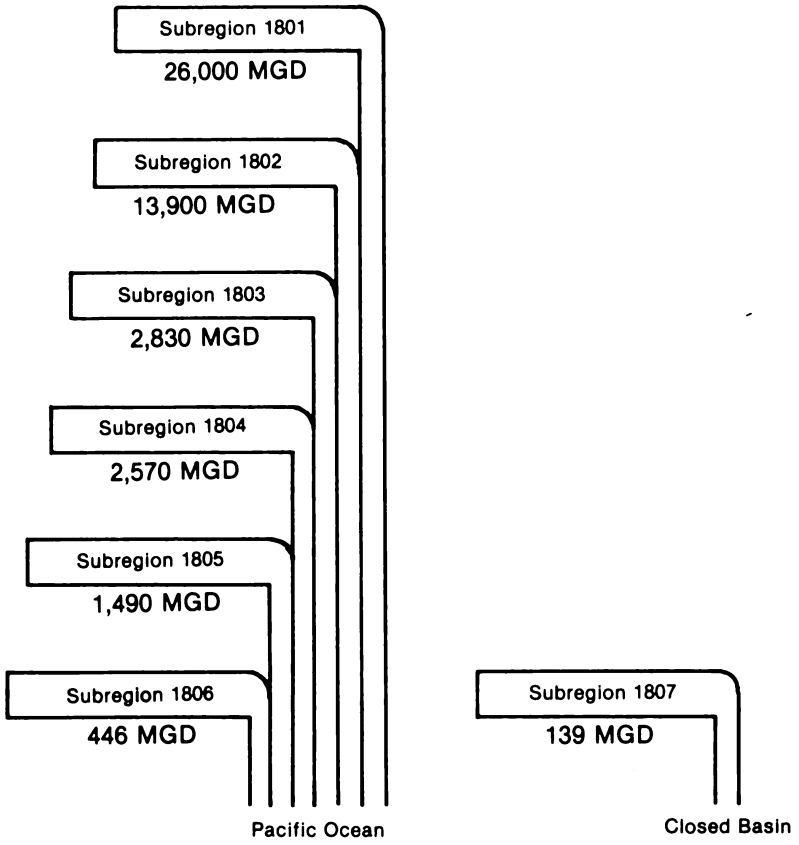

Figure 18-5. Streamflow*

Water storage has been fundamental to effective use of surface-water resources, and development has been extensive, both in number and size of reservoirs constructed and the total storage volumes created. Reservoir storage in and out of the region has made possible a great increase in the beneficial use of surface water for irrigation, municipal and industrial water supplies, and hydroelectric power generation, and has provided for pollution control, navigation, flood control, fish and wildlife enhancement, and recreation. As a prime example, reference is made to the extremely large carryover storage supplies and long-term safe yield of the Colorado River reservoir which served the State of California very effectively during the critical drought year of 1977 and in prior years.

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* See footnote, previous page.

Annual flood damages currently amount to $417 million. About $259 million, or 62 percent of the total, is estimated to occur in urban areas. By 2000, flood damages are expected to increase by about 16 percent. Annual agricultural flood damages total about $101 million and are expected to increase to about $115 million.

Ground Water

Most of the California Region's ground water occurs in alluvial material deposited by existing streams. These alluvial materials fill more than 250 valley areas of the region.

Ground-water basins underlie about 40 percent of the region's area. In the northeast corner of the State, northeast of San Francisco Bay, and along the east side of the Central Valley, there are extensive areas made up of a wide variety of volcanic materials, much of which are permeable and able to store ground water and transmit it to wells. Volcanics also occur in the northern portion of Owens Valley, in the desert areas, and along coastal Ventura and Los Angeles Counties; however, their potential for ground-water development is not clearly defined.

In a few areas in the higher mountains, glacial moraines are sufficiently permeable to provide usable supplies of ground water. In a few coastal areas, thin marine terraces provide usable supplies of ground water.

In much of the upland areas of the State, fractures and other spaces in harder rock formations yield small quantities of water sufficient for domestic supply for an individual home or for stock water. Where the harder rock formations are deeply weathered, as in San Diego County, they frequently provide supplies of ground water for domestic use. Availability of water in such formations can vary widely between areas, even if only a few feet apart.

Some of the deeper sediments in California's ground-water basins, especially in the Central Valley, were deposited in sea water. These marine sediments often contain salt water, in some areas 1,000 feet or more below the surface. In other areas, however, such as the Sacramento-San Joaquin Delta, the salt water is as little as 100 feet below the surface. Where these marine sediments have been lifted by geologic forces and the salt water has been flushed out by percolating fresh water, the sediments have become fresh-water aquifers supplying local water needs in such areas as coastal Sonoma and Santa Cruz Counties. Other examples of marine formations being flushed out and replaced by fresh water are in the Delano area of the San Joaquin Valley and in Ventura County.

In some basins, poor quality or high-temperature water, or both, occur where faults cut through the water-bearing sediments. Ground-water basins frequently overlie or adjoin the formations that contain salt water or sometimes discharge into the ocean. Salt water from such sources usually intrudes into the fresh-water aquifers when large quantities of the fresh water are pumped. Conversely, some of the confined fresh-water aquifers in coastal regions extend seaward under the ocean floor for considerable distances without any evidence that sea water has intruded. Formerly dewatered portions of ground-water basins now used for the storage of imported water supplies from the Owens Valley, northern California, and the Colorado River are important also.

The availability of large quantities of ground water from natural underground storage reservoirs has been a prime factor in the economic growth of the California Region. The largest use of ground water is for irrigation, but it is a significant source of supply for municipal, domestic, industrial, and livestock uses. Ground water presently supplies about 48 percent of the water withdrawals in the region. The major productive aquifers in the region are shown in Figure 18-6.

Water Withdrawals

The degree to which water is available for withdrawal is limited by occurrence, physical conditions, laws, administrative or institutional regulations, customs, patterns of use, purpose of use, and economics. Availability depends on the set of limitations selected.

The major withdrawal of water in the region is for irrigation. Other uses, not necessarily in the order of their importance or quantity used, include water for livestock, industrial uses including mining, municipal use, power generation, and fish and wildlife. Recreation generally uses water surface areas but requires little in the way of withdrawals.

Fresh water withdrawn from surface- and ground-water sources in 1975 averaged about 39,636 mgd. Withdrawals are projected to increase 3 percent by the year 2000 to a total of about 41,265 mgd. Irrigation accounts for about 34,611 mgd, 87 percent of the 1975 total withdrawal. The amount of water withdrawn for irrigation is expected to increase only slightly by 2000 to about 34,764 mgd. Irrigation will then account for about 84 percent of the total withdrawal.

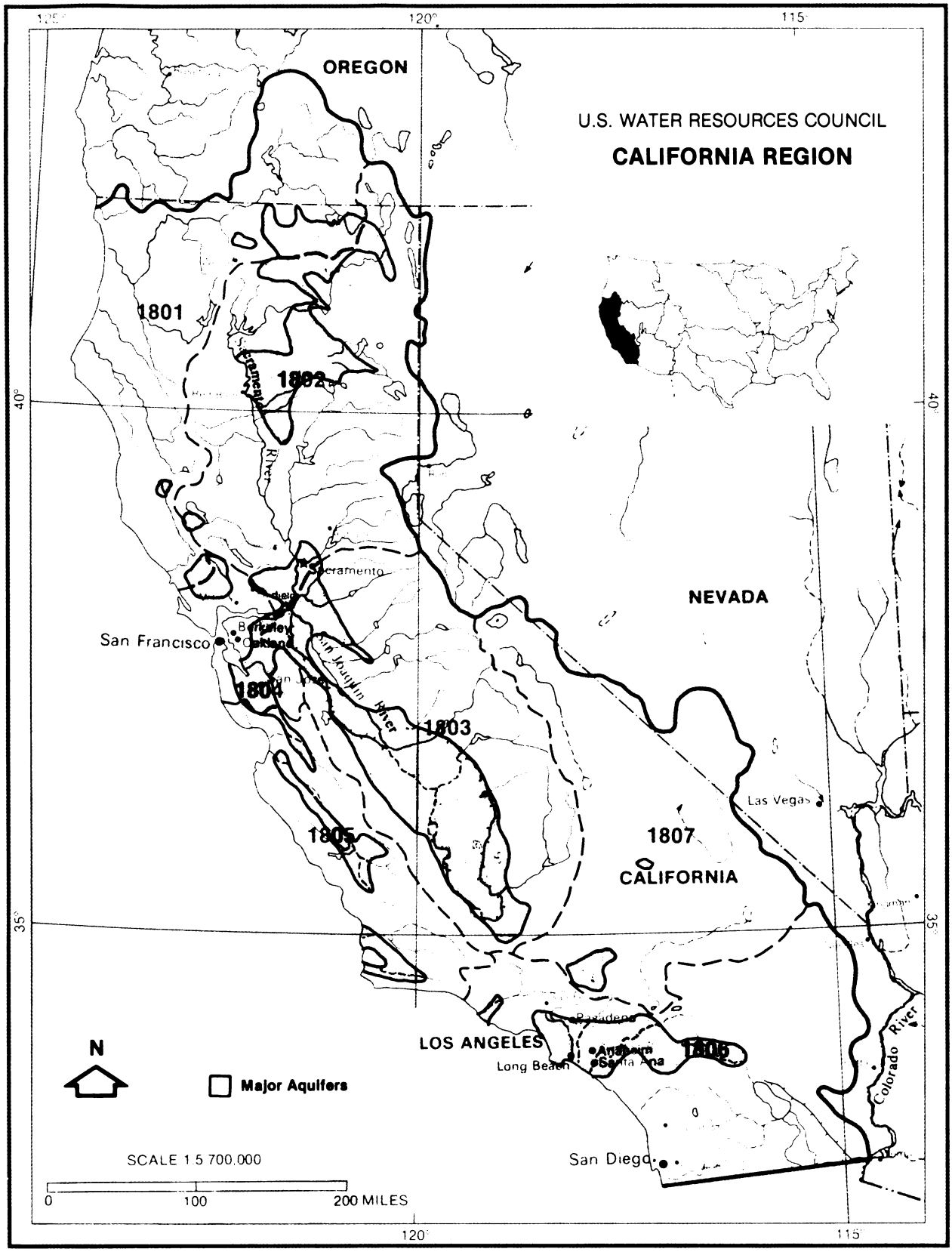


Figure 18-6. Major Aquifers

Water withdrawals for domestic, commercial, and institutional uses in 1975 were about 3,388 mgd and are anticipated to rise to about 4,360 mgd in the year 2000, an increase of 29 percent. Manufacturing withdrawals are also significant in the California Region, and accounted for withdrawals of 796 mgd in 1975. These are expected to increase 4 percent by 2000 to a usage of 828 mgd. Withdrawals for mining and public lands represent about 0.7 and 0.9 percent, respectively, of total withdrawals for 1975, and will remain small for the next 25 years. Other withdrawals totaled 181 mgd in 1975 and are expected to be 544 mgd by 2000. Figure 18-7 shows the division of water withdrawal by purposes in the region for 1975 and those estimated for the year 2000.

Water Consumption

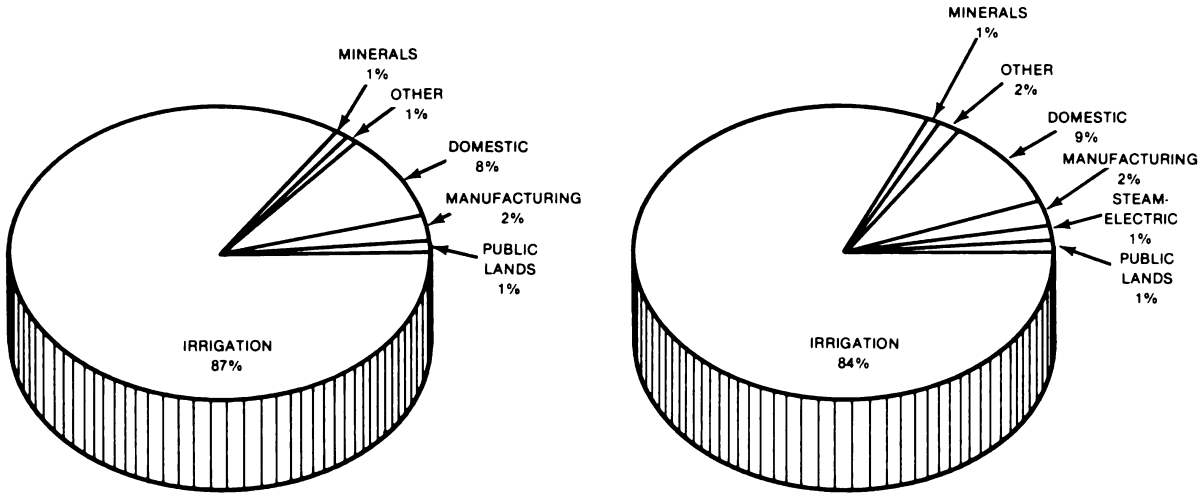
Water withdrawn from ground water or surface sources is seldom entirely used. Return of unconsumed water to streams makes it available for reuse in downstream areas. That portion of the water withdrawal that is not returned is lost to vegetative evapotranspiration and to other evaporation such as from cooling towers or other water surfaces. Also lost are irrigation, municipal, and industrial waste waters that, because of where they are used, are returned directly or through ground water to bodies of salt water.

The estimated total consumption of water in 1975 was about 26,641 mgd, distributed as shown in Figure 18-7. By year 2000, total consumption is expected to be about 29,699 mgd, an increase of 11 percent. About 91 and 89 percent of the total consumption is for irrigation in 1975 and 2000, respectively.

Consumption of surface water in 1975 for domestic, commercial, and institutional use was about 1,434 mgd, approximately 42 percent of the amount withdrawn for that purpose. The percentage of withdrawn water consumed is expected to remain about the same in 2000 as consumption for those purposes increases to 1,839 mgd. Consumption of surface waters for manufacturing is projected to rise from 257 mgd in 1975 to 576 mgd in 2000. Mining industry consumption of surface waters totaled 183 mgd in 1975 and is expected to increase to 213 mgd in 2000.

Water consumption for irrigation is projected to increase significantly between 1975 and 2000. Whereas consumption for irrigation in 1975 was 24,282 mgd, about 70 percent of irrigation withdrawals, it is expected to be 26,311 mgd in year 2000, amounting to about 76 percent of irrigation withdrawals. Average annual consumption of fresh water for steam electric power generation is expected to increase from 25 mgd in 1975 to 242 mgd in the year 2000. The distribution among purposes of projected water consumption in 2000 is shown in Figure 18-7.

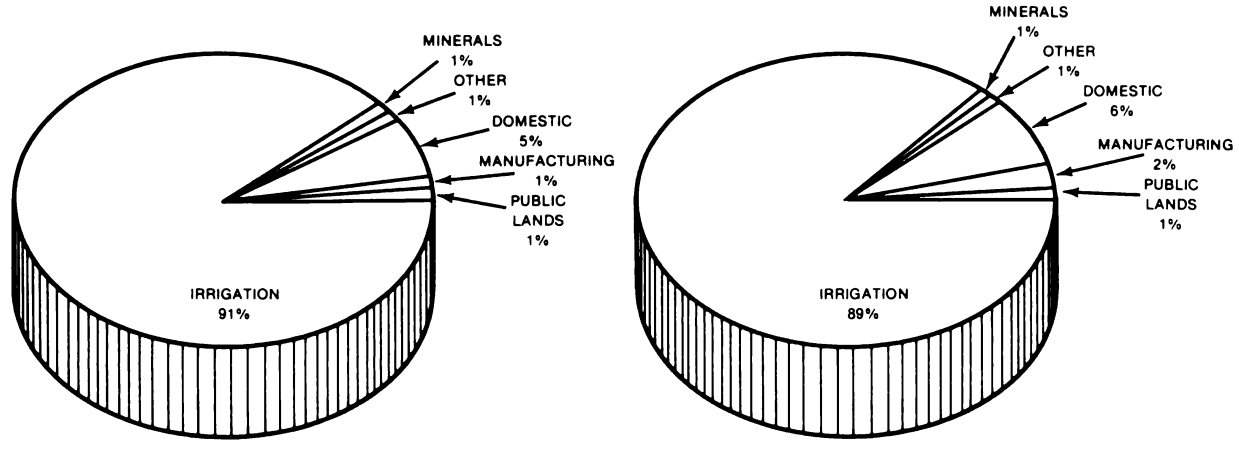
ANNUAL FRESHWATER WITHDRAWALS



1975
Total Withdrawals — 39,636 MGD

2000
Total Withdrawals — 41,265 MGD

ANNUAL FRESHWATER CONSUMPTION



1975
Total Consumption — 26,641 MGD

2000
Total Consumption — 26,699 MGD

Figure 18-7. Withdrawals and Consumption

Instream Uses

Many water uses in the region do not require withdrawal of water from the stream and do not consume water. Principal among these types of uses are water-associated recreation, navigation, fish and wildlife propagation, hydroelectric power production, and waste disposal, including salinity control.[1] These purposes require minimum levels of water quantity and/or quality. However, California rivers with salmonid runs actually require very tight control for temperature quality and minimum flows. The State would consider that a maximum level of control was required.

In whatever manner instream flow needs are described, the availability of water for satisfaction of those needs depends on a number of factors including how much unappropriated water is available in the stream, requirements to fulfill downstream water rights and interstate agreements, and points of diversion and use. One very important fact is that in periods of minimum flow many of the smaller streams in the southern portions of the region have reaches which go completely dry.

Historically, determination of instream flow needs in California has not kept pace with other functions considered in water resource planning. On regulated water courses in the past, most projects were formulated to meet very specific needs for economic growth and safety of readily identifiable beneficiaries expressing willingness to repay costs ascribed to them. It has only been in recent years that the public has expressed a high interest in instream flows. Recognizing the changing desires of the citizenry, significant effort is now underway to plan for and and to facilitate instream uses within existing laws.

California's State Water Resources Control Board has established water quality standards for the protection of the beneficial uses of the State's waters. Maintenance of these standards will require certain minimum instream flows. In addition, the State board has made several decisions that are important in allocating the use of water resources among competing beneficial uses for the Sacramento-San Joaquin Delta, the lower American River below Folsom Dam, and the Stanislaus and San Joaquin Rivers. At the present time, these decisions are in litigation. The question to be decided by the courts is whether or not Federal agencies are required to release water from storage projects to meet State and federally approved water quality standards.

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[1] The statement that salinity control does not consume water is not always true. The resultant mixture after salinity control may well exceed desirable limits for other specific uses. Reuse would be prohibited, and in the eyes of the State the fresh water would be considered "consumed" because of the quality loss.

Navigation can exert specific instream demands for water in order to maintain suitable depths for safe passage. Due to the shallow draft of most boats used for recreation on the State's inland waters, water depth has rarely been identified as a recreational boating problem. Most of the fresh-water channels used for commercial navigation are within the zone of tidal influence so that minimum depths do not depend entirely upon the rates of flow. The exception is the reach of the Sacramento River downstream from Colusa where very low river flows can result in below-minimum depths within the Sacramento River Shallow Draft Channel Project.

Both Congress and the California legislature have enacted legislation designating certain river basins or river segments worthy of special consideration and management plans. Those rivers selected for designation as National Wild and Scenic Rivers were chosen for their extraordinary scenic, recreational, fishery, or wildlife values which, together with the immediate environment, should be preserved for future generations in a free-flowing state. A protected management plan is stipulated for such designated rivers.

Wildlife maintenance water in the region is provided from local area supplies for a number of Federal- or State-managed wildfowl sites, principally in the Central Valley of California. The water supply often is agricultural drainwater, but may be withdrawn directly from the primary source.

Flow data for hydroelectric powerplants in the region are not routinely available.

The instream flow approximations (IFA)[1] for fish and wildlife for the combined outflow points of the subregions are as follows:

Subregion	IFA (mgd)	Average streamflow (mgd) at outflow point
1801	16,597	26,000
1802	9,077	13,900
1803	2,841	2,830
1804	2,250	2,570
1805	1,030	1,490
1806	343	446
1807	469	139
Total	32,607	47,375

The instream flow approximation cannot be met in subregions 1803 and 1807 in average years or in any subregion but 1801 in dry years under existing conditions of water management and legal allocations.

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[1] See Volume 3, Analytical Data, for a discussion of the meaning of the term "instream flow approximation."

Water Supply and Demand

An estimated average of about 200 million acre-feet of water falls on the region annually as precipitation. A large part is lost by evapotranspiration and another part percolates into the ground and adds to the ground water in storage. Runoff fluctuates greatly from less than 20 million acre-feet in a dry year to more than 130 million acre-feet in a very wet year. The total average annual water supply within the region includes the runoff and percolation to ground water of 71,819 mgd (80.6 million AF), including a diversion of about 5 million acre-feet presently utilized from the Colorado River. Reservoir and pond evaporation of about 669 mgd (751,000 AF) and ground-water mining of 2,197 mgd (2,465,000 AF) are not considered part of the long-range average available water supply.

On the average, the total natural surface water supply in the California Region is adequate to meet foreseeable demands. But natural stream runoff does not always occur at the time when it is needed nor in the right place. Most of the region's runoff is in the northern portion--about 75 percent occurs north of the latitude of Sacramento--while about 75 percent of the demand for irrigation and urban water is in the south.

The region experiences a considerable amount of natural regulation by which water from the wet season is held until the dry season. Winter snow in the high mountains of the Sierra Nevada and Cascade ranges and the Klamath Mountains gradually melts during the late spring and early summer to sustain dry-season flows in many streams and rivers. The vast alluvial ground-water basins also store percolating wet-season rainfall and streamflow in underground reservoirs where it is available for pumping as required.

About 60 percent of California's present water supply is derived from regulation and diversions of the natural runoff from surface streams. Natural flows in streams vary from as little as zero in late summer to many thousands of cubic feet per second during winter or spring floods. A wide variation in the total quantity of annual runoff among wet, normal, and dry years can also be expected. Total runoff during a wet year may be more than 10 times the quantity of runoff in a dry year. However, relatively uniform and firm water supplies can be obtained from such streams through regulation in reservoirs.

An extensive network of local, State, and Federal storage reservoirs provides a significant degree of control of the runoff of most streams in the more highly developed areas of the region. At present there are over a thousand reservoirs in California operated by State and local agencies and by individuals under State jurisdiction and 150 Federal reservoirs. Of these approximately 1,240 reservoirs, 141 have storage capacity between 10,000 and 100,000 acre-feet, 45 between 100,000 and 1 million acre-feet, and ten have capacity greater than one million acre-feet. Most of the larger projects are located on streams in California's Central Valley. Also, there is very large storage capacity on the Colorado River (outside the California Region) which is available to the State of California.

There is an estimated 90 percent probability of the availability of water to meet present requirements in subregions 1801, 1802 and 1804. Supplies for the remaining subregions are subject to greater variances.

Comparative Analysis

Table 18-5 compares the National Future (NF) and State-Regional Future (SRF) estimates of streamflows and water needs in the California Region.

The NF estimates for total fresh-water withdrawals are 3 percent over the SRF estimates for 1975. Both the NF and SRF projections call for an increase in fresh-water withdrawals. For the year 2000, the SRF estimate is about 10 percent larger than that of the NF. Between 1975 and 2000, NF withdrawals for agriculture are expected to remain about the same. The comparable data for the SRF calls for a 14 percent increase. The consumption situation is different. For 1975, the NF estimate exceeds that of SRF by 24 percent and for the year 2000, by 15 percent. Agricultural consumption estimates follow the trend set by total consumption. NF projections exceed SRF data by 31 percent in 1975 and by 22 percent in the year 2000. Both forecast increases in domestic, commercial, and institutional consumption. However, SRF estimates are larger by 17 percent in 1975 and 32 percent in the year 2000.

The differences noted between NF and SRF should not be surprising, as noted in the Foreword. When policy decisions are to be made, the effects at State, regional, and local levels should be carefully considered in light of the conditions that exist at the time.

Table 18-5.--Socioeconomic and volumetric data summary: the California Region

Category	1975		1985		2000	
	NF	SRF	NF	SRF	NF	SRF
SOCIOECONOMIC DATA (1000)						
Total population	21,160	21,168	23,703	24,422	27,093	29,344
Total employment	8,828	8,894	10,226	10,604	12,080	13,093
VOLUMETRIC DATA (mgd)						
-Base conditions-						
Total streamflow	71,819	NE	71,819	NE	71,819	NE
Streamflow at outflow point(s)	47,375	47,320	43,508	NE	41,546	NE
Fresh-water withdrawals	39,636	38,351	40,549	41,792	41,265	45,468
Agriculture	34,709	29,955	34,981	32,290	34,900	34,282
Steam electric	42	2,492	158	2,581	367	2,732
Manufacturing	796	859	830	897	828	890
Domestic	3,014	3,986	3,395	4,885	3,890	6,383
Commercial	374	[a]	414	[a]	470	[a]
Minerals	297	NE	359	NE	375	NE
Public lands	363	NE	371	NE	394	NE
Fish hatcheries	41	NE	41	NE	41	NE
Other	0	1,059[b]	0	1,139[b]	0	1,181[b]
Fresh-water consumption	26,641	21,544	27,932	23,629	29,699	25,849
Agriculture	24,380	18,675	25,252	20,223	26,447	21,638
Steam electric	25	48	101	147	242	302
Manufacturing	257	206	375	296	567	446
Domestic	1,279	1,673	1,436	1,955	1,641	2,421
Commercial	155	[a]	174	[a]	198	[a]
Minerals	183	NE	225	NE	213	NE
Public lands	362	NE	369	NE	391	NE
Fish hatcheries	0	NE	0	NE	0	NE
Other	0	942[b]	0	1,008[b]	0	1,042[b]
Ground-water withdrawals	19,160	12,510	NE	NE	NE	NE
Evaporation	669	1,122	679	1,186	686	1,186
Instream approximation						
Fish and wildlife	32,607	32,607	32,607	32,607	32,607	32,607

NE - Not estimated.

[a] SRF domestic water use includes commercial and institutional requirements.
[b] SRF other water use includes recreation and wildlife.

Problems

Pollution

Strong water quality control has been in effect in California since the late 1940's. In 1969, this control was further strengthened by the Porter-Cologne Water Quality Control Act which established a State policy that the quality of the water resources of the State shall be protected for the use and enjoyment of people and that activities which affect quality shall be regulated to attain the highest water quality which is reasonable considering all uses of the water and all values involved. Additional emphasis was placed on control of water quality by passage of the 1972 amendments to the Federal Water pollution Control Act (Public Law 92-500).

The present quality of most of the waters of the California Region is significantly superior to the average quality of the waters of the Nation. When values are weighted to reflect frequency and effect of pollution, the region's water pollution is measured to be a little more than one-third of the national average. There are, however, significant distributional differences. The Sacramento and central coastal waters are among the cleanest in the Nation; the San Francisco Bay waters are average in pollution; southern coastal waters are distinctly above average in both the amount and the degree of pollution that occurs. Water is also of poor quality in the lower portions of the enclosed basin in the southern portion of the region.

Heat discharges from powerplants and manufacturing activities are a significant problem in the California Region. In 1975 steam electric plants discharged 364 trillion Btu's to saline water, and manufacturing plants discharged 43 trillion Btu's to fresh and saline water.

Even with the expected shift toward recycling cooling systems, the amount of heat discharged to natural water bodies by powerplants is projected to increase to 970 trillion Btu's in 2000, all of which is expected to be discharged into saline waters. Shifts to recycling systems in manufacturing activities are expected to reduce manufacturing waste heat discharges to 6 trillion Btu's in the year 2000.

About 2.0 billion pounds of biochemical oxygen demand (BOD) was discharged into the region's water resources in 1975. Of this amount, almost half was produced in subregion 1806, mostly from municipal wastes. The amount of BOD discharged to water bodies is projected at about 2 billion pounds per year in 2000, mostly from municipal sources. With best available treatment (BAT) the amount discharged to water bodies could be reduced to about 0.7 billion pounds per year.

Total suspended solids (TSS) generation in the region was about 124 billion pounds in 1973. Of this, about 105 billion pounds was discharged to water bodies. With best practical treatment (BPT) the amount discharged to water bodies could have been reduced to 88 billion pounds.

Little improvement in water quality is anticipated from implementation of presently required pollution control programs, at least within the foreseeable future. Virtually all municipal and industrial wastes produced in the region are already treated to a high degree, with the exception of discharges to the Pacific Ocean. Thus, while a significant reduction in BOD can be expected from implementation of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500), the effect will be minimal. Salinity of southern and desert areas will be unaffected, and suspended solids, the most common of all pollutants, will be reduced very slightly by installation of BPT technology for point waste sources. In fact, based on economic and population growth projected for the area, the incremental effects of treatment of TSS in the water may be lost. It should be noted, however, that only about 5 percent of the 12,639 miles of streams inventoried to date would not meet existing water quality standards with best practical treatment.

Salinity is a major problem in the region, particularly in (1) the Sacramento-San Joaquin Delta area, (2) in waters imported from the Colorado River, and (3) in the Salton Sea. Waste-water and irrigation return flows with high concentrations of nitrates and salts also contribute to high salinity levels in these three problem areas. Salinity in the Sacramento-San Joaquin Delta is due primarily to sea-water intrusion into the delta because of inadequate fresh-water outflows to repulse tidal fluctuations. Fresh-water outflows to repulse salinity are determined by the amount of water released to the delta by Federal and State water resources developments and the amount withdrawn from export from the delta by resource projects. To date, no widely accepted plan for collection and disposition of drain water has been developed for that area. Ponding of saline return flow is being practiced as a temporary measure and has resulted in the establishment of a substantial wildlife habitat.

The salinity of the Colorado River is of concern to several States. California is by far the largest user of water from the lower Colorado River and stands to be damaged the most by deteriorating salinity conditions. On the other hand, California stands to gain the most from measures to control salinity. However, the San Joaquin Valley Interagency Drainage Program (IDP)--composed of State, Federal, and local water resources, agricultural, and environmental agencies--will, in early 1979, publish its recommendations for solutions to surface- and ground-water salinity problems due to agriculture return flow in the San Joaquin Valley.

The Salton Sea is the sump into which flow the drainage and seepage waters from irrigation in the Imperial and Coachella valleys and wastes and drainage from the Mexicali Valley area in Mexico. From 1925 to 1964, when the sea was expanding, the rise in surface elevation was a serious problem in that it threatened shoreline development. For the next ten years the surface elevation remained stable, but it has begun to rise again in the last few years. Salinity has increased to a present level of 38,000 parts per million (ppm) (ocean water has a salinity of 33,000 ppm). When the salinity reaches 40,000 ppm, which could occur by the mid-1980's, severe adverse effects on the sea's valuable sport fishery are expected. Ultimately, the fish will die out and other forms

of water-oriented recreation and wildlife uses will diminish. Several solutions have been defined, all of which are costly. A decision is needed as to whether a program to preserve the recreation and fish and wildlife uses of Salton Sea is feasible and justified, and, if so, to what extent the Federal Government should participate.

Erosion and Sedimentation

Sheet and rill erosion on harvested cropland averages about 1 ton per acre per year, less than for any other region. The sediment delivery from this source may exceed 1.3 million tons per year. However, rain-caused sheet and rill erosion from cropland is a very small part of total erosion in this region. Harvested cropland is less than 9 percent of the land area. Erosion on rangeland and sparsely covered forestland frequently exceeds the average erosion on cropland. Sediment deliveries from streambank and gully erosion, landslides, and mudflows probably exceed sediments from all the rain-caused sheet and rill erosion in the region. Part of the gully and streambank erosion is related to increased runoff caused by poor watershed conditions. The Eel River watershed in subregion 1801 has the highest recorded average annual suspended sediment yield per square mile of any watershed of comparable size in the United States. The Sacramento River in subregion 1802 and the San Joaquin River in subregion 1803 also have very serious sediment problems. Removing sediments from streams, navigation channels, and croplands is costly business. Sediments deposited in reservoirs gradually reduce their storage capacity.

The average annual sediment load delivered through streams in the region is about 62,690 acre-feet or about 123 million tons. With potential land treatment, this could be reduced to about 116 million tons.[1]

Flooding

Annual flood damages in the California Region currently amount to $417 million. About $259 million, or 62 percent of the total, is estimated to occur in urban areas. By the year 2000, urban flood damages in the region are expected to increase by about 16 percent. The largest increase in urban flood damage is expected to take place in subregion 1803. This projection is a function of growing urban development and the innate instability of the soils. Development of manufacturing and the regional infrastructure in some relatively small parts of the San Joaquin Basin are projected to involve a disproportionately large increase in flood hazard because of land subsidence due to ground-water overdrafts and petroleum extraction.

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[1] Using in situ weight at 90 lb/cubic foot. See Erosion, Sediment, and Related Salt Problems and Treatment Opportunities. USDA, SCS Special Projects Division, 1975.

Agricultural flood damages total about $101 million per year in the region. The damage is expected to show a greater percentage increase in the future than flood damages in urban areas.

Regional flood losses, assuming an active national flood control policy that is progressively less structure-intensive and more dependent on zoning and other nonstructural means of control, are expected to be reduced from $12.90 per capita to $11.60 per capita, in spite of a substantial economic expansion and consequent increase in the values of lands exposed to flood damage.

Water Quantity

Average annual runoff in the California Region varies from about 23 inches in subregion 1801 to less than one inch in subregion 1806. Large quantities of ground water are available, principally in the sedimentary fill of more than 250 valleys, the largest being the Central Valley, with an area of about 17,600 square miles.

The region's surface water supplies can meet most projected offstream water requirements. However, there are areas of water surpluses in the northern part of the region, while there are areas of primary water demand and water shortages in the central and southern portions. This condition has led to the long water transport facilities that characterize California's water supply system. Most of the rainfall and runoff occur during the winter and spring months, December through March. The peak irrigation season and water use period occurs from July through August. Thus peak supply and peak use are not coincidental in either time or geographic location.

For subregions 1801, 1802, and 1804, the availability of water to meet requirements is placed at a 90-percent probability. The remaining subregions' supplies have only a 50 percent probability of meeting normal requirements and are less certain due to greater variances in runoff locally and/or in imported supplies.

The shortage of ground water is a critical problem in subregions 1803 and 1805, and a somewhat less pressing problem in subregion 1804 and 1806. Pumping of ground water in excess of replenishment is estimated at 2,197 mgd for the region. Total consumption requirements are projected to increase about 11 percent for the region by 2000. An increase in consumption requirements of this amount would probably further complicate the ground-water overdraft problem in those areas which do not have an adequate surface-water supply.

Water Surface

About 81 percent of the water-related recreational activity in the California Region in 1975 was in the San Francisco area and southern California. Water surface area needed for recreation is projected to increase by 54 percent by the year 2000. About 1.2 million more acres will be needed at that time. However, this additional water surface area will not be available in 2000, and hence, the need will not be met.

Other

Navigation

The significant commercial navigation in the reach of the Sacramento River from the city of Sacramento to Colusa depends on adequate water depths which are, in turn, dependent on the rate of flow. Very low river flows can result in below-minimum (6 feet) depths within the Sacramento River Shallow Draft Channel Project.

The authorizing document for Shasta Dam provided for minimum releases of 2,588 mgd to maintain navigation depth. Releases for other Central Valley project purposes generally exceed the minimum requirement, but releases specifically for navigation are occasionally needed.

Drainage

Drainage problems in the California Region are associated with a high water table (5 feet or less from ground surface) and salt balance. They are reflected in reduced crop yields, limited cropping patterns, and an overall reduction in land management options and water quality degradation.

Drainage is a particularly severe problem in subregion 1803, yet has economic impact on the entire region. In subregion 1803, the drainage problem presently affects about 741,000 acres and is expected to affect about 1,977,000 acres by 2000 (based upon the main report of the San Joaquin Valley Basin Study).

Energy

Coastal land restrictions and environmental and public safety concerns may preclude siting new powerplants along the coast. However, the appropriateness and beneficiality of using any inland water for powerplant cooling has been questioned by agricultural interests and water agencies. Alternative cooling technologies (dry or wet/dry cooling towers) consuming little or no water may present added economic costs and energy penalties. Therefore, the resolution of the issue of water availability for powerplant cooling requires a mechanism to effectively balance the allocation of limited inland water supplies among competing uses. (The use of water for powerplant cooling has been projected to comprise at most about 1 to 1.5 percent of the State's water demand by the year 2000.) The lack of such a mechanism, or perhaps the existence of three possibly inconsistent mechanisms (one political, one legal, and one economic), hampers energy planning efforts because of uncertainty or inconsistencies in determining the appropriateness of such a use. (Other cooling options and cooling water sources are being studied which may represent a partial solution to the power plant cooling problem, e.g., wet/dry cooling and use of low-quality waters.)

Current water quality control planning efforts also have significant potential energy implications. Waste-water treatment and reclamation have been considered extremely energy intensive. However, this is not necessarily true when placed in perspective; e.g., importation of new water supplies to Southern California is more energy consumptive than in-basin reclamation.

Water Rights

Water rights in California are one of the region's major issues. Major aspects include lack of adequate provisions to control or manage ground-water use, transferability of water rights, and lack of an effective means to project minimum instream flows. Overriding the water rights picture is the possibility that Federal water law might be superimposed, upsetting the State's management efforts to maintain established policies.

As a partner in water management in California, the Federal Government is in the position to ensure that these water rights issues are recognized and that cooperative steps are taken to minimize adverse affects from on the State's task to conform with its water resource management goals.

Waste-water Reclamation

Reclamation and reuse of water could help California meet some of its expected additional water needs in the year 2000. The State recently adopted the Policy and Action Plan for Water Reclamation in California which encourages use of reclaimed water and construction of reclamation project facilities. However, there is a need for Federal support for research to overcome the serious deficiencies in knowledge of health effects of reclaimed water.

Environmental Protection

The recent (1975 to 1977) drought situation in the California Region has focused attention on the problem of protecting the Sacramento-San Joaquin Delta while providing as much water as possible for intraregion transfers. Representatives of the State and Federal Governments have historically sought to harmonize the operations of the respective water distribution systems as they relate to the delta. Estimates of water needed to control salinity intrusion into the delta have been enlarged with improved knowledge concerning the relationship between flow and salinity incursion and the demonstrated need for higher levels of protection and refinement. The U.S. Bureau of Reclamation recognizes only limited delta requirements and essentially releases only additional water which is surplus to its contractual obligations.

Individual Problem Areas

Problem areas were grouped, according to Water Resources Council guidelines, into one of the following categories: Group A or Group B. The criteria for these two categories are as follows:

Group A. Problem areas that are not getting any attention or sufficient attention under current programs and will probably continue to be severe if additional action is not undertaken.

Group B. Problem areas which are being addressed by ongoing Federal study programs or projects which, when implemented, should provide adequate solutions to all the major problem issues identified.

Each of the subregions in the region has problems of one type or another which are of approximately equal magnitude. The California National Assessment Committee identified 13 specific areas for detailed analysis based on its own criteria and the suggestions of the Water Resources Council. Specific problems affecting each of these areas were described and evaluated. The thirteen problem areas which were identified are:

Problem Number	Problem Area	Category
1	Trinity and Eel River Basins	B
2	Sacramento Valley	A
3	Lake Tahoe (Designated 208 Area)	B
4	Sacramento-San Joaquin Delta	B
5	San Joaquin Valley	A
6	Santa Clara County	B
7	San Francisco Bay	B
8	Salinas, Pajaro, and Carmel Valleys	A
9	Santa Ana River Basin	B
10	Colorado River	B
11	Coastal Lagoons	B
12	Salton Sea	B
13	Santa Clara River Basin (Designated 208 Area)	B

Figure 18-8a shows the location of the problem areas selected for detailed analysis. A summary describing each area, its problems, and their effects follows the figure. A tabulation of the type of problems found in each problem area is presented in Figure 18-8b. The figure also illustrates the problems identified for each subregion by Federal agency representatives.

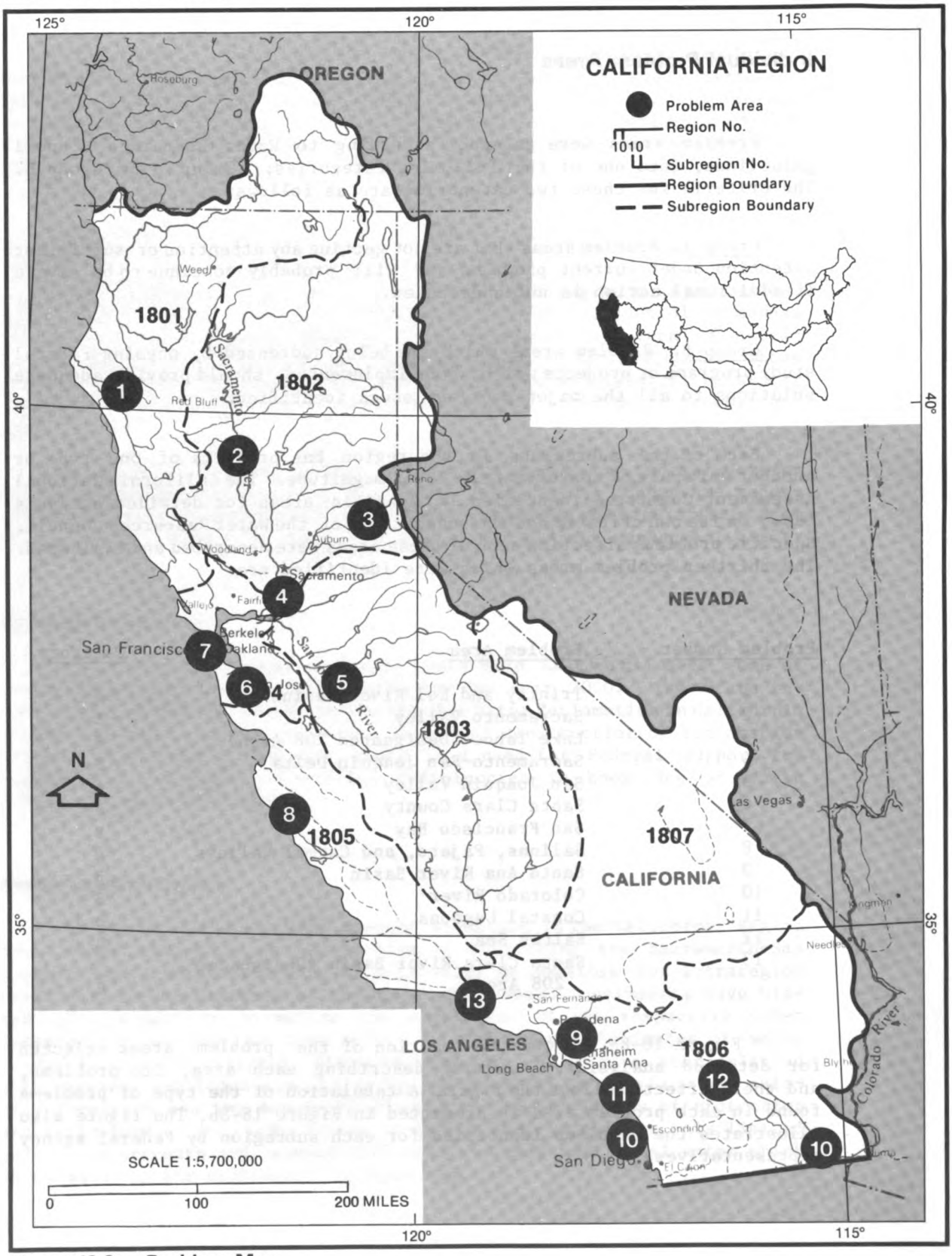

Figure 18-8a. Problem Map

CALIFORNIA REGION (18)

PROBLEM MATRIX

Problem area		Problem issues O= Identified by Federal Agency Representatives X= Identified by State-Regional Representative														
		Water quantity				Water quality				Related lands						
No. on map	Name	Fresh surface	Ground	Marine and estuarine	Surface/depth	Fresh surface	Ground	Marine and estuarine	Surface/depth	Flooding	Drainage	Erosion and sedimentation	Dredge and fill	Subsidence	Water related use conflicts	Other
Subregion 1801	Klamath-North Coastal	O				O				O	O	O				
Area 1	Trinity and Eel River Basins	X								X		X				X
Subregion 1802	Sacramento-Lahontan	O	O			O	O			O	O		O			
Area 2	Sacramento Valley	X			X					X	X	X			X	X
3	Lake Tahoe (Designated 208 Area)					X						X				
4	Sacramento – San Joaquin Delta					X				X						X
Subregion 1803	San Joaquin-Tulare	O	O				O			O	O	O				
Area 5	San Joaquin Valley	X	X			X	X			X	X			X	X	X
Subregion 1804	San Francisco Bay	O	O			O	O	O		O			O			
Area 6	Santa Clara County	X	X			X				X						X
7	San Francisco Bay							X		X		X	X	X		X
Subregion 1805	Central California Coast	O	O				O			O		O	O			
Area 8	Salinas, Pajaro, and Carmel Valleys		X				X			X						X
Subregion 1806	Southern California	O	O			O	O	O		O		O	O			
Area 9	Santa Ana River Basin		X				X			X						X
10	Colorado River – Salinity Impact on California	X														X
11	Coastal Lagoons	X						X			X	X				X
12	Salton Sea															X
13	Santa Clara River Basin (Designated 208 Area)		X				X									X
Subregion 1807	Lahontan–South	O	O			O						O				

Figure 18-8b. Problem Matrix

Category A Problems

Problem Area — Sacramento Valley

Description

The analytical problem area is located within subregion 1802. It encompasses approximately 4,800 square miles and covers most of the Sacramento Valley. The valley floor extends about 150 miles in length and 45 miles laterally at its widest point. On the north near the city of Red Bluff, at an elevation of 300 feet, the valley is only about 5 miles wide. To the south, the valley floor widens to about 45 miles near Sacramento, and the elevation drops to near sea level. The valley is surrounded on three sides by mountain ranges. The climate is characterized by hot dry summers and mild winters, with light precipitation decreasing from north to south.

The description of the problem relating to water issues makes no mention of the alternative which has been recommended by several agencies and studied by the U.S. Bureau of Reclamation. This alternative consists of releasing most of the Folsom South Canal water into the American River with later diversion near Hood on the Sacramento River. From Hood, the water would be transported by canal back to the Folsom South Canal at a point further south in the system. Numerous issues relating to the feasibility of this alternative have been identified by various agencies, and they will remain unresolved until policy decisions are made regarding Federal participation in in streamflow maintenance, construction, and operation of the Peripheral Canal, and salinity control in the Sacramento-San Joaquin River Delta.

The water supply for the problem area originates in the surrounding mountains and foothills. Most of the surface runoff of subregion 1802 normally enters the area via the Sacramento, Feather, Yuba, and American Rivers. Developed surface water in 300 reservoirs regulates a portion of the 20,000 mgd (22 MAF) annually. Surface and ground water usually provide ample water to meet the needs of the area and permit a present net export from the subregion of 3,500 mgd (3.9 MAF) to other areas of the State.

Agriculture, principally based on irrigation, is a major economic activity throughout the Sacramento Valley. In the industrial manufacturing sector metal fabrication and food processing are most prominent within the problem area. In the higher elevation counties along the periphery of the valley floor, abundant forests have stimulated lumbering and other wood byproducts industries, so that, in 12 of the 17 counties in subregion 1802, this is the leading manufacturing activity.

This problem area is situated within the most productive fish and wildlife habitat of the Central Valley; as a result, it accommodates varied and abundant wildlife resources. Wetlands and riparian habitat

provide cover and breeding areas for small terrestrial wildlife, while high water quality is sufficient to encourage the growth of numerous species of fish.

Water Issues

The major water issue in the problem area concerns flow levels in the lower American River. Before Folsom Dam was constructed, average-year summer and fall flows often receded to less than 300 cfs, and during dry periods to less than 25 cfs. Since the dam was completed, the minimum flows have usually been above 1,000 cfs and average summer and fall flows are in the 1,500 cfs range. This represents interim flow conditions since these releases are reserved primarily for diversion to the Folsom South Canal. Recreation and fisheries have developed and people have grown accustomed to the abundant flows.

If the Folsom South Canal were completed and operated as originally planned, interim flows in the lower river would eventually be reduced considerably. This would be objectionable to those who have come to depend in one way or another on the higher flows. Conversely, maintenance of the present flow levels would reduce the quantities available for diversion to the Folsom South service area, which would be objectionable to the potential water users.

Related Land Issues

There are several related land issues of importance in the Sacramento Valley including diminishing riparian habitat, declining Sacramento River salmon and steelhead runs, flood damages, and interrelated problems of erosion, deposition, navigation hazards, and seepage.

The decline of riparian wildlife habitat occurs as native vegetation areas are cleared for other uses, eroded away, or eliminated in the course of construction of bank protection or flood control works. During the period from 1952 to 1972, over 50 percent of the native vegetation on high terrace lands was lost through conversion to agriculture and other uses.

Counts and estimates of fish populations indicate a long-term decline in the numbers of fall-run salmon returning to the upper Sacramento River each year. The U.S. Bureau of Reclamation's Red Bluff Diversion Dam, completed in 1966, is alleged to be adversely affecting the migration and survival of both salmon and steelhead.

Periodic flooding in the Sacramento Valley damages or threatens to damage urban, rural, and agricultural development. Flood damages continue at a high level despite substantial investments in flood control facilities.

The interrelated problems stemming from the changes man has made in the larger valley rivers and in the lands along their banks are major concerns. One of the most obvious symptoms is bank erosion, which destroys both agricultural lands and natural areas. Bank erosion is most prominent in the unleveed reaches of the Sacramento River between Chico Landing and Red Bluff, but it also occurs in other locations along the valley floor rivers and streams. Deposits of sediment, debris, and snags are closely related to bank erosion; these interface with navigation, recreation, and fish-spawning areas and necessitate continuing expenditures for dredging and channel clearing work. Channel erosion may also be occurring downstream from dams on the valley floor; such erosion can harm fish-spawning areas by reducing the amount or quality of suitable spawning gravel. Another problem is seepage from a river channel to adjacent low-lying agricultural or residential lands. Seepage is a widespread problem in the leveed reaches of the Sacramento River downstream from Hamilton City, the Feather River downstream from Marysville, and the Sutter and Yolo Bypasses.

Adverse Effects

The principal direct adverse impact of delay in resolving the issue of lower American River flows results from the corresponding delay in completing the Folsom South Canal. This contributes to continuing overdraft of ground water for existing agriculture in portions of the Folsom South service area, further intrusion of saline water from the delta to the ground water, and increasing losses of yield from East Bay Municipal Utility District's Mokelumne River system.

The continued loss of riparian habitat will result in diminishing diversity and size of wildlife populations in the Sacramento Valley. Continued loss of riparian vegetation can also have a detrimental impact on erosion and downstream sediment deposition.

Failure to identify and correct the causes of declining salmon and steelhead runs would lead to continued reduction in both sport and commercial fisheries and cause significant economic losses.

If flooding problems are not resolved, flood damages averaging on the order of $20 million per year will continue in the Sacramento Valley.

The consequences of continued bank and channel erosion include loss of prime agricultural land, loss of valuable riparian wildlife habitat, added maintenance costs for dredging and channel clearing, continued hazards to small boat navigation due to snags and debris, and damage to salmon and steelhead spawning areas. Failure to resolve the seepage issue will result in continued hindrance of agricultural operations through delay of planting, limitations on crop types, decreased yields, and loss of orchard trees.

Problem Area — San Joaquin Valley

Description

The problem area is situated on the valley floor portion of San Joaquin Valley Basin in subregion 1803. The valley floor extends about 250 miles in length with a width of 75 miles at its widest point. It is surrounded on three sides by mountain ranges. The valley floor portion of the basin covers approximately 8.3 million acres. Both temperature and precipitation are widely variable in the area.

This valley contributes a substantial share of California's total agricultural production. Much of the agricultural commodities are grown on irrigated lands. Intense agricultural water use and topographic features of the valley give rise to several related problem issues.

The major water supply for this problem area originates in the Sierra Nevada. Lying in two hydrologic basins--San Joaquin and Tulare Lake--the problem area's surface runoff occurs from a number of rivers and streams. Part of the water is stored in reservoirs located at or above the foothills on the east side of the valley floor. The principal rivers are San Joaquin, Merced, Tuolumne, and Stanislaus in the San Joaquin hydrologic basin; and, Kings, Kaweah, Tule, and Kern in the Tulare Lake hydrologic basin. While a minor amount of the water supply is from the Coast Range to the west and from valley precipitation, ground water and imports from subregion 1802 provide the bulk of the remaining supply to the problem area.

Water Issues

Salt management is a major water issue in the San Joaquin Valley. Generally, in the Tulare Lake Basin, which is a closed basin, concentrations of salt accumulate in the upper layers of the soil profile. This accumulation is concentrated because of poor drainage, and because evapotranspiration by plants concentrates the salt in the water as the water penetrates the soil profile. The problem in the San Joaquin Basin is not primarily one of salt accumulation, but rather a salt level problem in the main stem of the San Joaquin River. The key issue in this problem area is the need for a valleywide management system which would collect, dispose of, or reuse saline drainage water to prevent disruption to the agricultural economy, degradation of surface water in the main stem of San Joaquin River, and endangerment of ground-water supplies.

A major factor in the issues which are discussed in this section of the report is that the Central Valley Project and the State water

project made water available in the San Joaquin Valley under conditions and at prices which encouraged land development. The increased land development resulted in problems, but there has been no acceptable way to assign responsibility for the problems and this has delayed their resolution. As an example, initial proposals for repayment of costs associated with construction of drainage facilities, put the responsibility on those who would benefit directly from the facilities, but no responsibility was assigned to the many water users in the San Joaquin Valley who were part of the cause of the problem.

Lack of sufficient water supply to meet all needs in the problem area has promoted long-term ground-water overdraft. Overdraft in the area supports approximatley 600,000 acres of crops. The gross production value for this amount of land approximates $613 million in 1975 dollars based on 1974 market place conditions. Associated with this overdraft condition has been land subsidence along the west side and southern part of the problem area. This subsidence, reaching a maximum decline of 28 feet southwest of Mendota, has caused numerous farming, drainage and engineering problems. The principal issue concerning ground water is whether the present economy of the area should be preserved and accommodate future growth that could be expected in a free society, or whether restrictions should be imposed to limit overall water demands within the water supply available.

Related Land Issues

As a result of man's activities on the flood plain in the San Joaquin Valley, periodic flood damages occur to rural, urban, and agricultural development, asserting a negative influence on the economy while posing some threat to the health and welfare of the occupants.

Fish and wildlife in the problem area have declined significantly as the result of water quality and quantity factors and land use changes. Future projections are not encouraging, and positive actions will need to be implemented to reverse this decline in fish and wildlife populations.

Institutional and Financial Issues

Drainage facilities for the San Joaquin Valley are an authorized part of California's State water project. However, farmers directly affected by the drainage problem have indicated an inability to pay all the associated reimbursable costs. With the certain knowledge that drainage problems are developing in the San Joaquin Valley, the crucial question is whether conditions will reach a crisis stage before a "rescue operation" must be mounted or if the problems will be solved before economic disruption reaches severe proportions.

Adverse Effects

Individual actions already taken indicate the willingness in the future of those affected to address the salt management problem piecemeal as long as favorable economics prevail in the market place. Consequently, the premise of no remedial steps taken beyond 1975 has no real basis for the issue other than to serve as a baseline for evaluation purposes. However, if nothing is done, the greatest economic impact would be loss in land productivity. Counties in the problem area account for about half of the State's total agricultural production. Preliminary studies have estimated an annual equivalent loss equal of up to $37 million. Based on estimates that $1 of gross farm income generates an additional $4 of economic activity in California, the impact of a $37 million reduction in gross income for the problem area would amount to $148 million. Reduced land values would also lower State revenues.

Ground-water overdraft in the problem area is expected to worsen in the future unless remedial action is taken. Attendent problems will be increased pumping costs (increased agricultural costs), degradation of water quality in localized areas, and subsidence problems. If overdraft continues indefinitely, at some future date land supported by overdraft will be forced out of production due to quality degradation and/or excessive pumping lifts. Without overdrafts, significant reduction in agriculture would be required, adversely affecting the economy of this area and the region as a whole. Regional economic impact as the result of lost productivity of 600,000 acres would be perhaps $1.2 billion based on the 4:1 generating ratio of activities to gross farm income.

Flood damage in this problem area will continue to increase in the future. Based on the 1975 level of protection, future economic impacts are projected to increase from $15 million average annual damages to $19 million by 1985 and $28 million by 2000.

Problem Area — Salinas, Pajaro, and Carmel Valleys

Description

This problem area is located in the northern two-thirds of subregion 1805. The area is a rather unusual agricultural area in which a combination of proper climate and availability of irrigable land produces nearly 25 percent of the truck crops grown in the region. This production has a major impact on the national supply of lettuce, broccoli, and artichokes.

The problem area is elongated in shape commencing approximately 75 miles south of San Francisco and extending in a southeasterly direction.

If averages about 40 miles in width and is about 150 miles in length. The area is enclosed on three sides by various mountain ranges opening into the Pacific Coast at Monterey Bay. The problem area land is distributed over the Salinas, Pajaro, and Carmel River watersheds in the proportions of 77 percent, 20 percent, and 3 percent, respectively. The Salinas Valley is the largest of the intermountain valleys of the Coast Range. Its downstream portion is a fertile alluvial plain, varying in width from about 10 miles near Monterey Bay to approximately 2 miles at San Ardo.

Water supplies in the problem area are derived chiefly from ground water, although surface water projects contribute to recharge by gradual releases of winter flood flows when downstream river beds have percolating capacity. The use of water generally exceeds the supply, accounting for lowering ground-water tables.

Ground-water overdraft approximates 80 mgd (0.09 MAF) over the entire area. Future projections indicate that by the year 2000, consumptive use will increase to 480 mgd (0.54 MAF). Without importation, the overdraft will continue to increase, although waste-water reclamation in the lower Salinas Valley might make a minor contribution toward meeting the increased need for water in that area.

Agriculture is the predominant economic activity in the problem area. Agricultural production was valued at more than $460 million in 1974 with vegetable crops accounting for about $270 million, and dairying, livestock, and poultry in excess of $65 million.

In 1970 there were 313,000 irrigated acres, 65 percent in the Salinas Basin and 35 percent in the Pajaro Basin. Projections show that by 2000, 380,000 acres will be irrigated, split in the same ratio as in 1970.

Water Issues

The principal water issue in the problem area results from an imbalance of the water supply-use relationship, and has both quality and quantity aspects. The ground-water overdraft has generated the movement of sea water into fresh-water aquifers near the coast, causing considerable degradation of the resource. Inland ground-water quality is also being degraded as a result of agriculture and related endeavors. Adverse water quality is affecting man economically and wildlife environmentally. Improved ground-water quality would lessen the quantity requirements in the farming operation and reduce domestic and industrial water treatment costs. Overall, the present limited supply-use relationships could be extended if water quality improved adequately.

Related Land Uses

Periodic flooding occurs as a result of storms lasting from three to six days, usually generated from a southward displacement of the Aleutian low. Because of the steep gradients involved, flood flows on streams draining the mountains of the Coast Ranges are characterized by extremely rapid rises and recessions. This has subjected agricultural and urban areas to flood damage. The steep slopes in the upper watersheds experience severe erosion during storm runoff, which deposits large amounts of sediment in the flood plains. Erosion rates are further intensified following wildfires, which destroy vegetation in the upper watersheds.

For a number of years, studies of varying degrees of intensity have been conducted to examine ways to mitigate the flood problem. Beyond the relatively low-level protection measures that now exist, implementation measures have not resulted for two reasons. There is a lack of project economic justification for areas devoted primarily to agriculture, and a lack of public support for project proposals where environmental considerations or other factors are involved.

Adverse Impacts

There are presently two major planning studies ongoing in the problem area, namely, the Salinas Monterey Bay Area Urban Water Resources and Waste-water Management Study by the U.S. Army Corps of Engineers, San Francisco District; and the Areawide Waste Treatment Management Planning (208) led by the Association of Monterey Bay Area Governments. In addition to these ongoing studies, the Bureau of Reclamation has identified service areas in portions of San Benito and Santa Clara Counties under the authorized San Felipe Division, Central Valley Project, California.

Implementation of features and management arrangements to be included in these various plans is expected to resolve all or most of the major problems in the area, and further large-scale, long-term adverse impacts are not anticipated.

Category B Problems

The ten problems in this category are scattered throughout the region. As one might expect, the greatest number of the problems are found in subregion 1806 where over one-half the population resides. There were no problems of this category in subregions 1803, 1805, and 1807.

Problem Area — Trinity and Eel River Basins: Fish, Wildlife, Sedimentation, and Flooding

Problem area 01 is located in northwest California encompassing 6,700 square miles (4,288,000 acres) of the Eel River and Trinity River basins. The area is very rugged and mountainous with a sparse population of about 100,000 permanent residents. The economy is heavily dependent upon forest products and recreation.

The issues in the Eel River Basin are high sediment load, decline in the anadromous fishery, periodic flooding in the winter, and low summer flows which affect recreation. In the Trinity River Basin, operation of Trinity Dam is being blamed for the marked decline in fall salmon and drastic reduction of steelhead entering the hatchery. Formation of Clair Engle Lake behind Trinity Dam has resulted in extensive habitat changes which may be contributing to declines in local deer herds. Natural erosion is prominent and accelerated by human activities. If those issues suspected of relating to operation of the Trinity project prove true, changes in the Federal authorization may be required along with joint cooperation from State agencies.

Problem Area — Lake Tahoe Pollution (Designated 208 Area)

Lake Tahoe is approximately 80 miles northeast of Sacramento, at an elevation of 6,223 feet, between the Sierra Nevada and the Carson Mountain Range. The lake has an average depth of 1,000 feet and a surface area of 191 square miles (123,400 acres).

The area has become famous for its exceptional beauty; Lake Tahoe is considered one of the purest lakes in the world. It is a highly desirable recreational site, and the population swells from 22,000 permanent residents to 160,000 during summer peaks.

Environmental preservation and enhancement are of great concern to the area and to the many visitors. Pollution in Lake Tahoe is the most severe problem resulting from erosion and storm-water runoff. Phosphorus concentrations in some near-shore portions of the lake are considered to be at a critical level. All threaten the exceptional clarity and beauty of the lake. Instrumental to the problem has been the extensive urban development which has stripped natural vegetation allowing organic and nutrient loads to run off into the lake and the excessive visitation from recreationists which overtaxes the area's handling capacity as to water supply and nonpoint source runoff pollution. More fundamental than the problem is how to remedy a situation which had its stimulus during the 1950's and 1960's with the approval of extensive land speculation developments. Today a dozen governmental agencies including the States of California and Nevada are struggling for answers to protect the future of the Lake Tahoe Basin both as to environmental aspects and economic rights of the private landowner. Unfortunately at present, some agencies appear to be struggling more against each other than toward a common solution.

Problem Area — Sacramento-San Joaquin Delta: Water Quality, Flooding, Fishery, and Recreation

The Sacramento-San Joaquin Delta problem area is a unique, man-made, artificially maintained environment overlapping subregions 1802, 1803, and 1804. (The problem area number was assigned in recognition of subregion 1802 being the primary source of water.) This triangular-shaped area, most of which lies between 5 feet above and 20 feet below sea level, encompasses 1,100 square miles (700,000 acres). It is interlaced with 700 miles of tidal waterways and more than 60 leveed islands. The delta has extensive fish and wildlife resources and a limited amount of urban and industrial development. The network of channels separating the islands serve as water supply conduits for natural flood waters, local irrigation water supplies, and saline drainage return flows. They also serve as interconnections for conveying Central Valley Project (CVP) and State Water Project (SWP) water supplies from north to south and west of the delta, and as receiving waters for unwanted wastes, as important habitat and migration paths for fish, and as waterways for commercial shipping, recreational boating, and other water-related sports.

The delta, therefore, is the focal point of California's water industry and an area subject to considerable environmental and political pressures. The issues of controversy in the delta concern a multiplicity of interrelated subjects.

The water issues relate to export of large quantities of water through the delta. Export diversions require the use of natural and manmade waterways of the delta. This means of conveyance may have damaging impact on fish and their food chain. Required pumping operation for the export conveyance systems through limited capacity channels leads to an argumentative issue concerned with water quality. Upstream storage projects provide a higher quality water to the delta than would occur under nonproject conditions.

This water moving across the delta reduces salinity in the immediately affected channels of conveyance giving local agricultural interests benefits they fail to acknowledge. Other parts of the delta face the probability of increased salinity being drawn in from the ocean by pumping export water during normal low summer and fall flows, although the increased salinity may be less than would have occurred under no upstream development conditions for the same period. In addition, the wildlife habitat of the Suisun Marsh which depends on the delta for a satisfactory ecosystem could be adversely affected if the salinity were increased to levels injurious to chosen duck food plants. (The Suisun Marsh is geographically located in Problem Area 042, the San Francisco Bay, but is mentioned here because of the area's unique interrelationship with the Delta.) And lastly, future increases in export pumping may have adverse impact on the morphology of the embankments and channels.

There are several related land issues. Flooding poses a serious threat to island agriculture, several urban developments, and to natural gas wells scattered throughout the area. Land subsidence under and immed-

iately adjacent to levees, bank erosion principally from wave wash generated by boats, and substandard levees contribute to the threat of inundation. From a recreational standpoint, there is a general lack of access sites and facilities to utilize the resources available. Land subsidence, in addition to being a major factor in potential inundation, causes increased farming operation costs requiring continual releveling of land, reconstruction of drainage ditches, and subsequent increased pumping needs.

Financing and repayment issues revolve around the lack of a financial plan involving Federal, State, and local interests. This is due, in part, to the general public's failure to recognize the need for public financing to upgrade levees where many of the delta islands are owned by relatively few individuals.

Institutional issues relate to negotiation and interpretation of laws designed to delineate water rights and to conflict of interest between recreationists, environmentalists, and SWP and CVP officials.

Problem Area — Santa Clara County: Flooding and Water Supply

The problem area consists of approximately 600 square miles (384,000 acres) of Santa Clara and portions of Alameda counties. The most striking feature of the area is the great expanse of urban development, the San Jose metropolitan area, with a population of almost 530,000. The problem area is drained principally by the Guadelupe River and Coyote Creek which flow through the city of San Jose, then into the south end of San Francisco Bay.

The primary issues in this problem area are water supply and flooding. Water supply is at present in a delicate state of equilibrium. In the recent past, the area has experienced severe overdraft conditions which have been mitigated by surface imports in the last few years. As demand increases in conjunction with low rainfall years, overdraft of ground water can be expected to recur.

Flooding in the highly developed urban areas has occurred every few years and damages have become increasingly serious because of expanding urban development and land subsidence associated with past overdraft conditions, particularly near the stream channels and low baylands. Reduction in channel carrying capacity has compounded the flooding problem along Coyote Creek and Guadelupe River and in the community of Alviso.

Local interests have provided protection for the more frequent floods in those urban sectors most susceptible to flood damage. The area is in a dilemma. There is a real widespread threat to the area from less frequent but larger flood flows. Economic justification by presently accepted justification procedures for the high degree of protection normally warranted for urban development of this intensity has been lacking to date. However, present planning studies reinitiated by the U.S. Army Corps of Engineers may result in justification.

Other issues regard the lack of both lake and streamside recreation

facilities within the problem area. Fish and wildlife habitat has greatly diminished due to water quality impairment, removal of stream bank vegetation, encroachment on stream banks by structures, and lining of stream beds for existing flood control.

Problem Area — San Francisco Bay: Water Quality, Tidal Flooding, and Sedimentation (Designated 208 Area)

This problem area is located on the central coast of California. It is surrounded by the second largest megalopolis in the region with a present population of 4.8 million. The San Francisco Bay is oriented in a northwest-southeast direction occupying about 4,300 square miles (2,752,000 acres) of land, 450 square miles (288,000 acres) of water, and 110 miles of coast. It includes those drainage areas tributary to San Francisco Bay and west of the Sacramento-San Joaquin Delta. While the area is primarly urban, agriculture is practiced in Napa, Petaluma, Sonoma, and lower Santa Clara Valleys, and in eastern Contra Costa County. Heavy industry is concentrated along the bay from Richmond to the Pittsburg-Antioch area.

Water quality is the paramount issue in this problem area and is directly related to the inflow of inadequately treated waste materials from point and nonpoint sources. It is most severe in the shallow extremities of the bay system where dispersion and dilution are not normally sufficient to maintain water quality objectives under current waste load parameters. High bacteria levels have forced closures of shellfish beds throughout the bay system. In the northern portion of the bay, fish kills result from unknown causes.

There are several land-related issues of concern in this area. Limited disposal areas exist for dumping large quantities of dredged materials and residual waste extracted from San Francisco Bay. Increasing waterborne commerce cannot be accommodated by present port development. Land subsidence increases the prospects of tidal flooding along the bayshore.

Much of the valuable marshland habitat has been reclaimed by urban development. Land-use conflicts exist between the pressure for continual urban development and the need for preservation of open space and valuable wetland habitats for future generations. Existing beaches around the bay are badly eroded and in need of periodic nourishment.

Of institutional concern is the lack of coordinated planning on the part of Federal, State, and local government agencies to develop control measures and best management practices to minimize pollutants in urban and nonurban runoff.

Problem Area — Santa Ana River Basin: Flooding, Water Quality, and Recreation

The Santa Ana River Basin encompasses 3,200 square miles (2,048,000 acres) within portions of Orange, Riverside, and San Bernardino Counties and the greater Los Angeles metropolitan area. Over the past 25 years, the basin has been one of the fastest growing areas in California and the Nation. In 1975 the tri-county population was estimated at 2,920,000.

In Orange County which contains the lower 28 miles of the Santa Ana River, the population has increased sevenfold in the past 25 years. Almost all of the growth has been centered in the flood plain. Western San Bernardino and Riverside Counties, upstream from Orange County, have undergone development at unprecedented rates. The growth has brought with it transformation from predominantly an agricultural area to a highly urbanized area. These changes have brought increasing concern to the water and land-related problems of the area.

The potential flood threat is the principal issue in this area, although not the only one. Approximately 300,000 people reside in the 100-year flood plain downstream of Prado Dam--a dam completed in 1941.

Over the past years, burgeoning development has increased the velocity and volumetric quantity of runoff from the upper watershed and has resulted in a decreased degree of flood protection afforded by Prado Dam and the present system of flood-control improvements. In addition, since 1941, 25,000 acre-feet of sediment deposited in Prado Reservoir has now reduced the total storage capacity 11 percent to 192,000 acre-feet. This reduction, combined with water course encroachments downstream in the Santa Ana Canyon developments, has constrained the operating efficiency of the Prado Reservoir. Consequently, damages that would occur from a major flood event would be catastrophic, accompanied by significant loss of lives.

Ground-water quality and quantity is an issue of concern to this problem area. In both the upper Santa Ana Basin and in coastal Orange County a ground-water overdraft exists. Agricultural return flows, percolation of high nutrients, and total dissolved solids (TDS) concentrations from sewage effluent have resulted in degraded quality of the ground-water resources.

Another issue relates to the salt-water marsh habitat near the mouth of the Santa Ana River. The marsh has been severely reduced in physical size and natural productivity by development, dredging, reclamation, pollution, and siltation. Water circulation in the salt-water marsh area is also poor. This area, like other estuaries along the coast, provides habitat for endangered species, as well as other estuarine-dependent fish and wildlife.

Problem Area — Colorado River Salinity: Impact on California

Colorado River water serves portions of all seven counties in subregion 1806. A population of nearly 11 million (one-half the California regional total) is economically affected to some degree by this salinity issue. In addition, 800,000 acres of irrigated agriculture in Imperial, Coachella, Palo Verde, and Yuma Valleys receive Colorado River water, and irrigation occurs on agricultural developments in San Diego, Riverside, San Bernardino, and Orange Counties.

Present TDS levels in Colorado River water used in southern California impair its usefulness for municipal, commercial, industrial, and irrigation purposes. Projected future levels will further impair its usefulness for these purposes unless salinity control measures are implemented. Water projects presently under construction, authorized, or planned within the basin States will require the full use of the Colorado River supplies; thus, solutions which rely only upon dilution are not feasible. Augmentation to meet future uses in the basin is being investigated, but the extent to which it will be feasible is not yet determined. For the next 20 to 30 years, salinity control can be achieved principally by a Colorado River Basin water quality improvement program and control measures instituted by basin States. Ground-water basins are degraded by use of high TDS water.

Because of high TDS levels of Colorado River water applied to irrigated crops, farmers in the interior desert valleys install expensive drainage systems and use scarce irrigation water in excess of plant needs to leach out the salt and maintain a favorable salt balance in the root zone.

Problem Area — Coastal Lagoons Preservation

This problem area is situated along the Pacific Ocean in San Diego County and the southern portion of the Orange County coastal plain. The inland boundary varies with each lagoon depending on the extent to which the watershed contributes to the overall problem.

Declining coastal lagoons are not just confined to subregion 1806; the problem exists the entire length of the coastline. However, urban expansion has been particularly rapid in the south coastal area, exerting tremendous pressure on remaining undeveloped lands along the coast. This expansion threatens a dozen coastal lagoons that remain in the south coastal area which are important terrestrial and aquatic habitat for a wide variety of fish and wildlife, including three endangered species. Historic fresh-water flows important to perpetuating the ecosystem within these lagoons have nearly ceased due to dams, diversion, and ground-water pumping within contributing watersheds. This lack of flow has allowed beach barriers to form, thereby reducing tidal flushing and compounding existing lagoon water quality problems. Recent prohibition of surface flow of sewage effluent into the lagoons has resulted in the loss of the only remaining "fresh" water inflow. Deposits of inadequately treated organic sludge from previous sewage inflows in some lagoons have accelerated highly eutrophic conditions adversely affecting the habitat.

The land-use issue pertains to sediment from the drainage areas undergoing suburban development. Sediment is reducing the depth of lagoons and the size of wetlands significantly in some areas. Other lagoons are privately owned and will fall to development as growth continues.

Until recently, not all levels of government have recognized the worth of wetlands as a resource and exercised protective measures. Now a first stage effort is underway to purchase remaining lagoons as money becomes available to develop management plans to ensure their preservation. However, funds to purchase lagoons and wetlands for future preservation are not adequately assured.

Problem Area — Salton Sea Salinity

The Salton Sea, located in the Colorado Desert portion of subregion 1806 in southeastern California, is the largest body of water in the State. This inland salt-water lake is 36 miles long by 9 to 15 miles wide, with a surface area of 360 square miles and a shoreline of 100 to 110 miles. The surface of the sea lies approximately 230 feet below sea level.

The sea is a designated repository for agriculture drainage, seepage, leaching, and control waters.

Unique setting and climate conditions make the basin a principal agricultural and recreation area as well as valuable habitat for fish and wildlife. While only partially developed, the sea and surrounding resources have attracted several million recreationists and tourists annually.

Continued use of the Salton Sea for multiple purposes has been threatened by three conditions:

1. Increasing salinity is adversely affecting fish and aquatic life and will discourage recreation use in general as the condition worsens. The declining fish and wildlife resources could unfavorably affect urban seashore development and related commercial endeavors and seriously affect recreation opportunities.

2. Rising water surface levels are adversely affecting wildlife wetlands habitat and surrounding public and private property.

3. Incoming mineral nutrients support algae growth that kills fish, contributing to fish declines, and causes obnoxious odors that reduce the sea's esthetic appeal.

A major issue is how to manage the salinity by selective evaporation and salt removal of a portion of the sea's volume to maintain a stable salinity level. Since the present replenishment supply is derived almost entirely from irrigation return flows and since the sea has no outlet, evaporation leaves salts behind, thus increasing the salinity.

An institutional issue has developed since 1974 when the State-Federal feasibility report was released. The attitude of the Secretary of the Interior has been not to support or fund remedial actions, declaring the issues as being of local concern. The State feels positive actions are warranted and that the Federal Government has a definite responsibility

for the problem because: most of the agricultural drainage and seepage into the Salton Sea results from the Federal Colorado River Project; return flow from other States and Mexico enters the sea; and a significant number of people from all over the United Staes and many countries in the world visit this unique area annually.

Problem Area — Santa Clara River Basin: Water Quality and Quantity (Designated 208 Area)

The Santa Clara River Basin is approximately 30 miles northwest of Los Angeles. The basin includes the drainage from Ventura and Santa Clara Rivers and their tributaries, and the Calleguas-Conejo system of creeks and arroyos. The basin is characterized by mountains and rolling hills with alluvial valleys and coastal flood plains.

Agriculture has long been economically important to the basin. In more recent years, urban development overflowing from the Los Angeles megalopolis has combined with agriculture to create problems. Groundwater extraction accounts for nearly 80 percent of the total water supply, prompting continuous overdrafting in certain areas, particularly the Oxnard plain aquifers where annual overdraft ranges between 40,000 and 65,000 acre-feet. Accompanying this overdraft is mineralization of ground water due to concentration of salts from direct irrigation and return flows and sea-water intrusion. Other issues relate to management of the conjunctive operation of both local and imported surface-water and local ground-water supply systems to maintain quality of the basin's water resources. Land-use decisions needed to control nonpoint source wastes will require coordination between local and State governmental agencies. Large-scale use of reclaimed waste water, if chosen as a feasible means to augment supplies, may require some changes in State governmental policy and public attitudes. Ground-water laws may need alteration to achieve overall management control of the quality degradation problem.

Summary

The California Region includes the State of California and Klamath County, Oregon. It includes 164,839 square miles and has 1,050 miles of coastline. The region is physiographically diverse with wide variations in topography, climate, and geology.

The region is characterized by a series of north-south mountain ranges and intervening valleys. The mild climate of the area provides two seasons--a wet winter season and a dry, warm summer season. Annual precipitation is highly variable, ranging from less than 10 inches to more than 100 inches at the highest elevations.

Population in the region exceeded 21 million in 1975 and is projected to grow to 27 million by the year 2000. More than half of the population resides in subregion 1806. Growth rates are in excess of the national average. Total employment in the region during 1975 was nearly 9 million with total earnings over $115 billion. About 75 percent of earnings are in the "other" category, with another 22 percent in manufacturing.

Land resources of the California Region range from prime agricultural lands to barren mountaintops and deserts. About 3 percent of the lands are classified as urban, and 42 percent as forest and woodland. Of the remaining, approximately 8.4 percent is irrigated farmland, and about 2 percent is dry cropland.

Numerous minerals are produced in the region including oil and gas, tungsten, mercury, rare-earth minerals, boron, gypsum, sodium compounds, sulfur ore, and diatomite. For many of these, the region's production is a significant share of total national or world production.

Livestock grazing is a major industry in the region and provides the number one commodity in terms of receipts. California, which makes up about 96 percent of the region, is the Nation's number one farm state, providing 10 percent of total national earnings from agriculture. Agriculture is centered in the Sacramento, San Joaquin, Coachella, Antelope and Imperial Valleys, and in a number of smaller valleys along the coast. About three-fourths of the cultivated lands are in the Sacramento and San Joaquin Valleys in subregion 1802 and 1803.

The rapid growth and industrialization in the region has required extensive development of energy resources, and energy needs are presently met from hydroelectric, petroleum, natural gas, geothermal, and nuclear sources. Over 120,000 gigawatt-hours of energy were generated in 1975 and over 343,000 gWh are estimated to be required by the year 2000. About 84 percent of steam electric plants use once-through cooling.

Commercial navigation in the California Region is centered in San Francisco, the Los Angeles-Long Beach area, San Diego, and a few smaller ports along the coast and inland on the San Francisco Bay-Sacramento River System. The major share of waterborne commerce is petroleum and petroleum products.

The environmental resources of the California Region are extensive and diverse. These include several national parks and mounuments, over 20 national forests, a variety of historical sites, and large fish and wildlife resources. Over 180 areas have been identified as critical for either recreational or for educational, historical, and archeological values, and some 3,000 miles of stream are designated as nationally significant.

The mean annual natural streamflow in the region is about 68,050 and is poorly distributed in place and time with respect to need. About 75 percent of the runoff occurs north of the Sacramento latitude while about 75 percent of the demand for irrigation and urban water is south of there. About 4,438 mgd of water is imported from the Lower Colorado Region. Reservoir storage and extensive conveyance facilities have been developed to permit effective use of surface water. Ground water has also been widely developed.

NF estimates are that total fresh-water withdrawals in 1975 averaged about 39,636 mgd with about 87 percent of that used for irrigation. About 26,641 mgd were actually consumed in functional uses. Projections of both the NF and the SRF data indicate total withdrawals and irrigation requirements will increase by the year 2000.

The quality of most of the water in the region is superior to the average quality of waters of the Nation, ranging from extremely high in alpine lakes to low along the southern coast and in the lower parts of closed basins. Principal water quality problems include heat discharges from powerplants and manufacturing activities, and the municipal discharge of BOD, salinity, and suspended solids. Point sources of wastes in the region are already highly treated and further reduction of pollution from those sources will be difficult and expensive. About 5 percent of the streams inventoried to date would not meet water quality standards with best practical treatment under Public Law 92-500.

Erosion is a widespread and major problem and the Eel River watershed in subregion 1801 has the highest recorded suspended sediment yield per square mile of any large watershed in the United States. Flooding is also a problem, causing annual damages of about $417 million. Other pressing problems include shortage of ground water in subregions 1803, 1804, and 1806, a large need for recreational water surface area, and drainage in subregion 1803.

Other major issues in the California Region include allocation of limited inland waters for powerplant cooling, water rights, waste-water reclamation, and environmental protection.

Three areas of the region for which inadequate information exists for formulation of a comprehensive planning effort have been identified. These include the Sacramento Valley, the San Joaquin Valley, and Salinas, Pajaro, and Carmel Valleys. The other problem areas for which comprehensive planning is either underway, or could be undertaken, are: (a) the Trinity and Eel River Basins; (b) Lake Tahoe; (c) the Sacramento-San Joaquin Delta;

(d) Santa Clara County; (e) San Francisco Bay; (f) the Santa Ana River Basin; (g) the southern California coastal area and the Colorado service area; (h) the Salton Sea; and (i) the Santa Clara River Basin.

Within these geographic areas are problem issues such as salinity pollution and preservation of coastal lagoons. Each area has problems unique to its environment. The following section describes these concerns and provides alternatives and suggestions for alleviating these problems.

Conclusions and Recommendations

Conclusions

1. A drastic decline in anadromous fish populations (salmon and steelhead) has occurred in the Trinity River during the past decade coincidental with completion and operation of the Federal Trinity River Project, California, for transbasin water export, major logging and roadbuilding activities in the basin, and fishery operations by local Indian tribes:

    A. Information from ongoing studies by the multigovernmental and local interests' Task Force on Trinity River Basin Fish and Wildlife suggests that no simple solution exists to resolve this issue but that answers can be found.

    B. Restoration of the fish and wildlife resources and improvement of the general environment in the Trinity River Basin are necessary before the north coast area can be considered as a source of water for other parts of the region.

    C. Actions to mitigate fishery problems would also assist in partial control of the serious erosion problem which exists in portions of the Trinity River Basin.

2. The State has a number of erosion-prone areas. The Eel River is the most erosion prone and the Sacramento River second in susceptibility to this problem. A significant reduction of existing erosion problems would require funds exceeding the financial capability of local interests except in a few localized areas:

    A. The Corps of Engineers is now studying the erosion problems of the Sacramento River (Sacramento River Bank Protection and Erosion Control Study); this may result in structural measures to help control erosion.

    B. The erosion problems of a portion of the Sacramento River were recognized since the 1950's and resulted in a bank stabilization program at selected sites along the upper Sacramento River.

    C. Any basin or river total plan of erosion and sediment control must consider the entire river system and not be piecemeal.

3. Periodic flooding will continue to have major and disproportionate adverse impact on life and the economy on the narrow flood plains of the Eel River Basin in California for an indefinite period, as a result of:

    A. The area's steep topography and development of the flood plains;

    B. The 1972 California Wild and Scenic Rivers Act which prohibits structural development for flood control in much of the area, with the exception of possible consideration of such measures after 1984 in the Eel River Basin; and

    C. Lack of implementation of nonstructural measures for flood loss reduction.

4. Water quality in Lake Tahoe is related to land disturbance in the surrounding area.

   A. Urbanization of private lands is threatening the lake's fragile ecosystem.

   B. The Tahoe Regional Planning Agency's Water Quality Management Study, funded by the U.S. Environmental Protection Agency under Section 208 of Public Law 92-500, has been beset by financial and legal problems, and the proposed draft plan for managing water quality has not been accepted by the public or the State of California.

   C. Differences in philosophy on accelerated versus limited growth in the Tahoe Basin have alined the State Government of California against the State Government of Nevada, citizens of California against the government of California, and the developers of both States against the environmentalists of both States to such an extent that the entire Tahoe Basin is boiling in strife. The State of Nevada has accepted the 208 report, but the California Water Resources Control Board rejected it. The board voted to terminate the designation of the Tahoe Regional Planning Agency as the manager of the 208 plan.

   D. Resolution of the issues concerning further development in the Tahoe Basin so as to protect environmental quality is possible, but will require a cooperative effort among Federal, State, and local agencies.

5. Construction of a multiple-staged Peripheral Canal transfer facility to move water from the upstream periphery of the Sacramento-San Joaquin Delta in California to the south should be begun.

   A. It would make water available to help meet the water quality requirements of the water users of the State Water Project and Federal Central Valley Project.

   B. It would best serve fish and wildlife protection needs if operated in conformity with State water quality standards.

   C. Unanswered questions regarding operation of the Peripheral Canal can be resolved during the staging and testing period to minimize its effect on fishery and wildlife resources, risk of water shortages to the export users, and water quality degradation to the delta area.[1]

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[1] The State Water Control Board of California has taken the differing view that this conclusion ". . . does not recognize that a major problem which has prevented starting the Peripheral Canal is the position of the Bureau of Reclamation that Federal project water cannot be required for salinity control in the Sacramento-San Joaquin River Delta. Contrary to Conclusion 5c there is no assurance that this problem can be resolved during the staging and testing period. It is our understanding that Federal participation in the Peripheral Canal has been influenced by the lack of resolution of this problem."

6. Federal participation through the U.S. Army Corps of Engineers in final planning and ultimate financing of levee reconstruction to improve flood protection in the Sacramento-San Joaquin Delta area and along the Sacramento River in California is justified and in keeping with the Federal interest in flood control for the following reasons:

    A. There is widespread public interest in ensuring that delta islands continue to be available for farming, recreation, transportation corridors, wildlife habitat, and natural gas extraction.

    B. About 60 percent of the nonproject levees (those not in a Federal project) in the delta are inadequate as a result of unstable foundation conditions and past construction and maintenace practices to protect the islands from inundation and preserve the delta channel configuration essentially as it is today.

    C. The frequency of flooding will increase in the future and recreation opportunities will be limited if the levees are not improved.

    D. The cost of improving the levee system appears to be economically justified by the flood damage reduction, land enhancement, levee erosion reduction, water quality, transportation, and recreation benefits.

    E. The Sacramento River Bank Protection Project is needed to maintain the integrity of the levee system and to preserve environmental values, particularly in the upper reaches of the project levee system.

7. Flood damage potential in Santa Clara County, California, is one of the greatest in the region from a gross economic standpoint, and the cost of corrective measures surpasses the county's financial capability.

8. Presently available water supplies for Santa Clara County, California, are inadequate to meet projected future demands, and failure to provide a new source of water would cause resumption of previous ground-water overdraft and accompanying land subsidence.

9. Water quality degradation in San Francisco Bay results from point and nonpoint sources of pollution due to inadequate treatment of controlled effluent and uncontrolled urban runoff:

    A. The magnitude of the problem is such that mitigation is very unlikely by the end of the 1985 time frame; and

    B. The lack of coordinated planning between all levels of government to develop control measures and best management practices will be instrumental in not reaching the near-term success required by Public Law 92-500.

10. The cost of the levee reconstructions along a substantial portion of the perimeter of San Francisco Bay, which is required by Federal and State standards for protection of urban areas, exceeds the financial capabilities of local governments. (The Department of Water Resources of California is concerned about the loss of wetlands if a widespread levee project were constructed. Consequently, the department would only support localized construction necessary to protect areas subject to subsidence.)

11. Maintenance dredging of navigational lanes in the San Francisco Bay system poses ecological and economic problems in disposing of the large quantities of sediment which move into the system from upstream subregions and local runoff.

12. The most severe flood problem in the region exists in the Santa Ana River Basin where:

    A. Flood control works are dangerously inadequate; and

    B. Present occurrence of the standard project flood would inundate an area containing one million people and cause over $3 billion in damages.

13. Degradation of ground-water quality is occurring in the Santa Ana River Basin from agricultural return flows and percolation of treated sewage effluents high in nutrients and total dissolved solids.

14. There is a general lack of outdoor recreation opportunities along the Santa Ana River.

15. The usefulness of the Colorado River water for municipal, commercial, industrial, and irrigation purposes is impaired by its salinity, causing economic and ecological impacts to the areas of use, and:

    A. Its usefulness will be further impaired unless measures are implemented to control projected future increases in salinity; and

    B. Salinity control measures which rely only on dilution are not feasible because of the overcommitment of Colorado River supplies.

16. The rapid deterioration of coastal lagoons which provide important terrestrial and aquatic habitat for a wide variety of fish and wildlife in the California Region has been accelerated by man's activities, and is symptomatic of an overtaxed environment. It should serve as a danger signal in the coming years.[1]

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[1] The deterioration process of coastal lagoons discussed in this paragraph is partially a natural process and cannot be attributed entirely to man's intervention. Man has accelerated the process but has not been the sole cause.

17. There is a need for the U.S. Army Corps of Engineers to assist in determining and implementing methodology to restore adequate tidal flushing to southern California wetlands by opening the seasonally closed mouths of lagoons.

18. The increase of total dissolved solids in the Salton Sea above approximately 40,000 mg/l (40 ppm) will have serious adverse impacts on the fishery resource and on wildlife aquatic plant food supply and will lessen the recreational desirability of the area.

19. The Federal Government has a responsibility to participate with local governments in planning and implementing measures to resolve the problems of water-level stability in the Salton Sea, because:

    A. The Salton Sea serves as a dump for the agricultural waste discharge from the reclamation area served by the Federal All-American Canal, and its water supply relates directly to operation of the reclamation area.

    B. The premise of the Salton Sea Feasibility Report that water-level stability had been reached is no longer valid, at least on a temporary basis;

    C. Actions originally recommended are no longer necessarily the most viable;

    D. Additional studies are required to determine the range of water-level fluctuations that are causing economic losses to local development and to identify remedial measures.

20. Problems of water shortages in the Santa Clara River Basin which cause overdraft of ground water, accompanied by sea-water intrusion and other water quality degradation, can only be resolved by:

    A. Surmounting institutional and financial restraints;

    B. Achieving a high level of management coordination among the many public and private agencies which have responsibility and interest in part of the overall situation; and

    C. Securing early approval and implementation of water quality management plans for the area.

21. Water rights are a major issue in the California portion of the region, particularly with regard to:

    A. Lack of adequate provisons to control or manage ground-water use;

    B. Transferability of water rights; and

    C. Lack of an effective means to provide minimum instream flows.

22. Reclamation and reuse of water could help meet the water needs projected for the California portion of the region in the year 2000.

23. Federal authorization of the Central Valley Project in California does not include provison for salinity control and, consequently, the U.S. Bureau of Reclamation only recognizes limited requirements for water to control salinity intrusion in the Sacramento-San Joaquin Delta. Accordingly, the Federal Central Valley Project should be reauthorized to include enhancement of fish, wildlife, water quality, recreation, and the environment as nonreimbursable project functions and to permit the U.S. Bureau of Reclamation to contract with the State for a water rights settlement and water quality improvement in the delta.

24. Long-range water conservation is essential in the California Region and can result in significant energy savings.

25. As there are large amounts of brackish water in the California Region and other portions of the western United States, demonstration projects are necessary to delineate the economics of using reverse osmosis desalination on a large scale.

26. Large benefits would be realized if effective and reliable long-range weather forecasts were available for planning water operations.

Recommendations

Federal Role

1. The Congress should:

   A. Modify the Federal authorization act for the Trinity River Project, California, if necessary, to allow compatible operation with the fishery life cycle in accordance with requirements to be established by the California Department of Fish and Game, and to provide instream flows to complement the environmental potential of the area where the costs would be imparted to Central Valley Project users,

   B. Reauthorize the Central Valley Project to include enhancement of fish, wildlife, water quality, recreation, and the environment as nonreimbursable project functions, and to permit the U.S. Bureau of Reclamation to contract with the State of California for a water rights settlement and water quality improvement in the delta; and

   C. Amend pertinent Federal laws such as the Fish and Wildlife Coordination Act, Public Law 85-624; Federal Water Project Recreation Act, Public Law 89-72; and project authorization

acts to provide for the Federal role to include:

i. support of California in the cooperative management of its Wild River System by Federal land and water agencies;

ii. evaluation, in cooperation with interested State agencies, of the utilization of natural resources to meet increasing demands for urban open-space and water recreation opportunities; and

iii. actions as required to remedy related problem issues linked to project operations.

D. Appropriate funds to:

i. study, in coordination with ongoing planning pursuant to Section 208 of Public Law 92-500, the flooding problem along the shoreline of San Francisco Bay as far upstream as the geographical limits of Contra Costa County, with emphasis on the integration of management measures for reduction of flood losses and pollution;[1] and

ii. help finance construction of a new levee system in the Sacramento-San Joaquin River Delta;

E. Appropriate funds to help the State of California acquire coastal lagoon wetlands through various Federal programs such as the Duck Swamp program and that pursuant to wetlands protection legislation;

F. Take appropriate actions to fund the staged construction of the Peripheral Canal water transfer facility in California, subject to resolution of guarantees to protect the delta, San Francisco Bay, Suisun Marsh and the North Coast environment;

G. Authorize a flood control alternative if one can be found that is environmentally sound and found acceptable by the public for the Sacramento-San Joaquin Delta area in California; and

H. Authorize and appropriate funds for resolving flood problems in Santa Clara County, California, if the present survey investigation by the Corps of Engineers identifies economically feasible structural or nonstructural measures, which are also environmentally sound.

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[1] The California Department of Water Resources has stated that it would only support construction of localized levees for areas subject to subsidence because of the threat of loss to wetland areas.

2. Federal Government agencies should:

A. Recognize the urgency and probable effect of the completion and operation of the Trinity River Project as a possible contributing cause of the decline in the anadromous fish population in the Trinity River Basin in California and continue providing adequate funds on a high priority basis to the Task Force on Trinity River Basin Fish and Wildlife;

B. Take whatever actions are found necessary in the Grass Valley Creek Watershed investigation being conducted by the California Department of Water Resources and U.S. Soil Conservation Service to effectively control the erosion and sediment movement known to be a major contributor to the fishery problem in the Trinity River in California;

C. Provide increased appropriations for established U.S. Department of Agriculture land treatment programs and assign direct leadership responsibility for action measures to a single agency or individual to prevent duplication by the several agencies administering the programs;

D. Require the examination of all appropriate Federal grant funds and Federal agency activities with respect to their effect on growth and the overall carrying capacity of the Lake Tahoe region;

E. Provide funds to purchase environmentally sensitive areas, commencing with support of Congressman "Bizz" Johnson's (CA) proposed legislation for $12 million;

F. Proceed expeditiously with the authorized San Felipe Project in California and provide Federal assurances that the environment of the Sacramento-San Joaquin Delta will be protected during project operations;

G. Continue and accelerate the Colorado River Water Quality Improvement Program of the U.S. Bureau of Reclamation to implement those advanced investigation programs which are considered cost effective, demonstrate immediate program benefits, and recognize environmental concerns;

H. Accelerate programs of the Department of Agriculture, Federal land management agencies, and other interested agencies as needed to meet salinity control objectives in the Colorado River;

I. Substantially increase funds for the Federal Insurance Administration's flood rate insurance studies to ensure completion of region-wide studies by the mandated year, 1983;

J. Provide grants to State universities and other academies to do basic research on wetlands productivity, salt pond habitat evaluation and restoration techniques, and parameters of a viable marsh (viz,

adequacy of tidal prism, effects and routes of sedimentation, water qualtiy, etc.);[1]

K. Participate in implementation of a feasible plan for control of salinity and erratic water levels in the Salton Sea;

L. Implement the "All River Plan," Alternative 6, as proposed in December 1975 report of the U.S. Army Corps of Engineers-Los Angeles District on the Santa Ana River Basin, California;

M. Implement more aggressively Section 73 of the Water Resources Development Act of 1974, Public Law 93-251, to provide full consideration and appropriate use of nonstructural measures for flood damage reduction; and

N. Encourage water conservation by;

i. providing additional funding of the Agricultural Conservation Program for purchase of irrigation equipment and other irrigation-related costs which will result in water savings;

ii. establishing a program to guarantee bank loans for purchase of irrigation equipment which will result in water savings;

iii. providing income tax credits for purchase of irrigation equipment and other improvements of irrigation systems which will result in water savings;

iv. providing funds through the Agricultural Conservation Program or other programs to share the cost of farmers' participation in an irrigation management service similar to that provided by the U.S. Bureau of Reclamation.

O. Proceed expeditiously with the authorized Sacramento and Tributaries Bank Protection and Erosion Control Study; furnish mitigation for fish and wildlife in connection with the Sacramento River Bank Protection Project; and provide funding for the Sacramento River Bank Protection Project with emphasis on the protection of the environmental values within the limits of the project.

P. Expeditiously take the actions needed to provide effective erosion control for the Eel River Basin.

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[1] Much work on wetlands research, marsh creation and restoration, etc., has already been done by the U.S. Army Coastal Engineering Research Center (CERC) in Washington, D.C., and the Waterways Experiment Station (WES) at Vicksburg, Mississippi. The assignment of additional research should fully consider the expertise of CERC and WES in these fields.

3. The Environmental Protection Agency should:

    A. Assume a stronger role in assuring that air and water quality standards are met in the Lake Tahoe Basin; and

    B. Approve and ensure enforcement of the California Water Resources Control Board's water quality standards.

4. The U.S. Bureau of Reclamation should expand its irrigation advisory service to include:

    A. More farms and other measures for making more efficient use of water;

    B. Improvements to irrigation distribution systems to and on the farm; and

    C. Management of return flows and drainage.

5. Among other endeavors, the State of California should take necessary steps, including appropriate legislation, to effectively control ground-water development and land use.

Planning

6. The Federal Government should:

    A. Continue participation in and support of State-interagency basinwide or regional planning efforts to address the interrelated problems and requirements of salinity control and water supply augmentation for the Colorado River;

    B. Assist California in the formulation of a multiple-agency committee to:

        i. coordinate the respective agencies' efforts to indentify the anticipated range of inflow and outflow from the Salton Sea under possible future conditions and the resulting levels of the Sea; and

        ii. study the feasibility of measures to alleviate the problem of salinity and erratic water levels in the Salton Sea.

    C. Assist in continuing the studies of the present Trinity River Basin Fish and Wildlife Task Force to resolve the factors contributing to the decline of fish and wildlife resources in the Trinity River; and

    D. Fund the proposed Special Study on Water Conservation of the California Department of Water Resources submitted to the U.S. Water Resources Council.

7. The U.S. Bureau of Reclamation should continue investigation of the potential for using Salton Sea water for injection as replacement fluids for geothermal energy production and/or for exportation out of the basin.

8. The U.S. Environmental Protection Agency should encourage planning now underway in Santa Clara River Basin, California, pursuant to Section 208 of Public Law 92-500, to identify and describe the extent and degree of pollution from irrigation return flows and develop site-specific solutions for those areas where return flows contribute significant pollutants.

9. The U.S. Army Corps of Engineers should:

   A. Continue and expedite its flood protection study in the Sacramento-San Joaquin Delta, California;

   B. Accelerate its survey investigation of flood problems and alternative solutions in Santa Clara County, California, with attention to both structural and nonstructural measures;

   C. Continue to monitor and develop the Alameda Marsh Program, and coordinate the conclusions and recommendations of the Dredged Material Disposal Study with other planning efforts affecting San Francisco Bay;

   D. Expedite the authorized Sacramento River and Tributaries Bank Protection and Erosion Control Study; and

   E. Continue funding and work on the Sacramento River Bank Protection Project to maintain the integrity of the levee system and to obtain authorization for mitigation at Federal expense for fish and wildlife habitat.

Data and Research

10. The Federal Government should:

   A. Increase funding for intensified long-range weather forecasting research;

   B. Fund two reverse osmosis desalination plants in the 2 to 5 mgd range in California to extend and benefit from work on developing pilot plants already done by the University of California and the California Department of Water Resources; and

   C. Support increased research concerning health effects of reclaimed water.

11. The U.S. Environmental Protection Agency should adequately fund the monitoring and research program required to gain knowledge of the impact of urban runoff on aquatic biota of San Francisco Bay until sufficient information has been gathered to support planning and implementation of appropriate control measures.

Institutional

12. The Congress should:

    A. Increase Federal cost-sharing for structural measures to control erosion;

    B. Initiate Federal cost-sharing programs for nonstructural measures to control erosion.

    C. Provide 100 percent of the costs for structural measures to control erosion in the Trinity and Eel River Basins in California, commensurate with erosion severity, to protect environmental values of the basin's natural resources;

    D. Support and strengthen the National Flood Insurance Program by:

        i. not amending the Flood Disaster Protection Act of 1973 (Public Law 93-234) in any way which would weaken or remove local incentives to adopt and enforce adequate flood-plain management standards or nullify potential savings to the taxpayers by the year 2000; and

        ii. modifying the Act as necessary to encourage communities to implement other nonstructural measures to reduce vulnerability to floods and reduce the impact of flooding.

    E. Designate the Lake Tahoe Basin an "area of natural environmental significance" and declare a Federal policy towards the preservation of the ecological integrity of Lake Tahoe; and

    F. Expand the authorities of the U.S. Army Corps of Engineers to include enhancement of coastal wetlands in addition to its jurisdiction and mission over "commerce, navigation and fisheries."

13. The Federal Government should:

    A. Adopt standards to prohibit cold-decking of logs within the hundred-year flood plain within Federal forestlands; and

    B. Recognize existing water rights issues in California and participate in cooperative efforts to minimize their adverse effects on the State's task to conform with its water resource management goals.

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Volume 4: California Region

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The United States Water Resources Council was established by the Water Resources Planning Act of 1965 (Public Law 89-80). The purpose of the Council is to encourage the conservation, development, and utilization of water and related land resources on a comprehensive and coordinated basis by the Federal government, States, localities, and private enterprises with the cooperation of all affected Federal agencies, States, local government, individual corporations, business enterprises, and others concerned.